WORKING PAPER

Data for Adjusting Disability Ratings to Reflect Diminished Future Earnings and Capacity in Compliance with SB 899

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ABSTRACT

The passage of SB 899 introduced sweeping reforms to the California workers' compensation system. One of these reforms was the requirement that the system for evaluating the severity of permanent disabilities incorporate empirical data on the long-term loss of income experienced by workers with injuries to different parts of the body. However, no previous work has provided enough information on the predicted loss of earnings capacity for different types of injuries to generate a complete set of adjustments to the rating schedule. This document summarizes the average disability ratings and 3-year cumulative proportional earnings losses for 23 different categories of disability. This includes a discussion justifying the use of standard ratings (ratings before age and occupation adjustments), proportional earnings losses calculated at the individual level, and estimates of ratings and losses for three separate regions of the spine.

PREFACE

The 2004 California workers' compensation reform legislation, SB 899, included the requirement that the Administrative Director develop a permanent disability rating schedule that incorporates empirical data on the loss of future earnings capacity experienced by workers with injuries to different parts of the body. The legislation cited previous research from the RAND Institute for Civil Justice for guidance on the method of estimating the loss of future earnings capacity. However, the previous research did not include estimates for many of the injury categories potentially affected by the reforms. This technical working paper provides information on the predicted loss of future earnings capacity for 23 different types of disabilities to inform the implementation of the reforms.

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BACKGROUND

The recently passed Senate Bill 899 requires the Administrative Director of the California Department of Industrial Relations to adopt the descriptions and measurements of physical impairments provided by the American Medical Association (AMA) *Guides to the Evaluation of Permanent Impairment*, 5th Edition (Section 32.b.1). In addition, the statute requires that the Administrative Director create a ratings schedule that incorporates information about "the average percentage of long-term loss of income resulting from each type of injury for similarly situated employees" (Section 32.b.2). Adjusting ratings to reflect earnings losses should increase equity in the system by ensuring that systematically higher lost earnings capacity for certain impairment types are reflected by higher Permanent Partial Disability (PPD) and Permanent Total Disability (PTD) benefits. The earnings loss estimates used for the adjustments are to come from the data used in Reville, Seabury and Neuhauser (2003).[1]

There are a number of methods for incorporating data on loss of earnings capacity into the ratings process, but the general approach is to reorder disability ratings so that injuries with the highest earnings losses receive the highest ratings. While Reville, Seabury and Neuhauser (2003) showed that this was true on average in the California system, there were some types of injuries that displayed systematically larger or smaller earnings losses than others for the same rating. Adjusting ratings to correct these disparities requires data on proportional earnings losses and average disability ratings for each of the different types of injuries that are to be adjusted.

In principle, the data used in Reville, Seabury and Neuhauser (2003) and the follow up work in Reville et al. (2004) are appropriate for the task of adjusting earnings losses. However, in neither of these documents are there sufficient data reported to

[1] Specifically, the statute requires that "[t]he administrative director shall formulate the adjusted rating schedule based on empirical data and findings from the Evaluation of California's Permanent Disability Rating Schedule, Interim Report (December 2003), prepared by the RAND Institute for Civil Justice, and upon data from additional empirical studies" (Section 32.b.2).

implement a full set of earnings loss adjustments. First, these reports tend to focus on *final ratings*, which are the ratings that have been adjusted for age and occupation. However, given that the age and occupation adjustments are still going to be used in the new schedule, it seemed that the initial *standard rating*, is a more appropriate tool with which to calculate the diminished future earnings capacity adjustments.[2] In addition, the aforementioned reports do not provide the necessary information for a comprehensive list of injury categories. The purpose of this document is to provide summary data that can be used to compute the diminished future earnings capacity adjustments in compliance with SB 899.

Data Description and Methods

The data we use here are the same as used previously by Reville et al. (2002) and Reville, Seabury and Neuhauser (2003). This database consists of matched administrative data on disability ratings and on earnings for PPD claimants in California. The data on disability ratings come from the State of California's Disability Evaluation Unit (DEU). The DEU performs between 60,000 and 80,000 ratings of permanent disabilities each year. Our dataset was drawn from evaluations done on injuries occurring between 1991 and 1997. The DEU data contain specific information about the type of impairment, severity of the impairment, and important demographic data (gender, age at injury, average weekly wage at injury, address, and occupation).

The earnings data are from the Base Wage file maintained by the California Employment Development Department (EDD). Every quarter, employers covered by Unemployment Insurance (UI) in California are required to report the quarterly earnings of every employee to the EDD. These reports are stored in the Base Wage file.

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[2] The precise manner in which the diminished future earnings capacity adjustment is incorporated into the rating process is a matter for the Administrative Director to decide. The scenario that seems most consistent with the current system is to start with the rating from the AMA Guides as the standard rating, and then apply the future earnings capacity adjustment (as a multiplier or as an add-on) along with the age and occupation adjustments.

The industries covered by UI are virtually identical to the industries covered by workers' compensation; therefore, a worker injured at a firm for which he or she can make a workers' compensation claim should also have a record for that quarter in the Base Wage file. With roughly 95 percent of employees in California covered by the UI system, the matched DEU-EDD data provide a substantially complete and accurate California quarterly earnings history for permanent disability claimants. We have data for every matched worker from the first quarter of 1991 through the first quarter of 1999.

The key feature of the RAND data for the purposes of adjusting disability ratings is that it includes the estimated earnings losses that injured workers suffer as a result of their disabling injuries. Earnings losses cannot be measured directly, because they are a function of what individuals would have earned had they not been injured. One way to estimate earnings losses is to use pre-injury earnings as the proxy, but this is problematic because it ignores the wage growth (or decline) that individuals experience over time. In numerous studies, beginning with Peterson et al. (1998), RAND has estimated earnings losses for disabled workers in California by comparing their post-injury earnings to those of uninjured "control" workers. Control workers are selected on the basis of pre-injury earnings; thus, earnings losses are estimated as the difference between the earnings of the injured workers and the earnings of the uninjured workers who appeared observably similar to the injured workers prior to the injury. This methodology has been described in numerous previous works, so we do not expand on it in detail here.[3] As in Reville, Seabury and Neuhauser and Reville et al. (2004), we focus on 3-year proportional earnings losses because these data provide the best balance between representing long-term outcomes and a sufficient number of observations with which to conduct our analysis.

There is one minor difference between the methods used here and those in previous studies, and that is the difference in how we calculate and report *proportional*

[3] In addition to the Peterson et al. (1998) study, see Reville (2001) and Reville and Schoeni (2001).

earnings losses, which are the percent of earnings that are lost because of an injury. Proportional earnings losses can be problematic to calculate at the individual level, because they are subject to extreme values (called "outliers"). Specifically, the highest value that proportional earnings losses can achieve is 100 percent, because injured workers cannot have less than zero earnings and control workers' earnings are positive or zero. However, earnings "losses" can be negative, in the sense that an injured worker's post-injury earnings can exceed that of the control workers.

Negative earnings losses occur because of the random nature of the sampling variance. For example, a given injured worker may have high post-injury earnings while the matched control(s) can have very low or even zero earnings. Hence, when injured workers' earnings exceed the controls, earnings losses are negative, and that negative number can approach infinity. Consequently, proportional earnings losses are bound at the top by one but not by zero (or negative one) at the bottom. This suggests that a few cases with substantially negative proportional earnings losses can drive the overall average losses below reasonable levels.

The impact of these few observations with large proportional losses can be seen in Table 1. Table 1 illustrates the distribution of proportional earnings losses in our sample, by displaying the value of a number of percentiles (the N^{th} percentile is the value that N percent of the observations lie below). We see from the first column that approximately 1 percent of observations have proportional losses of approximately –308 percent or more, while 99 percent of observations have proportional losses under 96.9 percent. This leads to a skewed average value of –11.7 percent, while the median (the 50^{th} percentile) proportional earnings loss is 9.9 percent. To see just how misleading this negative average proportional loss is, consider that the average dollar value of cumulative 3-year earnings losses in our sample is $14,625 in 1997 dollars.

To overcome this problem and present sensible average proportional losses for different injury categories, we trim the top and bottom 1 percent of the distribution of

Table 1

Illustration of the Effect of Extreme Observations on Average Proportional Earnings Losses

Percentile	Untrimmed	Trimmed
1	-3.080	-1.611
5	-0.721	-0.628
10	-0.393	-0.364
25	-0.109	-0.104
50	0.099	0.099
75	0.520	0.509
90	0.834	0.819
95	0.909	0.897
99	0.969	0.951
Mean	-0.117	0.143
N	110,583	108,373

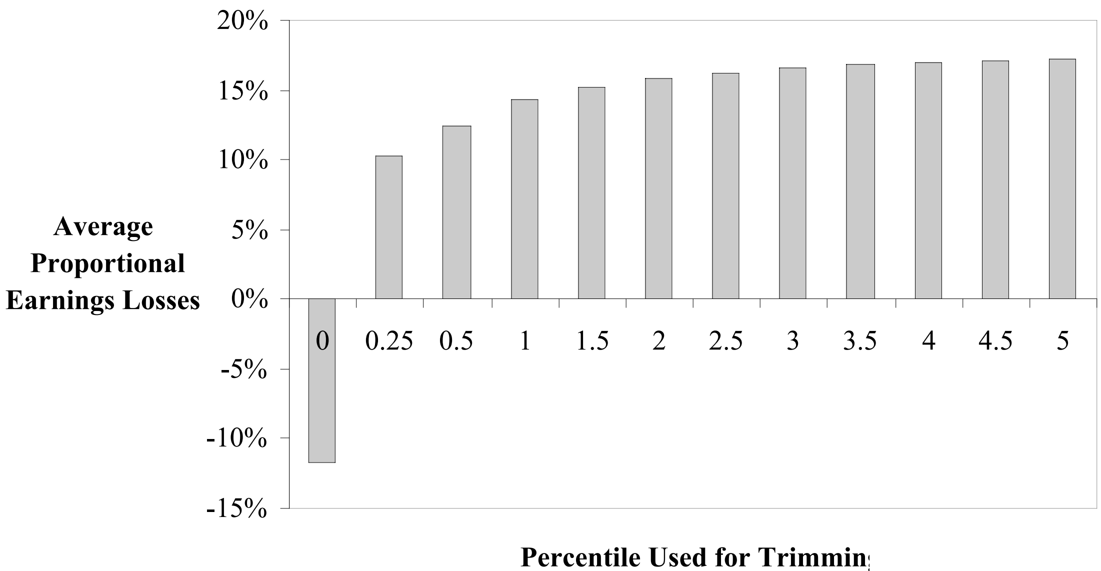
Notes: The N^{th} percentile represents the value of which N percent of the observations fall below. The trimmed data drop all observations that fall above the 99^{th} percentile or below the 1^{st} percentile.

proportional earnings losses. In other words, we drop all observations with proportional losses of less than–308 percent or greater than 96.9 percent (2,210 observations). This trimming procedure maintains the overall shape of the distribution of proportional earnings losses, while eliminating the undue effect of the extreme cases. From the final column of Table 1, we see that trimming leads to an average proportional earnings loss estimate of approximately 14.3 percent.

This trimming procedure is slightly different than what has been done in past RAND work. The past studies mentioned here have typically not focused on proportional losses at the individual level. Rather, proportional earnings losses were estimated by taking the ratio of average cumulative losses over the average cumulative earnings of control workers. While this approach produced sensible estimates of proportional earnings losses, it has limited use for our purposes because here it is necessary to estimate proportional losses at the individual level, for reasons that will become clear in the next section.

A common concern with trimming is that there is no theoretical basis for choosing the trimming "rule," the percentile above and below which observations are dropped. If the choice of a trimming rule has a large impact on the average proportional losses, then this raises concern that results using these numbers will not be robust. We address this concern in Figure 1, which displays the impact of different trimming rules

Figure 1. The Impact of Different Trimming Rules on Average Proportio Earnings Losses



on the average proportional earnings losses. The first bar represents the average losses with no trimming, approximately –12 percent. We see right away that the biggest impact occurs from going to no trimming to trimming above and below the 0.25th percentile, which leads to average earnings losses of about 10 percent. The remaining bars represent successive trimming rules at one-half percentile intervals until the 5th percentile. Average losses are increasing in the trimming percentile, though they appear to stabilize close to 17 percent.

Since average losses still appear to be increasing at the 1 percent level, this does raise the question as to whether or not it appears to be the appropriate choice. One reason to use a more conservative trimming rule is that it preserves observations, an effect that becomes important when attempting to estimate the losses for relatively infrequent injury types. Additionally, given that observations with negative proportional earnings losses are theoretically valid, we might worry that higher trimming rules lead us to exclude valuable information (i.e., we have no way of knowing if the converged value of 17 percent is really "better" than the 14 percent obtained when trimming at the first percentile). The figure shows that the average earnings losses resulting from the 1 percent trimming are close to the midpoint between the lowest and highest trimming rules, making it a conservative approach.

As a final justification for the 1 percent trimming level, consider that if we multiply the 14.3 percent average proportional losses by the average cumulative 3-year earnings for our sample ($102,441), we obtain predicted earnings losses equal to approximately $14,649. This differs from the observed earnings losses by just $24, or less than one percentage point.

Estimating Ratings and Losses for Different Separate Regions of the Spine

One of the key challenges in computing diminished future earnings capacity adjustments that comply with SB 899 is that Reville, et al. (2003) report earnings loss estimates for injury descriptions used by the California Permanent Disability Rating System (CPDRS) and the legislation requires the injury descriptions to be based on the AMA Guides. The disability descriptions in the CPDRS and the AMA Guides are quite different in practice. There currently exists no direct link between the descriptions of injuries in the California Disability Evaluation Unit (DEU) data used by RAND and the injury descriptions in the AMA Guides.

Given a lack of data on earnings losses for injuries evaluated under the AMA Guides, the adjustments must be calculated using data on earnings losses for impairment categories that are broad enough to be comparable in both systems.

However, this is problematic for impairments to the neck, spine or pelvis (which we term simply "back injuries"), the single largest category in the DEU data. The AMA Guides make separate distinctions between the Lumbar, Cervical and Thoracic regions of the spine, and rates them separately, while the DEU data uses a single classification for all three areas. In order to compute separate adjustments for all three regions of the spine we must estimate their average ratings and earnings losses.

The specific regions of the spine are estimated by combining the original DEU data with data from a survey of all medical reports involving the spine that were evaluated by the DEU on June 28th, 29th and July 1, 2004. This resulted in 247 single-injury cases that included an injury to either the lumbar, cervical or thoracic regions of the spine. Table 2 compares the mean and median ratings for the single-injury back

Table 2

Comparison of Average Back Ratings in DEU Back Survey to the RAND Data

	Mean	Median
DEU Back Survey	27.44	25
Summary Ratings in the RAND Data	19.70	15
Consults in the RAND Data	26.11	25
"Corrected" Consults in the RAND Data[1]	18.85	18.05

[1]The consult ratings are corrected by multiplying all ratings by the ratio of the average rating in the RAND data for the summary cases divided by the average rating of cases in the DEU back survey (approximately 1.3929).

claims in the DEU survey to the single-injury summary ratings in the RAND data. We can see that the ratings in the DEU survey are much higher at both the mean and the median than the RAND data. This is likely because the DEU explained that most of the ratings in the survey were *consult* ratings—that is, ratings requested by either the applicant or defense and are therefore more likely to involve a disputed claim. Past work has focused primarily on summary ratings, which contain a mix of disputed and undisputed claims. Disputed claims tend to be "higher-stakes" on average, and we can see that the consult ratings in the RAND data do tend to be quite similar to the ratings in the DEU back survey.

As we said, the focus for the adjustment factors is the sample of summary ratings, which are a more representative sample of claims. As such, we "correct" the data in the DEU back survey, by multiplying the ratings by the ratio of the average summary rating for back claims in the RAND data over the average rating in the DEU back survey. Table 2 displays the results of this correction when it is applied to the consults in the RAND data. We can see that this results in a sample of ratings that appears much closer to the summary ratings.

By applying this same correction to the data in the DEU back survey, we obtain our estimated average ratings for the lumbar, thoracic, and cervical regions of the spine. These results are displayed in Table 3. From the table we see that the lumbar region of

Table 3

Average Disability Ratings for Different Regions of the Spine

	Lumbar	Cervical	Thoracic
Average Observed Rating	28.98	22.23	23.27
Average Corrected Rating[1]	20.92	16.05	16.80
Number of Observations	183	53	11
Percent of cases	74.09	21.46	4.45

[1]The ratings are corrected by multiplying all ratings by the ratio of the average rating in the RAND data for the summary cases divided by the average rating of cases in the DEU back survey (approximately 0.72199882).

the spine tends to have the highest ratings on average (approximately 20.92 after the correction). The cervical and thoracic ratings are quite similar on average (with corrected ratings of 16.05 and 16.80, respectively). PPD claims for impairments to the lumbar region also appear to occur much more frequently, accounting for about 74 percent of observations compared to 21 percent for the cervical spine and about 4 percent for the thoracic spine.

While the DEU survey allows us to compute average ratings for the different regions of the back, it tells us nothing about the average proportional losses. The best we can do is to impute the average losses for the different regions of the spine based on the proportional earnings losses. Reville et al. (2004) shows that the disability ratings for back injuries are closely correlated with their proportional earnings losses. We predict losses for single-injury, summary-rated back injuries in the RAND data using a multivariate regression of proportional earnings losses on disability ratings, pre-injury quarterly earnings, a variable indicating whether it is a disputed claim (measured by whether there is also a defense or applicant rating for the same claim), year dummies and employer dummies. The disability ratings in the regression enter as a quadratic term, though very similar results obtain with a linear specification.

The regression results are reported in Table 4. All coefficients have their predicted signs: pre-injury earnings are negatively associated with earnings loss, disputed claims have higher losses, and the disability rating is highly correlated with the proportional losses. Using this regression we can estimate the proportional losses for the different injury types by multiplying the estimated coefficients for the linear and square terms to the disability rating and its square, respectively, and then adding the two together. If we carry out this calculation, we estimate proportional losses of 19.14 percent for the lumbar spine, 15.04 percent for the cervical spine, and 15.69 percent for the thoracic spine. While using the DEU back survey allows us to compute separate estimates of ratings and earnings losses for the three different regions of the spine, it is important to acknowledge the limitations of our analysis. First, we have to assume that the distribution of ratings across regions of the spine is the same in summary ratings and consult ratings. Specifically, we must assume both that the proportional difference between summary ratings and consult ratings is the same across regions of the spine and that the relative frequency with which the different types of injuries occur is the same in summary and consult ratings. If this assumption fails to hold, then our estimated ratings for the average rating and percent of cases in the summary data could be biased.

The second assumption we are forced to make is that the relationship between proportional earnings losses and disability ratings is the same across the different

Table 4

Regression of Proportional Earnings Loss on Disability Ratings for Single Injury, Summary Rated Back Cases in the RAND Data

Quarterly Pre-injury Earnings	-0.001
	(6.667e-05)**
Year = 1992	-2.578
	(0.881)**
Year = 1993	-4.075
	(0.944)**
Year = 1994	-2.841
	(1.025)**
Year = 1995	-3.142
	(1.028)**
Year = 1996	20.368
	(12.779)
Disputed claim	5.882
	(1.615)**
Standard rating	1.011
	(0.056)**
Standard rating squared	-0.005
	(0.001)**
Constant	12.825
	(1.102)**
Number of Observations	39198
R-squared	0.46

Notes: The table presents the estimated coefficients from a regression of 3-year proportional earnings losses on Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

regions of the back. While Reville, Seabury and Neuhauser (2003) and Reville et al. (2004) show that proportional earnings losses match disability ratings fairly closely on average, they also document that the relationship between the two often differs for various parts of the body. If there are similar differences between the different regions of the spine, then this could cause biases in the estimated proportional earnings losses.

From a practical standpoint, the estimated earnings losses for the different regions might be useful for examining absolute differences in severity, but not differences in severity relative to the disability rating. Because we are simply predicting losses based on differences in the disability rating between the regions, the proportionality between ratings and estimated losses for the different regions is approximately the same.[4] Therefore, any set of earnings loss adjustments that incorporate the California disability rating as a measure of severity will most likely result in approximately the same adjustment factor for the different regions of the spine with or without the estimates derived here. This would not (necessarily) be the case if the adjustments used some other variable to control for severity, such as the average AMA Guide ratings for the different regions.

RESULTS

Table 5 presents the standard ratings, proportional earnings losses, the ratio of the two, and the number of observations for each of the injury categories that can be considered separately in the RAND data. The table breaks the data down into 22 specific injury categories (20 if we consider spinal injuries together) and an "other" category. The smallest specific category is post-traumatic head syndrome (PTHS), with 96 observations. Almost all the various types of impairments in the other category have less than 96 observations.[5]

The highest rated type of impairment on average is heart disease, with a 29.78 percent rating on average, while the lowest are headaches with just 7.75 percent. The highest proportional losses, however, are for psychiatric impairments, with 49.01 percent. This suggests that individuals with psychiatric impairments lose nearly one-half of their earnings three years after an injury. The lowest proportional earnings losses, on average, accrue to impairments to the hand or fingers: just 4.89 percent.

[4] The proportionality would be exactly the same if we used a linear specification for the regression. With the quadratic specification, however, the proportionality is slightly different for the lumbar region (which has the highest ratings).

[5] The exception to this is facial and cosmetic disfigurements, which have 185 observations. These impairments were placed in the other category because they had negative proportional earnings losses on average. Conceptually, it is difficult to believe that the causal effect of such disfigurements is actually to increase earnings (though it could possibly have an effect of zero), so we simply placed these with the other injuries that had groups too small to reliably estimate proportional losses.

Table 5

Disability Ratings and Earnings Losses for Broad Injury Categories in the RAND Data

	Standard Rating	3-Year Proportional Earnings Loss	Ratio of Ratings over Losses	Number of Observations
Spine*	19.70	18.45	1.07	39,198
Lumbar	20.93	19.14	1.09	
Cervical	16.05	15.04	1.07	
Thoracic	16.80	15.69	1.07	
Knee	14.65	9.31	1.57	12,846
Loss of grasping power	11.21	8.73	1.28	11,776
General upper extremity	17.89	17.98	1.00	8,776
Shoulder	9.73	13.08	0.74	7,358
Hand / Fingers	8.86	4.89	1.81	6,895
Wrist	13.15	10.84	1.21	5,968
Ankle	14.12	9.28	1.52	4,151
Elbow	9.44	6.23	1.51	2,896
Hearing	10.71	17.69	0.61	2,068
General lower extremity	19.00	17.21	1.10	1,765
Psychiatric	22.13	49.01	0.45	1,433
Toe(s)	10.10	9.09	1.11	523
Hip	21.68	21.10	1.03	475
General abdominal	18.26	19.24	0.95	448
Heart disease	29.78	30.82	0.97	353
Vision	10.31	5.68	1.81	306
Lung disease	20.06	25.44	0.79	264
Headaches	7.75	12.35	0.63	181
Post-traumatic head syndrome	23.85	25.57	0.93	96
Other single	13.81	9.04	1.53	597
Total	15.58	14.25	1.09	108,373

* The specific regions of the spine are estimated by combining the original DEU data with data from a survey of all medical reports involving the spine that were evaluated by the DEU on June 28th, 29th and July 1, 2004. The DEU survey allows us to compute average ratings for the different regions of the back, allowing us to impute the average losses with an OLS regression of proportional earnings losses on disability ratings, pre-injury quarterly earnings, a variable indicating whether or nit it is a disputed claim, year dummies and employer dummies. The disability ratings in the regression enter as a quadratic term, and the predicted earnings losses are calculated accordingly (with the average rating multiplied by the coefficient on linear term, added to the product of the squared average rating and the coefficient on the square term). The average ratings in the DEU back survey are higher than in the original DEU data, so we scale the ratings down so that the mean is the same.

The purpose of adjusting disability ratings to reflect diminished future earnings capacity is to reduce the disparities between losses for different types of impairments conditional on a rating. Reville, Seabury and Neuhauser (2003) suggest the ratio of disability ratings over earnings losses as a straightforward measure of the average disparities. From Table 5, we see that the impairments to the hand or fingers and impairments of vision are tied for the highest ratings relative to earnings losses, at 181 percent. Psychiatric impairments have the lowest ratings relative to proportional earnings losses, at just 45 percent. As discussed in Reville, Seabury and Neuhauser (2003) and Reville et al. (2004), a set of adjustments that equalized the relative values of losses and earnings, called the *relativities*, would result in a constant ratio of ratings over losses. All relativities must be set equal to some baseline impairment, so this suggests that adjustment factors could be computed based on the ratio of ratings over losses for the baseline and for each individual category. Whether or not that precise method is used, the data in Table 5 at least provide the framework with which a set of adjustments could be calculated.

CONCLUSIONS

This document summarizes the data on disability ratings and earnings losses that have been collected by RAND for a number of specific injury categories. This should provide the necessary information to calculate adjustments for the diminished future earnings capacity suffered by disabled workers as required by SB 899. Note that the data presented here are really the minimal amount of information that could be used for these adjustments. Although the data here all pertain to the California system, ideally the ratings would be calculated combining information on earnings losses with actual AMA Guide ratings. Moreover, it is only possible to generate linear adjustments—i.e., adjustments that are constant for all values of the rating—with the information presented here. Again, ideally we might incorporate additional information to allow the adjustments to vary over more or less severe ratings (since the relationship between ratings and earnings losses is not necessarily constant over injury severity, according to

Reville et al., 2004). However, without any additional data that would allow a closer comparison between the earnings losses in the RAND data with AMA Guides ratings, the data here provide the best means with which to adjust disability ratings to reflect the long-term loss of earnings capacity by injured workers.

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