Evaluating the effectiveness of an Incident Management Team expansion in Utah

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Abstract

The abstract is a crucial component of any scientific paper, as it provides a summary of the research and its main findings. This paper provides guidelines for writing an effective scientific abstract. The first step is to identify the key elements of the research, such as the research question, methods, results, and conclusions. Next, the abstract should be written in a clear and concise manner, using simple language and avoiding technical jargon. The abstract should also be structured, with a clear introduction, methods section, results section, and conclusion. Additionally, the abstract should accurately and succinctly convey the main findings of the research, highlighting the significance and implications of the work. By following these guidelines, researchers can ensure that their abstract effectively communicates the key aspects of their research and attracts the attention of potential readers. - Written by ChatGPT

Preface

This is a template repository that I and my students can use to start projects that will implement the workflow presented in my lab documentation. It also serves as an instruction manual in this workflow, a template article, and a sandbox for me to practice and learn. I encourage students to use the Quarto Guide as their primary reference.

The document in this template renders to two[1] outputs:

- A website

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[1] I hope to make it possible to render the article to a BYU Engineering thesis as well. Give me a bit of time.

- An Elsevier journal article

To render this document, use the command `quarto render` in your terminal pointed at the working directory. This will create a website available locally in a `_book` folder and a PDF of the article stored in that folder.

To render your website *and* push its content to a live website, use the command `quarto publish gh-pages`. Details of this process are available on the Quarto guide.

You can change the article to a different publisher by following the directions at the Quarto Journal Templates GitHub repository.

1. Introduction

The introduction of your report is not simply an "introduction", but rather a **motivation** of why your project matters. What is the cost of not solving this problem? What have been previous attempts to solve this problem? The *why* is more important than the *what*. Why is this article worthy of archiving?

The introduction to an article is usually three or so paragraphs long. First, state the overall context of the problem, with citations to basic statistics and previous major findings. Then, Discuss the specific context of your research; why have previous methods or research not addressed your specific issue? You also need to have citations here.

In the third paragraph, you can introduce the purpose of your research and the new method or data you bring to the issue. This paragraph often begins with a statement similar to "In this paper, we present…"

An outline of the article is then usually a good idea, even though the outline might change little from article to article. A Literature Review details prior research in this area, and discusses its strengths and limitations. A Methodology section identifies the data, models, and other elements you use, while a Results section presents the outcomes of your methodology with tables and figures and a comprehensive discussion of their meanings. Discussions, and Conclusions sections may present your interpretations of your findings for future research, policy, etc.

2. Literature Review

The literature review is not simply a "review" or a list of what has been done in the past. This needs to a thoughtful synthesis that accomplishes two things:

- Shows that you understand the previous efforts that other people have made on this problem.

- Identifies the limitation or the gap in those previous efforts.

You will have already mentioned this gap in the introduction, but here you need to build a solid case for why what you are doing is a meaningful contribution.

Literature reviews do not have a specific guidelines for length or number of citations. It's more about making a rhetorical argument; if it's a new problem then the review can be shorter. But you'll need to refer to previous attempts at the problem, the methods you are trying, and other things.

2.1. Citations and Bibliographies

Quarto has a robust method for generating citations. If you follow the setup instructions, then you can easily search your database from inside Rstudio after typing the `@` command. Keep your Zotero database up-to-date and correct (and share it with your coauthors!) to minimize the pain you will feel in writing articles.

Note that there are two ways to make citations. Doing `@key` will give you a text citation, allowing you to refer to the author mid-sentence.

> Ben-Akiva and Lerman (1985) is the canonical reference in choice modeling for transportation.

But if you put the citation in brackets like `[@citationkey]` you can make parenthetical citations. You can also give page numbers for quotes or specific findings this way.

> The difference in the choice model logsum can be used as a measure of consumer surplus, and therefore accessibility improvement (Ben-Akiva and Lerman, 1985, p. 301).

3. Methodology

To estimate the impact of Utah's IMT program expansion, we collect data from UDOT and UHP and model the impacts with a linear regression analysis.

3.1. Data

Describe the UHP incident database.

Describe the UDOT incident database.

Describe efforts to clean and filter the data for usable records.

Table 1: Descriptive Statistics of Data by Crash Severity

		Fatal (N=6)		Personal Injury (N=217)		Property Damage (N=180)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
IMT responding		2.2	1.0	1.5	0.7	1.4	0.7
UHP responding		10.5	3.7	3.5	1.7	2.9	1.4
Response time		34.9	30.5	14.5	9.4	14.8	10.2
Roadway clearance time		198.2	33.8	50.0	31.6	37.0	30.9
Incident clearance time		190.5	8.9	65.5	35.3	59.7	28.7
Total lanes on roadway		5.3	0.5	5.1	1.3	5.2	1.1
Lanes closed for incident		4.2	1.6	2.0	1.1	1.9	0.9
Affected volume		7029.2	4739.6	6978.7	5035.0	7218.5	4878.6
Excess travel time		1608.0	2832.2	655.5	1052.8	572.5	876.5
Year		2020.7	2.1	2012.2	124.1	2010.0	134.8
		N	Pct.	N	Pct.	N	Pct.
Period	Afternoon Off Peak	3	50.0	87	40.1	62	34.4
	AM Peak	0	0.0	42	19.4	46	25.6
	Morning Off Peak	2	33.3	1	0.5	1	0.6
	Night Off Peak	1	16.7	21	9.7	4	2.2
	PM Peak	0	0.0	66	30.4	67	37.2

Table 1 presents descriptive statistics of the cleaned incident data by crash severity. Virtually all of the records are either property damage or personal injury crashes (approximately half each), with a handful of fatal crashes. The mean excess travel time for these fatal crashes is approximately three times higher than for the other more common crash types, though the wide standard errors and the high degree of skewness make conclusive statements about this question somewhat difficult.

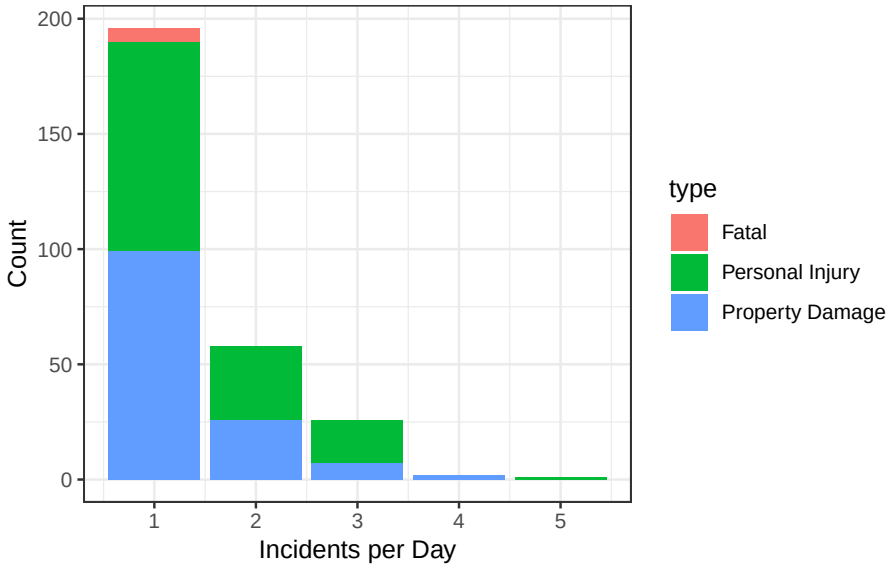

Figure 1: IMT-responding incidents per day by crash severity.

Figure 1 shows a distribution of incidents by day. This might not be the most relevant plot, but it's the one that I put together.

3.2. Models

We hypothesize that the increase in IMT units decreased response time as well as decreased excess travel time. This suggests two models,

$$\log(\text{IMT Response Time}_i) = X_i\beta$$

and

$$\log(\text{Excess Travel Time}_i) = X_i\beta + \delta \log(\text{IMT Response Time}_i)$$

where the index i denotes a single incident, X is a vector of controlling variables — the number of responding units, the size of the roadways, etc. — and β are estimated coefficients.

Table 2: Estimated Models of IMT Response Time

	Base	Year
(Intercept)	2.913***	2.976***
	(0.262)	(0.264)
Personal injury crash (ref. property damage)	0.030	0.058
	(0.104)	(0.105)
Fatal crash (ref. property damage)	0.922+	0.937*
	(0.470)	(0.469)
Total lanes on roadway	-0.057	-0.053
	(0.042)	(0.042)
N. IMT units	-0.139+	-0.141+
	(0.074)	(0.074)
N. UHP units	-0.006	-0.004
	(0.031)	(0.031)
2022 dummy (ref. 2018)		-0.179+
		(0.103)
Num.Obs.	384	384
R2	0.025	0.032
R2 Adj.	0.012	0.017

Standard errors in parentheses
Dependent variable: *textbackslashlog*(Response time).
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

4. Results

Table 2 shows regression estimates of models predicting the natural log of the IMT response time. A Base model

Table 3 shows estimates of regression models predicting the excess travel time.

4.0.1. Predictions

5. Conclusions

This section need not be overly long. You should address any limitations of your results, such as dependence on underlying assumptions or geographic scope. You should also provide a map for future research.

Finally, you should underline the contributions of this work and any practical relevance.

Table 3: Estimated Models of Excess Travel Time

	Base	Year	Year and RT
(Intercept)	3.303***	3.603***	3.049***
	(0.442)	(0.434)	(0.569)
Personal injury crash (ref. property damage)	-0.043	0.069	0.066
	(0.174)	(0.171)	(0.177)
Fatal crash (ref. property damage)	-1.488+	-1.449+	-1.630*
	(0.807)	(0.784)	(0.797)
Total lanes on roadway	0.189**	0.207**	0.182*
	(0.071)	(0.069)	(0.072)
N. IMT units	0.445***	0.432***	0.455***
	(0.126)	(0.122)	(0.126)
N. UHP units	0.135*	0.149**	0.157**
	(0.053)	(0.052)	(0.053)
2022 dummy (ref. 2018)		-0.834***	-0.390
		(0.169)	(0.465)
IMT response time			0.248+
			(0.136)
2022 $\times$ IMT Response time			-0.167
			(0.176)
Num.Obs.	403	403	384
R2	0.076	0.130	0.135
R2 Adj.	0.064	0.116	0.117

Standard errors in parentheses

Dependent variable: *textbackslashlog*(Excess travel time).

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

References

Ben-Akiva, M., Lerman, S.R., 1985. Discrete Choice Analysis: Theory and Applications to Travel Demand. MIT Press. URL: https://www.jstor.org/stable/1391567?origin=crossref.