Shulei Yang

Prompts Widespread Reforms in Forensic Science

Statistical Consulting 7995 University of Virginia Dr. Karen Kafadar

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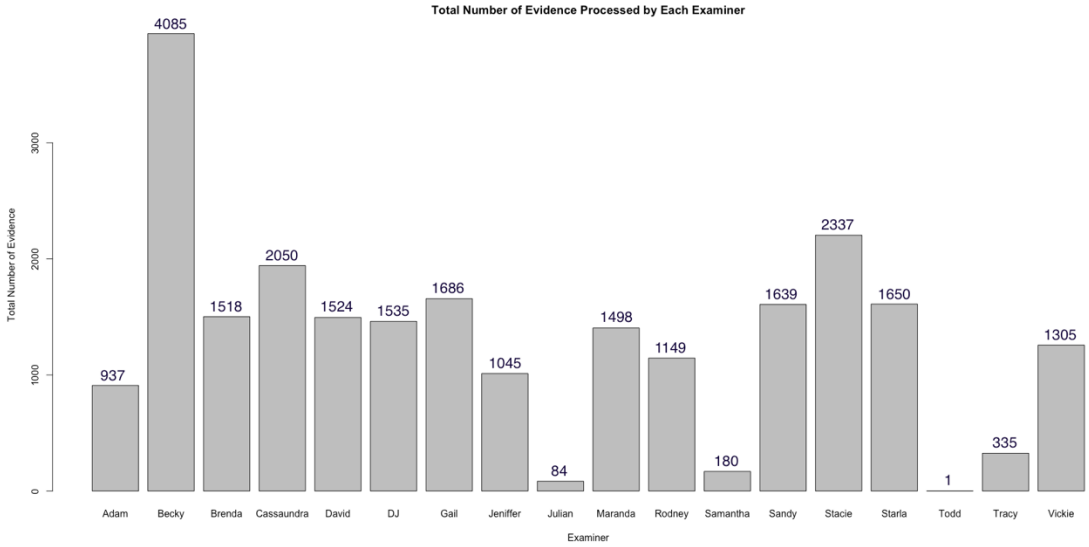
1. Introduction

This report consists of four parts and ultimately tries to evaluate the conclusion of each HFSC examiners and find their differences in case processing. In 'Method Overview', I will introduce all the technics I used in the analysis. Then in 'Result' section, I will present the results from my analysis and carefully show how I get to my conclusions. Finally, I will conclude my whole analysis in the 'Conclusion' section.

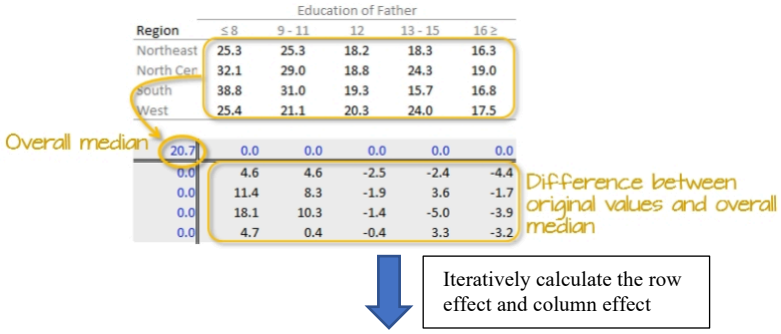
2. Methods Overview

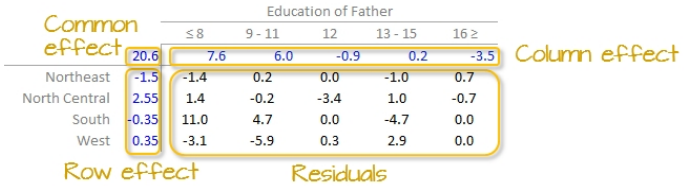
a. Median Polish

From the below bar chart we can see that the number of latent print processed by each examiner is very different. For example, Becky has processed 4085 latent print, but Todd has only processed 1 latent print. These huge differences will lead to bias if we do not make any transformation in our analysis. Therefore, in my analysis, I will use a technique called 'Median Polish' to make a transformation on the data.



Median polish is a simple and robust exploratory data analysis tool. It is usually used in a two-way table as the example shown below. Median polish will iteratively calculate the medians of the rows and the medians of the columns and use these medians as row effect and column effect. In the end, we can make decisions based on the residual part. This method can make our results insensitive to the outliers, which is very suitable for our dataset.





b. Data Cleaning

i. Remove Todd and Julian

After exploring the dataset, I found that Todd only processed 1 latent print and Julian only processed 84 latent print. The reason why these two examiners worked so little needs further research. But to avoid bias, I exclude Todd and Julian in the analysis.

ii. Regroup the variable 'Offense'

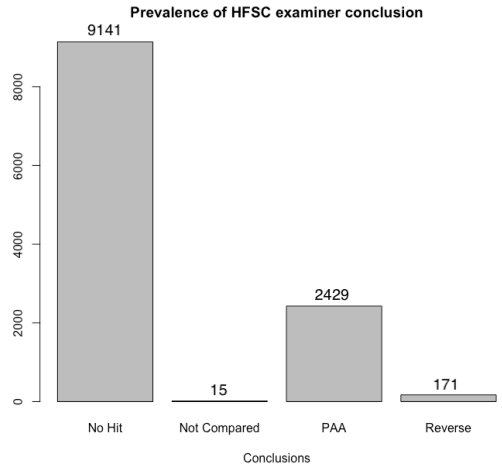
There were 166 different offense types in the original dataset, and too many offense types will introduce unnecessary complexity in the analysis. After further exploration, I found many of these offense types are similar. For example, in the original dataset, 'Homicide', 'HOM', 'Murder' and 'Murder by firearm' will count as four different offense types. But from my understanding, these four offense types can be considered together. Therefore, in order to facilitate the analysis, I regroup these 166 offense types into 21 different offense types. The detailed breakdown of these 21 offense types can be found in the Appendix.

3. Results

a. HFSC Examiner Conclusions

i. Prevalence of HFSC examiner conclusion

There are four possible examiner conclusions: PAA, No Hit, Not compared and Reversed. The following bar chart shows the prevalence of HFSC examiner conclusion. From the chart, we can see that most of the conclusion is 'No Hit'.



b. Examiner Differences in Case Processing

i. Sufficiency determination

Sufficiency indicates the overall quality of the latent print, and it is the first step of the ACE-V process. It includes NRD (no ridge detail), NV (No value), AQ (AFIS quality), and NAQ (Not AFIS quality). In this

section, I will show how each examiner is different from the sufficiency determination aspect.

I first collected the number of different sufficiency determination for each examiner, the result is shown below.

	Total	AQ	NV	NAQ	NDR
Adam	937	432	478	1	26
Becky	4085	1904	2037	7	137
Brenda	1518	972	530	4	12
Cassaundra	2050	957	985	63	45
David	1524	815	680	2	27
DJ	1535	831	630	16	58
Gail	1686	804	853	21	8
Jeniffer	1045	554	458	8	25
Maranda	1498	688	718	32	60
Rodney	1149	507	638	1	3
Samantha	180	63	106	11	0
Sandy	1639	1053	554	4	28
Stacie	2337	1102	1102	125	8
Starla	1650	840	771	31	8
Tracy	335	175	150	10	0
Vickie	1305	645	612	21	27

Because the number of total sufficiency determinations of each examiner is very different, I then applied median polish on this dataset. The result is shown below. I marked several notable numbers in blue. From the result we can see that Brenda has more than usual 'AQ' sufficiency determinations; Becky has less than usual 'NAQ' sufficiency determinations; also Stacie has more than usual 'NAQ' sufficiency determinations and less than usual 'NDR' sufficiency determinations.

	AQ	NV	NAQ	NDR
Adam	-0.14	0.07	-0.06	0.33
Becky	-0.12	0.15	-3.34	0.09
Brenda	1.03	0.08	-0.07	-0.18
Cassaundra	-0.05	0.06	0.74	-0.28
David	0.29	0.05	-0.50	-0.12
DJ	0.20	-0.19	-0.19	0.66
Gail	0.11	0.29	-0.06	-0.83
Jeniffer	0.01	-0.11	0.03	0.16
Maranda	-0.29	-0.15	0.16	0.56
Rodney	0.07	0.46	-0.03	-0.31
Samantha	-0.44	-0.21	0.83	0.14
Sandy	0.99	-0.11	-0.31	0.04
Stacie	-0.01	0.03	2.38	-1.66
Starla	0.05	-0.04	0.11	-0.97
Tracy	-0.23	-0.16	0.75	0.09
Vickie	-0.03	-0.03	0.17	-0.04

ii. Examiner and Offense Type

In general, I did not find any notable differences in examiners from the offense type aspect.

iii. Examiner and Anatomical Source

In general, I did not find any notable differences in examiners from the anatomical source aspect.

iv. Examiner and AFIS Result

AFIS Result contains four possible values: PAA , No Hit, Reverse and Not Compared. In this section, I will show how examiners are different from the AFIS result aspect.

I first collected the number of different AFIS results from each examiner, the result is shown below. From the result, we can see that most

examiners do not have 'Not Compared' as AFIS result. However, Gail has 8 'Not Compared'. Given the fact that Gail did not process much more latent print than other examiners, the reason why Gail has 8 'Not Compared' needs further investigation.

	No Hit	Not Compared	PAA	Reverse
Adam	319	0	93	3
Becky	1349	0	446	31
Brenda	726	2	162	21
Cassaundra	666	3	247	0
David	650	1	103	22
DJ	611	0	131	17
Gail	557	8	196	19
Jeniffer	419	0	89	22
Maranda	555	0	100	4
Rodney	408	1	65	1
Sandy	743	0	226	14
Stacie	862	0	202	4
Starla	639	0	165	4
Tracy	106	0	44	0
Vickie	466	0	140	9

Then I applied median polish on this dataset, the result is shown below. From the result, we can see that Gail has slightly less 'Not Hit' than other examiners, and Jeniffer has slightly more 'Reversed' than other examiners. But in general, these two differences are not very significant.

	Not Hit	PAA	Reversed
Adam	-0.43	0.10	-0.01
Becky	0.24	0.65	-0.24
Brenda	-0.09	-0.32	0.67
Cassaundra	-0.42	0.43	-1.54
David	0.01	-0.54	1.14
DJ	0.07	-0.06	0.84
Gail	-0.90	-0.18	0.27
Jeniffer	-0.19	-0.06	1.77
Maranda	0.24	0.00	-0.08
Rodney	0.04	-0.03	-0.06
Sandy	0.00	0.36	0.00
Stacie	0.82	0.51	-0.60
Starla	0.22	0.34	-0.40
Tracy	-0.80	0.00	0.09
Vickie	-0.28	0.20	0.21

4. Conclusion

In conclusion, most of the AFIS Results shown 'No Hit', I think this result indicates that the current AFIS system is not thorough and there are many improvements need to be made. Also, there are some findings regarding individual examiners that need our further investigations. First, we should find the reason why Todd and Julian processed much less latent print than other examiners. Then, we can check the differences of each examiner in sufficiency determination aspect and forensic conclusion aspect as I listed above. But in general, I don't think there are many significant differences between each examiner in case processing.

5. Appendix

Offense Type after Regrouping	Key Words Original Offense Type Contains
Attemp	Attemp
Assault	Assault, harassment, injury, offense, stalking
Kidnapping	Kidnapping
Robbery	Robbery, theft, burglary, stolen
Sex	Sex, rape, Improper Relationship Educator and Student,
Arson	Arson
Bomb	Bomb
Homicide	Homicide, murder, dead, deadly
Mischief	Mischief, vice, disorder, Unauthorized Use Of Motor Vehicle
Trespassing	Trespassing
Traffic	Traffic, vehicular, vehicle
Organized Crime	Organized Crime
Evade	Evade
Terroristic	Terroristic
Forgery	Forgery
Fraud	Fraud
Suicide	Suicide
Missing person	Missing person
Officer	Officer Firearm Discharge
Weapon	Unlawful carry weapon
Other	Other, Failure To Secure A Firearm From A Child, Failure To Stop And Render Aid, Fam Viol - Burg of Resid to Commit Assault, Found Property-All Other, Special crime Unclassified, Request: 0001