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# Replication and Reproduction in Canadian Policing Research: A Note

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*Dans cette étude, les auteurs discutent de l'importance de reprendre et de reproduire des études afin de bâtir une base de données probantes en recherche policière. Ces données probantes, notent-ils, sont importantes en ce qui concerne l'orientation des politiques et des pratiques policières et, de manière plus générale, les efforts de sécurité communautaire. Malgré la valeur reconnue d'un tel travail, une analyse de la portée des études en matière de recherches policières canadiennes, révisées par les pairs et publiées au cours des 10 dernières années, dévoile que très peu de chercheurs reproduisent d'autres études. Des solutions potentielles sont proposées à la conclusion de cette étude.*

*Mots clés : maintien de l'ordre, recherche, méthodologie, reprise, reproduction*

*In this paper, the authors discuss the importance of replication and reproduction studies to building an evidence base in policing research. This evidence base, they note, is important to the task of informing sound policy and practice in policing and in relation to community safety efforts more generally. Despite the recognized value of such work, a scoping analysis of peer-reviewed Canadian policing research published over the past 10 years reveals that very few researchers engage in research aimed at replicating other studies. Potential remedies are suggested in the paper's conclusion.*

*Keywords: policing, research, methodology, replication, reproduction*

Getting it right means regularly revisiting past assumptions and past results and finding new ways to test them. The only way science is successful and credible is if it is self-critical.

- Brian Handwerk (2015)

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## Introduction

In recent years, the field of psychology has been struggling with what has been termed the “replication crisis” (Maxwell, Lau, and Howard 2015). The genesis of this crisis was growing awareness that very few studies in this field had been subsequently re-tested and reanalysed by different researchers – that is, they had been neither replicated nor reproduced and thus lacked the credibility that comes from having one’s results subjected to independent verification (Makel, Plucker, and Hegarty 2012). In response, a group of researchers launched the Reproducibility Project, an initiative that encourages replication of existing psychology studies and provides open access to the research plans, hypotheses, methods, and data of these replication studies for other researchers to review, critique, and analyse. Among the products of this project is a landmark study carried out by the Open Science Collaboration (OSC), which found that fewer than half of 100 studies published in three top psychology journals in 2008 could be effectively replicated (OSC 2015).

The problem of lack of replication attempts is hardly unique to psychology. The bias in favour of publishing original results – particularly results that can be tagged as having some “innovative” and/or “novel” feature – can also be found in the field of criminology. A recent paper by McNeeley and Warner (2015: 581) contained results of an analysis that these authors had conducted on replication in criminology; they observed that “replication studies constitute just over 2 percent of the [criminology] articles published between 2006 and 2010.”<sup>1</sup> They further noted that of the replication studies published in criminology journals during that period, the tendency was to publish articles in which the second set of results conflicted with those of the original study (*ibid.*).

As part of the authors’ interest in advancing policing research in Canada, the first author has been conducting an analysis of the published Canadian policing-research literature. The original goal in conducting this scoping analysis was to be able to assess where identifiable research needs exist. However, being aware of the issues surrounding lack of replication and reproduction in social scientific research, her team also coded each of the studies collected as to whether they were a “replication,” a “reproduction,” or an “original” piece of research. The results were then analysed, and it is the findings of this analysis that inform the present research note.

## A note on terminology

There has been some debate in and across the social sciences about the appropriate terminology to use when discussing the reanalysis of existing studies (Drummond 2009). Whereas many researchers use the terms *replication* and *reproduction* synonymously, we treat them as two different types of study. To help the reader better understand how we use these terms, we offer some brief definitions and examples.

We define *replication* as an attempt to use the same methods used in an original piece of research to see whether a second (or third or fourth) study achieves similar results. Replications obviously differ from the original study because the experimenters are different; they may also differ because they rely on a different group of research participants or research locations. For example, if a study was done by one group of researchers looking at the discretion used by patrol officers in Chicago when interacting with mentally ill individuals, it could be replicated by another group of researchers looking at the discretion used by patrol officers in Los Angeles – *as long as the methods used were otherwise the same*. In other social sciences, this form of replication is sometimes referred to as a “direct” or “literal” replication (Schmidt 2009).

It is not always possible to recreate all aspects of a study’s methodology, and, in these cases, subsequent researchers have to make more significant modifications than simply changing the research location or research participants. But they try to reproduce the effects of an earlier study using a fairly similar research methodology. When this happens, we call the study a *reproduction*. An example of a reproduction study is one in which researchers tested the French version of an English-language interview tool (one that had already been tested) to see whether they would achieve results similar to those reported in the original study. Reproduction is sometimes referred to in other social sciences as a “conceptual” replication (Schmidt 2009).

## Methods

The present note contains data collected for a larger scoping review on the size, scope, and contents of the Canadian policing-research literature currently being conducted on behalf of the Canadian Society of Evidence Based Policing (CAN-SEBP). As part of its mandate to improve our understanding of the size and scope of the Canadian policing-research literature and its contents, CAN-SEBP is engaged in a

larger program of collecting and analysing, first, all the peer-reviewed, published Canadian policing research and, eventually, all the non-peer-reviewed work available. This project is being conducted in successive waves of collection and analysis, with the first wave entailing a scoping review of all published work from 2006 to 2015 (a 10-year period). Analysis of materials collected from the second wave, extending back to 2000<sup>2</sup> (a 16-year period), informs the results presented in this paper. A third wave (1990–2015) was begun shortly after this paper was first written and is still ongoing.

For the period 2000 to 2015, 218 pieces of published research on Canadian policing were systematically collected and coded. In the early stages of coding these materials, the decision was made to add three additional codes: replication, reproduction, and original. The addition of these codes led to three research questions.

- RQ1: How many published Canadian policing studies over the previous 16 years replicate or reproduce other studies?
- RQ2: What types of studies (by subject and methodology) have been replicated?
- RQ3: What types of studies (by subject and methodology) have been reproduced?

### **Data collection methods**

The 218 studies analysed were collected using a systematic searching process. Focusing on published studies for the period 2000 to 2015, the researcher and her team used various search engines against academic databases to identify any published journal articles that met the search criteria. Keywords used included variations of *Canada*, *Canadian*, *police*, *policing*, *research*, and *study*. Databases searched were Sociological Abstracts, Psycinfo, Criminal Justice Abstracts, PubMed, and Web of Science.

To sift through the search engine results, each abstract returned from a search was read based on a series of inclusion and exclusion criteria. The inclusion criteria were:

- the paper contains the results of a research study
- the focus of the research was some aspect of Canadian public policing
- the research drew (at least in part) on Canadian data

- the paper contained a clear description of the methodology employed

Exclusion criteria were:

- the paper did not contain discussion of a study (e.g., opinion piece, commentary, introduction)
- the study topic was not on some aspect of Canadian public policing (e.g., it was on private policing, international forms of policing, etc.)
- the study was a historical analysis
- the study was not published in English<sup>3</sup>
- the paper contained no discussion of research methodology
- we could not access the paper<sup>4</sup>

If it was not clear after reading the abstract whether a paper met the inclusion criteria, the article was downloaded and read in full.

### **Data coding and analysis**

The findings contained in this research note are based on results achieved from coding the collected studies using one of three codes we had devised: replication, reproduction, and original. These codes were defined using criteria established in the research literature.

To make our determinations as to how a study should be coded, we followed McNeeley and Warner's (2015) example. We engaged in line-by-line readings of the papers, examining how the author(s) described the study. A study was coded as a replication if the author(s) stated that it was an attempt to replicate previous research; a study was coded as a reproduction if the author(s) used language to indicate that their work was an attempt to replicate previous research, but that some key element of the methodology had been changed. By way of contrast, originality was assessed through author references to a study as "innovative," "original," or "filling a gap" (ibid.). Once each study was coded, all coding was independently verified by a second rater. Agreement between the first and second raters was 100%.

### **Findings**

We begin by presenting how many replication and reproduction studies have been conducted. We then examine the types of studies that have been replicated or reproduced.

**Table 1: Year and number of publications**

<b>Year</b>	<b>Replication (n)</b>	<b>Reproduction (n)</b>
2000	-	-
2001	-	1
2002	-	2
2003	-	1
2004	-	-
2005	-	1
2006	-	-
2007	1	-
2008	1	-
2009	1	-
2010	-	-
2011	2	3
2012	1	1
2013	-	1
2014	-	1
2015	-	1
<b>Total</b>	<b>6</b>	<b>12</b>

***How many Canadian policing studies are replications or reproductions?***

The first wave of this study resulted in a collection of 188 published research papers from the preceding 10 years (2006–2015); this was subsequently expanded to 218 papers over a 16-year period (2000–2015). Of these 218 papers, 18 (or approximately 8%) met the criteria for being either a replication of an existing study or a reproduction. As Table 1 shows, 6 were replications, and 12 were reproductions. The majority of replications were published before 2012, whereas most reproduction studies were published in 2011 and later.

***What types of policing studies have been replicated in Canada?***

As shown in Table 2, of the six replication studies identified, three were replications of existing studies on police interviewing practices. It is worth noting that each study came from the same research lab, which has been working on identifying best practices for police interviewing for several years. Subject matter covered in the remaining three

**Table 2: Topic and type of replications**

Topic	Methodology	Authors and year
Interviews/interrogations	Quantitative	King and Snook 2009
	Quantitative	Snook and Keating 2011
	Quantitative	Snook et al. 2012
Officer mental health	Quantitative	Asmundson and Stapleton 2008
Police discretion	Quantitative	Day and Ross 2011
	Quantitative	Schulenberg, Jacob, and Carrington 2007

studies was police discretion ( $n = 2$ ) and police mental health ( $n = 1$ ). The methods used in all the replication studies were uniformly quantitative. This is perhaps not a surprising finding given that quantitative methodologies can, depending on the particular methods employed, be easier to replicate than qualitative techniques, such as interviewing or field observation. That said, the particular methods used in each study were varied, ranging from statistical analyses using Uniform Crime Reporting data to coding and analysing interview transcripts and video data.

### ***What types of policing studies have been reproduced in Canada?***

As shown in Table 3, 12 studies met the criteria for a reproduction study. The subject matter covered was more diverse than in the

**Table 3: Topic and type of reproductions**

Topic	Methodology	Author(s) and year
Interviews/interrogations	Quantitative	Cyr and Lamb 2009
	Quantitative	Price and Roberts 2011
Officer health	Quantitative	Boivin, Boudreau, and Tremblay 2012
Officer mental health	Quantitative	Iwasaki et al. 2002
	Quantitative	Kohan and Mazmanian 2003
Police attitudes	Quantitative	Alain and Baril 2005
Police cautions	Quantitative	Davis, Fitzsimmons, and Moore 2011
Police recruitment	Quantitative	Anderson, Plecas, and Segger 2001
Police strength	Quantitative	Ruddell and Thomas 2015
Police training	Quantitative	Shipley and Baranski 2002
	Quantitative	Armstrong, Clare, and Plecas 2014
Specialized policing	Qualitative	Côté-Lussier 2013



replication studies, but two studies similarly explored police interviewing techniques. The remaining topics included police cautions, training, specialized policing, police organizational strength, and officer health. As with the replication studies, the majority of the reproduction studies were quantitative in nature. However, it is interesting to note that whereas none of the replication studies involved experimental designs, five of the reproduction studies reproduced experimental or quasi-experimental techniques. Eleven of them were quantitative studies, containing statistical analyses using data from surveys of police, census data, or coded interview transcripts. Only one study used qualitative techniques; it relied on interviews and document analysis.

## Discussion

The results above are disconcerting. Although we identified a greater percentage of studies in our sample as being replications or reproductions (approximately 8%) than McNeeley and Warner (2015) had found in their broader analysis of the criminological literature (just over 2%), the overall volume of studies that replicate or reproduce previous work remains low, and the range of topics covered in these replication/reproduction attempts is very narrow. Indeed, this figure has significant implications for how we address several issues related to community safety.

Problems associated with the general lack of replication in criminology become even more acute when one is interested in abstracting from the body of literature to inform public policy and practice. This is particularly the case in relation to evidence-based policing, which – not surprisingly, given its name – requires an evidence base on which to build an understanding of “what works” (Sherman 2015). Further, as anyone familiar with evidence-based policing knows, a fundamental component of this approach is the belief that policing should be informed by the results of methodologically rigorous studies (Braga, Welsh, and Bruinsma 2013). Central to this idea of “rigour” in the sciences is the axiom that studies be reproducible so that the results can be challenged to see whether they withstand careful scrutiny. If we rarely, if ever, replicate or reproduce studies, we have no way of knowing how rigorous the original research was, and we have no solid evidence base on which to build informed models, policies, and practices.

Drawing from the results obtained from the analysis presented here, in spring 2016 the CAN-SEBP launched its Replication and Reproduction

Project. Modelled after the Reproducibility Project, the aim of this initiative is to encourage researchers across Canada either to replicate existing studies that have examined some aspect of public policing in Canada or to reproduce them. Our inclusion of both types of reanalysis studies is what makes our project unique. (The Reproducibility Project restricted its studies to direct replications [OSC 2015].) We are aware that not all methodologies can be perfectly replicated; therefore, we also encourage researchers to re-test studies using different methods to see the extent to which the original findings will be robust across different populations and/or techniques.

### ***Moving forward***

How does CAN-SEBP plan to facilitate the Replication and Reproduction Project? As the research team organizing this project on behalf of CAN-SEBP, we envision it moving through the following phases: (1) selecting studies to be replicated or reproduced, (2) making attempts to replicate or reproduce the studies, (3) registering the studies and providing open access to study materials and data, and (4) disseminating the results. CAN-SEBP hopes to play a role in each of these phases.

#### *Selecting studies to be replicated or reproduced*

A primary goal of the Replication and Reproduction Project is to gauge the degree to which policing research in Canada can be systematically replicated or reproduced; thus, it is important that the initial selection of candidate studies be unbiased. The OSC developed a purposefully arbitrary selection protocol to ensure a fair test of the reproducibility of psychological science; we will draw on that protocol as much as possible.<sup>5</sup> Unfortunately, we must consider factors that the OSC did not need to consider (or at least not to the same extent), and this complicates the selection process. For example, unlike the replication studies conducted by the OSC (2015), the studies we select will likely require the support of a police agency (to provide access to data, expertise, participants, etc.), and thus those agencies must deem the selected studies to be relevant and valuable. In addition, policing studies can be extremely challenging to conduct (they may require security clearances, equipment purchases, extensive travel, etc.), and we anticipate having to take this factor into account relatively frequently when determining which studies are suitable for replication or reproduction.<sup>6</sup> While we will use an unbiased process to select an initial pool of studies for the Replication and Reproduction Project, these issues dictate that we must necessarily go through

a process (with the assistance of potential collaborators and policing partners) of removing studies from the pool that are perceived to be of low relevance or value and/or are deemed too logistically challenging. Our initial goal is to identify 10 studies for replication or reproduction, after which time we plan to expand the project.

#### *Making attempts to replicate or reproduce the studies*

CAN-SEBP also hopes to facilitate attempts to replicate or reproduce studies. This will involve two primary elements. Consistent with the process used by the OSC (2012), guidance will be provided to collaborators during the project (e.g., to collaborate with the original authors on the research design, collect large enough samples to ensure adequate power, provide important statistical information, etc.). The goals are to standardize the replication/reproduction process as much as possible to increase the ease with which replications or reproductions can be carried out and to maximize the quality of the attempts (ibid.). Given some of the logistical challenges we anticipate in conducting the replications or reproductions, and in motivating researchers to participate in the process, we also plan to explore funding opportunities that will allow us to cover the costs of expensive replication/reproduction attempts.

#### *Registering the studies and providing open access to study materials and data*

In addition to making replication/reproduction attempts, another key component of the Replication and Reproduction Project will be registering each of the replication or reproduction studies and providing access to study materials and data on an open-access website. Fortunately, the Open Science Framework (OSF), of which the OSC is a part, has already developed a web platform to manage projects like this.<sup>7</sup> Consistent with the practices of the OSC, we will be asking our collaborators to register their study once an assignment has been made and to upload key pieces of information to the project site over the course of the research project. This information will include details of the replicated study, the hypothesis that is being tested, the research design being used (including planned sample size and composition, conditions, materials), methods of analysis being used, analysis scripts used, and all raw data.

Why is this such an important element of the project? One reason to encourage open sharing of study materials and data is to prevent

questionable research practices from being used (e.g., failing to report all of a study's measures, deciding to collect more data after inspecting results for significant findings, inappropriately rounding off  $p$ -values to make them appear significant, etc.) – practices that are common in social science research (John, Loewenstein, and Prelec 2012). Another reason is that having access to the full details of the original and replication or reproduction studies will facilitate our understanding of the project's results (OSC 2015). For example, if a low replication or reproduction rate is found, having access to these details will make it easier to uncover the potential reasons.

### *Disseminating the results*

The final phase of the project will be disseminating the results. We anticipate presenting the findings from the project at academic conferences and publishing the results in a peer-reviewed journal, with authorship to include all the collaborators who took part in the replication/reproduction attempts. However, in the spirit of making the results of the project more openly accessible, we will also require collaborators to post standardized final reports of their studies to the OSF website, and we will post these reports on the CAN-SEBP site.<sup>8</sup>

### **Final remarks**

Like many other disciplines, there has been little effort in the field of Canadian policing research to replicate or reproduce findings. Our analysis suggests that the percentage of studies representing replications or reproductions of original Canadian policing studies is around 8%. Not only is this shocking given that “reproducibility . . . is one of science's defining features” (OSC 2012: 657), it is particularly troubling to find such a result in a field of research that attempts to inform public policy and practice. The CAN-SEBP Replication and Reproduction Project hopes to rectify this situation. We believe the results of this project will be important. If it reveals a high replication/reproduction rate, not only can we be more confident in using our research to inform evidence-based policing, but we can also be more confident in the state of our discipline and how we go about conducting, evaluating, and publishing research (OSC 2012).

However, even if the replication/reproduction rate is low – a real possibility, given the results from similar projects – we think the project can have a positive effect on our field. For example, a low reproducibility

rate may result in conversations among researchers about the state of our field that would not take place otherwise (e.g., see OSC 2015, 2016; Gilbert et al. 2016). These discussions will allow us to reflect on the research and publication practices that led to this result, and it may perhaps even inspire new studies to determine why the use of the same (or similar) procedures failed to result in the same (or similar) findings. Ultimately, this is what will be needed to develop a sufficient evidence base that the police can rely on to perform their duties more efficiently and effectively.

## Notes

- 1 This problem is also not restricted to the social sciences. Indeed, the same concern exists in fields as diverse as advertising, biology, and economics. One recent study that examined education research found that, out of the 164,589 studies examined, only 0.13% of them were replication attempts (Makel and Plucker 2014).
- 2 The year 2000 was selected as a cutoff for the second wave because of the increased difficulty of finding previously published articles. Many articles published earlier than 2000 are not indexed in as many article databases and thus require more intensive search methods.
- 3 The authors excluded papers in French on the grounds that neither the authors nor the independent coders are fluent in French.
- 4 If a paper was not available through the subscribed databases at the first author's university, efforts were made to retrieve it from other sources, including contacting the paper's author(s) directly.
- 5 In brief, the protocol adopted by the OSC (2012) involved selecting the first 30 articles appearing in three leading psychological journals in the year of publication (2008). Research teams would select a key finding from the last study in the article to replicate, unless for some reason they could not replicate it (e.g., because they needed specialized equipment). In those cases, they would select a key finding from the preceding study in the same article to replicate.
- 6 To an extent, this was also true in the case of the project carried out by the OSC. Indeed, a proportion of the studies in the "eligible pool" were ultimately not selected for replication because they required "specialized samples (such as macaques or people with autism), resources (such as eye tracking machines or functional magnetic resonance imaging), or knowledge making them difficult to match with [research] teams" (OSC 2015: 945).

7 For more on the OSF platform, go to <https://osf.io>.

8 The CAN-SEBP website can be found at <http://www.can-sebp.net>.

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