

# Vocational Rehabilitation Outcomes and Costs

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## Abstract

The analysis presented uses multiple regression analysis to overcome the problem of the multivariate data which was available for analysis. Thirteen projects from which data were available [\*] received 7,632 referrals from public welfare agencies. After reviews were made, 36% of the referred clients were accepted for rehabilitation services, 56% were rejected and 8% received no decision. The analysis of the process by which an applicant became a client for the rehabilitation projects starts with posing two questions. What factors were considered to be in favour of rehabilitation, as opposed to the two thirds who were rejected? What preconditioning variables were related to the chances of a referred client's acceptance for rehabilitation? The analysis focuses on three preconditioning factors:

- Demographic characteristics of the client.
- Skills and work history.
- Prior recognition of disability.

This study also investigates the predictability of selected client characteristics and vocational rehabilitation services with respect to rehabilitation outcomes and costs. The sample consisted of 1,100 cases who had received vocational rehabilitation services. The case data were provided by thirteen private rehabilitation companies providing services throughout the U.S.A. Client characteristics involved were, age, gender, education, occupation, race, public assistance received; and number of years since last full time employment.

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## **Assessment of the Different Factors Related to Acceptance into the V.R. Program**

To analyze the effects of the different factors involved (eg. sex, race, education,...) on the chances of being selected into the vocational rehabilitation projects, multiple regression analysis was used. Each factor was converted into one or several “coded variables”, which take the values of “1” or “0”. This implies that every category of a factor becomes a separate variable itself and allows one to assess the total effects of the independent factors on the dependent one. The factors involved may not necessarily be linear in form (eg. age is often U-Shaped in influence and fails to show significance in linear regression analysis), and it is useful that this method makes it possible to assess the effect of the independent factors, whether or not they are linearly related to the dependent variable and/or to each other. Table-I lists seventeen factors relating to acceptance (dependent variable) into the vocational rehabilitation projects.

### **Data Presented**

#### **1. Demographic Factors**

Race-ethnic group, sex and age are the three characteristics included and classified as demographic.

##### **Race-Ethnic Group:**

Even though five different categories were present, the majority of cases referred were Caucasian and black. Of the total 7,632 referred, 52.6% were Caucasian and 38.6% were black. From the proportions available it looks apparent that the Caucasian clients were favoured most, Hispanics second, and blacks least.

##### **Gender:**

The distribution of referrals was very much close to being even between males and females. However, the percentage accepted for rehabilitation was 56.3% males versus 43.6% females. The data suggests that the review committee favoured Caucasian and Hispanics over blacks, and males over females.

##### **Age:**

About one fifth of all the applicants were in each of the ten year category between twenty and sixty years. There was slight bias in favour of younger

applicants with regard to acceptance into projects.

## **2.Skills and Work History**

Education, occupation, number of years since last full time employment, and the number of weeks worked in past year (either as a part time or full time) were included, and are considered important, because they reflect some of the clients' attributes associated with poverty conditions and total accumulated skills.

## **3.Prior Recognition of Disability**

The study presented considered prior recognition of disability as an indicator of society's previous recognition of client dependence and/or disability (indicated by prior referral to vocational rehabilitation agency).

## **4.Receipt of Public Assistance Prior to Referral**

One in four of the project referrals had received some type of public assistance prior to their most recent opening as a client of public assistance. Which means that they had been at least once before, on public assistance rolls.

## **5. Prior Referral to Vocational Rehabilitation**

Only 15% of the clients had been referred to vocational rehabilitation previously (ie. within four years prior to referral). It is interesting to note that the persons having the least chances for acceptance by vocational rehabilitation projects were those who previously had been considered as not rehabilitated.

## **Types of Public Assistance Received by Clients at Referral**

- 1.APTD; aid to the partially and totally disabled.
- 2.AFDC; aid to families with dependent children.
- 3.AFDC-U; aid to families with dependent children, with father unemployed.
- 4.GA; general assistance.
- 5.AB; aid to the blind.
- 6.OAA; old age assistance.
- 7.MAA; medical aid to the aged.
- 8.NO PA; no public assistance.

**W**

**Table-I Lists The Different Coded Variables**

Definition of Coded Variable				
Variable	Values	Symbol	Values	International
Accepted V.R.	Yes	Y	1	
	No		0	
Disability Type				
	Speech Hearing or Visual	None		
	Physical Deformity	D1	1 0	
	Arthritis, Diabetes, Epilepsy, Hernia	D2	1 0	
	Cardiac	D3	1 0	
	Psychosis, Migraine & Alcohol, personality disorders	D4	1 0	
	Not otherwise Classified (ulcers)	D5	1 0	
	No Response	D6	1 0	
Age	Pregnancy	D7	1 0	
	01-24	None		
	25-29	A1	1 0	
	30-34	A2	1 0	
	35-39	A3	1 0	
	40-44	A4	1 0	
	45-49	A5	1 0	
	50-54	A6	1 0	
	55-59	A7	1 0	
	60-99	A8	1 0	

	No Response	A9	1	0	
Gender					
	Female	None			
	Male	S1	1	0	
Race - Ethnic Group					
	Hispanic/Native/Other	None			
	Caucasian	R1	1	0	
	Black	R2	1	0	
Education					
	01-07	None			
	08	E1	1	0	
	09-11	E2	1	0	
	12	E3	1	0	
	13-15	E4	1	0	
	No Response	E5	1	0	
Major Occupation for Past 5 Years					
	Unskilled	None			
	House Wife	O1	1	0	
	Professional, Semiprofessional, Technical	O2	1	0	
	Sales & Clerical	O3	1	0	
	Service Occupation	O4	1	0	
	Agriculture, Farming, Fishing & Forestry	O5	1	0	
	Skilled Occupation	O6	1	0	
	No Responseto Occupation	O7	1	0	

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Type of Public Assistance Received at Referral				
	Two or More Types	None	1 0	
	None	U1	1 0	
	General Assistance only	U2	1 0	
	Receiving AFDC	U3	1 0	
	Receiving APTD	U4	1 0	
	Receiving OAA, MAA or AID to Blind	U5	1 0	
PA Prior to Application				
	Yes	P1	1 0	
	No			
No. of YRS Since Last Full-Time Employment				
	Never Employed < 1	M1	1 0	
	1-2 Years	M2	1 0	
	3-4 Years	M3	1 0	
	≤ 5 Years	M4	1 0	
	Unknown Employment History	M5	1 0	
	No Response	M6	1 0	
V.R. Interviews				
	With Client 2 or More	11	1 0	
	With Family 1 or More	12	1 0	
	With Employer 1 or More	13	1 0	
	With Other Placement Source (1 or More)	14	1 0	

Evaluation Service Received				
	With Cost to Rehab. Center	C1	1 0	Yes No
	With Cost to Workshop	C2	1 0	Yes No
	With Cost to other Sources	C3	1 0	Yes No
Evaluation Service Received with and/or Without Cost				
	From Rehab. Center	C1	1 0	Yes No
	From Workshop	C2	1 0	Yes No
	From Other Sources	C3	1 0	Yes No
Some Cost to V.R. for Referral Evaluation Service		T	1 0	Yes No
Psychological Evaluation During Referral				
	Yes	X	1 0	Yes No
	No			
Prior Referral to V.R. in Last 4 RS				

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	Yes	V	1 0	Yes No
	No			
Work Record During Last Year				
	Some (≥ 1 Week) Full Time	W1	1 0	Yes No
	Part Time	W2	1 0	Yes No

A multiple regression analysis was conducted on the resulting coded variables.

$$Y = b + a_1 * A_1 + a_2 * A_2 + \dots + d_1 * D_1 + d_2 * D_2 + \dots + W_1 W_2$$

As a result each coded variable was estimated, these represent cell means where the cells are defined by the specified steps in the explanatory factors.

A multiple regression of the dependent factor Y on all coded variables gives a calculated value of Y, for any given X (i.e. an estimate of the conditional probability of Y given X).<sup>1</sup>

R<sup>2</sup> (coefficient of multiple determination), or the total variation in the dependent variable which is explained by all the independent factors.

$$R_A^2 = (R_A^2 - R_B^2) / (1 - R_B^2)$$

Where:

R<sub>A</sub><sup>2</sup> = Coefficient of multiple determination for the equation that includes factor A (eg. Age.)

R<sub>B</sub><sup>2</sup> = Coefficient of multiple determination for the equation before the factors representing factor A were added.

### Discussion of Regression Outcomes

#### Demographic Factors

The most important of these factors was the race-ethnic group, which explained about 3.4% of the variation into project acceptance. The second



most important of these factors was age explaining 2.6 %. Sex was not too important, since it only explained only 1.8%. When all three factors were combined they explained only 4.6% of the total variation in acceptance into rehabilitation projects.

### **Skills and Work History**

These include education, occupation, and work history. They explained 4.5% of the variation in acceptance into rehabilitation projects. The most important one was occupation explaining 2.5%. Work history, either as a part time or full time contributed very little to R<sup>2</sup>. (See Table-II).

**Table-II Represents the Coefficients of Partial Determination for each of Seventeen Independent Factors which were Utilized to Account for Acceptance into the Rehabilitation Projects**

Variable	Characteristics	Coefficient of Partial Determination	F - Test
X <sub>2</sub>	Race-Ethnic Group	0.034	61.66
X <sub>3</sub>	Sex	0.018	14.57
X <sub>4</sub>	Age	0.026	8.22
X <sub>2</sub> , X <sub>3</sub> , X <sub>4</sub>	Race-Ethnic Group, Sex & Age	0.046	18.50
X <sub>5</sub>	Education	0.021	7.40
X <sub>6</sub>	Occupation	0.025	8.97
X <sub>7</sub>	Employment	0.023	8.78
X <sub>5</sub> , X <sub>6</sub> , X <sub>7</sub>	Education, Occupation, & Employment	0.045	11.71
X <sub>8</sub>	Prior V.R. Referral	0.021	35.25
X <sub>9</sub>	Prior P.A. Receipt	0.020	25.02
X <sub>10</sub>	Part-Time Work in Past Year	0.017	77.33
X <sub>11</sub>	Full Time-Work Last Year	0.018	15.92
X <sub>12</sub>	All Types of Public Assistance Received at Referral	0.020	7.28
X <sub>13</sub>	All Types of Disability of Referred Clients	0.067	47.67

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X <sub>14</sub>	Interviews with Person, Family, Employer by V.R. During Referral	0.060	81.59
X <sub>15</sub>	Money Spent to Assess Rehabilitation	0.038	159.20
X <sub>16</sub>	Psychological Evaluation	0.026	61.40
X <sub>17</sub>	Evaluative Service	0.030	32.22
X <sub>18</sub>	Any Kind of Evaluative Services (Medical Exams, Psychological) with & without Cost	0.070	56.57

Where n = 7100

R<sup>2</sup> = 0.633

R = 0.7956

**Prior Acceptance of Disability**

Type of public assistance explained a very little variance in rehabilitation acceptance which was not explained by other factors. This does not imply that type of public assistance was unimportant in the selection process. It actually suggests that various characteristics the clients other than type of public assistance received were more important with respect to acceptance than public assistance.

**Types of Disability**

The second largest contributing factor in explaining the variation in the dependent variable was type of disability. 6.7% contribution to the total R<sup>2</sup> for acceptance was due to the type of disability as well as whether or not a secondary disability was present. There is considerable amount of bias for acceptance for persons with particular types of disabilities, the least likely for acceptance being psychosis, arthritis, cardiac, tuberculosis, and not otherwise classified disorders.

**Evaluative Services:**

The largest group of factors that contributed to R<sup>2</sup> the most was evaluation services. The factor representing two or more counselor interviews with the client and one or more with family member(s), employers, and other resource personnel during referral, explained the most variation in the total R<sup>2</sup> of any of the independent factors. As can be seen, if a person received no evaluation services, including psychological, and medical, then no acceptance of such a person is very likely. As can be seen 7.6% of the total variation in the dependent variable was due to evaluative services of all kinds.

## Relationship between Different Factors and Rehabilitation

As explained earlier, if a characteristic was present it was assigned "1" otherwise "0" was given. Table II contains 51 coded variables on which a stepwise regression analysis was conducted. All variables included were considered independent, except rehabilitation. The table shows the coefficient of partial determination for each of the eighteen independent factors with respect to rehabilitation.  $R^2$  of 0.633 was obtained which means that the variables included explained 63.3% of the variation in the dependent factor, rehabilitation.  $R^2$  and all independent variables are significant at the 0.05 level, except the factors race-ethnic group and education.

### Regression Analysis with Coded Variables

A linear regression model was used where all variables considered were coded with "1" or "0" depending on whether or not an observation was exhibited that particular characteristic. Continuous factors were divided into different categories. Each category was considered to be a separate variable, and each observation was coded with "1" if the given characteristic was present or "0" otherwise. Then a regression equation was fit to the variables in their coded form. Since the dependent variable is the cost of rehabilitation, the regression coefficients would give the average total rehabilitation costs for individuals with selected characteristics, with all other variables held constant.

If the cost found is considered to be the cost of a given characteristic, then it is feasible to add regression coefficient to obtain the average total cost for a person with a set of defined characteristics<sup>1</sup>, and is generally given by:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + \dots + u$$

Where  $b$ 's are the multiple regression coefficients and  $u$  is the error term. Each regression coefficient measures the net effect of being in each category as compared to the category is constrained to be "0". That is,  $b_1$  would measure the costs of rehabilitation associated with being male as opposed to being female. The influence of being female, Caucasian, and having more than eight years of education is contained in the intercept  $a$ . Therefore, the average total cost for an individual with any given combination of characteristics can be determined.

### Treatment Cost

The cost of vocational rehabilitation include diagnostic services, surgery and treatment, prosthetic appliances, hospitalization, training and retraining materials, maintenance, tools, licenses and equipment, and other non-

specified services. One category of costs, maintenance, may lead to some minor overstatement of the true cost of treatment. Actually, maintenance expenditures included some items like transportation expenses that were cost associated with rehabilitation. However, other costs such as living expenses should have been excluded. The 690 clients who were considered to be rehabilitated had an average treatment cost of \$580, where the cost for those considered as not rehabilitated was \$512. Expenditures for the rehabilitated group ranged from zero to nearly \$7,500 versus a range from zero to \$10,000 for the not-rehabilitated group. This large variation in cost expenditure is likely to be expected in such a program with greatly versatile service ranging from a hernia operation to the provision of expensive prosthetic devices, tools and job training.

**Total Cost of Rehabilitation**

Regression results are shown in Table-III reflect the total costs of vocational rehabilitation for clients who completed treatment. The figures in the table represent the amounts of money spent on treatment associated with that particular variable. The figures in parenthesis represent the standard errors of the parameter. These figures can be used to judge the significance of differences between the given regression coefficient and the basis variable whose value in each of the seventeen sets of coded variables is zero. The resulting equation for finding the costs of rehabilitation is:

$$Y_1 = 54.84 + F_{11}X_{11} + F_{12}X_{12} + F_{13}X_{13} + F_{14}X_{14} + \dots + F_{17}X_{17}$$

Multiple correlation coefficient = 0.698

Standard error of the estimate = 790.75

Where  $Y_1$  is the expected costs of rehabilitation services and  $F_{11} \dots F_{17}$  are the amounts of money associated with the various client characteristics as can be seen from Table-I. The equation used for obtaining Y has to be adjusted due to possibilities of negative cost estimates which may result as a result of the summing of different coefficients. The following adjustment is made:

$$Y_1 = Y_1 + F_{12}(Y_1)$$

The estimated rehabilitation cost is adjusted due to the fact that some estimates values may show negatives. This may result due to the assumption made earlier that the regression coefficient maybe added. Therefore, the following equation is used:

$$Y'_1 = Y_1 + F_{10}(Y_1)$$

Where  $Y'_1$  is obtained by first calculating  $Y_1$  from the regression equation and adding the correction term  $F_{10}(Y_1)$ , which is given in Table-IV. The numbers given in parenthesis in the following table represent the standard

errors of the residuals, and the term  $F_{10} (Y_1)$  is the mean of the residuals for each expected value. As can be seen the residuals are correlated to the predicted values of the dependent variable and that adjusting the predicted value of the dependent variable will improve the estimate when the predicted values are below 600. Again this is important since the additivity assumption was introduced.

**Table-III Regression Coefficients. Costs of Project Treatment for Clients who were Successfully Rehabilitated**

Type of disability	$F_{11}$	Age	$F_{12}$
Not otherwise classified	0	Under 24	0
Physical Impairment	-162.39 (86.36)	25-29	77.76 (125.50)
Visual, Speech, or Hearing	-225.13 (137.6)	30-34	133.01 (123.26)
Mental	-386.30 (101.0)	35-39	140.02 (128.27)
Arthritis, Diabetes, Epilepsy, Hernia	-117.21 (124.37)	45-49	103.11 (130.24)
Cardiac, TB or Pulmonary	-149.93 (113.06)	50-54	-156.71 (136.29)
		55-49	-82.91 (156.68)
		> 60	-130.20 (209.92)
		No Response	247.18 (288.66)
Gender	$F_{13}$	Race	$F_{14}$
Male	206.40 (75.80)	Caucasian	135.63 (115.8)
Female	0	Black	318.73 (119.26)
		Hispanic/ Other	0
Year of Education	Public Aid	$F_{16}$	Presence of Spouse
			$F_{17}$

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< 8	0	None	0	Present	-90.83 (72.79)
8	45.96(92.52)	General	161- 62(119.36)	Not present	0
9-11	129.84(87.37)	AFDC	368.81(76.71)		
12	344.53(95.22)	APTD	631.72(118.44)		
>12	291.28(177.31)	AB,OAA,MAA	1,112.95(410.65)		
		Two or More Types	5.54(176.61)		

**Table-IV Adjustment Factors for  $Y_1$**

$Y_1$	$F_{10}(Y_1)$
< 0	260.53 (50.53)
0-299	69.46 (29.40)
300-599	-78.23 (29.61)
600-899	-12.07 (61.27)
900-1199	-6.21 (144.44)
> 1200	399.91 (470.64)

**Vocational Rehabilitation as an Investment**

Here vocational rehabilitation is considered as investment in human resources.<sup>3,9,10,11</sup> It is considered as such because future earning can be compared to the costs of vocational rehabilitation<sup>4,14</sup>. In this way capital invested resembles machine investment with differences,<sup>2,10</sup> such as satisfaction and self content that the rehabilitated person feels which cannot be included or quantified in this economic analysis. However, they are to be kept in mind once such analysis are made. Many components of the vocational rehabilitation makes it possible for such analysis are made. Many components of the vocational makes it possible for such economic analysis since it is concerned with returning injured persons to productive jobs in society. Therefore, the vocational rehabilitation model is viewed as a private investment.<sup>3</sup> The investment will be made so long as the return from the

investment (wage increase) is higher than the vocational rehabilitation costs, and so the following relationship will decide whether the investment is made or otherwise.

$$K_0 \leq [(W_{a1} - W_1)/(1+r)] + [(W_{a1} - W_2)/(1+r)^2] + \dots + [(W_{an} - W_n)/(1+r)^n] \quad (1)$$

$$K_0 \leq \sum [(W_{an} - W_n)/(1+r)^n] \quad (2)$$

Where:

$K_0$  = Cost of the vocational rehabilitation.

$W_n$  = Wages before rehabilitation at any future age n.

$W_{an}$  = Wages after rehabilitation at any future age n.

r = Discount rate.

The inequality above doesn't take into consideration the fact that individuals don't know their future wages with certainty due to several factors such as: unemployment, probability of death, possible future recessions, and future disabilities. Such factors may be incorporated into the relationship, but would make things far more complicated and hence results be more vulnerable to errors. Therefore, the assumption here is that future wages and periods of unemployment are known.

The sum of the discounted future increment in wages attributable to rehabilitation is the present worth value (or worth) of that income stream given the discount rate. Future incomes must be discounted because a dollar paid at some future date is worth less than a dollar in one year at a positive interest rate.<sup>5</sup> In any case, the individual's incentive to invest in vocational rehabilitation is greater the lower the discount rate, the higher the incremental benefits from rehabilitation, and the lower the cost of rehabilitation. If the individuals lived in a perfectly competitive market economy and if they had complete knowledge, then investment in rehabilitation would continue until the *marginal gain* from rehabilitation was just equal to the marginal cost in equilibrium. The equality in the equation would then hold for the *marginal investment* in rehabilitation and the discount rate would be equal to market rate interest.

Of course, perfectly competitive markets are not easy to find or guarantee. Imperfections in the capital market may prevent individuals from obtaining funds or make the cost of funds very high for individual investment. This could result from the fact that there is no physical asset which the lending institution can consider as collateral. These factors would not be limitations if state or federal governments were undertaking the investment. This could

result from the fact that there is no physical asset which the lending institution can consider as collateral. These factors would not be limitations if state or federal governments were undertaking the investment. Imperfections in the capital markets, then, are often cited as reasons for substituting government investment in human capital for individual investments. Such considerations have no doubt had an influence on society's decisions to provide public education, public vocational rehabilitation, and other types of services. Furthermore, there may be a disparity between the benefits and costs which the individual would consider and those which society would consider.

For example, vocational rehabilitation might have an indirect effect of reducing the crime rate because fewer individuals would have to resort to illegal means for earning a living. Such benefits would be considered by society, although they might be ignored by individuals.<sup>3</sup>

### Rehabilitation and Public Assistance

Since the Workers Compensation Board (WCB) and other public assistance institutions offer assistance funds to various categories of injured and disabled persons, an evaluation of the consequences of losing their public assistance or WCB funds needs to be done for those considered for vocational rehabilitation programs. The institutional arrangements of society often have effects which are perceived by individuals in one way and by society in another. Persons on public assistance who are considering whether to participate in vocational rehabilitation programs must evaluate the consequences of losing their welfare payments in the event that they become successfully rehabilitated. Society, on the other hand, is not faced with such an evaluation. When public assistance payments are made by society, more wealth is not created; it is merely redistributed among different members of the society.

Society's decisions, then, regarding the costs and benefits of rehabilitating public assistance recipients can be conceptualized in terms of equation 2 which was shown earlier.

Decisions by individuals, however, are based on a more complex pattern of considerations. Assuming that everything else in equation 2 remains the same (for the individual as for the society), the following equation is presented which incorporates the individual's costs of the possible loss of his or her public assistance payments:

$$K_{0+} \sum [(A_n) / (1+r)^n] \leq \sum [(W_{an} - W_n) / (1+r)^n] \quad (3)$$



Where  $A_n$  is the public assistance payments for all future periods  $n$ ; and all other symbols are the same as in equation 2.

If the benefits from rehabilitation exceed the costs and provided that the discount rate reflects the opportunity cost of other investment in vocational rehabilitation should provide a potential gain in welfare for a competitive market economy. In the event that the assumption of competitive economy is fairly realistic and given a mechanism for distributing costs and benefits properly, it is equation 2 that should be relied upon as a guide to the gains from rehabilitation. This conclusion should hold equally as well as for individuals as for the society. For if rehabilitation programs have the effect of increasing society's wealth, then there should be enough fiscal gains to reimburse any individuals who endure the cost of the program.

### **Marginal Analysis**

#### **Resource Allocation for Different Types of Rehabilitation**

Marginal analysis<sup>5</sup> is used here to decide the resource allocation for different types of rehabilitation programs. Before allocating resource to different vocational rehabilitation programs, two points are of great concern:

1. How vocational rehabilitation agencies allocate given budgets for providing services to different types of persons with various disabilities.

2. How is it determined whether budgets should be increased or decreased.

Before offering any answers, the following assumptions need to be made:

i. Vocational rehabilitation agencies are trying to allocate budgets so as to achieve optimum economic.

ii. Marginal costs of rehabilitation increases as additional persons with the same characteristics are rehabilitated. So for equilibrium, agencies will allocate budgets to maximize revenue when the marginal costs are equal for each different type of client.

$$MB_1/MC_1 = MB_2/MC_2 = \dots = MB_n/MC_n(4)$$

Equation 4 states that economic returns (or profits) to be at a maximum for any given budget, the extra revenue per dollar spent must be equal when profits are maximized. Since marginal revenue functions are either decreasing or constant and marginal cost functions are increasing, the equality of the marginal ratios implies that to take an extra dollar away from one type of

rehabilitation service and spend it on another type results in a lower return from that dollar.

Once the equality is attained, no future reallocation of resources will add to total profits.

It is now possible to incorporate the model for the costs and benefits analysis of rehabilitation with the rule for efficient allocation of funds among different types of vocational rehabilitation clients. It thus can be stated that a given rehabilitation center will have allocated its budget efficiently when:

$$[\sum [W_{nb} *(I+r)^a]]/[K_b] = [\sum W_{nz} *(I+r)^a]/[K_c] = \dots = [\sum W_{nz} *(I+r)^a]/[K_z] \quad (5)$$

Where:

$K_b \dots K_z$  are the additional costs of rehabilitating an additional client with characteristics  $b \dots z$ ;  $W_{nb} \dots W_{nz}$  is the next expected future return during all future periods  $n$  for individuals with characteristics  $b \dots z$ ;  $a$  is the clients' present age; and  $r$  is the discount rate. Because the clients' age is one of the characteristics in the equation, any two ratios could be used to compare people of different ages.

If the optimum size of the budget, rather than the allocation of a fixed budget, is of concern here, then given certain assumptions about the market structure (that it is in competitive equilibrium and there are no external effects present), then it is wanted to increase the budget as long as the ratios in equation 4 are greater than one. That is, expenditures should be increased as long as marginal benefits are greater than marginal costs.

### Vocational Rehabilitation Benefits in Future Periods

In order to estimate the benefits from the rehabilitation of injured workers and those receiving public assistance, data is needed which would include the following parameters:

1. Clients' rehabilitation status when leaving the program.
2. Income before and after leaving the program.
3. Type of injury.
4. Different time service frames:
  - a. Date of injury to 90-day benefit call.
  - b. 90-day benefit call to initial interviews.

- c. Initial interview to plan start.
- d. Plan start to plan completion.
- e. Plan completion to return to work date.
- f. Total medical evaluation.
- g. Total vocational rehabilitation length.

Having provided such data, the benefits that will accrue to an individual entering the program can be estimated. These benefits may continue over the individual's whole life, but it is not known for certain whether these benefits from treatment will remain constant over time. However, in this study constant benefits are assumed. Other assumptions can be made but at the expense of making the computations more difficult. Therefore, the present value of all future benefits attributable to treatment can be calculated with the following equation:

$$B_v = B_t \{[(1+r)^t - 1] / [r(1+r)^t]\} \quad (6)$$

Where  $B_v$  is the value of all benefits from treatment;  $B_t$  is the constant benefit over all future periods  $t$ ;  $r$  is the discount rate and  $\{[(1+r)^t - 1] / [r(1+r)^t]\}$  is the formula for computing the present value of a constant benefit stream accruing over "t" years.

Equation 6 follows from the fact that the present value of future income is the sum of a series. Let  $S_n$  be the present value of the future incremental income due to rehabilitation and let the worklife of an individual be "t" years, then:

$$S_n = B_t \{ [1/(1+r)] + [1/(1+r)^2] + \dots + [1/(1+r)^t] \} \quad (7)$$

Multiplying both sides of the equation (7) by  $(1+r)$  gives:

$$(1+r) S_n = B_t \{ 1 + [1/(1+r)] + \dots + [1/(1+r)^{t-1}] \} \quad (8)$$

Subtracting (7) from (8) gives:

$$S_n = B_t \{ [(1+r)^t - 1] / [r(1+r)^t] \} \quad (9)$$

These value-benefits from treatment will eventually be used to compare the costs and benefits of the rehabilitation program. To adjust for the fact that people may not live to receive program benefits, an average survival

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probability is to be computed for individuals in each age category, and this probability is then multiplied by the benefits computed in equation 4.

The regression model described above has several advantages in estimating expected costs and benefits associated with a rehabilitation program:

**First**, it allows for the estimation of costs and benefits, controlling for a large number of characteristics.

**Second**, the model allows the presentation of results rather compactly in several regression equations, thus making it possible for the analyst to generate any number of cost-benefit relationships. Even though the reliability of the estimates obtained by use of this model is somewhat limited by problems which are inherent in the technique such as the additivity assumption, it still appears that the merits of this technique far outweigh the limitations for the purpose in mind.

## Discussions

The results of this study indicate that disabled public assistance clients indeed profit from vocational rehabilitation. One out of three of the referrals from public welfare was accepted for vocational rehabilitation services. At the end of the project, 66 per cent of the closed cases were closed with the status of rehabilitated. Approximately one of three of the clients accepted for rehabilitation services was still active at the end of the program. In this group, over 55 per cent of the clients had been admitted during the last year of the program.

Although the program was considerably highly successful, there are some suggestions which could increase the effectiveness and broaden the base so that a higher proportion of disabled public assistance clients could be accepted into such a program. It is suggested that more public assistance applicants and/or recipients would be accepted into such program if more extensive use was made of diagnostic and evaluative services during referral and if additional attention was paid by the categories of public assistance status (No PA, GA, AFDC, and APTD). AFDC clients received more councilor interviews during referral than did clients in the other three groups. Their acceptance rate was the highest of the four categories and their screening process were least discriminating. That is, AFDC clients tended to be accepted for project services regardless of age, education, and occupational levels. When these

facts are related to the rehabilitation outcome of each of the four PA categories, it is surprising that AFDC once again had the best rates. The group of clients who were allowed into the projects regardless of their apparent feasibility for benefiting from services had the highest proportion closed as rehabilitated.

As a result one can see that for a case of a client being male had a strong positive influence on client expenditures. As an explanation, if the rehabilitation agency expects a higher return from the male population given the fact that higher return from the male population given the fact that men earn more in the labour-market, then such influence maybe justifiable. But it can be argued that such an influence has been fading away, since more of the other sex (females) are taking over more and more jobs in the labour market especially in the recent years.

Higher expenditures were also seen on clients with higher education levels. The reasons maybe due to the fact that those with higher education levels are able to be retrained due to their general abilities in reading, writing, mathematics, and communications skills.<sup>3</sup> The involved training maybe very expensive, and the fact that those with more education earn more may have motivated the greater expenditures.

The general negative influence of the client's type of disability is difficult to explain, since disability maybe related to some other factors that has a negative influence on expenditures and that this factor maybe a proxy for a variable not specified in the developed equation. This is true since the information available does not contain the severity of the disability.

While clearly significant relation between age and expenditure amounts, the negative sign after the age of fifty may indicate that programs may have been less likely to make expenditures on those with little remaining time before retirement.

Both Caucasians and blacks had significantly higher expenditures than for the Hispanics and others. This may have been due to the fact that Hispanics are very likely to be in rehabilitation projects that have a lower than average expenditure for all clients.

The huge amounts spent on recipients of different types of public assistance, welfare, and different types of assistance may reflect the seriousness of these disabilities. It may also have been due to the pressure felt due to the presence of dependents. The high expenditures maybe justified as a means of reducing public aid given in the future (ie. after rehabilitation).

The presence of a spouse is not significantly influential, but the negative sign may suggest that clients with someone to care for them needed less for

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rehabilitation.

It is of great hazard to impute a rational process to a program on the basis of regression results. Interpretations should not be made on the basis of a model which explains such moderately small amount of the total variation. Nevertheless, the general relationship of expenditures to the characteristics of the sample does seem to suggest the conclusions drawn above.

### **Future Concerns**

It is a matter of fact that, for people with moderate or severe disabilities, it can cost more to work than they earn. So work is not worthwhile for them. People with disabilities face extra costs while working for things such as special equipment and therapy. They don't get this money back. They don't earn any extra money either.

There was bias regarding type of disability, because vocational rehabilitation programs were traditionally designed to care for people with physical disabilities. This is not to criticize such programs, but to point out to the existing fact so that possible alterations may be considered.

The trends indicated by the analysis seem to suggest bias against blacks, but one should point out to the fact that vocational rehabilitation agencies were not really prepared for people whose most pressing needs were job training, lack of motivation, loss of hope, etc. Which were likely the true disability of many of the black referrals.

### **Finally:**

1. For future research, severity of the disability needs to be identified so that results are more meaningful.
2. Above all, one must not just look at the monetary fulfillment of rehabilitation received by employee and employer. One must also look at the personal fulfillment from contributing to society at large.

### **Conclusions**

High number of workplace injuries reported results in high number of work days lost, which necessitate use of such cost predicting models. Also, budgets are always in short and prior knowledge related to rehabilitation cost is very useful. Model can be used to identify areas with high rehabilitation costs, so that proper safety measures can be incorporated. Since the main

goal of vocational rehabilitation is to provide successful employment for the physically challenged to be able to obtain some sort of employment.<sup>7</sup> This is all done in parallel with the new and continually amended laws which require more and more employment of the physically challenged. As such, the Vocational Rehabilitation Act of 1973 requires employers with more than \$2,500 contracts to “take affirmative action to employ and advance in employment qualified handicapped individuals”.<sup>6</sup>

Therefore, different arrangements need to be done regarding such people with disabilities these are classified as follows:

1. Job design.
2. Job redesign.
3. Job analysis.
4. Job accommodation.
5. Job appraisal.
6. Work measurements.
7. Work simplification.
8. Tooling.
9. Task analysis.

In the rehabilitation process, a recommendation is made that more services in the area of job training and re-training be given to the clients. One of the study’s conclusions is that being poor and having a physical disability means something quite different for the black and Hispanic than it does for the Caucasian. In many cases among the Caucasians, physical or mental restoration is the crucial factor and re-entering the labour market is relatively easy once the disabling conditions are corrected. However, among the black and Hispanic disabled public assistance clients, while physical or mental disabilities are crucial factors, equally important is the training or re-training which is necessary to place them in positions to accept jobs in the labour market. It is this subtle distinction which is not fully recognized (or at least it appears that it is not recognized) by the rehabilitation counselor. This is the basis for the suggestion for the increased utilization and provision of evaluative services in the early phase of selection and of training, and related services during the rehabilitation process.

At this time, it appears reasonable to conclude that the vocational rehabilitation projects described in this study made an important and effective attempt to identify and cope with the disabilities of poverty in society. It is

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hoped that this study will both point out those areas in which such efforts were successful and encourage the expansion of rehabilitation programs where their chances for success appear to be good.

### **The Economic Aspect**

The economic model for estimating the costs and benefits from vocational rehabilitation might best be described as a preface to planning in this area of social investment. Further gains in efficient project evaluation in this area can best be achieved through a continuing effort to obtain better data concerning the clients in these programs. There are a number of ways in which the data used in this analysis could be improved:

#### **First:**

It would be useful to know what had happened to those cases which were still active at the time the projects were terminated. This could substantially influence the conclusions concerning the efficiency of the program. For example, when only the closed cases are considered, the rehabilitation rate for clients accepted into the program is really quite high. If this rehabilitation rate held for those still active in the program, it would be a supporting factor for continuing the program. Of course, the analysis does not suggest that the clients who are still active in the program were those who entered the program later than those who had completed the program when the investigation ended. In any case it would be desirable to know something about the disposition of those still active in the program.

#### **Second:**

It would be useful to know the influence of vocational rehabilitation over the entire life span of the client. This would be an expensive procedure and might not be worth the expenditure. However, information concerning the future aspects and effects of vocational rehabilitation would be quite helpful in evaluating the program. Such information would tell us whether increases in earnings are maintained over an individual's entire life or whether further investments are necessary to maintain the individual in the labour force. This might not change the general conclusions about the utility of the program, but might change the general attitudes concerning the type of client that is best suited for vocational rehabilitation. For example, mental patients may have shorter periods of successful rehabilitation than patients with physical



disabilities. This might reverse the general conclusion that mental patients have higher benefit-cost ratios than patients with physical disabilities.

**Third:**

The estimating models would have been greatly improved if information concerning the severity of the clients' disabilities were available. It would appear that this is a dominating factor in the client's probability of being rehabilitated. It is likely also to be important in the amount of expenditure made on any given client. Information concerning both the severity of a client's disability and the nature of his or her life experiences would increase the predictive value of the estimating models. It is interesting to note that the use of coded variables makes it possible to include variables like severity of disability without its having to be continuous in form.

The general conclusions of this analysis, with all its limitations are quite clear.

Vocational rehabilitation programs represent a good investment for the public and for the individual who receives the services. It should be emphasized once again that economic returns accounted for in the developed equations do not take into account many of the social and individual benefits which very likely are associated with vocational rehabilitation. In addition, it suggests reasons for continuing the program even if the economic returns are very low or even negative. For example, social services agencies might decide to provide people with artificial limbs because it is believed that everyone should have the use of all of his or her faculties whether or not he or she is ever involved in a productive job. Therefore, economic and marginal analysis alone can never determine proper policy decisions, but the information which accrues from such analysis is vital and necessary for rational decisions in governments.

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  15. \* Analyzed data was provided to the author by a US organization with the condition of not to release the name of the provider.
- \* The presented data in this study was prepared by a US organization through the Industrial Engineering Department, University of Windsor, Windsor, Ontario, Canada.

\* تم إعداد البيانات المستخدمة في هذه الدراسة من قبل أحد المؤسسات بالولايات المتحدة الأمريكية عن طريق قسم الهندسة الصناعية بجامعة ونديور الكندية بمدينة ونديور أونتاريو بكندا.