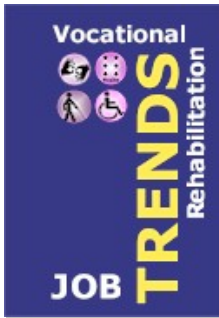




# DSHS | Vocational Rehabilitation Rates Since 2000

Report 10.10 | Prepared for DSHS Division of Vocational Rehabilitation



## Examining Washington State's Vocational Rehabilitation Rates: *Why the decline?*

### A Study of Two Cohorts

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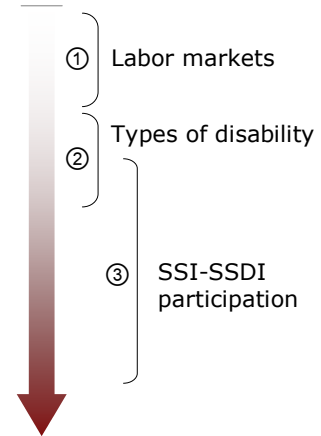
Rehabilitation rates for the Division of Vocational Rehabilitation (DVR) prior to 2000 were relatively high – above 60 percent on average. They declined after 2000 to around 40 percent, and all but four of the 44 field offices statewide experienced declines. DVR requested this analysis to help explain why.<sup>1</sup>

#### What caused the decline?

This study found that three main factors accounted for almost all of the drop in average rehabilitation rates after 2000:

1. A **struggling state economy** with a declining state labor market beginning in 2001, sustained through 2003.
2. An **increase in the proportion of DVR clients with more severe disabilities**, based upon the federal Order of Selection criteria, which began in November 2000.
3. An **increase in the proportion of DVR clients on disability-related economic assistance** (SSI and SSDI) who had greater difficulty finding employment after 2000.

#### Decline is explained by:



Statistically estimated decreases in likelihood (odds) of rehabilitation for the average DVR client after 2000:

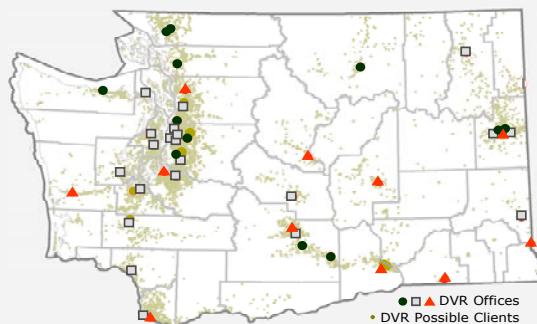
- ① 11-15%    ② 10-14%    ③ 24-39%

NOTE: Odds are non-additive.

#### Some offices did better than expected

All the top performing offices in 2000 – those in the top quartile – achieved higher than expected rehabilitation rates. Expectations were based on local labor markets, mix of clients, prior job experiences, grants received, and types and length of DVR services. Two thirds of the DVR offices changed rank after 2000, and there were several new top performers. *DVR might learn from the effective practices of the most successful offices.*

#### Location and Performance of Field Offices



Top performing offices in 2002-03 are mapped in green, low performers in red, in-between in grey.

#### How much of office variation is explained?

Variation in rehab rates between offices was related to wide differences in local labor markets, types of clients served, job experiences, distance from offices, services offered, time spent receiving services, and dollars spent. This study calculated the effects of all these factors for individuals and offices, and then calculated 'expected' rehab rates for each office. *Factors examined explained 60 percent of differences among clients, but only one third of the differences across offices.* Other factors, still unmeasured, probably account for the remaining variation. These may be differences in office practices, the way counselors managed their cases, counselor-client relations, plan quality, client voice and buy-in, and networking among service providers.

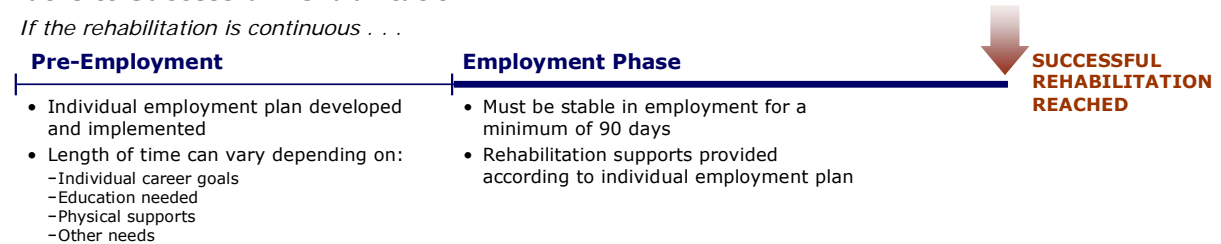
<sup>1</sup> DVR works with clients to develop and implement individualized rehabilitation plans. Successful rehabilitation refers to clients who achieve employment lasting at least 90 days. Rehabilitation rate is the percent of cases closed that result in successful employment.

## The rehabilitation process and service priorities

The path to rehabilitation is a three-stage process for DVR. It begins with a pre-employment process when career goals, training needs, and supports are identified, leading to an individual rehabilitation plan. Second, counseling and guidance, services, and supports are provided according to the plan in order to obtain employment. Stage three involves helping persons function well and keep the job. Rehabilitation success means the individual is stable in employment for a minimum of 90 days.

### Paths to Successful Rehabilitation

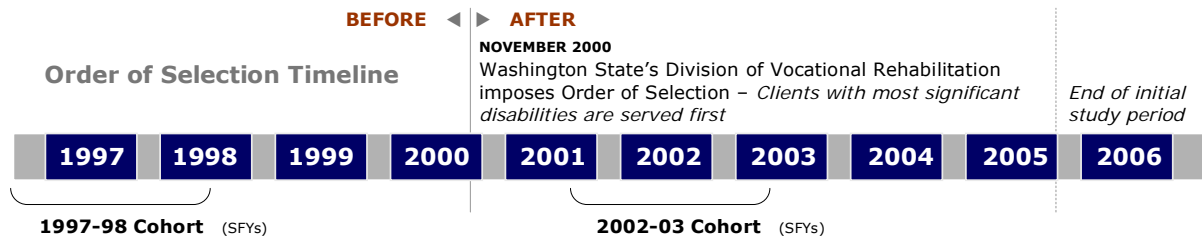
*If the rehabilitation is continuous . . .*



SOURCE: *Life in Vocational Rehabilitation After Order of Selection*, DSHS Financial Services Administration, August 2002 (Felver with Bush).

### A Change in Service Priority

Prior to November 2000, all eligible persons entering DVR were served on a “first come, first served” basis. As a consequence, persons with a variety of disabilities were provided services. However, since more persons applied and became eligible than DVR had the capacity to serve, there were delays in services. In November 2000, DVR moved into the federally required “Order of Selection” process, which requires that clients with “most significant” disabilities are served first.



## The Analysis

Two DVR entry cohorts were used. Characteristics of persons entering in FY 2002 to FY 2003 were compared with persons entering in FY 1997 to FY 1998. Each group was followed for at least two and a half years, and a multivariate analysis was conducted to explain the decline in rehabilitation.

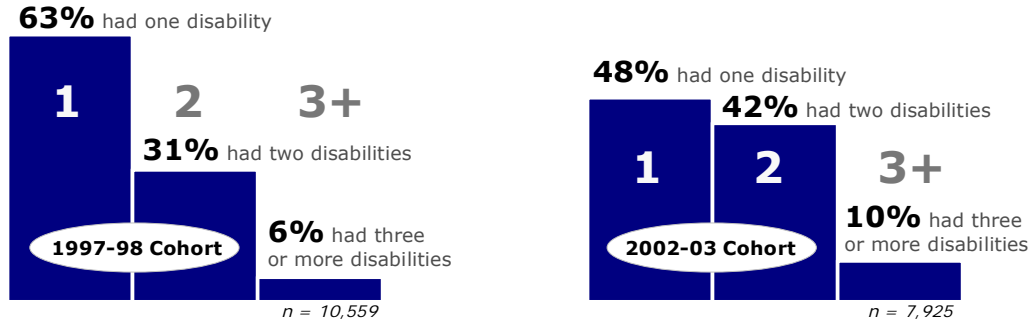
1997-98 Cohort Selection	2002-03 Cohort Selection
<p>The entry window for the before cohort included persons who started developing their plan anytime from July 1996 through June 1998.</p>	<p>The after cohort included persons who started developing their plan in the window from July 2001 through June 2003.</p>
<p>The follow-up period was at least two years before the Order of Selection went into effect and was based on the start date of plan development.</p> <div style="text-align: center;"> <p><b>1997-98 Cohort</b> N = 10,559</p> <p>SFYs 1997-98</p> </div>	<p>The follow-up period was again at least two and a half years from the start of plan development to the last date data was available for this study (December 2005).</p> <div style="text-align: center;"> <p><b>2002-03 Cohort</b> N = 7,925</p> <p>SFYs 2002-03</p> </div>
<p>Cases with missing information on key factors were eliminated, as were the very few persons who were still active on the DVR caseload as of December 2005.</p>	<p>Again, cases missing key information were eliminated, as were the few persons who were still active on the DVR caseload as of December 2005.</p>

## When selection criteria changed, caseload mix did, too

Once Order of Selection was implemented, the caseload mix in DVR began to change. The contrasting characteristics of our two cohorts show clearly. We see:

- A **41 percent increase** in the proportion of clients with **two or more disabilities** (37 percent before, 52 percent after).
- A **74 percent increase** in the proportion of clients with **mental health disabilities** (31 percent before, 54 percent after). For clients with a single disability, the rate was four times higher (11 percent before, 44 percent after).

### A Different Caseload Mix



#### Type of Disability

... if only 1

Mental Health	11%
<b>Cognitive</b>	<b>50%</b> ◀ HIGH
Mobility	31%
Deaf/Blind	8%
<b>TOTAL</b>	<b>100%</b>

n = 6,612

... included if 1 or more

including Mental Health	31%
including <b>Cognitive</b>	<b>50%</b>   HIGH
including <b>Mobility</b>	<b>42%</b>   HIGH
including Deaf/Blind	11%

n = 10,559

#### Type of Disability

... if only 1

<b>Mental Health</b>	<b>44%</b> ◀ HIGH
Cognitive	29%
Mobility	20%
Deaf/Blind	7%
<b>TOTAL</b>	<b>100%</b>

n = 3,838

... included if 1 or more

including <b>Mental Health</b>	<b>54%</b>   HIGH
including <b>Cognitive</b>	<b>45%</b>   HIGH
including <b>Mobility</b>	<b>38%</b>   HIGH
including Deaf/Blind	12%

n = 7,925

## Changes in types of disability affected rehabilitation rates

The estimated direct impact of changes in the types of disabilities after 2000 was a **10 to 14 percent decrease** in the likelihood of successful rehabilitation.

This was mainly a product of two findings:

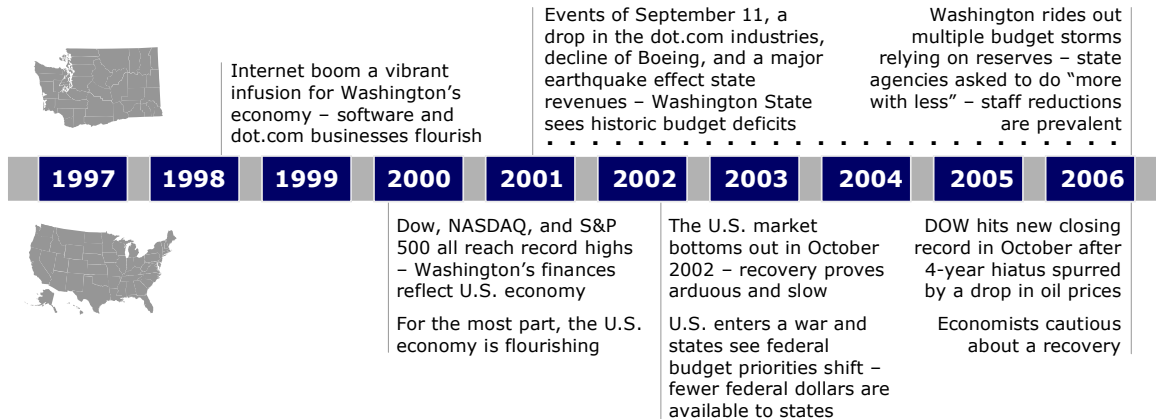
1. After 2000, there were more clients with mental health related disabilities. *See findings above.*
2. Plus, clients with mental health related disabilities were least likely to implement fully their plans and become stably employed.

After 2000 persons with mental health disabilities had a 20 percent lower likelihood of rehabilitation. People with mobility disabilities had 11 percent lower likelihood of rehabilitation. Persons with cognitive disabilities had a 6 percent lower likelihood of rehabilitation. Persons who were deaf or blind actually had a greater chance; they were 41 percent more likely to be successfully rehabilitated.

## Labor markets went downhill after 2000

The second factor pressuring rehabilitation rates was an economy that changed dramatically after September 2001. Washington's economy faltered beginning in 2000 due to a drop in the dot.com industry, a decline in Boeing revenues, and a major earthquake near the state capitol.

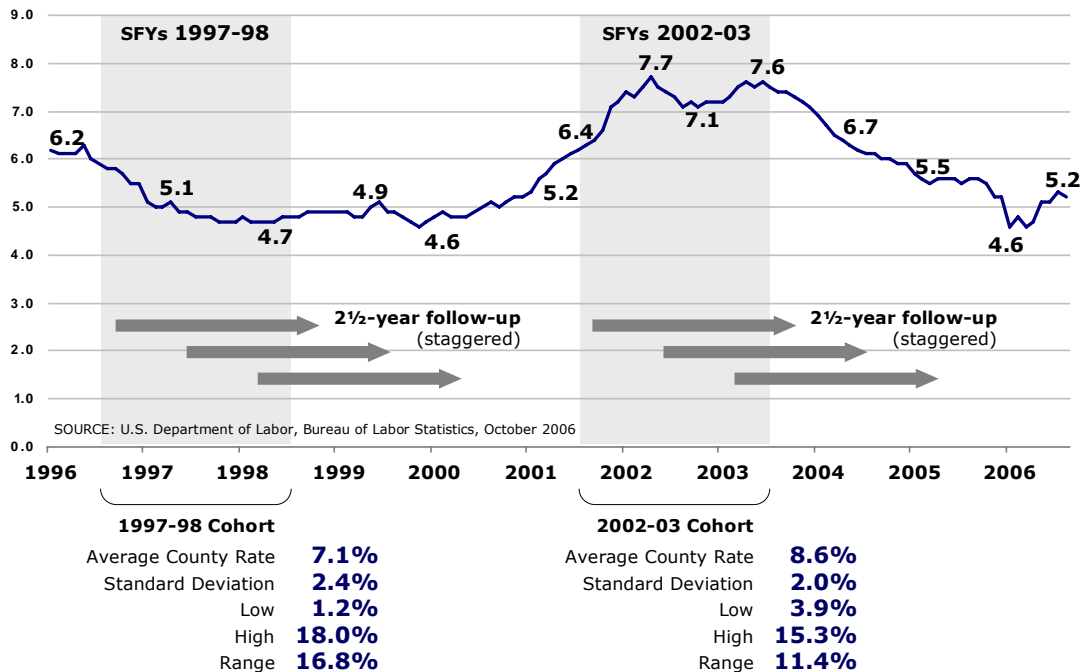
### Economic Perspectives



Unemployment rates climbed after 2000. The seasonally adjusted unemployment rate from 1996 through 2006 is shown below. Average county-based unemployment rates for DVR clients in the two cohorts increased one and a half percentage points: from 7.1 to 8.6 percent.

### Labor Market

Washington State Seasonally Adjusted Unemployment Rate, 1996 – 2006



### Chances of rehabilitation declined with employment rates

The estimated impact of labor market changes was an **11 to 15 percent** decrease in the likelihood of successful rehabilitation. This estimate was based on two factors:

1. The 1.5 percent increase in unemployment experienced by DVR clients, and
2. The finding that a one percentage point increase in unemployment was associated with a 6 percent decrease in the likelihood of rehabilitation in the before cohort and an 8 percent decrease in the after cohort.

One should note that the large variations in labor markets across the state generated large differences in expected rehabilitation rates. A 4 percent poorer market in one part of the state could mean a 26 percent less likelihood of successful rehabilitation compared to another part.

## More DVR clients received disability related economic assistance

The prevalence of DVR persons on “SSI or SSDI” disability related grants **almost doubled from 20 to 39 percent** after 2000. Reasons for this increase are probably related to changes in the caseload mix after the Order of Selection – persons with more significant and multiple disabilities would be receiving SSI or SSDI grants.

Tightening of funding and availability of other DSHS services during this same period – especially for mental health and developmentally disabled clients – may have led to an increase in applications for alternate programs such as DVR ones.

## The likelihood of rehabilitation declined after 2000 for DVR clients on SSI/SSDI or TANF economic assistance

In the before cohort, when labor markets were relatively good, receiving grant income did not greatly affect chances of rehabilitation. In the after cohort, when labor markets were tighter, receiving such economic assistance **decreased the likelihood of rehabilitation by 61 percent**.

Other factors may also have been influential. Historically, receipt of SSI/SSDI grants presents barriers to maintaining wages and keeping cash benefits over time. Medicaid rules can impact both maintaining medical coverage and acquiring any assets over \$2,000. The largest barrier to individuals with disabilities is the misinformation, presented as *facts*, regarding the impact that working has on the level and continuation of benefits. There is a belief that only full-time, high-wage jobs make sense if you are going off SSI/SSDI, otherwise “you risk too much.”

## SSI/SSDI changes had large impacts

The estimated overall impact was a decrease of **24 to 39 percent** in the odds of rehabilitation between cohorts.

The large range in this estimate is due to possible “overlapping” impacts of changes in the two factors, in prevalence of types of disability and of economic assistance, under different conditions of a third factor, labor markets. The effects were found to be independent, but prevalence increases were related.

## Job placement was effective before and even more so after 2000

DVR asked whether contracted job placement services helped persons increase their chances of rehabilitation after 2000.

They did. Actually we found that the impact of placement services became greater after 2000:

- In the before cohort, persons receiving job placement services were 36 percent more likely to be rehabilitated successfully.
- In the after cohort, persons receiving such services were 82 percent more likely to be rehabilitated.

This increase in effectiveness is probably explained both by the increased importance of placement supports for more significantly disabled clients and by DVR efforts at making such contractual services better.

## Education/training had positive impacts, both before and after 2000

DVR also asked about the impacts of their education/training services.

- Education/training services had equally positive impacts on both cohorts of DVR clients. This means that education/training continues to be helpful, even in the rehabilitation of clients who are more significantly disabled and in the context of tighter labor markets.

## DVR field offices performed very differently in both cohorts

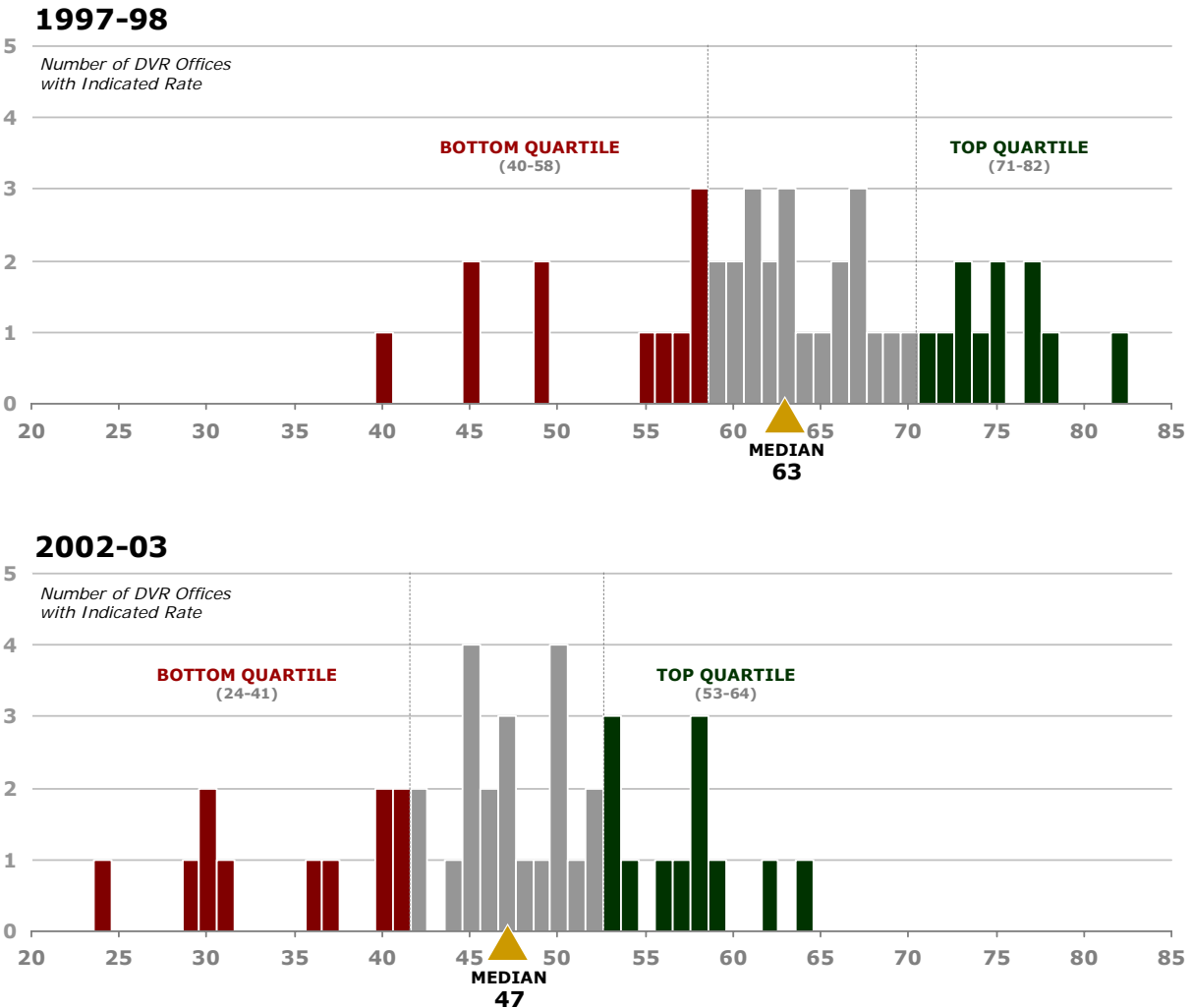
DVR had 44 field offices in our study period. They were located in many different parts of the state, with different labor markets, serving different types of clients. We first examined the degree to which they performed differently- based simply on observed average rates of rehabilitation, without controlling for labor markets, client or service mix.

The chart below depicts the distribution of observed average rehabilitation rates by office in the two study cohorts. Offices are ranked by rehabilitation rate. Top performing offices, ones in the top quartile are marked in green, those in the bottom quartile in red, those in-between in grey.

We noted the following:

- The after cohort distribution just shifted to lower values than the before cohort.**  
 Almost all field offices were affected: only four offices maintained similar rates. In the FY 1997-98 cohort offices clustered around the median of 63 percent. In the FY 2002-03 cohort they clustered around the lower median of 47 percent.
- In both cohorts field offices differed greatly in the rates of rehabilitation achieved.**  
 Differences remained large: 40 or more percentage points. Rehabilitation rates ranged 43 points, from 40 to 83 percent in the before-cohort. Rates ranged 40 points, from 24 to 64 percent in the after-cohort.

### Rehabilitation Rates Observed in Each DVR Office for those Starting in 1997-98 and 2002-03

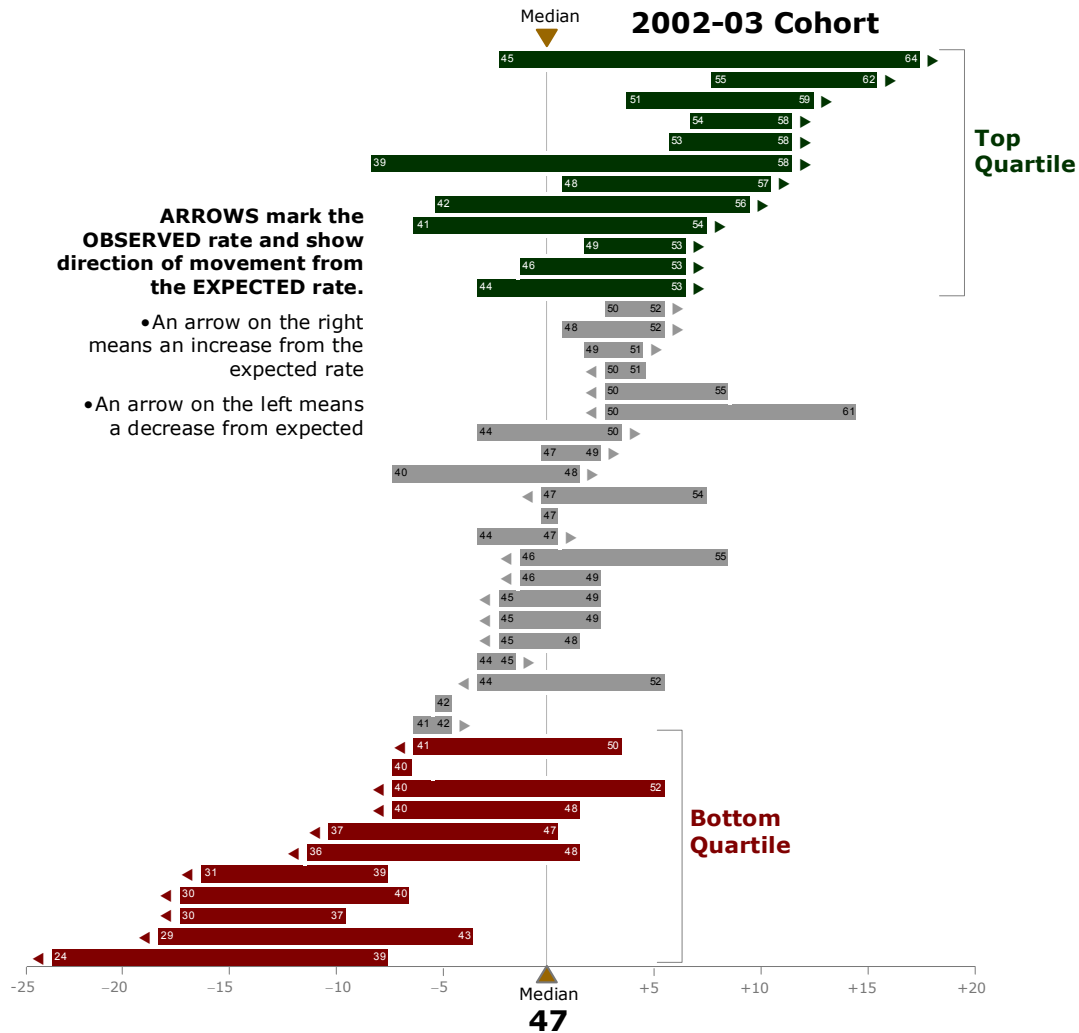


## Many offices did better or worse than expected

We statistically estimated the combined impact of all factors available in this study to predict the likelihood of rehabilitation for each client. These included local labor market conditions, type of disabilities among clients, types of economic assistance, contracted services offered, distance of residence from DVR offices, amount of time spent in DVR services, clients' education levels, previous job experiences, marital status, number of dependents, gender, age and race/ethnicity.

We then calculated the expected rates of rehabilitation for each office, based on the office specific values of the above factors - client factors and measured service factors. We took the difference between the observed and the statistically expected rehabilitation rate for each office and graphed the results. This generated a graph depicting which offices performed close to what one would expect, and which offices did much better or worse than expected.

- **All the high performers, those in the top quartile, did much better than expected:** their observed rehabilitation rates were at least 4 percent higher than expected. Six offices achieved rates 9 to 19 percent higher than expected. *See longer green bars, below.*
- **The bottom quartile did worse than expected:** all but one had lower than expected rates. Six offices did much worse: 10 to 15 percent lower. *See longer red bars, below.*
- **Many offices performed close to expectation.** They were mainly offices that were in the middle half of the distribution. *See shorter grey bars, below.*



## The unexpected differences were larger than the expected ones

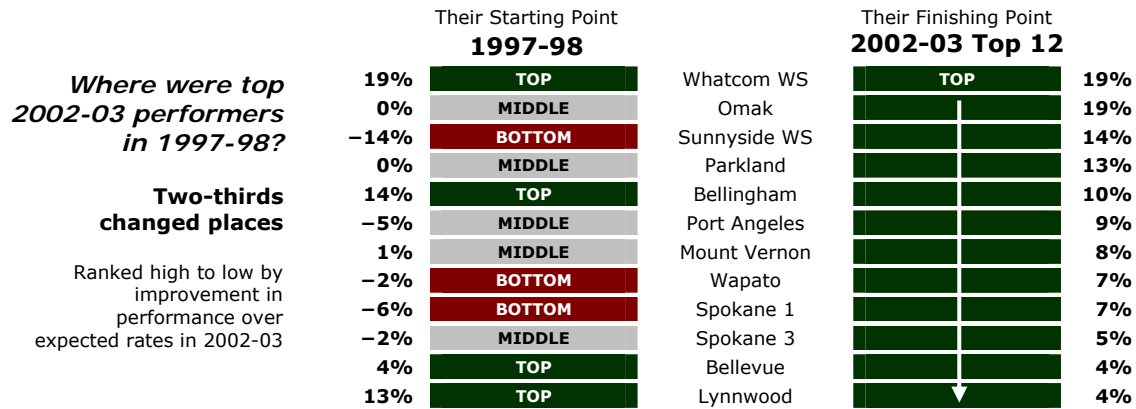
Some of these differences in office success rates were "explained" by local office differences in labor markets and client characteristics. But two-thirds of the differences between offices was not explained by those factors. This suggests that there are unmeasured differences in the service practices of the different offices which affect successful rehabilitation rates. Perhaps these differences - if they can be identified - are the "best practices" of the future.

## Offices did not stay better or worse in performance across cohorts

Many offices performed differently in FY 2002-03 than they did before in FY 1997-98. Higher achieving offices, those doing better than expected in 2002-03, were mainly new in 2002-03.

- Most offices that did better than expected in 2002-03 had not done better than expected in 1997-98.
- A minority (four offices) did better than expected in both time periods.

This suggests that strategies that worked in one period – better labor markets and a less significantly disabled caseload – were not successful in the subsequent period, after 2000.



## What office practices can explain unexpectedly high performances?

Companies who want to improve their bottom line profits sometimes discover that some subsidiaries perform much better than others.<sup>2</sup> The research question then becomes “*Why? What is different about these places?*”

Uncovering such promising practices is far from simple. Various methods are used to gather information: a combination of observation, interviews with participants and focus groups. It is also useful to have some ideas about what sorts of characteristics to examine.

Persons conducting the research need to be seen as “non-threatening,” “neutral,” “expert,” “open minded” consultants who can be trusted. If they are seen as management “spies” or “outside enforcers of new standards” they risk becoming ineffective in their search.

However difficult this research may be, this study suggests that it offers great promise.

- The statistical model developed in this study is powerful in predicting individual likelihoods of rehabilitation (explaining about 60 percent of individual variation) but there is variation still to be explained.
- There is also much variation between offices not explained by the ‘regular’ factors examined in this study.

So the discovery of more effective office practices could lead to better explaining individual and inter-office variations in rehabilitation rates. More importantly, they could lead to overall improvements in rehabilitation rates if these practices were to be implemented statewide.

<sup>2</sup>Andersson, Maria, *Creating and Sharing Subsidiary Knowledge in Multinational Corporations*, Uppsala University, Department of Business Studies, Uppsala, Sweden, 2003.

Barkowski, Susan, *International Managerial Performance Evaluation: A Five Country Comparison*; Journal of International Business Studies, Vol. 30, 1999.

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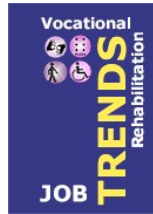
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## A Study of Two Cohorts



FEBRUARY 2007

## Technical Attachments

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### STUDY LIMITATIONS

#### ***Our estimates of labor market effects are conservative***

Labor markets were measured by average employment levels in each county in Washington State. This is the best measure available. However it still does not reflect the availability of relatively lower skilled jobs or the availability of such jobs in different parts of highly populated counties like King or Pierce.

#### ***Our estimates of effects of changes in patterns of disability are conservative***

We were not able to measure directly "changes in functional loss" or measure accurately "primary disability" and "multiple disabilities." DVR had measures of different types of disability, but they were not always ranked by priority, and not all disabilities were consistently recorded.

#### ***Probable interactions between patterns of disability and SSI-SSDI participation are not identified***

Time and resource constraints allowed testing for differences in effects of major factors between the two cohorts only, before and after 2000. Further exploration of important interactions between types of disability, receipt of SSI-SSDI economic supports and different local labor markets in Washington State could provide insight into:

- Specific factors that contribute to disincentives for employment among SSI-SSDI recipients.
- Factors responsible for increasing prevalence of mental health disability, its relation to other disabilities, and whether mental health conditions always represent obstacles to employment irrespective of locality or labor market conditions.

This may be important in developing policies for SSI-SSDI recipients who are mentally ill so they may become productively employed and make steps towards an eventual recovery.

#### **We estimated impacts in terms of effect ranges**

A more precise estimate of overall impacts is possible, but requires more analyses.

#### ***More work is needed to provide a complete picture of clients' progress through the DVR steps***

Preliminary analyses suggests the usefulness of further examination of:

- Factors that lead to successfully signed individual rehabilitation plans.
- Factors that lead to higher wage jobs among DVR clients who are rehabilitated.

#### ***We did not use available measures of differences among offices***

Variation in performance among DVR field offices may be explained by staff characteristics, contracted service providers, and their ability to network with other DSHS programs, particularly mental health providers in their specific Regional Support Network.

A look at other administrative records that contain such information may provide reasons for some of the unexpected differences in rehabilitation rates among offices.

## REHABILITATION STEPS

### Application, Eligibility and Waiting Lists

About 8,000 persons with disabilities apply for vocational rehabilitation services each year and DVR staff determines nearly 7,500 eligible for such services. Given funding constraints not everybody can be served immediately. Since November 2000 the division operates under Order of Selection, which is required by federal law when either staff levels or funds are insufficient to serve all who apply. Under Order of Selection, clients with the most significant disabilities are served first. Washington State defines "most significant disability" as having four or more functional losses and DVR serves these clients first. The division now has about 10,000 eligible applicants on waiting lists.

### Developing a Rehabilitation Plan

Based on time of application and priority status, DVR releases about 9,000 individuals from the waiting list, making them eligible to start developing a rehabilitation plan with DVR counselors in order to reach their job goal. Assessment services are sometimes provided at this point to help design the plan. About 4,500 persons reach agreement on an individually tailored rehabilitation plan each year.

### Plan Implementation

Services begin soon after the plan is signed. Depending on the plan, DVR customers may receive services, like vocational and technical training and job placement and retention, often through contracted providers. DVR counselors meanwhile provide individual counseling and guidance – throughout the time necessary to implement the plan. This period varies in length from a few months to two or more years.

Federal rules require that a person be employed for at least 90 days before DVR can consider the rehabilitation outcome successful. Some succeed and find jobs early on, some later; some do not find jobs, some may not successfully retain the job long enough.

## STUDY DESIGN: CHOICE OF TIME PERIODS AND PERSONS TO STUDY

### Time Periods

Since we were interested in explaining factors associated with the likelihood of successful rehabilitation we needed to test differences in the effect of factors both before and after the year 2000. We examined the experiences of two groups or cohorts of DVR clients, one before the year 2000, the other after 2000:

1. **A FY 1997-98 cohort** – For the *before-cohort* we had to allow enough time for most persons to be successfully rehabilitated, BEFORE the year 2000. We chose an "entry window" – dates in which persons started developing their plan- of two years: Fiscal Years (FY) 1997-98 starting in July 96 and ending in June-98. We could then have a long enough "follow-up period," to examine their experiences during both the plan development and implementation periods, covering a follow-up period of least two and a half years before the occurrence of the events in 2000.
2. **A FY 2002-03 cohort** – For the *after-cohort* we had to allow a few months to elapse so that the system "normalized a bit" after the introduction of the newly imposed "Order of Selection" procedures, training and reorganization. The entry window chosen was again two years long: Fiscal Years 2002-03 extending from July 2001 through June 2003. This allowed for a similar minimum follow up time of two and a half years for this group – from July 2003 through December 2005, the last month for which we could obtain data from DVR for this study.

### Numbers of Persons in Our Study Population

Statistical modeling requires large samples in order to obtain stable estimates of impacts, particularly since we had to test for sub-group differences: between two cohorts and between field offices in each cohort.

The above sampling design provided us with a large total sample of 38,327 DVR clients who started developing a plan in the windows indicated above. 21,225 of these completed and signed a rehabilitation plan. This number got reduced slightly, to 19,338 due to some clients still receiving DVR services after December 2005. Both cohort samples were large: 10,929 in the before-cohort, 8,409 in the after-cohort.

After eliminating 424 cases with missing information, we obtained our study sample population of 18,914. Among them 10,885 persons, 57 percent became "successfully rehabilitated."

### Drop in Rehabilitation Rates between Sample Cohorts

In the before-cohort 63 percent were successfully rehabilitated compared to 47 percent in the after-cohort: a 16 percent drop. These figures are consistent with DVR reports monitoring changes in rehabilitation rates over this period.

## **OTHER FINDINGS ON DETERMINANTS OF REHABILITATION**

*Based on plan completers*

### **Impacts of Individual Characteristics**

- More highly educated, younger, white clients and those with dependents all had unique independent positive impacts on their likelihood of rehabilitation.
- Gender, marital status, ethnicity, and being in special education were NOT significantly predictive of rehabilitation success or failure, when the influence of other variables was controlled. These characteristics may have some impact because of their relation to others: females by having dependents, Native Americans and Hispanic by living in counties with poorer labor markets.
- "Other disabilities," other than the four main types analyzed separately (mental, cognitive, mobility and blind/deaf), were associated with lower chances of rehabilitation. These include general physical debilitation, respiratory impairments, and other physical impairments.

### **Impacts of Access to DVR Services**

- Large distances from DVR offices, greater than 50 miles, were associated with lower chances of rehabilitation.
- Amounts of time spent on formulating an agreed upon rehabilitation plan and amounts spent on assessment services were NOT associated with a greater or lesser likelihood of rehabilitation.
- The longer clients took to implement their rehabilitation plan the less the chance of rehabilitation. This was LESS true for clients living in counties with poorer labor markets.
- The higher the amounts spent on training and technical education the higher the chances of rehabilitation: this was true in both cohorts.
- The higher the amounts spent on job placement services the higher the chances of rehabilitation: impacts were greater in the FY 2002-03 cohort.

### **Impacts of Economic/Medical Services other than SSI/SSDI**

- Clients receiving other economic assistance (like TANF) had lower likelihoods of becoming successfully rehabilitated, but these likelihoods became much smaller in the 2002-03 cohort. The number of such clients dropped by about 60 percent: from 28 percent in the FY 1997-98 cohort to 11 percent in the FY 2002-03 one, probably due to changes in the TANF program.
- Receiving medical assistance (Medicaid) had a strong negative effect on the likelihood of rehabilitation in the FY 1997-98 cohort while it did NOT have a separate unique effect in the FY 2002-03 one. We speculate that these differences are related to changes in patterns of disabilities in the two cohorts and associated changes in SSDI-SSI and TANF recipients.

## **PRELIMINARY FINDINGS OF DETERMINANTS OF COMPLETED PLAN DEVELOPMENT AFTER 2000**

*Based on all eligible clients who started developing a rehabilitation plan*

### **Characteristics Associated with Differences in Rates of Completed Plan Development**

Characteristics leading to a **HIGHER** likelihood of completed plan development were the following:

- Being better educated, a white or a Hispanic or a foreign speaker, a woman, a person with dependents, and living closer to a DVR office.

Leading to a **LOWER** likelihood of completed plan development were:

- Being a Native American, employed ten years before but losing that job, and being on TANF public assistance.

## **PRELIMINARY FINDINGS OF DETERMINANTS OF HIGHER MONTHLY EARNINGS AFTER 2000**

*Based on all successfully rehabilitated clients*

### **Characteristics Associated with Differences in Monthly Earnings**

Characteristics leading to **HIGHER** earnings were:

- Being older, male, married, with dependents, employed before, living far from a DVR office and in a county with high unemployment rates, but having a post secondary education and receiving DVR contracted educational and technical training.

Leading to LOWER earnings were:

- Having a cognitive disability, receiving medical assistance (Medicaid), SSI-SSDI economic assistance or other (TANF) assistance.

## METHODS FOR ESTIMATING "IMPACT" OF SPECIFIC FACTORS

### Measurement

The "impact" of major factors (labor market, type of disability, type of economic/ medical assistance, and type of DVR services received) and other client characteristics (for example, education, distance from office) were estimated in terms of their ability to explain *the likelihood* of successful rehabilitation.

Statistically, these likelihoods are derived from '*odd ratios*' often referred to as '*odds*' – higher or lower chances of an event (rehabilitation). Likelihoods are calculated by taking the odds minus 1.00.

Odds are calculated by taking the exponential value of the relevant '*log-odd*' coefficient or sum of relevant log-odd coefficients – referred to as log-odds. They are estimated by a logistical regression model. *See the coefficients in the statistical model reported on the next page.* The formulas are:

$$\text{Likelihood} = (\text{Odds} - 1.00) \quad \text{Odds} = \text{Exp} [\text{Sum of Log-odds}]$$

$$\text{So: Likelihood} = (\text{Exp} [\text{Sum of Log-odds}] - 1.00)$$

For example: A post secondary degree is associated with a log-odd of 0.3223. *See model.* The odds ratio is the exponential value of 0.3223: 1.38. The likelihood is 0.38 (1.38 minus 1.0); it is interpreted as a 38 percent increase in the chances of being successfully rehabilitated if a DVR client has such a degree.

### 'Unique' impact of a factor on a client in a given time period

"Unique" impacts of a factor – labor markets, for example, were estimated with a statistical model **that controlled for the effects of all other relevant variables**: type of disability, economic/medical grants, type of DVR services received, clients' demographic characteristics, education and previous employment, distance from DVR offices and time spent in DVR services. *See model.*

For example, we estimated the effect of the local labor market (measured by the unemployment rate in the county of residence at the time the client was trying to get employed) on the likelihood of rehabilitation for the client. The effect of a one percent difference in the local unemployment rate in FY 2002-03 on the likelihood of rehabilitation was calculated as – .08 (8 percent decreased chance):

$$\text{Likelihood} = (\text{Exp} [\text{Log-odds}_{(\text{unemployment for } 02-03)}] - 1) = (\text{Exp} [-.0870] - 1.00) = (0.92 - 1.00) = -.08$$

### 'Overall' impact of changes in a factor across time, from before 2000 to after 2000

To statistically estimate the change we did the following:

1. **Tested for changes in effects** – We tested whether the effect of a factor was the same, stronger or weaker after 2000 by comparing the log-odd coefficient of a factor in the 1997-98 cohort with that in the 2002-03 cohort. For example, the effect of unemployment rate was -0.087 in the 2002-03 cohort versus -0.0663 in the 1997-98 one.
2. **Ascertained whether there were composition changes** – We calculated the average of a variable (like unemployment rate) in each cohort, or the percentages of clients having a characteristic (like mental health disability) and examined their differences. For example, unemployment rates increased from 7.1 to 8.6, from the 1997-98 to the 2002-03 cohort.
3. **Calculated the overall impact of both changes in effect and in composition** – We estimated the overall impact by taking the difference in the products of effects (log-odds) and composition (means) between the cohorts. The formula for change in likelihood between cohorts is:

$$\text{Likelihood} = \text{Exp}[\text{Log-odd} \times \text{mean}_{(\text{unemployment } 02-03)}] - \text{Exp}[\text{Log-odd} \times \text{mean}_{(\text{unemployment } 97-98)}]$$

$$\text{So, the impact of the labor market change was } \text{Exp}[-0.087 \times 8.6] - \text{Exp}[0.0663 \times 7.1] = -0.15$$

This is a 15 percent decrease in the rehabilitation rate for the state from before 2000 to after.

### Estimates of impacts are reported as a range resulting from two different estimation methods:

For the impacts of labor markets and type of disability:

1. The more conservative estimates were based only on statistically significant differences in effects between cohorts.
2. The more liberal estimates were based on the best point estimates of effects regardless of statistical significance.

In the case of the SSI/SSDI impact, we were concerned that the increase in prevalence of SSI/SSDI clients could be related to the increase in prevalence of persons with more significant/multiple disabilities. The range of estimates in this case includes:

1. A more liberal estimate that assumes little or no relationship, and
2. A more conservative estimate that assumes total overlap between these composition changes.

## THE STATISTICAL MODEL

VARIABLES IN THE STATISTICAL LOGISTIC REGRESSION MODEL	Var. Effects for 02-03 Cohort		Diff. of 97-98 from 02-03 Cohort		Var. Effect for 97-98 Cohort
	Log Odds	Sig. Level	Log Odds	Sig. Level	Log Odds
<b>LABOR MARKET</b>					
Unemployment Rate	-0.0870	0.0300	0.0207	0.2004	-0.0663
<b>TYPE OF DISABILITY</b>					
Mental Health	-0.2256	<.0001	-0.0479	0.5142	-0.2735
Cognitive	-0.0887	0.1275	0.1911	0.0115	0.1024
Mobility	-0.1225	0.0284	-0.0002	0.9978	-0.1227
Deaf/Blind	0.3452	<.0001	-0.1496	0.1809	0.1956
<b>ECONOMIC &amp; MEDICAL ASSISTANCE</b>					
SSDI-SSI Economic Assistance	-1.2599	<.0001	1.0885	<.0001	-0.1714
TANF and Other Economic Assistance	-2.3698	<.0001	1.8966	<.0001	-0.4732
Medicaid-Medical Assistance	-0.0030	0.9740	-0.8132	<.0001	-0.8162
<b>DVR SERVICES &amp; AMOUNT SPENT</b>					
Job Placement Services \$ 501-1500	0.2150	0.0015	0.1457	0.0855	0.3607
\$ 1501-3000	2.1797	<.0001	-1.2457	<.0001	0.9340
\$ 3001-4500	2.8154	<.0001	-1.4370	<.0001	1.3784
\$ 4501+	3.6737	<.0001	-2.2464	<.0001	1.4273
Education/Training \$ 501-1000	0.1886	0.0145	-0.1181	0.2064	0.0705
\$ 1001-2500	0.1422	0.1574	0.1648	0.1747	0.3070
\$ 2501-4500	0.6593	<.0001	0.0082	0.9610	0.6675
\$ 4501+	1.1828	<.0001	-0.3158	0.0431	0.8670
Assessment Services \$ 501-1500	-0.0963	0.1370	0.1393	0.0908	0.0430
\$ 1501-3000	-0.0812	0.3154	0.1512	0.1713	0.0700
\$ 3001+	0.0125	0.9212	-0.0523	0.7691	-0.0398
<b>DIFFERENCES OF 97-98 FROM 02-03 COHORT</b>					
			0.3807	0.0194	
<b>DEMOGRAPHICS, EDUCATION, &amp; PRIOR JOB</b>					
Gender (Female)	0.0055	0.8717			
Age (When Implementing Plan)	-0.0045	0.0068			
Marital Status (Married)	0.0045	0.9217			
Dependents (Any)	0.1718	<.0001			
High School Grad. or GED	0.0242	0.6177			
Post Secondary Ed. (No Degree)	-0.1786	0.0043			
Post Secondary Ed. (Degree)	0.3223	<.0001			
Special Education	-0.0718	0.5224			
Other Disability	-0.1417	0.0006			
Ever Employed (10 Years Before DVR)	-0.1394	<.0001			
African American	-0.2684	<.0001			
Asian Pacific	-0.2100	0.3703			
American Indian	-0.1386	0.0834			
Hispanic	-0.0723	0.2844			
Native Language (Non English)	-0.0635	0.4260			
<b>DISTANCE FROM OFFICE &amp; TIME IN SERVICE</b>					
Living 11-50 Miles from DVR Office	-0.0464	0.2370			
Living Further than 50 Miles	-0.3376	0.0001			
Log of Time in DVR since Start of Plan	-0.4645	<.0001			
Interaction of Log of Time with Unempl. Rate	0.0221	0.0006			
Log of Time Spent Developing Plan	0.0177	0.5794			
Interaction of Log of Time with Unempl. Rate	-0.0103	0.0109			
INTERCEPT	2.8516	<.0001			

Based on 18,914 DVR clients in the before and after cohorts who had completed and signed their rehabilitation plan and whose cases were closed before December 2005. See page 10 for details.

### Association of Predicted Probabilities and Observed Responses

Percent Concordant	76.2	Somers' D	0.54
Percent Discordant	22.9	Gamma	0.541
Percent Tied	0.2	Tau-a	0.264
Pairs	87,395,665	c	0.77

## ESTIMATING STATISTICAL POWER

### *How accurately did we explain differences in rehabilitation?*

#### **Power of predicting accurately the likelihood of rehabilitation for any given DVR client**

Our most complete logistic regression model took into account the effects of all measured variables and selected interactions. See *logistic regression model on previous page*.

We used measures of "goodness of fit" to estimate the statistical power of this model:

1. Logistic regression compares all possible pairs of observations. The percent of concordant pairs (ones in which the model predicted accurately the difference in rehabilitation outcomes for any pair of individuals) was 76.9; the percent of discordant pairs was 22.9. These pairs would have been 50/50 if the model failed to predict anything; close to 100/0 if the model predicted correctly the rehabilitation outcomes of all cases. This can be interpreted as meaning that we "predicted correctly the individual rehabilitation outcomes for more than half the persons studied."
2. Somers' D and Kendal's Gamma were both 0.54. This may be interpreted as saying that the model "explained more than half the individual differences in rehabilitation outcomes."
3. The measure 'c' (varying from 0 to 1) is similar to a multiple correlation coefficient. It was 0.77. Its squared value, 0.59, can be interpreted as a percentage of explained variance: the model explaining 59 percent of the differences in rehabilitation outcomes.

The three measures gave us similar results: the model explained 55 to 60 percent of the differences in outcomes.

The "power" of the statistical model is relatively high: most statistical models predicting individual outcomes of DSHS services usually "explain 25 to 35 percent of the variance in outcomes."

#### **Power of explaining the drop in statewide rehabilitation rates after 2000**

We introduced a 'cohort' variable in the statistical model. The estimated coefficient for this 'cohort' variable indicates the difference in rehabilitation rates between the two cohorts studied that are still left unexplained by the variables in the model. We found that this cohort variable became smaller, almost not significant, the larger the number of factors included in the model. It became non-significant (a 0.052 significance level) when all variables were included other than the DVR service ones: labor market, disability, economic assistance, and client mix variables.

This is only true for the additive effects of all the factors in the model – not the interactive effects of factors with the cohort variable, but it provides a partial indication of how well the model explained the drop in rehabilitation rates.

#### **Power of explaining differences in rehabilitation rates across the 44 DVR field offices**

We calculated predicted rehabilitation rates for each office, the 'explained' inter-office variance in rates, the total inter-office variance, and the explained variance as a proportion of the total.

First, we calculated the predicted rehabilitation rate for each of the 44 DVR office ( $i=1-44$ ) based on the results of the statistical model that included all sixty measured variables ( $i=1-60$ ) that could influence rehabilitation success. The formula is:

$$\text{Expected rehabilitation rate for office } (i) = \text{Exp}[\text{Sum } (i=1-60) (\text{log-odds of variable } (j) * \text{mean of variable } (j) \text{ for office } (i))] - 1.00$$

Second, we calculated the explained variance based on the differences of predicted office rates from the overall state rate. The formula:

$$\text{Explained variance} = [\text{Sum } (i=1-44) (\text{predicted office rate } (i) \text{ minus state rate})^2] / \# \text{ of offices} = 0.0025$$

Finally, we calculated the total variance based on the differences of observed office rates from the state rate. The formula:

$$\text{Total variance} = [\text{Sum } (i=1-44) (\text{observed office rate } (i) \text{ minus state rate})^2] / \# \text{ of offices} = 0.00753$$

We found that the percentage of explained inter-office variance as the proportion of total variance was relatively low:  $0.0025 / 0.00753 = 32.7$  percent. Two thirds of the inter-office variance, 67.3 percent, was unexplained.

Additional copies of this paper may be obtained from: <http://www1.dshs.wa.gov/RDA/>.