RESPONSE TO *COMMISSIONER'S INTERROGATORIES TO PARTIES' EXPERTS*

State of Washington v. Allen Eugene Gregory
No. 88086-7

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Interrogatory 1

Are you aware of cases that are in fact missing from the trial reports, or should your statement be taken as a caveat that you have not independently verified the inclusiveness of the trial reports?

We would like to address the first question even though it was directed to Dr. Scurich in order to provide relevant context. The data set for the study consisted of all Trial Reports (TRs) filed with the Supreme Court through May of 2014 (numbers 1-331). In November 2013, Mr. Gregory's attorneys filed a Motion to Complete the Process of Compiling a Full Set of Aggravated Murder Reports. This motion included attachments documenting over thirty aggravated murder cases for which final trial reports were missing. In January 2014, the Supreme Court denied the motion. The Court had already ruled that the data set was complete enough to perform proportionality review, the purpose of which "is to avoid random arbitrariness and imposition of the death sentence based on race."[1]

Although the Supreme Court ruled that the data set was complete enough to perform proportionality review, several missing trial reports were filed between January and May of 2014, and we performed the study anew in order to use the most comprehensive data set possible.[2] Trial reports are still missing for some of the aggravated murder cases listed in the Motion to Complete. However, only three missing reports relate to special sentencing proceedings; all three of these proceedings involved white defendants who received life sentences.[3]

Interrogatory 2

Please provide a fuller description of the methods utilized by coders who coded mitigating circumstances, identify any applicable written protocols for this coding, and explain any unwritten data coding protocols that were used.

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[1] *In re Elmore*, 162 Wn.2d 236, 270, 172 P.3d 335 (2007).

[2] In several places in our *Response to Evaluation*, we represented the total sample size as 297 cases. Because we included TR 34A in these analyses, the correct number is 298.

[3] These three are: (1) Duane Bartholomew's second special sentencing proceeding following reversal of death sentence, remand, and new jury trial resulting in life without parole sentence (*see* TR 3); (2) Mitchell Rupe's third special sentencing proceeding following first two reversals and final jury trial resulting in life without parole sentence (*see* TRs 7 & 31); and (3) Charles Finch's second special sentencing proceeding following reversal of death sentence, remand, and new jury trial resulting in life without parole sentence (*see* TR 154). Although a jury entered a life sentence in Mr. Finch's second trial, he committed suicide before the judgment was entered. Arguably, no trial report need be entered as no judgment was entered.

The Commissioner correctly identified the coding protocol for the mitigating circumstances. Specifically, the protocol was as follows:

1. Enter the number of discrete statutory mitigating circumstances from question 3(c) into the Mit_Circum_Statutory field.
    a. If the "No" box is checked, enter zero.
    b. If the "Yes" box is checked with no description, enter one.
    c. If nothing is checked and the description field is empty, enter zero.
    d. If nothing is checked but the judge has described one or more mitigating circumstances, count them and enter the appropriate number.
    e. If one or more mitigating circumstances in this field is actually non-statutory, count it in the Mit_Circum_Non-Stat field instead.
2. Under question 3(d), evaluate the number of individual concepts described by the trial judge and enter that number into the Mit_Circum_Non-Stat field.
    a. If the "No" box is checked, enter zero.
    b. If the "Yes" box is checked with no description, enter one.
    c. If nothing is checked and the description field is empty, enter zero.
    d. If nothing is checked but the judge has described one or more mitigating circumstances, count them and enter the appropriate number.
    e. If a one or more descriptions in this field is actually statutory, count it in the Mit_Circum_Statutory field instead.
3. Add the numbers from 3(c) and 3(d) and enter the total into the TotMitCircum field.

Where a factor could fairly be characterized as either statutory or non-statutory, it was left in its original category. Also, please note that steps (1)(e) and (2)(e) above were not critical because the total number of mitigating circumstances was used in the analyses.

The Commissioner correctly identified one data entry error: The number of mitigating circumstances for TR 25 should have been 2, not 1. In light of this discovery, we re-checked *all* trial reports for cases that had a special sentencing proceeding, and confirmed that TR 25 was the only one with such an error. We did, however, discover that a 0 rather than a 1 had been entered for the number of aggravating circumstances found by the judge/jury for the proceeding associated with TR 34A, so also corrected this.

Correcting these isolated errors and re-running the analysis does not alter the regression results in a meaningful way. Specifically, for the model presented in Table 7 of the *Updated Report*, the p-value for Black defendant was 0.040; after the changes, this p-value is 0.039. The coefficient for this variable was previously reported as 1.573 (meaning that Black defendants were 4.82 times as likely than non-Black defendants to be sentenced to death); after the corrections, this

figure changes very slightly to 1.582. When transformed to an odds ratio, the latter figure indicates that Black defendants were 4.86 times as likely as non-Black defendants to be sentenced to death. Table 1 below shows these results. The unaltered output associated with these analyses is shown beneath the table.[4]

Table 1. Revised Table 7 from *Updated Report* with Data Entry Errors Corrected and TR 34A Added: Impact of Case Characteristics and Defendant Race on Capital Sentencing Outcomes in Death Eligible Cases, December 1981 - May 2014

N= 77	Death Penalty Imposed			Pseudo R^2 = .2361
Variable	Coefficient	Exact P-Value	Odds Ratio	Referent (Compared to)
Prior Convictions (logged)	-0.091	.510	.913	
1 Victim	-0.722	.221	.486	Multiple victims
Aggravating Circumstances	0.630	.016	1.88**	
Mitigating Circumstances (logged)	-0.258	.089	.773*	
Defenses	-0.794	.034	.452**	
Victim Held Hostage	0.717	.222	2.05	Not held hostage
Black Defendant	1.582	.039	4.86**	Non-black

* significant at α = .10 ** significant at α = .05 *** significant at α = .01

UNALTERED STATISTICAL OUTPUT ASSOCIATED WITH TABLE 1: DATA ENTRY ERRORS CORRECTED AND TR 34A ADDED

```
logit DP_Sentence  lnPriors Vics_1Total AppliedAggCir_Num LnTotMitCircum Defenses_Num
Vics_AnyHostage D_RaceB , level(90) ;
Iteration 0:   log likelihood = -52.583924
Iteration 1:   log likelihood = -40.664023
Iteration 2:   log likelihood = -40.170014
Iteration 3:   log likelihood = -40.166274
Iteration 4:   log likelihood = -40.166273

Logistic regression                                     Number of obs   =         77
                                                        LR chi2(7)      =      24.84
                                                        Prob > chi2     =     0.0008
Log likelihood = -40.166273                             Pseudo R2       =     0.2361

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
         lnPriors |  -.0913328   .1385858    -0.66   0.510    -.3192863    .1366206
      Vics_1Total |  -.7215931   .5896597    -1.22   0.221    -1.691497    .2483108
AppliedAggCir_Num |   .6299845   .2624197     2.40   0.016     .1983425    1.061627
LnTotMitCircum    |  -.2575945   .1513135    -1.70   0.089     -.506483   -.0087059
     Defenses_Num |  -.7935932   .3740099    -2.12   0.034    -1.408785   -.1784016
  Vics_AnyHostage |   .7169782   .5866349     1.22   0.222    -.2479504    1.681907
          D_RaceB |   1.581795    .767834     2.06   0.039     .3188205     2.84477
            _cons |  -1.114036   .7731921    -1.44   0.150    -2.385824    .1577521
```

[4] Throughout this document, the output shown is unaltered other than the fact that significant findings have been bolded.

To be clear, these results show that Black defendants are 4.86 times as likely as other defendants to be sentenced to death after controlling for the other, legally relevant case characteristics included in the model. To put the magnitude of this effect in context, this means that the substantive impact of a defendant being Black on sentencing outcomes is greater than the impact of having four additional aggravating circumstances.[5] This finding regarding defendant race is significant at p=.039.

Please note that when re-analyzing data in response to subsequent interrogatories, we always use the updated data set that corrects all data entry errors.

Interrogatories 4-6

Are the following trial reports the reports that relate to the denominator of 14 black defendants in Table A of the *Response to Evaluation* at 16: Trial Reports 29, 77, 88, 119, 135, 157, 177, 180, 185, 186, 194, 216, 281, 312? If your response is "no," please list the trial reports that relate to this denominator.

Are the following trial reports the reports that relate to the denominator of 57 white defendants in Table A of the *Response to Evaluation* at 16: Trial Reports 2,3,7, 9, 15, 20, 23, 25, 26, 31, 34, 34a, 36, 39, 42, 43, 44, 45, 47, 48, 51, 52, 53, 56, 58, 62, 63, 64, 65, 66, 75, 76, 86, 92, 93, 95, 125, 132, 140, 144, 154, 164, 165, 167, 174, 175, 176, 182, 183, 184, 190, 220, 227, 251, 258, 303, 313? If your response is "no," please list the trial reports that relate to this denominator.

Are the following trial reports the reports that relate to the denominator of 1 "other race" defendants in Table A of the *Response to Evaluation* at 16: Trial Reports 8, 13, 14, 60, 158, 160, 181, 197, 224, and 256? If your response is "no," please list the trial reports that relate to this denominator.

In each of these interrogatories we were asked to confirm that the listed Trial Reports correspond to a specific group of defendants in our *Response to Evaluation*. In each case, we confirmed that this was the case. The answer to these questions is yes.

Interrogatories 7 and 8

Please indicate whether Trial Reports 92, 167, 182, and 224 were in fact included in the set of cases used to calculate the percentages of aggravated murder cases with special sentencing proceedings in which juries imposed a death sentence, by race of defendant. If these trial reports were included in this set of cases, please indicate whether you maintain they were properly included and, if so, the basis for this position.

[5] An odds ratio of 4.86 means that Black defendants are 386% more likely than non-Black defendants to be sentenced to death. An odds of ratio of 1.88 means that each additional aggravating circumstance increases the likelihood that a death sentence will be imposed by 88%. 386% divided by 88% = 4.4.

Please indicate whether cases that are the subject of Trial Reports 92, 167, 182, and 224 were or were not included in the regression analysis relating to special sentencing proceedings in which juries imposed a death sentence. If any of the cases that are the subject of these trial reports were included in the regression analyses, please explain the reasons for such inclusion.

Before answering the central question, we would like to clarify two issues. First TRs 92, 167, 182 and 224 *were* included in all of the regression analyses as well as in the descriptive analyses. By contrast, TRs 81, 152, and 153 were included in the descriptive and regression analyses of prosecutorial *filing* decisions, but excluded from the descriptive and regression analyses of *sentencing* decisions.

The principle that guided this decision is as follows: because our second set of analyses assesses whether race and other factors affect sentencing outcomes, we included all special sentencing proceedings regardless of whether a judge or jury served as the decision-maker in the proceeding. As we stated in our *Updated Report*, in most cases a jury served as the decision-maker, but in some, the defendant waived his or her right to a jury and the judge served as the decision-maker (see footnote 5, p. 19).

We included all special sentencing proceedings in our analyses of sentencing decisions because if a special sentencing proceeding occurred, a sentence of death *could* have been imposed by the judge or jury. The difference between the included and excluded cases is that in the former, a special sentencing proceeding actually occurred. Although it is true that in three of these four cases the prosecution stipulated during this proceeding that it could not prove beyond a reasonable doubt that there were not sufficient mitigating circumstances to warrant leniency, the death notices do not appear to have been withdrawn, special sentencing proceedings actually took place, and the judge, exercising independent judgment based upon the facts of the crime, could still have imposed a death sentence.

By contrast, in the excluded cases (TRs 81, 152 and 153), there was no evidence that a special sentencing proceeding actually occurred. Although the judge did enter a date of a special sentencing proceeding, it is clear that this was simply the date on which the sentence was imposed; no information about a special sentencing proceeding is provided. Instead, these trial reports indicate that there was a guilty plea with an agreement of a life without parole sentence, suggesting that the death notice had been withdrawn. It thus appears that in these cases, the defendant was sentenced for non-capital aggravated murder after offering a guilty plea based on an agreement of a life without parole sentence. In these cases, the judge was precluded from sentencing the defendant to death as a result of the structure of the plea deal. The judge would not have had the legal ability to weigh the facts of the crime and determine

whether death was appropriate. For this reason, these three cases were not included in our analyses of sentencing outcomes.[6]

Interrogatory 10

Do you maintain the accuracy of the description of Table 1 as showing the share of convictions that resulted in a death sentence? If yes, please explain.

Table 1 of our *Updated Report* shows the proportion of aggravated murder cases with death-eligible defendants in which a death sentence was sought and imposed, by county. As the title of this table and the surrounding discussion suggests, the unit of analysis is case, not conviction. We inadvertently used the word "conviction" in the penultimate sentence of p. 14 of the *Response to Evaluation* when discussing these findings; we should have used the word "case" or "proceeding" in this sentence. The title of the table and all other references to the table correctly identify the unit of analysis as "case," not conviction. The numbers shown in the table are correct.

Please note: We recognize that the term "case" has a specific legal meaning. However, in our analyses of sentencing outcomes, we use the word "case" to refer to our data points, namely, special sentencing proceedings.

Interrogatory 11

Is it correct that you added the "unknown" case to the numerator but mistakenly did not add it to the denominator? If no, please explain the basis for the numerator and denominator.

The Commissioner is correct: we added the case (i.e. proceeding) in which the race of defendant is unknown to the numerators but not the denominators in Table 2 of our *Updated Report*. Including this case in the denominator does not alter the percentages reported in the table. In the "death notice filed" column, adding this case to the denominator leads to a result of 28.96 percent, which would have been rounded to 29 percent, as is shown. In the "death penalty imposed" column, adding this proceeding to the denominator leads to a result of 11.78 percent, which would have been rounded to 12 percent, as is shown. Finally, adding this proceeding to the denominator in the "death penalty retained" column changes the result to 4.38 percent, which would have been rounded to 4 percent, as is shown.

This proceeding was also excluded from the figures presented in the bottom row of Table B of our *Response to Evaluation*, but again, including it does not meaningfully alter the results. Below, we first present Table B of the *Response to Evaluation*, then Table 2 which updates

[6] These three proceedings all involved white defendants who killed multiple victims.

these figures to include the omitted case and to reflect the data entry corrections. The figures that differ between Table B and Table 2 are bolded.

Table B. Comparison of Case Characteristics in Cases with Special Sentencing Proceedings, by Race of Defendant (From *Response to Evaluation*)

	Number of aggravating circumstances		Number of mitigating circumstances		Number of victims		Number of violent prior convictions		Victim held hostage	Total number of cases
	Mn	Md	Mn	Md	Mn	Md	Mn	Md	Percent	N
Black Defendants	2	1	2	2	1	1	2	2	42.9% (6/14)	14
Non-Black Defendants	2	2	2	2	2	1	1	1	**31.8% (21/66)**	67
White Defendants	3	2	**2**	2	2	1	1	1	35.1% (20/57)	57
Other Defendants	2	2	2	1	4	1	1	0	11.1% (1/9)	10
All Defendants	2	2	2	2	2	1	1	1	33.3% (27/81)	**81**

Notes: Mn represents mean (average); Md represents median (the typical value). Defendant race is unknown in one case; the number of defendants broken out by race is 81 although the total number of all defendants with death notices filed and special sentencing proceedings is 82. Here we refer to the number of aggravating circumstances found by the jury (as opposed to the number alleged by prosecutors). Information on whether the victim was held hostage was missing in one Trial Report (n=81).

Table 2. Comparison of Case Characteristics in Cases with Special Sentencing Proceedings, by Race of Defendant, Including Case with Racially Unidentified Defendant

	Number of aggravating circumstances		Number of mitigating circumstances		Number of victims		Number of violent prior convictions		Victim held hostage	Total number of cases
	Mn	Md	Mn	Md	Mn	Md	Mn	Md	Percent	N
Black Defendants	2	1	2	2	1	1	2	2	42.9% (6/14)	14
Non-Black Defendants	2	2	2	2	2	1	1	1	**31.3% (21/67)**	67
White Defendants	3	2	**3**	2	2	1	1	1	35.1% (20/57)	57
Other Defendants	2	2	2	1	4	1	1	0	11.1% (1/9)	10
All Defendants	2	2	2	2	2	1	1	1	33.3% (27/81)	**82**

Notes: See Table B notes above.

Interrogatory 13

Is the difference in the 85 cases used in the *Updated Report* at 21 and the 81 cases that comprise the denominators used in Table A in the Response to Evaluation at 16 due to the removal of Trial Reports 68, 152, 153, 217, and 308 and the addition of Trial Report 34A? If not, please explain.

Yes, the removal of TRs 68, 152, 153, 217 and 308, and the addition of TR 34A, explains the difference in the denominators in these documents.

Interrogatory 14

Please indicate whether you agree or disagree with the identification of the cases that are appropriately included in the calculations of the percentages. If you agree, please recalculate the resulting percentages. If you do not agree, please explain.

Yes, the cases that were included in Table A should have been included. However, we should not have specified in the title that the death sentence must have been imposed by a jury; it could have been imposed by either a judge or jury. The correct title of Table A is: *Percent of Special Sentencing Proceedings in which a Death Sentence was Imposed, by Race of Defendant.*

Interrogatory 15

Please list the trial report numbers of cases included in the "death penalty retained" column of Table 2 and further explain why the listed cases are considered "retained."

We included in the "retained" category any defendant sentenced to death under the current statute whose death sentence has not, to date, been reversed. This includes people who have been executed or who remain on death row. The list of such individuals is available through the Washington State Department of Corrections (DOC).[7]

At the time we accessed this information, a total of 13 individuals met these criteria. These included five people who have been executed: Cal Brown (TR 140, white); Charles Campbell (TR 9, white); Westley Dodd (TR 76, white); James Elledge (TR 183, white); and Jeremy Sagastegui (TR 160, other). They also included eight people who remain on death row: Dayva Cross (TR 220, white); Cecil Davis (TR 180, black); Clark Elmore (TR 165, white); Jonathan Gentry (TR 119, black); Allen Gregory (TR 216, black); Conner Schierman (TR 303, white); Byron Scherf (TR 313, white); Dwayne Woods (TR 177, black); and Robert Yates (TR 251, white). Because Mr. Woods died of a cardiac arrest while on death row in January of 2017, he no longer appears on the DOC list of people currently on death row.

[7] See http://www.doc.wa.gov/docs/publications/reports/100-SR001.pdf and http://www.doc.wa.gov/docs/publications/reports/100-SR002.pdf

Interrogatory 17

Please list the trial report numbers of cases included in the "death penalty retained" column of Table 3 and further explain why the listed cases are considered "retained."

We included in the "retained" category any defendant sentenced to death under the current statute whose death sentence has not, to date, been reversed (see our answer to Interrogatory 15). In Table 3 of our *Updated Report*, we included only cases that involved a single white or black victim, as described in the note that appears beneath the table. Of the 13 cases in the general retained category, we included five that involved a single black or white victim. These are: Elmore (TR 165), Gentry (TR 119), Gregory (TR 216), Elledge (TR 183) and Brown (TR 140). Scherf (TR 313) was incorrectly coded as not having the death penalty retained so was excluded from this table.

Adding TR 313 has no impact on the percentages shown in the table. Specifically, if we add this case (which involved a white defendant and a single white victim) to the figures reported in Table 3 of the *Updated Report*, we can calculate that the percentage of cases involving a white defendant and a single white victim for which the death penalty has been retained remains 3 (3.4) percent. It is also worth noting that "retained" status is not included in any of the regression analyses, so the regression results are also unaffected by the omission of Scherf (TR 313) from Table 3 of the *Updated Report*.

Interrogatory 19

What p-value results if the model reported in Table 7 of the *Updated Report* is run with the three coding errors corrected, the first sentencing proceedings reported in Trial Reports 7, 180, and 216 removed, and with the logarithmic transformations of variables set forth in the Response to Evaluation?

In these interrogatories, we are asked to report the p-values that result if the model described in Table 7 of the *Updated Report* is run with the three data entry errors corrected, TRs 7, 180 and 216 removed, and with the logarithmic transformation of variables described in our *Response to Evaluation*. In Interrogatory 20, we are asked to also include the case associated with TR 34A in this model.

To be clear, the results presented in our *Response to Evaluation* already reflect the correction of the three previously identified data entry errors, the logarithmic transformation of variables, and the proceeding associated with Trial Report 34A. It is our practice to always re-analyze data with corrections when data entry errors have been identified. It is also our practice to always perform appropriate transformations of variables.

We believe that excluding the proceedings described in TRs 7, 180 and 216, as suggested by Dr. Scurich, is highly improper for the reasons we articulated in our *Response to Evaluation* and are described below. Our analyses of sentencing outcomes are designed to assess whether race and other factors influence sentencing decisions in Washington State capital cases in which a death sentence may be imposed. The unit of analysis in these models is the sentencing proceeding, not the defendant. That is, each data point in the analysis represents a proceeding and associated decision – in this case, the decision to impose a sentence of death.

Intentionally excluding proceedings in which a death sentence could have been imposed from the analysis is improper, as the second trials of the defendants involved in TRs 7, 180 and 216 occurred substantially later than the first, involved different juries and, in two of the three instances, different case characteristics. As a result of these meaningful differences, the first and second proceedings could very well have resulted in a different sentencing outcome. In Mr. Gregory's case, for example, the number of mitigating circumstances and the number of prior convictions were different in the two proceedings. In addition, Mr. Gregory's special sentencing proceedings were separated by eleven years and involved different juries and defense attorneys (see TRs 216, 312). The characteristics associated with Mr. Davis' first and second special sentencing proceedings were also quite different: the two trials were separated by nine years, involved different juries and defense attorneys, and the number of prior convictions was different in the two proceedings (see TRs 180, 281).

Moreover, there is no rational basis for deciding which of a defendant's two special sentencing proceedings to include. Deciding to keep the first but exclude the second, or vice versa, would be arbitrary, but because the proceedings involve different characteristics, either decision could have an impact on the results.

Dr. Scurich suggested that including both the first and second cases of the three defendants who had two special sentencing proceedings violates the assumption that the cases included in the regression model are independent (see pp. 25-27 of his critique). Although it is true that a defendant's second special sentencing proceeding is not entirely independent of his or her first proceeding, it is also true that any proceedings adjudicated by the same judge, involving the same attorneys, or adjudicated in the same county also violate the assumption of independence. Nonetheless, as a practical matter, researchers using regression methods to analyze sentencing outcomes routinely include cases that involve the same judges, attorneys,

counties, and defendants in their analyses, and the results are often published in well-regarded, peer-reviewed journals.[8]

For all of these reasons, we strongly believe that it is highly inappropriate to remove these three proceedings from the analysis, just as it would be improper to exclude second proceedings (TRs 31, 281 and 312) and include only the first proceedings. It is also inappropriate to exclude the proceeding associated with TR 34A, which was included in the analyses presented in our *Response to Evaluation*, because TR 34A represents a completely different crime and jury proceeding than TR 34. Below, we exclude these cases despite these concerns in order to be responsive to the Commissioner's request. For reference, Table 1 of this document is copied below, which presents the results of the model that includes all relevant cases, including Trial Report 34A, the appropriate logarithmic transformation of variables is performed, and data entry errors have been corrected.

Table 1. Revised Table 7 from *Updated Report* with Data Entry Errors Corrected and TR 34A Added: Impact of Case Characteristics and Defendant Race on Capital Sentencing Outcomes in Death Eligible Cases, December 1981 - May 2014

N= 77	Death Penalty Imposed			Pseudo R^2 = .2361
Variable	Coefficient	Exact P-Value	Odds Ratio	Referent (Compared to)
Prior Convictions (logged)	-0.091	.510	.913	
1 Victim	-0.722	.221	.486	Multiple victims
Aggravating Circumstances	0.630	.016	1.88**	
Mitigating Circumstances (logged)	-0.258	.089	.773*	
Defenses	-0.794	.034	.452**	
Victim Held Hostage	0.717	.222	2.05	Not held hostage
Black Defendant	1.582	.039	4.86**	Non-black

* significant at α = .10 ** significant at α = .05 *** significant at α = .01

[8] For examples in which Washington State sentencing data are analyzed, and the sentencing outcome rather than the defendant is the unit of analysis, see Randy R. Gainey, Sara Steen and Rodney L. Engen, "Exercising Options: An Assessment of the Use of Alternative Sanctions for Drug Offenders", *Justice Quarterly* 22:4, 488-520 (2005); Rodney L. Engen, Randy R. Gainey, Robert D. Crutchfield, and Joseph G. Weis, "Discretion and Disparity Under Sentencing Guidelines," *Criminology* 41, 1: 99-130 (2003); Rodney L. Engen, "The Power to Punish: Discretion and Sentencing Reform in the War on Drugs," *American Journal of Sociology* 105, 5: 1357-1395 (2000); and Alexes Harris, Heather Evans and Katherine Beckett, "Courtesy Stigma and Monetary Sanctions: Toward a Socio-Cultural Theory of Punishment," *American Sociological Review* 76, 2: 234-64 (2011).

The Commissioner requests that we present this model without Trial Report 34A and removing three other relevant cases: Trial Reports 7, 180 and 216. The results are shown in Table 3 below. The unaltered statistical output appears beneath the table.

Table 3. Re-Run of Table D from *Response to Evaluation* (see notes for details)
Impact of Case Characteristics and Defendant Race on Capital Sentencing Outcomes in Cases with Special Sentencing Proceedings, December 1981 - May 2014

N= 73	Death Penalty Imposed			Pseudo R^2 = 0.2142 LR chi2(7) = 21.18 Prob > chi2 = 0.0035
Variable	Coefficient	Exact P-Value	Odds Ratio	90% Confidence Interval
Prior Convictions (ln)	-0.040	0.787	0.961	-.284, .204
1 Victim	-0.653	0.266	0.520	-1.62, .313
Aggravating Circumstances	0.568	0.028	1.764**	.144, .991
Mitigating Circumstances (ln)	-0.257	0.103	0.773	-.517, .003
Defenses	-0.706	0.059	0.494*	-1.32, -.091
Victim Held Hostage	0.739	0.209	2.094	-.228, 1.71
Black Defendant	1.392	0.075	4.022*	.104, 2.68

* significant at α = .10 ** significant at α = .05 *** significant at α = .01

Note: In this model, Trial Reports 7, 180, 216 and 34A were removed.

UNALTERED STATISTICAL OUTPUT ASSOCIATED WITH TABLE 3

```
logit DP_Sentence  lnPriors Vics_1Total  AppliedAggCir_Num  LnTotMitCircum
Defenses_Num  Vics_AnyHostage D_RaceB, level(90) ;

Iteration 0:   log likelihood = -49.436013
Iteration 1:   log likelihood = -39.188099
Iteration 2:   log likelihood = -38.849462
Iteration 3:   log likelihood = -38.847338
Iteration 4:   log likelihood = -38.847337

Logistic regression                                 Number of obs   =         73
                                                    LR chi2(7)      =      21.18
                                                    Prob > chi2     =     0.0035
Log likelihood = -38.847337                         Pseudo R2       =     0.2142

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
         lnPriors |  -.0401487   .1485276    -0.27   0.787    -.2844549    .2041574
      Vics_1Total |  -.6533524   .5876376    -1.11   0.266     -1.61993    .3132254
AppliedAggCir_Num |   .5676415   .2575915     2.20   0.028      .1439412    .9913417
   LnTotMitCircum |   -.257243   .1579313    -1.63   0.103    -.5170169    .0025309
     Defenses_Num |  -.7058531   .3736433    -1.89   0.059    -1.320442   -.0912646
  Vics_AnyHostage |   .7392167   .5882227     1.26   0.209    -.2283235    1.706757
          D_RaceB |   1.391851   .7827078     1.78   0.075     .1044113    2.679291
            _cons |  -1.135606   .7708462    -1.47   0.141    -2.403535    .1323229
```

Thus, when the three disputed cases and TR 34A are excluded, the results continue to indicate that the race of defendant has a substantial and statistically significant impact on sentencing outcomes. Specifically, removal of these cases reduces the coefficient for Black defendant modestly, from 1.58 to 1.39. When expressed as log odds, the latter indicates that Black defendants are 4.02 times as likely than non-Black defendants to be sentenced to death after controlling for the other variables in the model.

Removal of the disputed cases as well as TR 34A increases the p-value from .041 to .075, both of which indicate a statistically significant effect in the context of this study. As we have explained, the latter p-value (p= .075) does indicate a statistically significant relationship, as the appropriate alpha level in this study is .10 rather than .05. To reiterate, this is because the primary hypothesis being tested (i.e. that Black defendants are more likely to be sentenced to death than other, similarly situated defendants) is directional, and is therefore appropriately paired with an alpha level of .10.[9] The directionality of this hypothesis is grounded in the empirical record. As the literature review presented in our *Updated Report* shows, when studies find evidence that race matters, they find that a) Black/minority defendants are treated comparatively harshly; and/or that b) defendants convicted of killing White victims are treated comparatively harshly (see pp. 5-12). Recent studies of jury selection processes and decision-making dynamics provide additional evidence of these patterns.[10] Indeed, we are unaware of any studies in Washington State or the United States that show that White defendants or defendants convicted of killing people of color are treated comparatively harshly. As a result,

[9] Pillemer, David, *One-versus Two-Tailed Hypothesis Tests in Contemporary Educational Research*, EDUCATIONAL RESEARCHER, 20, 9: 13-17 (1991); Ringwalt, C., Paschall, M. J., Gorman, D., Derzon, J., & Kinlaw, A., *The use of one-versus two-tailed tests to evaluate prevention programs*, EVALUATION & THE HEALTH PROFESSIONS 34, 2: 135-150 (2011); Agresti, A. and B. Finlay, *One-sided alternative hypotheses*, STATISTICAL METHODS FOR THE SOCIAL SCIENCES (Upper Saddle, NJ: Prentice Hall, 1997, 3rd edition) at 165-166.

[10] See especially Jennifer L. Eberhardt, Paul G. Davies, Valerie J. Purdie-Vaughns & Sheri Lynn Johnson, *Looking Deathworthy: Perceived Stereotypicality of Black Defendants Predicts Capital-Sentencing Outcomes*, 17 PSYCHOLOGICAL SCIENCE 383 (2006); Phillip Atiba Goff, Jennifer L. Eberhardt, Melissa J. Williams & Matthew Christian Jackson, *Not Yet Human: Implicit Knowledge, Historical Dehumanization, and Contemporary Consequences*, 94 J. PERS. & SOC. PSYCHOL. 292 (2008); Radha Iyengar, *Who's the Fairest in the Land? Analysis of Judge and Jury Death Penalty Decisions*, 54 J. L. & ECON. 693, 695–96, 708 (2011); Justin D. Levinson, Robert J. Smith & Danielle M. Young, *Devaluing Death: An Empirical Study of Implicit Racial Bias on Jury-eligible Citizens in Six Death Penalty States*, 89 N.Y.U. L. REV. 513 (2014); Tara L. Mitchell, Ryann M. Haw, Jeffrey E. Pfeifer & Christian A. Meissner, *Racial Bias in Mock Juror Decision-Making: A Meta-Analytic Review of Defendant Treatment*, 29 LAW & HUMAN BEHAV. 621, 631 (2005); Mona Lynch & Craig Haney, *Looking Across the Empathic Divide: Racialized Decision Making on the Capital Jury*, 2011 MICH. ST. L. REV. 573 (2011); Mona Lynch & Craig Haney, *Emotion, Authority and Death: (Raced) Deliberations in Mock Capital Jury Deliberations*, 40 LAW & SOC. INQUIRY 377 (2015).

testing a directional hypothesis and the use of the p < .1 threshold is appropriate. Setting the alpha level at .10 is also standard practice in this area: studies of capital sentencing published in highly regarded and peer-reviewed journals include an alpha level of .10.[11] Because .075 is less than .10, this p-value indicates a statistically significant result.

To summarize, relevant cases should not be removed from the analysis. However, even when these four relevant trial reports are excluded, the findings continue to indicate that Black Defendants are four times as likely to receive the death penalty. The p-values also remain below the .10 threshold.

Interrogatory 20

What p-value results if the model reported in Table 7 of the *Updated Report* is run with the three coding errors corrected, the first sentencing proceedings reported in Trial Reports 7, 180, and 216 removed, Trial Report 34A added, and with the logarithmic transformations of variables set forth in the *Response to Evaluation*?

Please see our response to Interrogatory 19 regarding the propriety of excluding these three cases. We nevertheless comply with the Commissioner's request below.

When the three disputed cases are removed, TR 34A is included, and the appropriate logarithmic transformation of variables is conducted, the model results continue to indicate that the race of defendant has a substantial and statistically significant impact on sentencing outcomes (see Table 4 and associated output below). Specifically, removal of these three relevant cases reduces the coefficient for Black defendant modestly, from 1.58 to 1.44. When expressed as log odds, these results indicate Black defendants are 4.2 times as likely than non-Black defendants to be sentenced to death after controlling for the other variables in the model - despite the fact that two of the three excluded proceedings involved Black defendants who were sentenced to death. Removal of the disputed cases increases the p-value from .039 to .066, but both of these values indicate a statistically significant effect in the context of this study for the reasons described above.

[11] See, for example, David C. Baldus, Catherine M. Gross, George Woodworth and Richard Newell, *Racial Discrimination in the Administration of the Death Penalty: The Experience of the United States Armed Forces (1984-2005)*, JOURNAL OF CRIMINAL LAW & CRIMINOLOGY 101, 4: 1227-1336 (2012); John Donahue III, *Empirical Evaluation of the Connecticut Death Penalty System Since 1973: Are There Unlawful Racial, Gender and Geographic Disparities?* JOURNAL OF EMPIRICAL LEGAL STUDIES 11, 4: 637-96 (2014).

Table 4. Re-Run of Table D from *Response to Evaluation* (see notes for details)
Impact of Case Characteristics and Defendant Race on Capital Sentencing Outcomes in Cases with Special Sentencing Proceedings, December 1981 - May 2014

N= 74	Death Penalty Imposed			Pseudo R^2 = 0.2186 LR chi2(7) = 21.84 Prob > chi2 = 0.0027
Variable	Coefficient	Exact P-Value	Odds Ratio	90% Confidence Interval
Prior Convictions (ln)	-0.041	0.772	0.960	-.287, .203
1 Victim	-0.666	0.258	0.514	-1.63, .308
Aggravating Circumstances	0.582	0.024	1.79**	.162, 1.01
Mitigating Circumstances (ln)	-0.240	0.118	0.787	-.503, .009
Defenses	-0.747	0.044	0.474**	-1.34, -.125
Victim Held Hostage	0.754	0.200	2.13	-.218, 1.72
Black Defendant	1.44	0.066	4.21*	.142, 2.71

* significant at α = .10 ** significant at α = .05 *** significant at α = .01

Note: In this model, Trial Reports 7, 180, 216 were removed.

UNALTERED STATISTICAL OUTPUT ASSOCIATED WITH TABLE 4

```
Iteration 4:   log likelihood = -39.040982

Logistic regression                               Number of obs   =         74
                                                  LR chi2(7)      =      21.84
                                                  Prob > chi2     =     0.0027
Log likelihood = -39.040982                       Pseudo R2       =     0.2186

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
         lnPriors |  -.0412258   .1492527    -0.28   0.782    -.2867246    .2042731
      Vics_1Total |  -.6662877   .5885473    -1.13   0.258    -1.634362    .3017865
AppliedAggCir_Num |   .5823349    .258483     2.25   0.024     .1571682    1.007502
   LnTotMitCircum |  -.2398228   .1535997    -1.56   0.118    -.4924718    .0128263
     Defenses_Num |  -.7469499   .3710391    -2.01   0.044    -1.357255   -.1366449
  Vics_AnyHostage |   .7541935   .5890277     1.28   0.200    -.2146709    1.723058
          D_RaceB |   1.436577   .7811117     1.84   0.066     .1517627    2.721392
            _cons |   -1.15871   .7728872    -1.50   0.134    -2.429996    .1125764
```

To summarize, relevant cases should not be removed from the analysis. However, even when three or four relevant trial reports are excluded, the findings continue to indicate that Black defendants are at least four times as likely to receive the death penalty as non-Black defendants. The exact p-values also remain below the .10 threshold. Table 5 below summarizes these results.

Table 5. Summary: Results of Original Model and Two Variants Excluding Relevant Cases		
Cases Included	**Odds Ratio**	**Exact P-value**
All relevant TRs included (N=77)	4.9	0.039**
TRs 7, 180 and 216 excluded (N=74)	4.2	0.066*
TR 7, 180, 216 and 34A excluded (N=73)	4.0	.075*

* significant at α = .10 ** significant at α = .05 *** significant at α = .01

Note: Data entry errors have been corrected and the appropriate logarithmic transformations have been conducted in all of these models.

Interrogatory 23

Do you agree with the above general description of MLEs? If not, please indicate what corrections you would make in the description.

Yes, we are comfortable with the general description provided by the Commissioner of Maximum Likelihood Estimates (MLEs). We would, however, add some relevant context. The last sentence of the description provided by the Commissioner on p. 25 reads: "MLE procedures are generally used for larger datasets for the reason that chance variation may account for the distribution of the bulk of the data in a small dataset, in contrast to a large dataset where it is unlikely that the distribution of the bulk of the data is due to chance variation."

To clarify, all data sets, large or small, contain some systematic variation that can be explained and chance or random variation, which cannot. Random variation is different than sampling bias. If researchers draw a sample from the relevant population, they must address the possibility that the distribution of the data in the sample is not fully representative of the population they seek to understand. In this study, however, we are not analyzing a sample of Washington State capital cases. Instead, the data include *all* Washington State aggravated murder proceedings that took place from 1981 to May of 2014 for which trial reports are available. The data thus consist of the population of relevant proceedings rather than a sample of that population; sampling bias cannot account for the distribution of our data.

We used MLE procedures because MLE is an estimation method used for analyzing binary outcomes (e.g., death imposed vs. death not imposed.) In addition, the MLE equation is derived from the probability distribution of the dependent variable, producing a set of parameters for which the probability of the observed data is greatest. The benefit of this technique is that it produces estimates that tend toward the true values and uses the data most efficiently to do so. In statistical terms, MLE generates estimates that are consistent, asymptotically normal, and

asymptotically efficient.[12] These advantages are amplified when data sets are large, but also exist for smaller datasets.

One of the main concerns regarding analysis of small datasets is they may not have sufficient power to identify significant effects where they exist. Clearly, this is not a problem in this analysis. We consistently find, across many model variations, that Black defendants are four times as likely to be sentenced to death in Washington State as similarly situated non-Black defendants.

It is also important to ensure that the findings derived from smaller datasets are robust across numerous model specifications. By robust, we mean that the findings are similar across different model specifications. It is for this reason that we ran numerous models to ensure that the finding regarding the impact of defendant race is consistent rather than aberrational (see Appendix E of our *Updated Report*, pp. 78-89 of our *Response to Scurich,* and the findings reported in this document). The fact that the number of sentencing outcomes analyzed is relatively small also means that these results should be interpreted in conjunction with the descriptive findings. In this case, the descriptive results indicate that 38.8 percent of non-Black defendants, but 64.3 percent of Black defendants, were sentenced to death in special sentencing proceedings in which capital punishment could have been imposed by the judge or jury. The descriptive results also provide evidence that this large discrepancy is not a function of differences in case characteristics (see Table B on p. 17 of our *Response to Evaluation).*

Interrogatory 24

Does identifying and removing a data point that is an outlier address the extent to which chance variation accounts for the distribution of the remaining data for the purposes of MLEs? If yes, please explain.

No, outliers do not have a significant impact on the overall distribution of the data, although they may have an impact on the regression results.

To clarify, a data point may be an outlier with respect to a single variable or with respect a constellation of variables. Outliers with respect to a single variable are comparatively easy to detect. For example, by examining descriptive statistics for the full dataset, including minimum and maximum values, we determined that a handful of proceedings are outliers with respect to the number of victims (see our *Updated Report* at p. 19). In order to retain as complete a dataset as possible, we measured the number of victims in terms of three categories: one victim; two-four victims; or five or more victims. We also constructed a binary variable in which

[12] See Jeffrey Woolridge, INTRODUCTORY ECONOMETRICS: A MODERN APPROACH, 3rd Ed. Mason, Ohio: Thomson Higher Education, 2006, p. 586-594.

cases were coded as involving one or more than one victim. The use of these categories eliminated potential outliers with respect to number of victims.

Diagnostic tests are used to identify data points that are outliers with respect to a constellation of variables. As noted in our *Response to Evaluation*, use of these tests, including examination of Standardized Pearson Residuals, Deviance Residual, and leverage plots, indicated that one case in our dataset may have been an outlier (see fn. 91 on p. 51).[13]

However, removing this case (TR 31) from the analysis had little effect on the results. Specifically, after removing this case, the coefficient for Black defendant was 1.56 (meaning that Black defendants are 4.75 times as likely than non-Black defendants to be sentenced to death after controlling for the other variables in the model) with a p-value of 0.042 (see unaltered output below). When this case is included, the coefficient for Black defendant is 1.58 (meaning that Black defendants are 4.8 times as likely than non-Black defendants to be sentenced to death after controlling for the other variables in the model) with a p-value of 0.039 (see Table 1 of this document). All results presented in this and prior reports include this case.

OUTPUT AFTER DROPPING TR 31

```
logit DP_Sentence  lnPriors Vics_1Total AppliedAggCir_Num LnTotMitCircum
> Defenses_Num Vics_AnyHostage D_RaceB , level(90) ;

Iteration 0:   log likelihood = -51.727841
Iteration 1:   log likelihood = -39.757487
Iteration 2:   log likelihood = -39.344986
Iteration 3:   log likelihood =  -39.34175
Iteration 4:   log likelihood = -39.341749

Logistic regression                               Number of obs   =         76
                                                  LR chi2(7)      =      24.77
                                                  Prob > chi2     =     0.0008
Log likelihood = -39.341749                       Pseudo R2       =     0.2394

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
         lnPriors |  -.0377231   .1499017    -0.25   0.801    -.2842895    .2088433
      Vics_1Total |  -.6689286   .5932979    -1.13   0.260    -1.644817    .3069596
AppliedAggCir_Num |   .5891134   .2602286     2.26   0.024     .1610754    1.017151
   LnTotMitCircum |  -.2634829   .1508145    -1.75   0.081    -.5115507    -.015415
     Defenses_Num |  -.7721959   .3723614    -2.07   0.038    -1.384676    -.159716
  Vics_AnyHostage |   .7485637   .5888958     1.27   0.204    -.2200837    1.717211
          D_RaceB |   1.557717   .7665897     2.03   0.042     .2967894    2.818645
            _cons |  -1.152822   .7754773    -1.49   0.137    -2.428369    .1227246
```

[13] Out of an abundance of caution, we also assessed the impact of a small number of other data points that showed potential leverage or influence.

Interrogatory 25

Does testing for robustness address the degree to which chance variation accounts for the distribution of the data for purposes of MLEs? If yes, explain.

Robustness and chance variation are separate issues. The robustness of the results is a concern in all regression-based studies, but, as noted above, is of particular concern where datasets are small. As has been made evident, we conducted numerous analyses to ensure that the findings presented in our work are robust across many different model specifications.

Interrogatory 26

Please provide a full description of the methods and associated testing used in selecting which case characteristic variables to include or exclude in analyses of sentencing decisions and the results of such selection methods and testing. The description of methods and associated testing should include, but not be limited to, the variable Judge_ProlongedSuffInd.

In modeling both prosecutorial decisions to file a death notice and jury/judicial decisions to impose a death sentence, we adopted the following strategy: 1) test case characteristics, all but one of which are expected to impact case outcomes; 2) test social characteristics of the defendant found to be relevant in other death penalty studies; 3) test social characteristics of the victim(s) found to be relevant in other death penalty studies; and 4) test other social factors found to be relevant in other studies and that were consistently recorded in the trial reports. Our decisions about variable selection were also influenced by technical issues, including the limit to the number of variables that could be included in a given model at once, the results of diagnostic tests, and the results of sensitivity analyses.

When introducing new variables to the model, we employed a "stepwise" approach, adding one new variable at a time to a base model to examine differences in the results. We first included selected case characteristics to determine their impact, then examined the correlation matrix of these variables to check for potential collinearity. Next, we examined the distributions of each variable and assessed whether variable transformations resulted in improved fit of the data.

Below, we provide a narrative description of the methods and associated testing used in selecting which case characteristics to include in the analyses, and how to measure them, followed by the unaltered statistical output for these models. Because we understand this interrogatory to pertain to the process of selecting variables for the logistic regression models regarding sentencing decisions (as opposed to prosecutorial filing decisions), we focus on the former here. A guide for interpreting STATA output is available in our *Response to Evaluation* at 54-58.

The Model Building Process

After identifying eight main variables that captured potentially relevant case characteristics that would have been known by judges and jurors and for which sufficient data existed,[14] we began by testing a subset of these, consistent with the stepwise approach to model-building. These three variables include the number of aggravating circumstances found, the number of prior convictions, and the total number of mitigating circumstances. Two cases with missing information on prior convictions were dropped from this preliminary analysis, resulting in 80 observations. The output associated with this model appears below. Significant findings are highlighted.

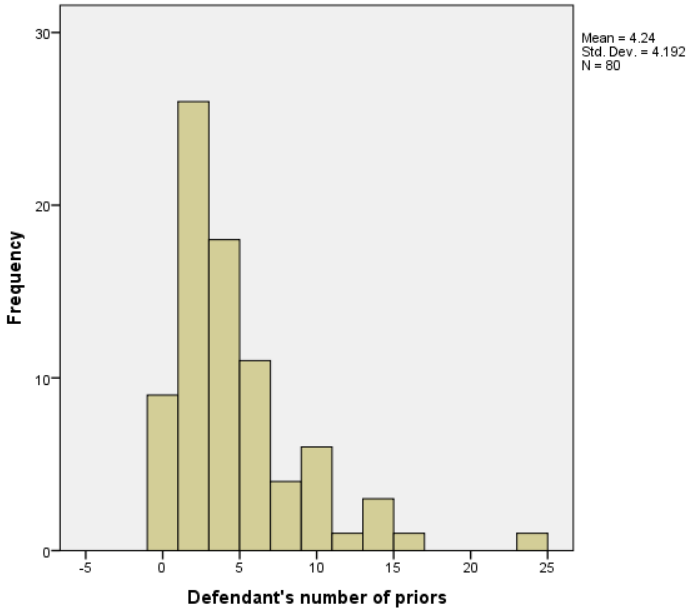
```
BASE MODEL OF CASE CHARACTERISTICS

logit DP_Sentence  Priors AppliedAggCir_Num TotMitCircum1, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -49.078276
Iteration 2:   log likelihood = -49.008453
Iteration 3:   log likelihood = -49.008331
Iteration 4:   log likelihood = -49.008331

Logistic regression                               Number of obs   =         80
                                                  LR chi2(3)      =      11.08
                                                  Prob > chi2     =     0.0113
Log likelihood = -49.008331                       Pseudo R2       =     0.1016

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
           Priors |   .0893749   .0605603     1.48   0.140    -.0102379    .1889876
AppliedAggCir_Num |   .3892101   .1828195     2.13   0.033     .0884989    .6899214
    TotMitCircum1 |  -.1152768   .1244844    -0.93   0.354    -.3200355    .0894818
            _cons |  -1.287502   .5817227    -2.21   0.027    -2.244351   -.3306532
```

In this model, only the number of aggravating circumstances is significantly associated with death sentences (p =.033) when these variables are included in their untransformed form.

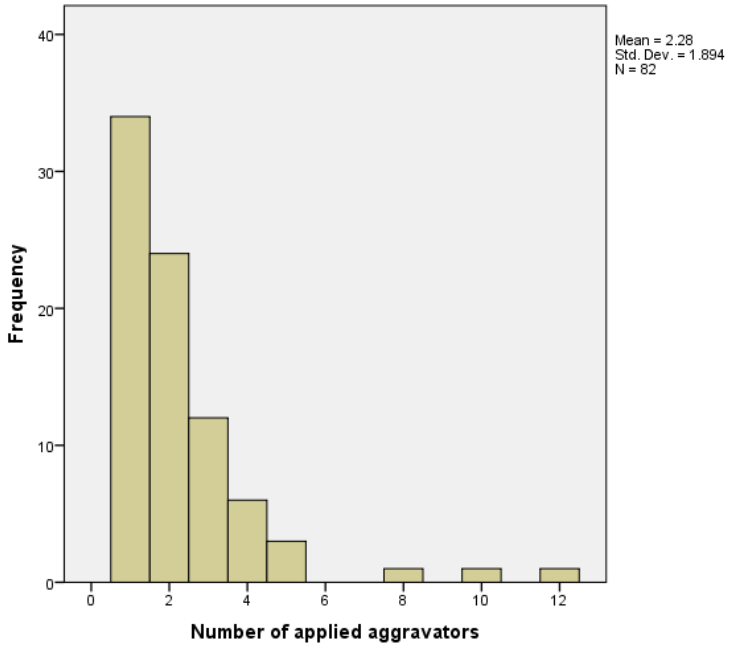
Next, we examined each of these variable's distribution in order to determine whether it was appropriate to transform them. Decisions regarding variable transformation are based on a number of factors, including the degree of skew, the range of values involved, issues of collinearity, and the degree to which transforming the variable improves model fit. Histograms for the three independent variables included in this model appear below.

[14] These include: the number of aggravating circumstances, mitigating circumstances, prior convictions, defenses, and victims; the nature of the defendant's plea; and two measures of victim suffering (victim held hostage and prolonged suffering).

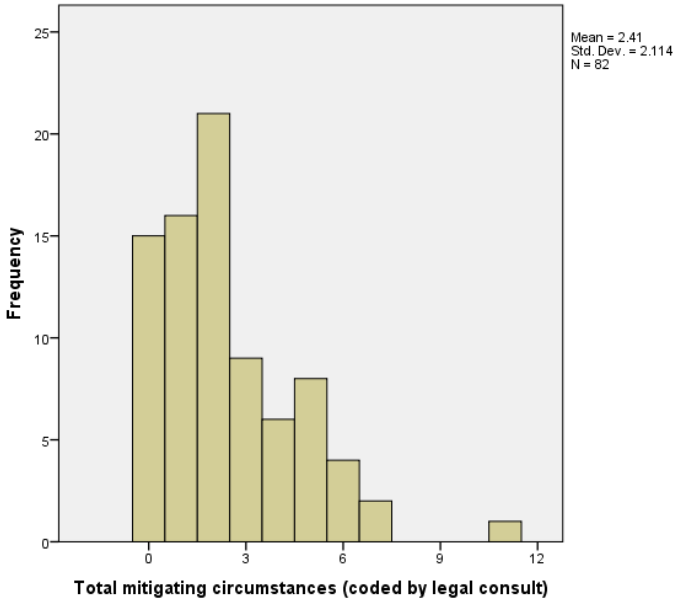
Histogram of Number of Prior Convictions: Skewed to the Right, Range = 0 - 25



Histogram of Number of Aggravating Circumstances: Skewed to the Right, Range = 1-12



Histogram of Number of Mitigating Circumstances: Skew to the Right, Range = 0 - 11



All three of these variables showed some signs of skew; we therefore tested a natural log transformation of these variables. In cases in which the associated defendant had zero prior convictions or mitigating circumstances, we added 0.001 to these zeroes, as is standard practice, and then calculated the natural log of the relevant variable.

We also assessed the collinearity among the transformed variables. A correlation matrix of the transformed variables appears below.

```
CORRELATION MATRIX

pwcorr DP_Sentence lnPriors LnAppliedAgg LnTotMitCircum, sig

             | DP_Sen~e lnPriors LnAppl~g LnTotM~m
-------------+------------------------------------
 DP_Sentence |   1.0000
             |
             |
    lnPriors |   0.1034   1.0000
             |   0.3612
             |
LnAppliedAgg |   0.2825   0.0967   1.0000
             |   0.0101   0.1034
             |
LnTotMitCi~m |  -0.2228  -0.0952  -0.0026   1.0000
             |   0.0442   0.3980   0.9815
```

Because the correlation matrix shows no significant correlation between these independent variables, we determined that all could be included in the same model. We tested each of the transformed variables in the model, including one at a time to see if inclusion of the

transformed version of the variable notably changed the results or improved model fit. The output associated with each of these three models appears below.

```
TESTING LOGGED PRIOR CONVICTIONS

logit DP_Sentence  lnPriors AppliedAggCir_Num TotMitCircum1, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -50.131102
Iteration 2:   log likelihood = -50.097959
Iteration 3:   log likelihood = -50.097926
Iteration 4:   log likelihood = -50.097926

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(3)      =       8.90
                                                        Prob > chi2     =     0.0306
Log likelihood = -50.097926                             Pseudo R2       =     0.0816

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
         lnPriors |   .0527723   .1232335     0.43   0.668    -.1499287    .2554734
AppliedAggCir_Num |   .4057318   .1881323     2.16   0.031     .0962817    .7151819
    TotMitCircum1 |  -.1200149   .1222348    -0.98   0.326    -.3210732    .0810434
            _cons |  -.9532644   .5259274    -1.81   0.070    -1.818338   -.0881907
```

The results indicate that number of prior convictions is not a significant predictor of death sentences in either its transformed or untransformed state. Because this variable's distribution does indicate significant skew, and involves relatively expansive range of values, we subsequently included the logged version of this variable.

```
TESTING LOGGED AGGRAVATING CIRCUMSTANCES

logit DP_Sentence  Priors LnAppliedAgg TotMitCircum1, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -49.724273
Iteration 2:   log likelihood = -49.711064
Iteration 3:   log likelihood = -49.711062

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(3)      =       9.67
                                                        Prob > chi2     =     0.0215
Log likelihood = -49.711062                             Pseudo R2       =     0.0887

------------------------------------------------------------------------------
  DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
--------------+-----------------------------------------------------------------
       Priors |   .0873797   .0609057     1.43   0.151    -.0128013    .1875607
 LnAppliedAgg |   .9048161   .4092111     2.21   0.027     .2317237    1.577909
TotMitCircum1 |  -.1220763   .1238665    -0.99   0.324    -.3258186     .081666
        _cons |  -.9676286   .5156375    -1.88   0.061    -1.815777   -.1194803
```

The number of aggravating circumstances is statistically significant when included as a logged variable and when untransformed. Since the distribution of this variable is only moderately

skewed, we decided to include the untransformed version because it allows for a more straightforward interpretation.

```
TESTING LOGGED MITIGATING CIRCUMSTANCES
logit DP_Sentence  Priors AppliedAggCir_Num LnTotMitCircum, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -47.660848
Iteration 2:   log likelihood = -47.509421
Iteration 3:   log likelihood = -47.509186
Iteration 4:   log likelihood = -47.509186

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(3)      =      14.08
                                                        Prob > chi2     =     0.0028
Log likelihood = -47.509186                             Pseudo R2       =     0.1290

------------------------------------------------------------------------------
 DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
-------------+----------------------------------------------------------------
      Priors |   .0926632   .0608088     1.52   0.128    -.0073584    .1926849
AppliedAggCir_Num |   .4230316   .2001541     2.11   0.035     .0938074    .7522559
LnTotMitCircum |  -.2210948   .1147082    -1.93   0.054    -.4097731   -.0324166
       _cons |   -1.67609   .5403908    -3.10   0.002    -2.564954   -.7872262
```

Mitigating circumstances showed signs of significant skew, and logging improves the model fit (i.e., with the correction to TR 25, the Pseudo R^2 increases from .1016 to .1290). We therefore used the logged version of this variable. Please note that the output shown above includes all data entry error corrections.

Our base model thus includes the logged number of prior convictions and mitigating circumstances as well as the (untransformed) number of aggravating circumstances.

```
BASE MODEL WITH CASE CHARACTERISTICS (MODEL A)

logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -48.797886
Iteration 2:   log likelihood = -48.691842
Iteration 3:   log likelihood = -48.691734
Iteration 4:   log likelihood = -48.691734

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(3)      =      11.71
                                                        Prob > chi2     =     0.0084
Log likelihood = -48.691734                             Pseudo R2       =     0.1074

------------------------------------------------------------------------------
 DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
-------------+----------------------------------------------------------------
     lnPriors |    .047665   .1249077     0.38   0.703    -.1577899    .2531199
AppliedAggCir_Num |   .4474499   .2048967     2.18   0.029     .1104248    .7844749
LnTotMitCircum |  -.2171533    .113546    -1.91   0.056    -.4039198   -.0303868
       _cons |   -1.35109   .4924975    -2.74   0.006    -2.161176   -.5410038
```

We next assessed the possibility that while the total number of prior convictions is not a significant predictor of sentencing outcomes, the number of specific types of prior convictions might be. The trial reports contain information regarding prior convictions for homicide as well as violent and sex offenses. These variables are also skewed. We tested transformations of these variables. The correlation matrixes for types of prior convictions before and after logarithmic transformation appear below.

CORRELATION MATRICES

```
pwcorr DP_Sentence Priors D_PriorsHomicide D_PriorsViolent D_PriorsSex , sig

             | DP_Sen~e   Priors D_Prio~e D_Prio~t D_Prio~x
-------------+---------------------------------------------
 DP_Sentence |   1.0000
             |
             |
      Priors |   0.1998   1.0000
             |   0.0755
             |
D_PriorsHo~e |   0.1427   0.2325   1.0000
             |   0.2065   0.0001
             |
D_PriorsVi~t |   0.2243   0.5625   0.5278   1.0000
             |   0.0455   0.0000   0.0000
             |
 D_PriorsSex |   0.1560   0.1171  -0.0132   0.2278   1.0000
             |   0.1670   0.0486   0.8248   0.0001
             |

. pwcorr DP_Sentence lnPriors lnHomocidePriors lnViolentPriors lnSexPriors , sig

             | DP_Sen~e lnPriors lnHomo~s lnViol~s lnSexP~s
-------------+---------------------------------------------
 DP_Sentence |   1.0000
             |
             |
    lnPriors |   0.1034   1.0000
             |   0.3612
             |
lnHomocide~s |   0.1612   0.1514   1.0000
             |   0.1531   0.0106
             |
lnViolentP~s |   0.0629   0.5431   0.2249   1.0000
             |   0.5795   0.0000   0.0001
             |
 lnSexPriors |   0.1094   0.2022  -0.0021   0.2607   1.0000
             |   0.3341   0.0006   0.9713   0.0000
```

As is shown above, the number of prior convictions is significantly correlated with the number of prior homicide, violent, and sex offense convictions at high levels. Moreover, the strength of correlations is relatively high. This collinearity exists regardless of whether these variables are transformed. This indicates that only one of these variables should be included in the model at a time.

We assessed whether the number of prior violent convictions is a significant predictor of sentencing outcomes. For reference, we first provide the output obtained when total prior convictions is included, then show the results obtained when the number of prior violent, homicide and sex convictions is included.

MODEL A USING LOGGED NUMBER OF (ALL) PRIOR CONVICTIONS

```
logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -48.797886
Iteration 2:   log likelihood = -48.691842
Iteration 3:   log likelihood = -48.691734
Iteration 4:   log likelihood = -48.691734

Logistic regression                               Number of obs   =         80
                                                  LR chi2(3)      =      11.71
                                                  Prob > chi2     =     0.0084
Log likelihood = -48.691734                       Pseudo R2       =     0.1074

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
         lnPriors |    .047665   .1249077     0.38   0.703    -.1577899    .2531199
AppliedAggCir_Num |   .4474499   .2048967     2.18   0.029     .1104248    .7844749
   LnTotMitCircum |  -.2171533    .113546    -1.91   0.056    -.4039198   -.0303868
            _cons |   -1.35109   .4924975    -2.74   0.006    -2.161176   -.5410038
```

MODEL A USING LOGGED NUMBER OF VIOLENT PRIOR CONVICTIONS

```
logit DP_Sentence  lnViolentPriors AppliedAggCir_Num LnTotMitCircum, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -48.842185
Iteration 2:   log likelihood =  -48.73727
Iteration 3:   log likelihood =  -48.73718
Iteration 4:   log likelihood =  -48.73718

Logistic regression                               Number of obs   =         80
                                                  LR chi2(3)      =      11.62
                                                  Prob > chi2     =     0.0088
Log likelihood =  -48.73718                       Pseudo R2       =     0.1065

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
  lnViolentPriors |   .0224711   .0936624     0.24   0.810    -.1315899    .1765321
AppliedAggCir_Num |   .4549994   .2034407     2.24   0.025     .1203692    .7896296
   LnTotMitCircum |  -.2169371   .1141925    -1.90   0.057     -.404767   -.0291072
            _cons |  -1.298301   .5339382    -2.43   0.015    -2.176551   -.4200508
------------------------------------------------------------------------------
```

MODEL A USING LOGGED NUMBER OF HOMICIDE PRIOR CONVICTIONS

```
logit DP_Sentence  lnHomocidePriors AppliedAggCir_Num LnTotMitCircum, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -48.287297
Iteration 2:   log likelihood = -48.165373
Iteration 3:   log likelihood =  -48.16411
Iteration 4:   log likelihood = -48.164109

Logistic regression                               Number of obs   =         80
                                                  LR chi2(3)      =      12.77
                                                  Prob > chi2     =     0.0052
Log likelihood = -48.164109                       Pseudo R2       =     0.1170

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
 lnHomocidePriors |   .2406648   .2409062     1.00   0.318    -.1555906    .6369202
AppliedAggCir_Num |   .4577821   .2012391     2.27   0.023     .1267733    .7887909
   LnTotMitCircum |   -.186735   .1181576    -1.58   0.114    -.3810869    .0076169
            _cons |  -.2965373   1.167782    -0.25   0.800    -2.217368    1.624293
------------------------------------------------------------------------------
```

MODEL A USING LOGGED NUMBER OF SEX PRIOR CONVICTIONS

```
logit DP_Sentence  lnSexPriors AppliedAggCir_Num LnTotMitCircum, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -48.857738
Iteration 2:   log likelihood = -48.757666
Iteration 3:   log likelihood =  -48.75757
Iteration 4:   log likelihood =  -48.75757

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(3)      =      11.58
                                                        Prob > chi2     =     0.0090
Log likelihood =  -48.75757                             Pseudo R2       =     0.1062

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
      lnSexPriors |   .0196884   .1521259     0.13   0.897    -.2305366    .2699133
AppliedAggCir_Num |   .4540187   .2076052     2.19   0.029     .1125386    .7954989
   LnTotMitCircum |  -.2187364   .1144848    -1.91   0.056    -.4070471   -.0304257
            _cons |  -1.258491   .8517008    -1.48   0.140    -2.659414    .1424323
```

Because the logged number of violent, homicide, or sex prior convictions are not significant predictors of sentencing outcomes, we determined that controlling for criminal history using the total number of prior convictions is most appropriate as it provides the most comprehensive measure of prior criminal involvement.

We then began to test other case characteristics that would have been known to juries and/or judges. These include: the nature of the defendant's plea (guilty vs. not guilty), the number of defenses offered, and the number of victims.[15] We examined the correlation matrices of these case characteristics as a set (see below).

[15] There are no cases in which there is missing information on the number of victims, number of aggravating circumstances found, or the defendant's plea. Two cases do not have information on the number of prior convictions.

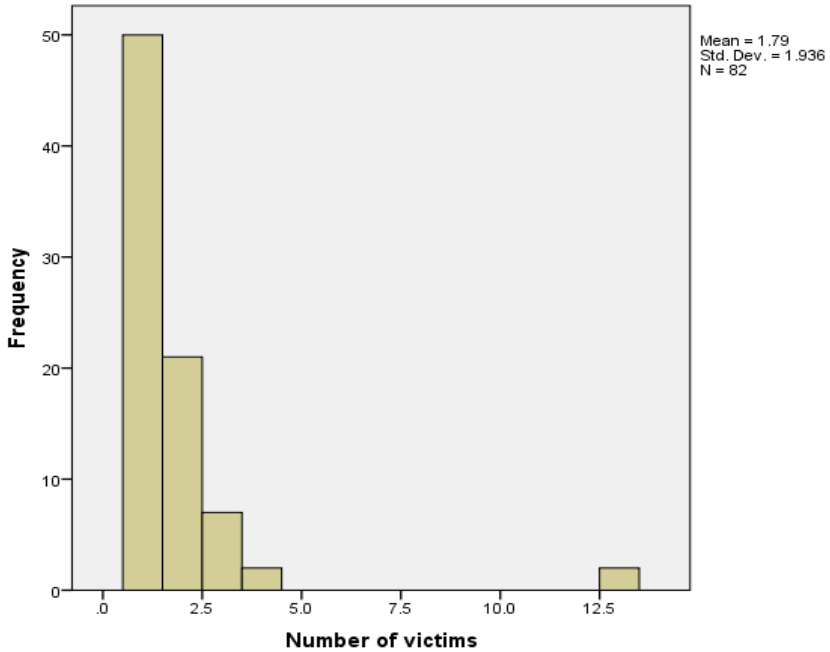
CORRELATION MATRIX

```
pwcorr DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum Defenses_Num Vics_Num,
sig
             | DP_Sen~e lnPriors Applie~m LnTotM~m Defens~m Vics_Num
-------------+------------------------------------------------------
 DP_Sentence |   1.0000
             |
             |
    lnPriors |   0.1034   1.0000
             |   0.3612
             |
AppliedAgg~m |   0.2906   0.1130   1.0000
             |   0.0081   0.0567
             |
LnTotMitCi~m |  -0.2228  -0.0952  -0.0750   1.0000
             |   0.0442   0.3980   0.5001
             |
Defenses_Num |  -0.2284  -0.1112   0.0327   0.1879   1.0000
             |   0.0403   0.0671   0.5826   0.0909
             |
    Vics_Num |   0.1002  -0.0318   0.0196   0.0650  -0.0334   1.0000
             |   0.3702   0.5932   0.7361   0.5596   0.5752
```

The correlation matrix indicates very modest correlation between number of defenses and mitigating circumstances (correlation coefficient = .1879) and number of defenses and logged number of priors (correlation coefficient= -.1112). This level of correlation does not pose a problem for including all three variables in the same model.

We also tested whether the number of victims impacts sentencing decisions.

Histogram of Number of Victims, Skew to the Right, Range 1-13



In addition to being skewed to the right, the minimum number of victims is 1 with a maximum of 13 and a mean of 1.94. This indicates that there are a small number of outliers with values that are extreme compared to the other observations. Over one-half (61%) of proceedings involve only one victim and the vast majority (86.6%) include one or two victims.

Vics_Num Number of victims

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	50	61.0	61.0	61.0
	2	21	25.6	25.6	86.6
	3	7	8.5	8.5	95.1
	4	2	2.4	2.4	97.6
	13	2	2.4	2.4	100.0
	Total	82	100.0	100.0	

Based on this information, and to avoid unnecessarily dropping cases, we transformed the number of victims into an ordinal variable with three categories: 1) Vics_1Total, 2) Vics_2-4Total, 3) Vics_5PlusTotal. Because just over one-half of the cases involve only one victim, we also created a binary variable: 1) Vics_1Total and 2) Morethan1VicTotal.

Regression results testing these two alternative measures appear below.

MODEL B INLCUDING NUMBER OF VICTIMS AS THREE CATEGORIES: 1 VICTIM, 2-4 VICTIMS, 5+ VICTIMS

```
logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum Vics_1Total
Vics_2_4Total, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -48.173443
Iteration 2:   log likelihood = -48.055823
Iteration 3:   log likelihood = -48.055641
Iteration 4:   log likelihood = -48.055641

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(5)      =      12.99
                                                        Prob > chi2     =     0.0235
Log likelihood = -48.055641                             Pseudo R2       =     0.1190

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
        lnPriors |   .0811414   .1318695     0.62   0.538    -.1357647    .2980474
AppliedAggCir_Num |    .413191   .2102976     1.96   0.049     .0672823    .7590997
   LnTotMitCircum |  -.2442835   .1188293    -2.06   0.040    -.4397403   -.0488266
      Vics_1Total |  -1.048636   1.514604    -0.69   0.489    -3.539939    1.442666
    Vics_2_4Total |  -.5037135   1.516274    -0.33   0.740    -2.997762    1.990335
            _cons |  -.4691061   1.516853    -0.31   0.757    -2.964108    2.025896
```

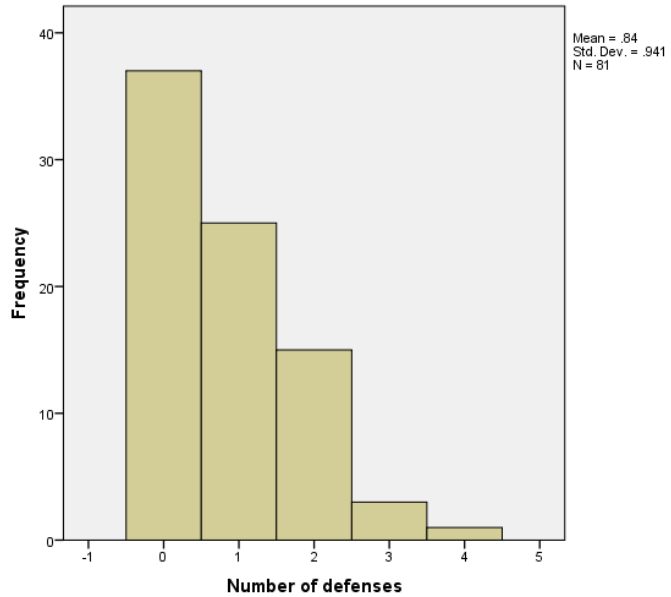
MODEL B INLCUDING NUMBER OF VICTIMS AS TWO CATEGORIES: 1 VICTIM, MULTIPLE VICTIMS

```
logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum Vics_1Total , level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -48.227205
Iteration 2:   log likelihood = -48.110674
Iteration 3:   log likelihood = -48.110491
Iteration 4:   log likelihood = -48.110491

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(4)      =      12.88
                                                        Prob > chi2     =     0.0119
Log likelihood = -48.110491                             Pseudo R2       =     0.1180

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
         lnPriors |   .0714309   .1275776     0.56   0.576    -.1384155    .2812774
AppliedAggCir_Num |   .4123641    .210538     1.96   0.050     .0660599    .7586682
   LnTotMitCircum |   -.244045   .1188967    -2.05   0.040    -.4396128   -.0484773
      Vics_1Total |  -.5777524   .5374276    -1.08   0.282    -1.461742    .3062374
            _cons |  -.9296028   .6209588    -1.50   0.134    -1.950989    .0917835
------------------------------------------------------------------------------
```

As this output shows, the number of victims (measured two different ways) is not a significant predictor of death sentences. For ease of interpretation, we include the number of victims as the binary variable in the model.

We then tested in a step-wise fashion the impact of other case characteristics, including the number of defenses and whether the defendant pled guilty, on sentencing outcomes.

Histogram of Number of Defenses, Mild Skew to the Right, Range = 0-4



Defenses_Num Number of defenses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	37	45.1	45.7	45.7
	1	25	30.5	30.9	76.5
	2	15	18.3	18.5	95.1
	3	3	3.7	3.7	98.8
	4	1	1.2	1.2	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

The variable number of defenses shows modest skew to the right, but has a limited range (minimum of 0, max of 4) with 98.8% of the observations between 0 and 3. This indicates that variable transformation is not necessary.

Information on number of defenses is missing for one case, reducing the total number of cases analyzed to 79.

```
MODEL C ADDING NUMBER OF DEFENSES

logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum Vics_1Total
> Defenses_Num, level(90) ;

Iteration 0:   log likelihood = -53.684127
Iteration 1:   log likelihood = -45.100595
Iteration 2:   log likelihood = -44.930182
Iteration 3:   log likelihood = -44.929614
Iteration 4:   log likelihood = -44.929614

Logistic regression                               Number of obs   =         79
                                                  LR chi2(5)      =      17.51
                                                  Prob > chi2     =     0.0036
Log likelihood = -44.929614                       Pseudo R2       =     0.1631

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
         lnPriors |   .0247077   .1297988     0.19   0.849    -.1887923    .2382076
AppliedAggCir_Num |   .5001099   .2298201     2.18   0.030     .1220895    .8781303
   LnTotMitCircum |  -.2387313   .1256659    -1.90   0.057    -.4454332   -.0320293
      Vics_1Total |  -.6274877   .5574814    -1.13   0.260    -1.544463    .2894875
     Defenses_Num |  -.6099021   .3238293    -1.88   0.060    -1.142554   -.0772502
            _cons |   -.627894   .6594722    -0.95   0.341    -1.712629    .4568411
```

And here is the output after information regarding the nature of the plea is added to the model.

```
MODEL D ADDING NATURE OF PLEA

logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum Vics_1Total Defenses_Num
Plea_Guilty, level(90) ;

Iteration 0:   log likelihood = -53.684127
Iteration 1:   log likelihood = -44.461162
Iteration 2:   log likelihood = -44.280709
Iteration 3:   log likelihood = -44.279615
Iteration 4:   log likelihood = -44.279615

Logistic regression                                     Number of obs   =         79
                                                        LR chi2(6)      =      18.81
                                                        Prob > chi2     =     0.0045
Log likelihood = -44.279615                             Pseudo R2       =     0.1752

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
         lnPriors |   .0298853   .1290122     0.23   0.817    -.1823209    .2420915
AppliedAggCir_Num |   .4795732   .2294081     2.09   0.037     .1022304     .856916
   LnTotMitCircum |  -.2411986   .1261485    -1.91   0.056    -.4486945   -.0337027
      Vics_1Total |  -.6413235   .5603693    -1.14   0.252    -1.563049     .280402
     Defenses_Num |  -.7723393   .3619775    -2.13   0.033    -1.367739   -.1769393
      Plea_Guilty |  -.8148265   .7248246    -1.12   0.261    -2.007057    .3774039
            _cons |  -.3048369   .7205419    -0.42   0.672    -1.490023    .8803491
```

As this output shows, the number of defenses is a significant predictor of a death sentence: each additional defense is associated with a decrease in the likelihood of receiving a death sentence. However, the nature of defendants' pleas does not appear to be significantly correlated with death sentences when controlling for other variables in the model.

Including these latter two variables does not dramatically impact other relationships in the model: the magnitude, direction, and significance of aggravating circumstances and number of defenses remain consistent across models. The (logged) number of mitigating circumstances consistently has a negative impact on sentencing outcomes; this effect is significant in most models. The consistency of these findings across a variety of models strengthen our confidence in these findings.

Two Measures of Victim Suffering: Victim Held Hostage and Prolonged Suffering

It is conceivable that judges and juries are more likely to impose death sentences when the crime is especially heinous. The model described above includes two measures of heinousness: the number of victims and aggravating circumstances. There were two other potential indicators of heinousness, and, specifically, victim suffering, that might have been included in the analyses. First, the trial reports prompt judges to indicate whether a victim was held

hostage, which undoubtedly compounds the suffering of the victim.[16] The trial reports list two boxes labeled "Yes" or "No" for the judges to check.

Vics_AnyHostage Any victim held hostage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 no	54	65.9	66.7	66.7
	1 yes	27	32.9	33.3	100.0
	Total	81	98.8	100.0	
Missing	999	1	1.2		
Total		82	100.0		

A second option was to create a measure of suffering from Part (4)(h) of the trial report. Part (4)(h) states: "Please describe the nature and extent of any physical harm or torture inflicted upon the victim prior to death." This question is not phrased as a yes or no question, but rather as an open-ended, compound question in which judges were invited to describe any physical harm *or* torture that occurred.

In an effort to create an additional measure of victim suffering, and in the absence of "yes" and "no" boxes, the protocol instructed coders as follows (from the Codebook at 71):

116: Victim(s): *Prolonged suffering*: does the description of the murder indicate that one or more of the victim's suffering was prolonged or allowed to endure over time?

a. Enter 0 for no.
b. Enter 1 for yes.

Per these instructions, coders entered a 0 when judges provided no description of physical harm or torture or when the description provided did not indicate that the victim's suffering was prolonged; coders entered a 1 when judges indicated a victim's suffering was endured over a prolonged period of time.

In retrospect, the coding protocol did not capture the compound nature of the question as it appears on the trial report. In addition, the coding protocol did not provide sufficient guidance to coders for determining what constitutes "prolonged." As a result, we did not see this variable as the most reliable measure of victim suffering. Although we did test Prolonged Suffering in the model including only case characteristics, we chose to include Victim Held Hostage as our measure of victim suffering in the models we presented because we have greater confidence in

[16] Part (4)(g) reads: "Was the victim held hostage during the crime?"

this measure. However, in light of the Commissioner's question about the prolonged suffering variable, we present analyses including each of these two measures of victim suffering below.

Below, the output shows that neither measure of victim suffering has a statistically significant impact on sentencing outcomes in capital cases. The number of aggravating circumstances and defenses, and the (logged) number of mitigating circumstances continue to be significant predictors of sentencing outcomes when Victim Held Hostage is added to the model.

MODEL E ADDING VICTIM HELD HOSTAGE

```
logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum Vics_1Total Defenses_Num
Plea_Guilty Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood = -53.138727
Iteration 1:   log likelihood = -42.747574
Iteration 2:   log likelihood = -42.426599
Iteration 3:   log likelihood =  -42.42515
Iteration 4:   log likelihood =  -42.42515

Logistic regression                               Number of obs   =         78
                                                  LR chi2(7)      =      21.43
                                                  Prob > chi2     =     0.0032
Log likelihood =  -42.42515                       Pseudo R2       =     0.2016

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
         lnPriors |  -.0454251    .137801    -0.33   0.742    -.2720876    .1812375
AppliedAggCir_Num |   .5196788   .2425385     2.14   0.032     .1207384    .9186192
   LnTotMitCircum |  -.2976283   .1392095    -2.14   0.033    -.5266075   -.0686491
      Vics_1Total |  -.6346856   .5725699    -1.11   0.268    -1.576479     .307108
     Defenses_Num |  -.7950692   .3715923    -2.14   0.032    -1.406284   -.1838542
      Plea_Guilty |  -.6789026   .7613904    -0.89   0.373    -1.931278    .5734731
  Vics_AnyHostage |   .8627311   .5715877     1.51   0.131     -.077447    1.802909
            _cons |  -.6152901   .7579476    -0.81   0.417    -1.862003    .6314228
```

MODEL F SUBSTITUTING PROLONGED SUFFERING FOR VICTIM HELD HOSTAGE

```
logit DP_Sentence  lnPriors AppliedAggCir_Num LnTotMitCircum Vics_1Total Defenses_Num
Plea_Guilty Judge_ProlongSuffInd, level(90) ;

Iteration 0:   log likelihood = -53.684127
Iteration 1:   log likelihood = -42.982838
Iteration 2:   log likelihood = -42.746661
Iteration 3:   log likelihood = -42.745544
Iteration 4:   log likelihood = -42.745544

Logistic regression                                     Number of obs   =         79
                                                        LR chi2(7)      =      21.88
                                                        Prob > chi2     =     0.0027
Log likelihood = -42.745544                             Pseudo R2       =     0.2038

------------------------------------------------------------------------------
         DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
---------------------+--------------------------------------------------------------
           lnPriors |  -.0075088   .1324349    -0.06   0.955    -.2253448    .2103272
  AppliedAggCir_Num |   .5015173   .2391731     2.10   0.036     .1081125    .8949221
     LnTotMitCircum |  -.2389256   .1340487    -1.78   0.075     -.459416   -.0184352
        Vics_1Total |   -.679632   .5728606    -1.19   0.235    -1.621904    .2626398
       Defenses_Num |  -.8678216   .3771392    -2.30   0.021     -1.48816   -.2474828
         Plea_Guilty |  -.7875189   .736982     -1.07   0.285    -1.999746    .4247087
Judge_ProlongSuffInd |   1.379501   .9385685     1.46   0.144     .0378586    2.721143
               _cons |  -.4310373   .7352897    -0.59   0.558    -1.640481    .7784066
```

As shown above, neither measure of victim suffering is a significant predictor of sentencing outcomes (p-values = .131 and .144). In addition, neither measure has a substantive impact on the coefficients and significance of other independent variables included in the model. The number of aggravating circumstances continues to have a significant, positive association with the imposition of death sentences in either case, and the number of mitigating circumstances and defenses continue to have a significant, negative association with death sentences.

Table 6 below displays a summary of the models discussed above, listing the number of cases included, the model fit metrics, odds ratios, and exact p-values of the variables included.

Table 6. Summary of Models with Case Characteristics						
	Model A Base Model	**Model B**	**Model C**	**Model D**	**Model E**	**Model F**
N	80	80	79	79	78	79
Prob > chi2	.0084	.0119	.0036	.0045	.0032	.0027
Pseudo R2	.1074	.1180	.1631	.1752	.2016	.2038
	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)
Number of Prior Convictions (logged)	1.05 (0.703)	1.07 (0.576)	1.03 (0.849)	1.03 (0.817)	.956 (0.742)	.993 (0.955)
Number of Aggravating Circumstances	**1.56 (0.029)**	**1.51 (0.050)**	**1.65 (0.030)**	**1.62 (0.037)**	**1.68 (0.032)**	**1.65 (0.036)**
Number of Mitigating Circumstances (logged)	**0.805 (0.056)**	**.783 (0.040)**	**.788 (0.053)**	**.786 (0.056)**	**.743 (0.033)**	**.787 (0.075)**
1 Victim (referent: more than 1 victim)		.56 (0.282)	.534 (0.260)	.527 (0.252)	.530 (0.268)	.507 (0.235)
Number of Defenses			**.543 (0.060)**	**.462 (0.033)**	**.452 (0.032)**	**.420 (0.021)**
Pled Guilty (referent: plead not guilty)				.443 (0.261)	.507 (0.373)	.455 (0.285)
Victim Held Hostage					2.37 (0.131)	
Prolonged Suffering Indicated by the Judge						3.97 (0.144)

Notes: All statistically significant results are bolded. Odds Ratio = 1 indicates no effect; Odds Ratio < 1 indicates a negative effect; Odds Ratio > 1 indicates positive effect.

In this table, all statistically significant results are bolded. The results show that the number of aggravating circumstances, mitigating circumstances, and defenses consistently reach significance at an alpha level of .10. That is, these findings are robust across numerous model specifications.

Given the small number (82, with several dropped due to missing data) of cases in the population under study, it is inappropriate to include more than seven variables in our models at once. In order to test whether race of the defendant or other factors significantly predict death sentences, a model with fewer variables or a more parsimonious version of the base model must be established.

Establishing a Model that Controls for All Relevant Case Characteristics

Given the consistency of the finding that the number of aggravating circumstances, mitigating circumstances, and defenses are significantly correlated with death sentence, these variables should be included in the control model for testing other variables. We next test to see if the relationships among the other four independent variables change when they are substituted out for each other while also including some measure of victim suffering.

First, we test the significance of guilty pleas when including the two different measures of victim suffering. The output appears below.

```
MODEL G INCLUDING PLEA AND VICTIM HELD HOSTAGE

logit DP_Sentence AppliedAggCir_Num LnTotMitCircum Defenses_Num Plea_Guilty
Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood = -43.980881
Iteration 2:   log likelihood = -43.709737
Iteration 3:   log likelihood = -43.708796
Iteration 4:   log likelihood = -43.708796

Logistic regression                               Number of obs   =         80
                                                  LR chi2(5)      =      21.68
                                                  Prob > chi2     =     0.0006
Log likelihood = -43.708796                       Pseudo R2       =     0.1987

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
AppliedAggCir_Num |   .5503119   .2294586     2.40   0.016     .1728862    .9277377
   LnTotMitCircum |  -.2603829    .129725    -2.01   0.045    -.4737615   -.0470042
     Defenses_Num |  -.8090715    .357461    -2.26   0.024    -1.397043   -.2211005
      Plea_Guilty |  -.7466242   .7410054    -1.01   0.314     -1.96547    .4722213
  Vics_AnyHostage |   .8782137   .5561479     1.58   0.114    -.0365682    1.792996
            _cons |  -1.054217   .6359766    -1.66   0.097    -2.100306   -.0081289
```

MODEL H SUBSTITUTING PROLONGED SUFFERING FOR VICTIM HELD HOSTAGE

```
logit DP_Sentence AppliedAggCir_Num LnTotMitCircum Defenses_Num Plea_Guilty
Judge_ProlongSuffInd, level(90) ;

Iteration 0:   log likelihood = -55.097186
Iteration 1:   log likelihood =  -44.50221
Iteration 2:   log likelihood = -44.284795
Iteration 3:   log likelihood = -44.284045
Iteration 4:   log likelihood = -44.284045

Logistic regression                                     Number of obs   =         81
                                                        LR chi2(5)      =      21.63
                                                        Prob > chi2     =     0.0006
Log likelihood = -44.284045                             Pseudo R2       =     0.1963

------------------------------------------------------------------------------
         DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
---------------------+--------------------------------------------------------------
   AppliedAggCir_Num |   .5556942    .228948     2.43   0.015     .1791082    .9322801
      LnTotMitCircum |  -.2092867   .1273068    -1.64   0.100    -.4186877    .0001144
        Defenses_Num |  -.9209201   .3700266    -2.49   0.013     -1.52956   -.3122804
         Plea_Guilty |  -.8415821   .7215402    -1.17   0.243     -2.02841    .3452458
Judge_ProlongSuffInd |   1.309944   .8950166     1.55   0.103     .0037182    2.61617
               _cons |  -.8805813   .6000578    -1.47   0.142    -1.867589    .106426
------------------------------------------------------------------------------
```

Below we test number of prior convictions (logged) with two different measures of victim suffering.

MODEL I INCLUDING PRIOR CONVICTIONS AND VICTIM HELD HOSTAGE

```
logit DP_Sentence AppliedAggCir_Num LnTotMitCircum Defenses_Num lnPriors
Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood = -53.138727
Iteration 1:   log likelihood = -43.727982
Iteration 2:   log likelihood =  -43.43278
Iteration 3:   log likelihood = -43.431995
Iteration 4:   log likelihood = -43.431995

Logistic regression                                     Number of obs   =         78
                                                        LR chi2(5)      =      19.41
                                                        Prob > chi2     =     0.0016
Log likelihood = -43.431995                             Pseudo R2       =     0.1827

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
AppliedAggCir_Num |   .5793639   .2386559     2.43   0.015     .1868098     .971918
   LnTotMitCircum |  -.2752854   .1331734    -2.07   0.039    -.4943362   -.0562347
     Defenses_Num |  -.6762022   .3316308    -2.04   0.041    -1.221686    -.130718
         lnPriors |  -.0869814   .1332577    -0.65   0.514    -.3061708     .132208
  Vics_AnyHostage |   .7945714   .5604813     1.42   0.156    -.1273382    1.716481
            _cons |  -1.282906    .597073    -2.15   0.032    -2.265004   -.3008084
------------------------------------------------------------------------------
```

MODEL J INCLUDING PRIOR CONVICTIONS AND SUBSTITUTING PROLONGED SUFFERING FOR VICTIM HELD HOSTAGE

```
logit DP_Sentence AppliedAggCir_Num LnTotMitCircum Defenses_Num lnPriors
Judge_ProlongSuffInd, level(90) ;

Iteration 0:   log likelihood = -53.684127
Iteration 1:   log likelihood = -44.238541
Iteration 2:   log likelihood = -44.031064
Iteration 3:   log likelihood = -44.030662
Iteration 4:   log likelihood = -44.030662

Logistic regression                                     Number of obs   =         79
                                                        LR chi2(5)      =      19.31
                                                        Prob > chi2     =     0.0017
Log likelihood = -44.030662                             Pseudo R2       =     0.1798

------------------------------------------------------------------------------
         DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
---------------------+--------------------------------------------------------------
   AppliedAggCir_Num |   .5687897   .2336428     2.43   0.015     .1844814     .953098
      LnTotMitCircum |  -.2006527   .1262117    -1.59   0.112    -.4082525    .0069472
        Defenses_Num |   -.723918    .334463    -2.16   0.030    -1.274061   -.1737753
            lnPriors |  -.0409044   .1306145    -0.31   0.754    -.2557461    .1739373
Judge_ProlongSuffInd |   1.327467   .8949449     1.47   0.123     .0445416    2.610393
               _cons |  -1.221101   .5503326    -2.22   0.026    -2.126317   -.3158841
```

Below, we test number of one victim compared to multiple victims with the two different measures of victim suffering.

MODEL K INCLUDING NUMBER OF VICTIMS AND VICTIM HELD HOSTAGE

```
logit DP_Sentence AppliedAggCir_Num LnTotMitCircum Defenses_Num  Vics_1Total
> Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood =  -43.68075
Iteration 2:   log likelihood = -43.337332
Iteration 3:   log likelihood = -43.336339
Iteration 4:   log likelihood = -43.336338

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(5)      =      22.42
                                                        Prob > chi2     =     0.0004
Log likelihood = -43.336338                             Pseudo R2       =     0.2055

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
AppliedAggCir_Num |   .5274189   .2336575     2.26   0.024     .1430864    .9117513
   LnTotMitCircum |  -.3084567   .1388158    -2.22   0.026    -.5367884    -.080125
     Defenses_Num |  -.6674569   .3306395    -2.02   0.044    -1.211311   -.1236033
      Vics_1Total |  -.7376737   .5580146    -1.32   0.186    -1.655526    .1801787
  Vics_AnyHostage |   .8811137   .5572725     1.58   0.114    -.0355181    1.797745
            _cons |   -.812933   .6974202    -1.17   0.244    -1.960087    .3342211
```

MODEL L INCLUDING NUMBER OF VICTIMS AND SUBSTITUTING PROLONGED SUFFERING FOR VICTIM HELD HOSTAGE

```
logit DP_Sentence AppliedAggCir_Num LnTotMitCircum Defenses_Num  Vics_1Total
Judge_ProlongSuffInd, level(90) ;

Iteration 0:   log likelihood = -55.097186
Iteration 1:   log likelihood =  -44.25512
Iteration 2:   log likelihood = -43.999909
Iteration 3:   log likelihood = -43.999472
Iteration 4:   log likelihood = -43.999472

Logistic regression                                     Number of obs   =         81
                                                        LR chi2(5)      =      22.20
                                                        Prob > chi2     =     0.0005
Log likelihood = -43.999472                             Pseudo R2       =     0.2014

------------------------------------------------------------------------------
         DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
---------------------+--------------------------------------------------------------
   AppliedAggCir_Num |   .5231211   .2331648     2.24   0.025     .1395991     .906643
      LnTotMitCircum |   -.242838   .1342841    -1.81   0.071    -.4637158   -.0219603
        Defenses_Num |  -.7417002   .3363259    -2.21   0.027    -1.294907   -.1884934
         Vics_1Total |  -.7756938   .5576442    -1.39   0.164    -1.692937    .1415492
Judge_ProlongSuffInd |   1.376672   .8535412     1.60   0.112     .0655444    2.687799
               _cons |  -.6518518   .6637885    -0.98   0.326    -1.743687    .4399831
```

Table 7 below shows the summary results of the models described above.

Table 7. Establishing Control Variables for Case Characteristics, Testing Measure of Victim Suffering						
	Model G	**Model H**	**Model I**	**Model J**	**Model K**	**Model L**
N	80	81	78	79	80	81
Prob > chi2	.0006	.0006	.0016	.0017	.0004	.0005
Pseudo R2	.1987	.1963	.1827	.1798	.2055	.2014
	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)	Odds Ratio (P-Value)
Number of Aggravating Circumstances	**1.73 (0.016)**	**1.74 (0.015)**	**1.78 (0.015)**	**1.77 (0.015)**	**1.69 (0.024)**	**1.69 (.025)**
Number of Mitigating Circumstances (logged)	**.771 (0.045)**	**.811 (0.100)**	**.759 (0.039)**	.818 (0.112)	**.735 (0.026)**	**.784 (0.071)**
Number of Defenses	**.445 (0.024)**	**.398 (0.013)**	**.509 (0.041)**	**.485 (0.030)**	**.513 (0.044)**	**.476 (0.027)**
Pled Guilty (referent: pled not guilty)	.474 (0.314)	.431 (0.243)				
Number of Priors (logged)			.917 (0.514)	.960 (0.754)		
One Victim (referent: more than 1 victim)					.478 (0.186)	.460 (0.164)
Victim Held Hostage	2.41 (0.114)		2.21 (0.156)		2.41 (.114)	
Prolonged Suffering Indicated by the Judge		3.671 (0.103)		3.77 (0.123)		3.96 (0.112)

Note: All statistically significant results are bolded. Odds Ratio = 1 indicates no effect; Odds Ratio < 1 indicates a negative effect; Odds Ratio > 1 indicates a positive effect.

In summary, after testing a variety of constellations of variables together, the results indicate that neither measure of victim suffering is a significant predictor of death sentences and neither affects the overall pattern of results. Because we are less confident in the variable Prolonged Suffering, we included Victim Held Hostage as the measure of victim suffering in the model controlling for case characteristics. It also worth noting that the number of aggravating circumstances and victims also capture aspects of the heinousness of the crime.

Based on the analyses shown above, we identified the following variables to be included in the model that controls for case characteristics: logged number of prior convictions, whether one victim or multiple victims were involved, the number of aggravating circumstances, the logged number of mitigating circumstances, the number of defenses presented, the nature of the defendant's plea, and whether the victim was held hostage. The results of this model (with data errors corrected and including Trial Report 34A) is presented below in Table 8. The unaltered statistical output follows. This table contains the same variables as Table 6 in the *Updated Report* (at 31).

Table 8. Model M: Impact of Case Characteristics on Capital Sentencing Outcomes in Cases With Special Sentencing Proceedings, December 1981 - May 2014

N= 78	Death Penalty Imposed			Pseudo R^2 = 0.2016 LR chi2(7) = 21.43 Prob > chi2 = 0.0032
Variable	Coefficient	Exact P-Value	Odds Ratio	90% Confidence Interval
Prior Convictions (ln)	-0.045	0.742	0.956	-.272, .181
1 Victim	-0.635	0.268	0.530	-1.58, .307
Pled Guilty	-0.679	0.373	0.507	-1.93, .573
Aggravating Circumstances	0.520	**0.032**	**1.68****	.121, .919
Mitigating Circumstances (ln)	-0.298	**0.033**	**0.743****	-.527, -.069
Defenses	-0.795	**0.032**	**0.452****	-1.41, -.184
Victim Held Hostage	0.863	0.131	2.37	-.077, 1.80

* significant at α = .10 ** significant at α = .05 *** significant at α = .01

MODEL M OUTPUT ASSOCIATED WITH TABLE 8

```
logit DP_Sentence lnPriors Vics_1Total Plea_Guilty AppliedAggCir_Num LnTotMitCircum
Defenses_Num  Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood = -53.138727
Iteration 1:   log likelihood = -42.747574
Iteration 2:   log likelihood = -42.426599
Iteration 3:   log likelihood =  -42.42515
Iteration 4:   log likelihood =  -42.42515

Logistic regression                               Number of obs   =         78
                                                  LR chi2(7)      =      21.43
                                                  Prob > chi2     =     0.0032
Log likelihood =  -42.42515                       Pseudo R2       =     0.2016

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
         lnPriors |  -.0454251    .137801    -0.33   0.742    -.2720876    .1812375
      Vics_1Total |  -.6346856   .5725699    -1.11   0.268    -1.576479     .307108
      Plea_Guilty |  -.6789026   .7613904    -0.89   0.373    -1.931278    .5734731
AppliedAggCir_Num |   .5196788   .2425385     2.14   0.032     .1207384    .9186192
   LnTotMitCircum |  -.2976283   .1392095    -2.14   0.033    -.5266075   -.0686491
     Defenses_Num |  -.7950692   .3715923    -2.14   0.032    -1.406284   -.1838542
  Vics_AnyHostage |   .8627311   .5715877     1.51   0.131     -.077447    1.802909
            _cons |  -.6152901   .7579476    -0.81   0.417    -1.862003    .6314228
```

Interrogatory 27

Please provide a full description of the method and any associated testing used in selecting which variable to remove from those included in the model shown in Table 6 in order to add the race of defendant variable to the model as shown in Table 7.

As described in our response to Interrogatory 26, we first identified and tested a model that includes potentially relevant case characteristics that would have been known to the judge or jury. Of these variables, three showed a consistent and significant relationship to decisions to impose death: the number of aggravating circumstances, the number of defenses, and the (logged) number of mitigating circumstances (see Table 8 above). This table contains the same variables as Table 6 in the *Updated Report* at p. 31.

Next we sought to test whether judges and juries are more likely to impose a death sentence when the defendant is Black, controlling for relevant case characteristics. As a reminder, given that the dataset analyzed includes 77 special sentencing proceedings with no missing values, we were limited to seven or fewer explanatory variables in the regression model. We elected to drop defendant plea in order to accommodate defendant race, for several reasons (please see our response to Interrogatory 28 for an explanation of this decision).

Table 9 below shows the results of the model dropping defendant plea and adding defendant race. This table contains the same elements as Table 7 in the *Updated Report* at 32. The unaltered statistical output follows.

Table 9. Impact of Legally Relevant Case Characteristics and Defendant Race on Capital Sentencing Outcomes in Cases with Special Sentencing Proceedings, December 1981 - May 2014

N= 77	Death Penalty Imposed			Pseudo R^2 = 0.2377 LR chi2(7) = 24.84 Prob > chi2 = 0.0008
Variable	Coefficient	Exact P-Value	Odds Ratio	90% Confidence Interval
Prior Convictions (ln)	-0.091	0.510	0.913	-.319, .137
1 Victim	-0.722	0.221	0.486	-1.69, .248
Aggravating circumstances	0.630	0.016	**1.88****	.198, 1.06
Mitigating Circumstances (ln)	-0.258	0.089	0.**773***	-.507, -.009
Defenses	-0.794	0.034	0.**452****	-1.41, -.178
Victim Held Hostage	0.717	0.222	2.05	-.248, 1.68
Black Defendant	1.58	0.039	**4.86****	.319, 2.84

* significant at α = .10 ** significant at α = .05 *** significant at α = .01

UNALTERED OUTPUT ASSOCIATED WITH TABLE 9

```
logit DP_Sentence lnPriors Vics_1 Total  AppliedAggCir_Num LnTotMitCircum Defenses_Num
Vics_AnyHostage D_RaceB, level(90) ;

Iteration 0:   log likelihood = -52.583924
Iteration 1:   log likelihood = -40.664023
Iteration 2:   log likelihood = -40.170014
Iteration 3:   log likelihood = -40.166274
Iteration 4:   log likelihood = -40.166273

Logistic regression                                     Number of obs   =         77
                                                        LR chi2(7)      =      24.84
                                                        Prob > chi2     =     0.0008
Log likelihood = -40.166273                             Pseudo R2       =     0.2361

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
         lnPriors |  -.0913328   .1385858    -0.66   0.510    -.3192863    .1366206
      Vics_1Total |  -.7215931   .5896597    -1.22   0.221    -1.691497    .2483108
AppliedAggCir_Num |   .6299845   .2624197     2.40   0.016     .1983425    1.061627
   LnTotMitCircum |  -.2575945   .1513135    -1.70   0.089     -.506483   -.0087059
     Defenses_Num |  -.7935932   .3740099    -2.12   0.034    -1.408785   -.1784016
  Vics_AnyHostage |   .7169782   .5866349     1.22   0.222    -.2479504    1.681907
          D_RaceB |   1.581795    .767834     2.06   0.039     .3188205     2.84477
            _cons |  -1.114036   .7731921    -1.44   0.150    -2.385824    .1577521
```

As Table 9 and associated output shows, substituting defendant race for defendant plea improves the fit of the model (Prob > chi2 = .0008 compared to .0032; Pseudo R^2 =2361 compared to .2016.) In this model, the number of aggravating circumstances, the (logged) number of mitigating circumstances and the number of defenses continue to be statistically significant. Defendant race is also statistically significant (p=.039). When the coefficient for defendant race is expressed as an odds ratio, the results show that Black defendants are 4.9 (4.86) times as likely as non-Black defendants to be sentenced to death, controlling for the other (legally relevant) variables included in the model.

Model N shows the results of the most parsimonious model that includes only the variables that have been shown to be significant predictors of sentencing outcomes: defendant race, number of aggravating circumstances, the (logged) number of mitigating circumstances, and the number of defenses. This is the base model used to test the impact of other social factors presented in the *Response to Evaluation* Tables G and H, at p. 36-38. This is also the base model used to show the impact of defendant race tested across 13 models summarized in *Response to Evaluation* Table I at p. 39-40.

MODEL N PARSIMONIOUS MODEL

```
logit DP_Sentence D_RaceB AppliedAggCir_Num LnTotMitCircum Defenses_Num , level(90) ;

Iteration 0:   log likelihood = -54.548369
Iteration 1:   log likelihood =   -43.7756
Iteration 2:   log likelihood = -43.508641
Iteration 3:   log likelihood = -43.507072
Iteration 4:   log likelihood = -43.507072

Logistic regression                                     Number of obs   =         80
                                                        LR chi2(4)      =      22.08
                                                        Prob > chi2     =     0.0002
Log likelihood = -43.507072                             Pseudo R2       =     0.2024

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------------
          D_RaceB |   1.578166   .7229784     2.18   0.029      .388972    2.767359
AppliedAggCir_Num |   .6296285    .235125     2.68   0.007     .2428823    1.016375
   LnTotMitCircum |  -.1556172   .1300711    -1.20   0.232    -.3695651    .0583307
     Defenses_Num |  -.7689575   .3462735    -2.22   0.026    -1.338527   -.1993884
            _cons |  -1.389417   .5818862    -2.39   0.017    -2.346535   -.4322999
```

In light of the Commissioner's previous question about the prolonged suffering variable, we reiterate that we have significant concerns about the validity of this measure. Nonetheless, we provide regression results for a model in which this measure of victim suffering is included in place of Victim Held Hostage. Please see Table 10 and associated output below.[17] As these results indicate, the race of the defendant continues to have a large and significant impact on

[17] Associated output for model including Victim Held Hostage appears beneath Table 9.

sentencing outcomes when this measure of victim suffering is included in place of Victim Held Hostage.

Table 10. Testing Black Defendant, Comparing Different Measures of Victim Suffering		
	Including Victim Held Hostage	**Including Prolonged Suffering Indicated by Judge**
N	77	78
Prob > chi2	.0008	.0011
Pseudo R2	.2361	.2274
	Odds Ratio (P-Value)	Odds Ratio (P-Value)
Black Defendant	**4.86** (0.039)**	**4.24** (0.064)**
Number of Aggravating circumstances	**1.88** (0.016)**	**1.81** (0.020)**
Number of Mitigating Circumstances (logged)	**.773** (0.089)**	**.819 (0.160)**
Number of Defenses	**.452** (0.034)**	**.447** (0.030)**
Number of Priors (logged)	.913 (0.510)	.967 (0.800)
1 Victim (referent: multiple victims)	.486 (0.221)	.461 (0.186)
Victim Held Hostage	2.05 (0.222)	
Prolonged Suffering Indicated by Judge		2.57 (0.264)

* significant at α = .10 ** significant at α = .05 *** significant at α = .01 Note: All statistically significant results are bolded. Odds Ratio = 1 indicates no effect; Odds Ratio < 1 indicates a negative effect; Odds Ratio > 1 indicates positive effect.

OUTPUT ASSOCIATED WITH TABLE 10 ABOVE, SUBSTITUTING PROLONGED SUFFERING FOR VICTIM HELD HOSTAGE

```
logit DP_Sentence D_RaceB AppliedAggCir_Num LnTotMitCircum Defenses_Num  lnPriors
Vics_1Total Judge_ProlongSuffInd, level(90) ;

Iteration 0:   log likelihood = -53.138727
Iteration 1:   log likelihood = -41.411662
Iteration 2:   log likelihood = -41.055936
Iteration 3:   log likelihood = -41.054392
Iteration 4:   log likelihood = -41.054392

Logistic regression                                     Number of obs   =         78
                                                        LR chi2(7)      =      24.17
                                                        Prob > chi2     =     0.0011
Log likelihood = -41.054392                             Pseudo R2       =     0.2274

------------------------------------------------------------------------------
         DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
---------------------+--------------------------------------------------------------
           D_RaceB |   1.443602   .7785106     1.85   0.064     .1630657    2.724138
   AppliedAggCir_Num |   .5934399   .2558277     2.32   0.020     .1726407    1.014239
      LnTotMitCircum |  -.1993755   .1420597    -1.40   0.160     -.433043    .0342919
       Defenses_Num |  -.8057725   .3703869    -2.18   0.030    -1.415005   -.1965403
           lnPriors |  -.0338136   .1331936    -0.25   0.800    -.2528976    .1852704
         Vics_1Total |  -.7734375   .5850693    -1.32   0.186    -1.735791    .1889159
Judge_ProlongSuffInd |   .9447178   .8461125     1.12   0.264    -.4470134    2.336449
               _cons |  -.9264907   .7294082    -1.27   0.204     -2.12626    .2732791
```

Interrogatory 28

Please explain the basis for your statement that the model that omitted this variable [nature of defendant's plea] and added race of defendant is a model that still "included (or controlled for) all relevant case characteristics."

As noted in our response to Interrogatory 27, there are four case characteristics that did not show a significant relationship to sentencing outcomes during model testing. These include: the (logged) number of prior convictions, the number of victims (measured as one vs. more than one victim), victim suffering (measured as whether the victim was held hostage or as prolonged suffering), and whether the defendant entered a guilty plea. We determined that one of these non-significant variables should be removed in order to create space to test the impact of defendant race.

When selecting a single case characteristic to be removed from the model, we chose to remove defendant plea, for several reasons. First, as noted above, defendant plea consistently showed no significant relationship to the decision to impose death (see the analyses presented in response to Interrogatory 26). Second, unlike the other case characteristics, a defendant's plea is not a pre-existing characteristic of either the crime or the defendant. For this reason, it is qualitatively different from the other case characteristics and arguably unrelated to the question of culpability. Finally, the decision to remove this variable was also based on our

understanding that the nature of the defendant's plea ("guilty" or "not guilty") cannot lawfully be the basis of the decision to impose a death sentence, unlike the other case characteristics tested.[18] Therefore, when deciding which category to remove from the model, we removed the category that was less legally relevant than other factors such as number of victims, prior convictions, and victim held hostage, which are proper considerations for imposing death or a life without parole sentence.

It is worth noting, however, that substituting other non-significant case characteristics and including the nature of the plea in their stead does not alter the pattern of results: in all of these models, the same three case characteristics (number of aggravating circumstances, (logged) number of mitigating circumstances, and number of defenses) remain significant, as does race of defendant. The odds ratios for defendant race ranges from 4.2 to 4.9 in these models. Please see the output shown below.

```
MODIFIED TABLE 7 FROM UPDATED REPORT, DROPPING PLEA
logit DP_Sentence D_RaceB AppliedAggCir_Num LnTotMitCircum Defenses_Num lnPriors
Vics_1Total Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood = -52.583924
Iteration 1:   log likelihood = -40.664023
Iteration 2:   log likelihood = -40.170014
Iteration 3:   log likelihood = -40.166274
Iteration 4:   log likelihood = -40.166273

Logistic regression                               Number of obs   =         77
                                                  LR chi2(7)      =      24.84
                                                  Prob > chi2     =     0.0008
Log likelihood = -40.166273                       Pseudo R2       =     0.2361

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
          D_RaceB |   1.581795    .767834     2.06   0.039     .3188205     2.84477
AppliedAggCir_Num |   .6299845   .2624197     2.40   0.016     .1983425    1.061627
   LnTotMitCircum |  -.2575945   .1513135    -1.70   0.089     -.506483   -.0087059
     Defenses_Num |  -.7935932   .3740099    -2.12   0.034    -1.408785   -.1784016
          lnPriors |  -.0913328   .1385858    -0.66   0.510    -.3192863    .1366206
       Vics_1Total |  -.7215931   .5896597    -1.22   0.221    -1.691497    .2483108
  Vics_AnyHostage |   .7169782   .5866349     1.22   0.222    -.2479504    1.681907
             _cons |  -1.114036   .7731921    -1.44   0.150    -2.385824    .1577521
```

[18] *See State v. Frampton*, 95 Wn.2d 469, 627 P.2d 922 (1981) and *State v. Martin*, 94 Wn.2d 1, 614 P.2d 164 (1980).

MODIFIED TABLE 7 FROM UPDATED REPORT, KEEPING PLEA, DROPPING VICTIM HELD HOSTAGE

```
logit DP_Sentence D_RaceB AppliedAggCir_Num LnTotMitCircum Defenses_Num lnPriors
Vics_1Total Plea_Guilty, level(90) ;

Iteration 0:   log likelihood = -53.138727
Iteration 1:   log likelihood = -41.930564
Iteration 2:   log likelihood = -41.622847
Iteration 3:   log likelihood = -41.621278
Iteration 4:   log likelihood = -41.621278

Logistic regression                                     Number of obs   =         78
                                                        LR chi2(7)      =      23.03
                                                        Prob > chi2     =     0.0017
Log likelihood = -41.621278                             Pseudo R2       =     0.2167

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
          D_RaceB |    1.60189   .7731817     2.07   0.038     .3301193    2.873661
AppliedAggCir_Num |   .5795735    .251185     2.31   0.021      .166411     .992736
   LnTotMitCircum |  -.1924647   .1377282    -1.40   0.162    -.4190075    .0340781
     Defenses_Num |  -.8127501   .3912228    -2.08   0.038    -1.456254   -.1692459
         lnPriors |   -.011408   .1311572    -0.09   0.931    -.2271424    .2043265
      Vics_1Total |  -.7376041   .5794988    -1.27   0.203    -1.690795    .2155867
      Plea_Guilty |  -.2944573   .7692464    -0.38   0.702    -1.559755    .9708405
            _cons |  -.7672557   .7915007    -0.97   0.332    -2.069158    .5346471
------------------------------------------------------------------------------
```

MODIFIED TABLE 7 FROM UPDATED REPORT, KEEPING PLEA, DROPPING PRIORS

```
logit DP_Sentence D_RaceB AppliedAggCir_Num LnTotMitCircum Defenses_Num  Vics_1Total
Plea_Guilty Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood =  -53.99031
Iteration 1:   log likelihood = -41.175559
Iteration 2:   log likelihood = -40.751979
Iteration 3:   log likelihood = -40.749699
Iteration 4:   log likelihood = -40.749699

Logistic regression                                     Number of obs   =         79
                                                        LR chi2(7)      =      26.48
                                                        Prob > chi2     =     0.0004
Log likelihood = -40.749699                             Pseudo R2       =     0.2452

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
          D_RaceB |   1.446545   .7843018     1.84   0.065     .1564829    2.736606
AppliedAggCir_Num |       .582   .2489025     2.34   0.019     .1725918    .9914082
   LnTotMitCircum |  -.2547214   .1484752    -1.72   0.086    -.4989414   -.0105014
     Defenses_Num |  -.8267372   .3896202    -2.12   0.034    -1.467605   -.1858689
      Vics_1Total |  -.8447283   .5772446    -1.46   0.143    -1.794211    .1047545
      Plea_Guilty |  -.2936731   .7919355    -0.37   0.711    -1.596291    1.008945
  Vics_AnyHostage |   .7593045   .5762541     1.32   0.188    -.1885491    1.707158
            _cons |  -.8880676   .8038664    -1.10   0.269     -2.21031    .4341751
------------------------------------------------------------------------------
```

MODIFIED TABLE 7 FROM UPDATED REPORT, KEEPING PLEA, DROPPING NUMBER OF VICTIMS

```
logit DP_Sentence D_RaceB AppliedAggCir_Num LnTotMitCircum Defenses_Num
 lnPriors Plea_Guilty Vics_AnyHostage, level(90) ;

Iteration 0:   log likelihood = -52.583924
Iteration 1:   log likelihood = -41.310023
Iteration 2:   log likelihood = -40.906496
Iteration 3:   log likelihood = -40.904163
Iteration 4:   log likelihood = -40.904163

Logistic regression                               Number of obs   =         77
                                                  LR chi2(7)      =      23.36
                                                  Prob > chi2     =     0.0015
Log likelihood = -40.904163                       Pseudo R2       =     0.2221

------------------------------------------------------------------------------
      DP_Sentence |      Coef.   Std. Err.      z    P>|z|     [90% Conf. Interval]
------------------+-----------------------------------------------------------
          D_RaceB |    1.48011   .7707575     1.92   0.055     .2123266    2.747893
AppliedAggCir_Num |   .6597761   .2571962     2.57   0.010     .2367261    1.082826
   LnTotMitCircum |  -.2235114   .1427053    -1.57   0.117    -.4582407    .0112179
     Defenses_Num |  -.8139001   .3877491    -2.10   0.036    -1.451691   -.1761095
         lnPriors |   -.111648   .1373369    -0.81   0.416    -.3375471    .1142512
      Plea_Guilty |  -.1725729   .7918347    -0.22   0.827    -1.475025    1.129879
  Vics_AnyHostage |    .696654   .5826205     1.20   0.232    -.2616715    1.654979
            _cons |   -1.53174   .7347455    -2.08   0.037    -2.740289   -.3231912
```

Interrogatory 32

Do you maintain that the results of any of the models presented in the *Updated Report* provide a basis to determine the percentage of variation in outcomes that is explained by the case characteristics included in the models? If yes, please identify the models and explain.

No, we do not maintain that the models presented in the *Updated Report* provide a basis to determine the percentage of explained variation. Logistic regression does not have an equivalent to the R-squared that is found in OLS regression. However, many people have tried to develop one, and there are a wide variety of pseudo-R-square statistics. Although Pseudo R-squared statistics cannot be interpreted independently or compared across datasets, they are valid and useful in evaluating multiple models predicting the same outcome using the same dataset.[19] For these reasons, and because this statistic does not mean what R-square means in OLS regression (the proportion of variance explained by the predictors), we suggest using this statistic only to compare models using the same dataset. In this situation, the higher pseudo R-squared identifies the model that better predicts the outcome.

[19] Scott J. Long, and Jeremy Freese, REGRESSION MODELS FOR CATEGORICAL DEPENDENT VARIABLES USING STATA (2nd Ed. College Station, Texas: StataCorp LP, 2006) pp.107-113.

The Statistical Consulting Group at UCLA point to the McKelvey and Zavoina's Pseudo R-squared measure as the closest to approximating an OLS R-squared that provides the percentage of variation explained:

> "Attempts have been made to assess the accuracy of various pseudo R-squareds by predicting a continuous latent variable through OLS regression and its observed binary variable through logistic regression and comparing the pseudo R-squareds to the OLS R-squared. In such simulations, McKelvey & Zavoina's was the closest to the OLS R-squared."[20]

In Table 11 below we present the results of multiple Pseudo R-squared values, comparing these values across three models: 1) the null model with no predictors, 2) the model with only legally relevant case characteristics (6 predictors), and 3) the same legal model with defendant race added (7 predictors.) We have highlighted the McKelbey and Zavoina Pseudo R-squared values for each model.

[20] Commonly Encountered Pseudo R-squareds. UCLA: Statistical Consulting Group, from https://stats.idre.ucla.edu/other/mult-pkg/faq/general/faq-what-are-pseudo-r-squareds/ (accessed July 7, 2017).

Table 11. Comparing Pseudo R-squared Values Across Three Models

Null Model (No predictors)	Legally Relevant Characteristics (6 Predictors)	Legally Relevant Characteristics and Defendant Race (7 predictors)
Code: logit DP_Sentence	Code: logit DP_Sentence lnPriors Vics_1Total AppliedAggCir_Num LnTotMitCircum Defenses_Num Vics_AnyHostage	Code: logit DP_Sentence lnPriors Vics_1Total AppliedAggCir_Num LnTotMitCircum Defenses_Num Vics_AnyHostage D_RaceB
| logit	| logit	| logit
Log-likelihood |	Log-likelihood |	Log-likelihood |
Model | -55.957	Model | -42.830	Model | -40.166
Intercept-only | -55.957	Intercept-only | -53.139	Intercept-only | -52.584
Chi-square |	Chi-square |	Chi-square |
Deviance (df=81) | 111.914	Deviance (df=71) | 85.659	Deviance (df=69) | 80.333
LR (df=0) | 0.000	LR (df=6) | 20.618	LR (df=7) | 24.835
	p-value | 0.002	p-value | 0.001
R2 |	R2 |	R2 |
McFadden | 0.000	McFadden | 0.194	McFadden | 0.236
McFadden (adjusted) | -0.018	McFadden (adjusted) | 0.062	McFadden (adjusted) | 0.084
McKelvey & Zavoina | 0.000	**McKelvey & Zavoina | 0.439**	**McKelvey & Zavoina | 0.496**
Cox-Snell/ML | 0.000	Cox-Snell/ML | 0.232	Cox-Snell/ML | 0.276
Cragg-Uhler/Nagelkerke | 0.000	Cragg-Uhler/Nagelkerke | 0.312	Cragg-Uhler/Nagelkerke | 0.370
Efron | 0.000	Efron | 0.226	Efron | 0.267
Tjur's D | 0.000	Tjur's D | 0.229	Tjur's D | 0.274
Count | 0.573	Count | 0.654	Count | 0.675
Count (adjusted) | -0.000	Count (adjusted) | 0.182	Count (adjusted) | 0.242
IC |	IC |	IC |
AIC | 113.914	AIC | 99.659	AIC | 96.333
AIC divided by N | 1.389	AIC divided by N | 1.278	AIC divided by N | 1.251
BIC (df=1) | 116.320	BIC (df=7) | 116.156	BIC (df=8) | 115.083
Variance of |	Variance of |	Variance of |
e | 3.290	e | 3.290	e | 3.290
y-star | 3.290	y-star | 5.867	y-star | 6.533

All Pseudo R-squared measures presented above show that the model containing case characteristics is a better fit of the data than a model containing no predictors (called the null model.) These same measures also demonstrate that including defendant race when controlling for relevant legal characteristics improves the model fit. The McKelvey & Zavoina measure for the model containing only legally relevant case characteristics is 0.44; when defendant race is included, this measure increases to .50. Although none of the Pseudo R-squared measures can be interpreted as an exact percentage of variation explained, none of these values approaches 1.0, indicating there is much unexplained variation in the decision to impose death.

IN THE SUPREME COURT OF THE STATE OF WASHINGTON

STATE OF WASHINGTON, Respondent, v. ALLEN GREGORY, Appellant.	)))))))))	NO. 88086-7

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