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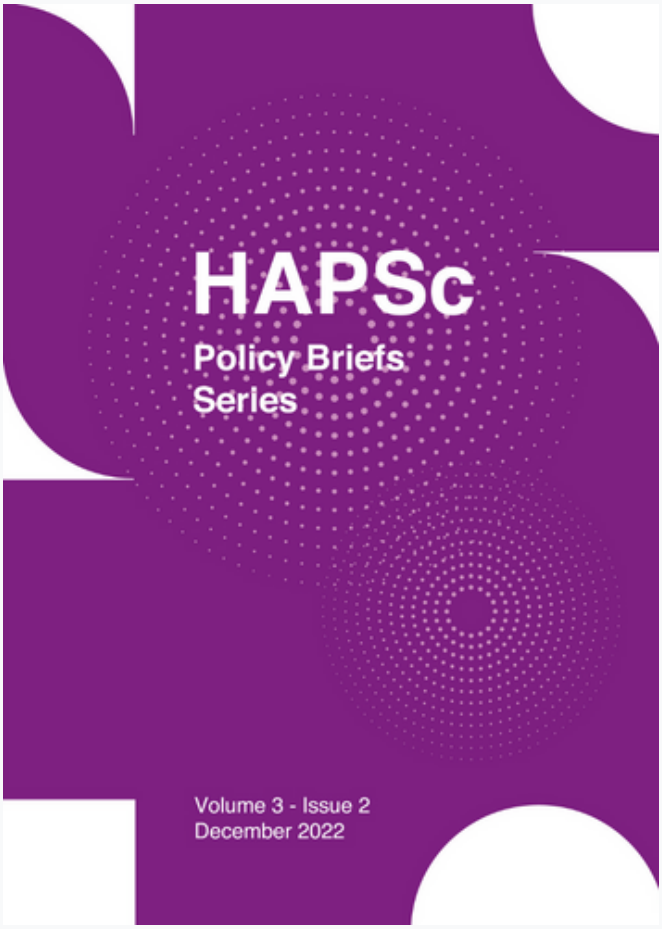

How Heart Rate Variability Biofeedback Can Improve Police Performance: Public Policy Based on Evidence

Tânia Pinc, Luiz H. Caparroz, Maria Rita C. Santos, Tatiana C. Nery, Marcio Silva Santos

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How Heart Rate Variability Biofeedback Can Improve Police Performance: Public Policy Based on Evidence[1]

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Abstract[5]

We tested the impact of heart rate variability biofeedback (HRV-BF) on police performance in order to reduce protocol gaps and response time in scenarios that simulate life-threatening situations. The sample gathered fifty-one frontline police officers from the city of Barueri in Brazil who were distributed into two groups: (i) the experimental group (26 officers) which attended a 5-days protocol of HRV-BF training; and (ii) the control group (25 officers) which did not train. The performance of both groups was assessed before and after the HRV-BF training, and the results were compared. The findings show that HRV-BF positively impacted the experimental group's performance by decreasing procedural gaps and timing. In contrast, the performance of the control group remained stable. Based on this evidence, the Secretariat of Urban Security and Social Defense of Barueri decided to make HRV-BF into public policy.

Keywords: Police Performance; HRV Biofeedback; Protocols; Time Response; Lethal Force; Public Policy; Brazil.

Introduction

Shooting or not shooting: it is not a simple decision. Invariably, it must be made in a life-threatening situation, which requires the police officer to be fast and follow procedures to reduce his/her exposure to risk and avoid the misuse of lethal force. In order to improve the performance of its personnel, police organizations have traditionally standardized operating procedures (SOP) and invested in training. However, even well-trained police officers can decrease performance under pressure (Arble et al., 2019; Pinc, 2011; 2007; Nieuwenhuys et al., 2009), and such errors may be costly for society and the government.

The key point of the problem is the spontaneous physiological response to threat, which provokes changes in the body, such as an increase in heart rate that moves blood to the members, and prepares

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[5] The pilot study was supported by the Use of Force Lab and the Secretary of Urban Security and Social Defense of City of Barueri. Use of Force Lab is a research and development center that investigates police performance and develops interdisciplinary strategies to improve the performance of frontline police officers.

it to "fight or flight" (LeDeoux & Damasio, 2014). In other words, the organism triggers the state of defense whose condition does not favor coherent decision-making.

As part of a set of public security policy reforms, the Secretariat of Urban Security and Social Defense of Barueri decided to do a pilot study to test heart rate variability biofeedback (HRV-BF). This study would be done in addition to procedural and technical training to manage the effects of the autonomic body response and improve police performance. Evidence has shown that HRV-BF can promote (i) a direct effect on the nervous system restoring the inner balance or promoting cardiac coherence[6] (McCraty, 2015); and (ii) an indirect effect on the performance decreasing errors in the use of lethal force (Andersen et al., 2018).

Pilot Study Design

In some Brazilian police organizations, such as the Civil Guard of Barueri, a calendar of five days of training a year is usual. According to police managers, a training period longer than that would impact the budget and policing, because it takes place during service hours reducing the personnel in policing. Taking this into account, we introduced an HRV biofeedback protocol in the regular training schedule (Table 1).

TABLE 1 – Regular Training *with* HRV Biofeedback Protocol

Schedule	Monday	Tuesday	Wednesday	Thursday	Friday
Morning	Performance evaluation	HRV-BF P&T	HRV-BF P&T	HRV-BF P&T	Performance evaluation
Afternoon	HRV-BF theory and practice	HRV-BF P&T	HRV-BF P&T	HRV-BF P&T	

P&T, Procedural and Technical Training.
HRV-BF, Heart Rate Variability – Biofeedback.

The pilot study design arranged the regular training schedule to evaluate performance pre and post-intervention, which means, before and after the HRV biofeedback protocol. The study gathered a sample of 51 police officers who were distributed into two groups: (i) the experimental group (26 participants), which received the intervention; and (ii) the control group (25 participants), which did not practice HRV-BF.

[6] Cardiac coherence is a term used to describe the measurement of the order, stability, and harmony in the oscillatory outputs of the body's regulatory systems (Tiller et al., 1996).

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The purpose was to compare the performance of the two groups, before and after the intervention, to find out if there was any improvement in the experimental group and if this improvement was greater than that of the control group. In that regard, the activities of the control group training were organized in the same order as the experimental group's training but without the HRV-BF protocol (Table 2).

TABLE 2 – Regular Training *without* HRV Biofeedback Protocol

Schedule	Monday	Tuesday	Wednesday	Thursday	Friday
Morning	Performance evaluation	P&T	P&T	P&T	Performance evaluation
Afternoon	P&T	P&T	P&T	P&T	

P&T, Procedural and Technical Training.

The training schedule of the control group took place in the week of August 29 to September 02, 2022 (Table 2), and that of the experimental group, from September 12 to 16, 2022 (Table 1). There was only one week between the training scales of the two groups.

Sample selection was non-random in the reason of the policing shifts. However, the professional characteristics of both groups were very similar: they carried out the same policing activity, in the same area and reported to the same commander. Any existing individual differences remained stable during the pilot study; therefore, we assume that they did not interfere with the results.

Performance Evaluation

Performance was evaluated in a scenario where participants had to fire ten shots and there were four targets they should shoot and two they should not. Considering that in a life-threatening situation, police officers must follow security rules and make their decision in a short time, the evaluation was based on two criteria: (i) golden rules, which are safe procedures; and (ii) timing. A set of ten golden rules were defined, and the score was either 0 (followed) or 1 (not followed), and there were also penalties that added 10 scores each. A timing scale was established and the shorter the time, the lower the score. In the end, the scores achieved in each criterion were added. Therefore, lower scores are equivalent to better performance.

The analysis presented in this paper did not consider the accuracy of the shots because the purpose was to evaluate what preceded them. However, this measurement will be introduced in future studies.

HRV Biofeedback Protocol

HRV-BF is a non-invasive technique that consists of providing an individual with real-time feedback on instantaneous heart rate and respiration changes while being instructed to breathe at low frequencies (Lehrer & Gevirtz, 2014). The HRV-BF training employs an electronic device with a sensor to monitor the heart rate and a pacer to guide the breath frequency.

The best-known HRV-BF protocols indicate five to ten weeks of training, and they have been used for treating health conditions involving asthma, pain, anxiety, depression, and other psychophysiological disorders (Lehrer et al., 2013; 2000). Studies to improve police performance demonstrated a four-day HRV-BF protocol was successful (Andersen et al., 2018); and one day was insufficient (Di Nota et al., 2021).

Lehrer's protocols seek to improve health, and the protocols of Andersen and Di Nota focus on performance. Both cases show that training schedules can vary; however, HRV-BF protocol for improving performance tends to be shorter because the purpose is to teach police officers how to self-regulate when in the face of critical situations.

The HRV-BF protocol designed for the pilot study was inspired by Andersen's research (2018). It was introduced to the experimental group in the afternoon of day 1 (Monday) through theoretical class followed by practice. Understanding how the body works when facing a threat and how HRV-BF promotes self-regulation was essential knowledge to begin the intervention. From day 2 (Tuesday) to day 4 (Thursday), participants practiced 40 minutes of HRV-BF twice a day before activities of procedural and technical training (Table 1).

The HRV-BF training used the cardioEmotion®, which is made in Brazil. This device is connected to a computer through a USB stick, and its sensor is plugged into the earlobe or finger. The participant chooses one of nine options and starts the biofeedback training, breathing in and out, following the pacer that is displayed on the computer screen. The objective of the training is to keep the pacer in green color as long as possible because it is an indicator of cardiac coherence.

Unlike other protocols that use one biofeedback device per person, this study employed a single device, and the HRV-BF training was made in groups. One participant plugged in the sensor, and the images of the computer were projected onto a big screen to allow all other participants to adjust their breathing to the pacer rate. In each forty-minute session, an average of five participants took turns

training with the device, so that by the end of day 4, everyone had completed both individual and group training.

We used this method for two main reasons: (i) cost, there were not enough resources to buy a device for each participant; and (ii) group coherence, participants work together – four police officers in a patrol car. HRV-BF can promote group coherence, and in a coherent team, there is freedom for the individual members to do their part and thrive while maintaining cohesion and resonance within the group's intent and goals (McCraty, 2015). Police officers responded positively to the intervention, and the training method increased group interaction. The group's interest in biofeedback training exceeded expectations.

Outcomes

Following protocols and acting in a short time are requirements to reduce errors in the use of lethal force. Therefore, the methodology intended to create a measure to reveal the performance gaps regarding protocols and response time. According to this methodology, the best score would be 0 (zero). However, Table 3 shows that the lowest score was 19,9 from a participant in the experimental group in the post-intervention. The findings suggest that it is possible to reduce the gaps but not eliminate them. In other words, there is no perfect police performance in a life-threatening situation.

TABLE 3. Performance Measurement

	Pre-intervention		Post-intervention	
Group	Score Range	Mean Score	Score Range	Mean Score
Control	28,0–80,4	52,5	28,0–80,4	52,5
Experimental	22,1–100,7	52,5	19,9–68,6	41,4

However, we want to know the impact of HRV biofeedback on police performance in scenarios that simulate a life-threatening situation. To this end, we selected the mean score to compare before and after biofeedback training results within and between groups.

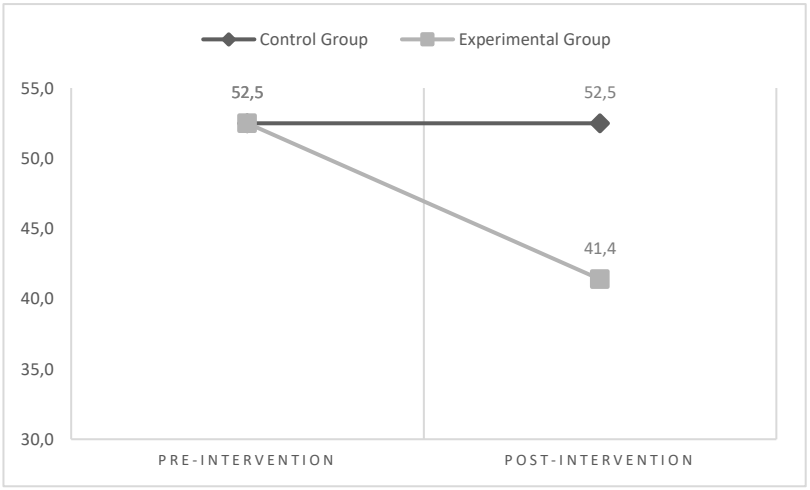

Figure 1. Mean performance of the groups before and after HRV-BF training. The control group's performance remained stable, and there was an improvement in the performance of the experimental group after the intervention.

The findings represented in Figure 1 show the performance of both groups is similar in pre-intervention[7]. The score of the control group did not vary from pre- to post-intervention, the experimental group improved its performance by diminishing the score, which means, reducing the gaps in protocol and time of response. After HRV-BF training, the performance of the experimental group improved by 21.2% (11.1) compared to the control group. The findings show HRF-BF provided a positive impact on police performance.

Towards Public Policy

Based on the evidence from the pilot study, the Secretariat of Urban Security and Social Defense of Barueri decided to implement HRV-BF training as public policy. The next steps are to arrange a schedule to train the police officers who integrated the control group, and to introduce the 5-day HRV-BF protocol into regular training in the year 2023.

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