

# Funding source and author affiliation in TASER research are strongly associated with a conclusion of device safety

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**Background** Controversy exists regarding the safety of electrical stun guns (TASERs). Much of the research on TASERs is funded by the maker of the device and, therefore, could be biased. We sought to determine if funding source or author affiliation is associated with TASER research conclusions.

**Methods** MEDLINE was searched for TASER or electrical stun gun to identify relevant studies. All human and animal studies published up to September 01, 2010, were included. Reviews, editorials, letters, and case reports were excluded from the analysis. Two independent reviewers blinded to this study hypothesis evaluated each article with regard to conclusions of TASER safety.

**Results** Fifty studies were reviewed: 32 (64%) were human studies and 18 (36%) were animal studies. Twenty-three (46%) studies were funded by TASER International or written by an author affiliated with the company. Of these, 22 (96%) concluded that TASERs are unlikely harmful (26%) or not harmful (70%). In contrast, of the 22 studies not affiliated with TASER, 15 (55%) concluded that TASERs are unlikely harmful (29%) or not harmful (26%). A study with any affiliation with TASER International had nearly 18 times higher odds to conclude that the TASER is likely safe as compared with studies without such affiliation (odds ratio 17.6, 95% CI 2.1-150.1,  $P = .001$ ).

**Conclusions** Studies funded by TASER and/or written by an author affiliated with the company are substantially more likely to conclude that TASERs are safe. Research supported by TASER International may thus be significantly biased in favor of TASER safety. (*Am Heart J* 2011;162:533-7.)

Conducted electrical weapons are used worldwide by law enforcement agencies to incapacitate violent, combative individuals. The deployment of these devices by police departments is increasing.<sup>1</sup> TASERs, the most popular brand of electrical stun guns, deliver electrical pulses leading to stimulation of both sensory and motor nervous system and involuntary muscle contractions.<sup>2</sup>

Research studies thus far on TASERs have had conflicting results. Although some have found that TASER deployment is associated with an increased risk of injuries and sudden death,<sup>3-5</sup> others concluded that these devices cause no significant harm.<sup>6,7</sup>

A substantial number of studies on the TASER are funded by the manufacturer of the device, TASER

International. It has been suggested that this may have led to bias.<sup>8</sup> We sought to determine whether funding from TASER International or author affiliation with the company is associated with the conclusion that the device is safe.

## Methods

### Article selection

TASER literature was identified by searching the National Library of Medicine's MEDLINE for terms TASER and stun gun. All peer-reviewed articles including human and animal studies published up to September 01, 2010, were included. Exclusion criteria were established before study inclusion and data analysis. All review articles, editorial letters, and case reports were excluded. No language restriction was imposed.

### Article assessment

The entire manuscript including the conflict of interest statement and acknowledgment section of all articles were reviewed by 2 independent reviewers. A study was classified as having a TASER-affiliated author if one or more of the authors either had received funding from the company or had disclosed

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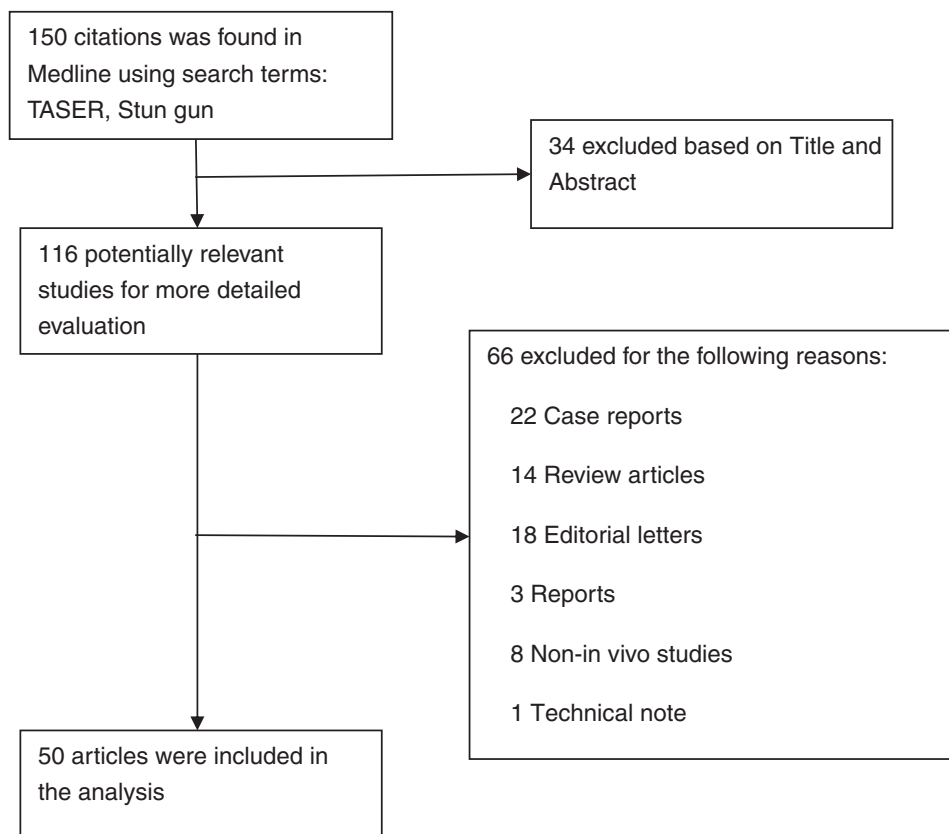
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**Figure 1**

Study flow chart.

a financial relationship with the company somewhere in the article. The assessment of funding source and author affiliation was not based on any data beyond what was disclosed in the articles. Studies either fully or partially funded by TASER International were considered TASER funded.

### Article conclusions

Two independent reviewers blinded to the hypothesis of our study evaluated each article's conclusions regarding the safety of TASERs. Based on the results and conclusion sections, the study outcomes were classified as harmful, probably harmful, unlikely harmful, and not harmful. Study outcomes of unlikely harmful and not harmful were considered a conclusion of safety. If the 2 reviewers classified the conclusions of an article differently, a third independent reviewer decided which of the 2 preliminary classifications would be used for analysis.

### Statistical analysis

Statistical analyses were performed using SPSS software for Windows version 16.  $\chi^2$  Analyses were conducted to compare proportions to test the null hypothesis that TASER affiliation is not related to conclusion about safety of TASERs. Logistic regression analysis was performed to calculate odds ratios (ORs)

and 95% CIs of dichotomous outcomes. Two-tailed  $P < .05$  was considered significant.

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The authors are solely responsible for the design and conduct of this study, all study analyses, the drafting and editing of the manuscript, and its final contents.

## Results

A total of 119 published articles on TASER were identified in the literature. Sixty-nine articles did not meet the inclusion criteria for the reasons shown in Figure 1, leaving 50 publications retained for analysis.<sup>3-7,9-53</sup> Descriptive characteristics of the studied articles are shown in Table I. All the studied articles were written in English.

Thirty-two (64%) of the articles reported human studies, and 18 (36%) reported studies performed on animals. Overall, 23 (46%) of the articles were funded by TASER or authored by an affiliate of the company (Table II). Twenty-two (96%) of these articles concluded that TASERs are unlikely harmful (26%) or not harmful (70%). In contrast, of the 27 studies not affiliated with

**Table I.** Descriptive characteristic of articles on TASER

Characteristic	Articles (N = 50)
Study population, n (%)	
Human	32 (64)
Animal	18 (36)
Author affiliation, n (%)	
Yes	19 (38)
No	31 (62)
Funding source, n (%)	
TASER	14 (28)
Non-TASER	11 (22)
No funding	25 (50)
Conclusion, n (%)	
Harmful	7 (14)
Probably harmful	6 (12)
Unlikely harmful	14 (28)
Not harmful	23 (46)

Values are presented as n (%).

**Table II.** Level of safety by any commercial affiliation

Study conclusion	TASER affiliation	
	Yes (n = 23)	No (n = 27)
Harmful	0 (0)	7 (26)
Probably harmful	1 (4)	5 (18)
Unlikely harmful	6 (26)	8 (30)
Not harmful	16 (70)	7 (26)

Values are presented as n (%).

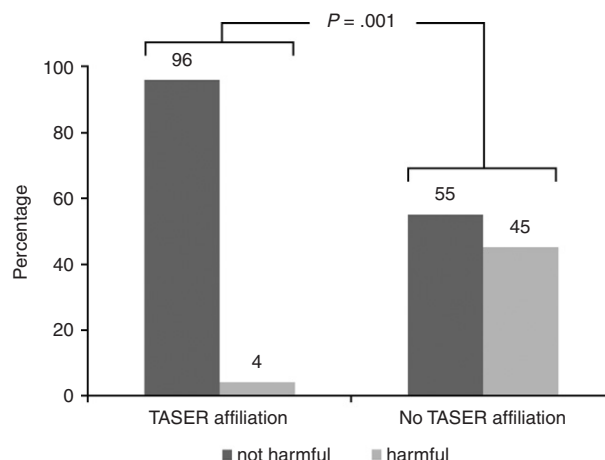
TASER International, 15 (55%) found that TASERs are unlikely harmful (29%) or not harmful (26%).

TASER-supported articles included a similar number of patients as studies without TASER affiliation (mean of 129 vs 166,  $P = .40$ ). Shown in Figure 2, a study with any affiliation with TASER International had 17.6 times greater odds of concluding that the TASER is likely safe as compared with studies without such affiliation (95% CI 2.1-150.1,  $P = .001$ ). This corresponds to a 75% greater probability that studies with TASER affiliation would conclude that the TASER is unlikely or not harmful.

## Discussion

With the rapid expansion of stun gun deployment by law enforcement agencies, several research studies have been performed to determine the safety of these devices. Many of these studies are funded by TASER International, which manufactures and markets the stun gun most commonly used by law enforcement in the United States. In our study, any affiliation with TASER International was strongly associated with concluding that TASERs are safe. This finding demonstrates that TASER International funding source and/or author affiliation may have a great influence on article conclusions.

**Figure 2**



Proportion of TASER articles with device-safety conclusions.

Although the safety of electronic control devices including TASERs has been investigated by several studies, controversy still exists as to whether TASERs can cause serious injuries. Some investigations have demonstrated that TASERs are safe with regard to cardiac arrhythmias, respiratory arrest, rhabdomyolysis, and acidosis.<sup>9-12</sup> However, all such studies were performed on animals or healthy volunteers, and the results would be difficult to extrapolate to the stressful circumstances during an arrest. Furthermore, many of these studies were supported by TASER International or authors affiliated with the company, which may influence the results and conclusions.<sup>13-16</sup> On the other hand, several studies have concluded that TASER deployment is dangerous, with the potential to cause ventricular fibrillation and sudden death.<sup>4,5,17,18</sup> There are also 22 case reports describing injuries associated with the TASER, most of which were not funded by the TASER International.<sup>54-56</sup> Notably, these case reports were excluded from our analysis.

There are several possible explanations for the disparate conclusions of the 2 groups of studies. The first possibility is that the literature may be biased; either research supported by TASER was done in a way to misleadingly conclude that the TASER is safe or likely safe or research performed by independent investigators was done in a way to misleadingly conclude that the TASER is harmful or likely harmful. It is clear why researchers being funded by TASER International or being paid by the company might have a tendency to bias their research in favor of the TASER. It is less evident the incentive for researchers without an affiliation with the TASER International to bias their research against TASER, although one might hypothesize that they strive for recognition for provocative research. Furthermore, some of these authors may serve as expert witnesses in lawsuits

against TASER International and thereby have secondary gain from vilifying the device. We were unable to accurately ascertain which authors were serving as expert witnesses in court cases.

The other possibility is that the study protocols chosen led to disparate conclusions about the TASER. It is possible that the authors who were funded by TASER International or had a financial affiliation devised study protocols more likely to show that the TASER is safe, whereas the authors with no affiliation with the company may have devised study protocols more likely to show that the TASER is harmful. For example, some of the TASER-funded studies examined the effects of healthy humans being stunned in the back, distant from the cardiac axis and thus unlikely to have significant effects on the heart.<sup>9,19</sup> In contrast, some animal studies analyzed the effect of TASER discharges very close to the heart in anesthetized pigs.<sup>4,5</sup> Swine hearts are more prone to ventricular tachyarrhythmia than those of humans,<sup>57</sup> and therefore, the choice of a pig model may make the TASER seem more dangerous.

The other explanation for this discrepancy is that studies sponsored by TASER International might have been less likely to be published if they found possible harm than if they found safety.

### Study limitations

Our study has several important limitations. First, our analysis is based on a relatively small sample size. Given limited published articles in this field, further studies are required with regard to the safety of TASERS. Second, the studies included in our analysis differ from each other in terms of study design and methodology. This heterogeneity makes comparison of the conclusions in these studies more difficult. Finally, the determination of funding source or author affiliation may have been incomplete or inaccurate. We relied primarily on the disclosures in the journal article, which may be unreliable.

### Conclusion

These data demonstrate that studies funded by TASER International or written by authors affiliated with the company are nearly 18 times more likely to conclude that TASERS are safe. Research supported by TASER International may thus be significantly biased in favor of TASER safety. Readers of articles about the TASER should consider funding and author affiliations in their evaluation of the article's conclusions.

### Disclosures

No conflict of interest; No financial support.

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