



## **PART 2 OF THE FBI PAPER: HANDGUN WOUNDING FACTORS AND EFFECTIVENESS**

### **The Allure of Shooting Incident Analyses**

There is no valid, scientific analysis of actual shooting results in existence, or being pursued to date. It is an unfortunate vacuum because a wealth of data exists, and new data is being sadly generated every day. There are some well publicized, so called analyses of shooting incidents being promoted, however, they are greatly flawed. Conclusions are reached based on samples so small that they are meaningless. The author of one, for example, extols the virtues of his favorite cartridge because he has collected ten cases of one shot stops with it.(38)

Preconceived notions are made the basic assumptions on which shootings are categorized. Shooting incidents are selectively added to the "data base" with no indication of how many may have been passed over or why. There is no correlation between hits, results, and the location of the hits upon vital organs.

It would be interesting to trace a life-sized anatomical drawing on the back of a target, fire 20 rounds at the "center of mass" of the front, then count how many of these optimal, center of mass hits actually struck the heart, aorta, vena cava, or liver. (39) It is rapid hemorrhage from these organs that will best increase the likelihood of incapacitation. Yet nowhere in the popular press extolling these studies of real shootings are we told what the bullets hit.

These so called studies are further promoted as being somehow better and more valid than the work being done by trained researchers, surgeons and forensic labs. They disparage laboratory stuff, claiming that the "street" is the real laboratory and their collection of results from the street is the real measure of caliber effectiveness, as interpreted by them, of course. Yet their data from the street is collected haphazardly, lacking scientific method and controls, with no noticeable attempt to verify the less than reliable accounts of the participants with actual investigative or forensic reports. Cases are subjectively selected (how many are not included because they do not fit the assumptions made?). The numbers of cases cited are statistically meaningless, and the underlying assumptions upon which the collection of information and its interpretation are based are themselves based on myths such as knock-down power, energy transfer, hydrostatic shock, or the temporary cavity methodology of flawed work such as RII.

Further, it appears that many people are predisposed to fall down when shot. This phenomenon is independent of caliber, bullet, or hit location, and is beyond the control of the shooter. It can only be proven in the act, not predicted. It requires only two factors to be effected: a shot and cognition

of being shot by the target. Lacking either one, people are not at all predisposed to fall down and don't. Given this predisposition, the choice of caliber and bullet is essentially irrelevant. People largely fall down when shot, and the apparent predisposition to do so exists with equal force among the good guys as among the bad. The causative factors are most likely psychological in origin. Thousands of books, movies and television shows have educated the general population that when shot, one is supposed to fall down.

The problem, and the reason for seeking a better cartridge for incapacitation, is that individual who is not predisposed to fall down. Or the one who is simply unaware of having been shot by virtue of alcohol, adrenaline, narcotics, or the simple fact that in most cases of grievous injury the body suppresses pain for a period of time. Lacking pain, there may be no physiological effect of being shot that can make one aware of the wound. Thus the real problem: if such an individual is threatening ones life, how best to compel him to stop by shooting him?

The factors governing incapacitation of the human target are many, and variable. The actual destruction caused by any small arms projectile is too small in magnitude relative to the mass and complexity of the target. If a bullet destroys about 2 ounces of tissue in its passage through the body, that represents 0.07 of one percent of the mass of a 180 pound man. Unless the tissue destroyed is located within the critical areas of the central nervous system, it is physiologically insufficient to force incapacitation upon the unwilling target. It may certainly prove to be lethal, but a body count is no evidence of incapacitation.

Probably more people in this country have been killed by .22 rimfire's than all other calibers combined, which, based on body count, would compel the use of .22's for self-defense. The more important question, which is sadly seldom asked, is what did the individual do when hit?

There is a problem in trying to assess calibers by small numbers of shootings. For example, as has been done, if a number of shootings were collected in which only one hit was attained and the percentage of one shot stops was then calculated, it would appear to be a valid system. However, if a large number of people are predisposed to fall down, the actual caliber and bullet are irrelevant. What percentage of those stops were thus preordained by the target? How many of those targets were not at all disposed to fall down? How many multiple shot failures to stop occurred? What is the definition of a stop? What did the successful bullets hit and what did the unsuccessful bullets hit?

How many failures were in the vital organs, and how many were not? How many of the successes? What is the number of the sample? How were the cases collected? What verifications were made to validate the information? How can the verifications be checked by independent investigation?

Because of the extreme number of variables within the human target, and within shooting situations in general, even a hundred shootings is statistically insignificant. If anything can happen, then anything will happen, and it is just as likely to occur in your ten shootings as in ten shootings spread over a thousand incidents. Large sample populations are absolutely necessary.

Here is an example that illustrates how erroneous small samples can be. I flipped a penny 20 times. It came up heads five times. A nickel flipped 20 times showed heads 8 times. A dime came up heads 10 times and a quarter 15 times. That means if heads is the desired result, a penny will give it to you 25% of the time, and nickel 40% of the time, a dime 50% of the time and a quarter 75% of the time. If you want heads, flip a quarter. If you want tails, flip a penny. But then I flipped the quarter another 20 times and it showed heads 9 times - 45% of the time. Now this "study" would tell you that perhaps a dime was better for flipping heads. The whole thing is obviously wrong, but shows how small numbers lead to statistical lies. We know the odds of getting a head or tail are 50%, and larger numbers tend to prove it. Calculating the results for all 100 flips regardless

of the coin used shows heads came up 48% of the time.

The greater the number and complexity of the variables, the greater the sample needed to give meaningful information, and a coin toss has only one simple variable it can land heads or it can land tails. The coin population is not complicated by a predisposition to fall one way or the other, by chemical stimuli, psychological factors, shot placement, bone or obstructive obstacles, etc.; all of which require even larger numbers to evidence real differences in effects.

Although no cartridge is certain to work all the time, surely some will work more often than others, and any edge is desirable in one's self defense. This is simple logic. The incidence of failure to incapacitate will vary with the severity of the wound inflicted.(40) It is safe to assume that if a target is always 100% destroyed, then incapacitation will also occur 100% of the time. If 50% of the target is destroyed, incapacitation will occur less reliably. Failure to incapacitate is rare in such a case, but it can happen, and in fact has happened on the battlefield.

Incapacitation is still less rare [reliable] if 25% of the target is destroyed.

Now the magnitude of bullet destruction is far less (less than 1% of the target) but the relationship [between destruction and incapacitation] is unavoidable.

The round which destroys 0.07% of the target will incapacitate more often than the one which destroys 0.04%. However, only very large numbers of shooting incidents will prove it. The difference may be only 10 out of a thousand, but that difference is an edge, and that edge should be on the Officers side because one of those ten may be the subject trying to kill him.

To judge a caliber's effectiveness, consider how many people hit with it failed to fall down and look at where they were hit. Of the successes and failures, analyze how many were hit in vital organs, rather than how many were killed or not, and correlate that with an account of exactly what they did when they were hit.

Did they fall down, or did they run, fight, shoot, hide, crawl, stare, shrug, give up and surrender? ONLY falling down is good. All other reactions are failures to incapacitate, evidencing the ability to act with volition, and thus able to choose to continue to try to inflict harm.

Those who disparage science and laboratory methods are either too short sighted or too bound by preconceived (or perhaps proprietary) notions to see the truth. The labs and scientists do not offer sure things. They offer a means of indexing the damage done by a bullet, understanding of the mechanics of damage caused by bullets and the actual effects on the body, and the basis for making an informed choice based on objective criteria and significant statistics.

The differences between bullets may be small, but science can give us the means of identifying that difference. The result is the edge all of law enforcement should be looking for. It is true that the streets are the proving ground, but give me an idea of what you want to prove and I will give you ten shootings from the street to prove it. That is both easy, and irrelevant. If it can happen, it will happen.

Any shooting incident is a unique event, unconstrained by any natural law or physical order to follow a predetermined sequence of events or end in predetermined results. What is needed is an edge that makes the good result more probable than the bad.

Science will quantify the information needed to make the choice to gain that edge. Large numbers (thousands or more) from the street will provide the answer to the question "How much of an edge?".(41) Even if that edge is only 1%, it is not insignificant because the guy trying to kill you

could be in that 1%, and you won't know it until it is too late.

## **Conclusions**

Physiologically, no caliber or bullet is certain to incapacitate any individual unless the brain is hit. Psychologically, some individuals can be incapacitated by minor or small caliber wounds. Those individuals who are stimulated by fear, adrenaline, drugs, alcohol, and/or sheer will and survival determination may not be incapacitated even if mortally wounded.

The will to survive and to fight despite horrific damage to the body is commonplace on the battlefield, and on the street. Barring a hit to the brain, the only way to force incapacitation is to cause sufficient blood loss that the subject can no longer function, and that takes time. Even if the heart is instantly destroyed, there is sufficient oxygen in the brain to support full and complete voluntary action for 10-15 seconds.

Kinetic energy does not wound. Temporary cavity does not wound. The much discussed "shock" of bullet impact is a fable and "knock down" power is a myth. The critical element is penetration. The bullet must pass through the large, blood bearing organs and be of sufficient diameter to promote rapid bleeding. Penetration less than 12 inches is too little, and, in the words of two of the participants in the 1987 Wound Ballistics Workshop, "too little penetration will get you killed."(42,43)

Given desirable and reliable penetration, the only way to increase bullet effectiveness is to increase the severity of the wound by increasing the size of hole made by the bullet. Any bullet which will not penetrate through vital organs from less than optimal angles is not acceptable. Of those that will penetrate, the edge is always with the bigger bullet. (44)

## **References/Endnotes**

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2 Ideally, immediate incapacitation occurs instantaneously.

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6 Josselson, A., MD, Armed Forces Institute of Pathology, Walter Reed Army Medical Center, Washington, D.C., lecture series to FBI National Academy students, 1982-1983.

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12 Fackler, M.L., Surinchak, J.S., Malinowski, J.A.; et.al.: "Bullet Fragmentation: A Major Cause of Tissue Disruption", *Journal of Trauma* 24: 35-39, 1984.

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17 Bruchey, W.J., Frank, D.E.: *Police Handgun Ammunition Incapacitation Effects*, National Institute of Justice Report 100-83. Washington, D.C., U.S. Government Printing Office, 1984, Vol. 1: Evaluation.

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29 Goddard, Stanley: "Some Issues for Consideration in Choosing Between 9mm and .45ACP Handguns", Battelle Labs, Ballistic Sciences, Ordnance Systems and Technology Section, Columbus, OH, presented to the FBI Academy, 2/16/88, pages 3-4.

30 Goddard, Stanley: "Some Issues for Consideration in Choosing Between 9mm and .45ACP Handguns", Battelle Labs, Ballistic Sciences, Ordnance Systems and Technology Section, Columbus, OH, presented to the FBI Academy, 2/16/88, pages 3-4.

31 Newton, Sir Isaac, Principia Mathematica, 1687, in which are stated Newton's Laws of Motion. The Second Law of Motion states that a body will accelerate, or change its speed, at a rate that is proportional to the force acting upon it. In simpler terms, for every action there is an equal but opposite reaction. The acceleration will of course be in inverse proportion to the mass of the body. For example, the same force acting upon a body of twice the mass will produce exactly half the acceleration.

32 Lindsay, Douglas, MD, presentation to the Wound Ballistics Workshop, Quantico, VA, 1987.

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38 He defines a one shot stop as one in which the subject dropped, gave up, or did not run more than 10 feet.

39 This exercise was suggested by Dr. Martin L. Fackler, U.S. Army Wound Ballistics Laboratory, Letterman Army Institute of Research, San Francisco, California, as a way to demonstrate the problematical results of even the best results sought in training, i.e., shots to the center of mass of a target. It illustrates the very small actually critical areas within the relatively vast mass of the human target.

40 Severity is a function of location, depth, and amount of tissue destroyed.

41 The numbers can be held down to reasonable limits by a scientific approach that collects objective information from investigative and forensic sources and sorts it by vital organs struck and

target reactions to being hit. The critical questions are what damage was done and what was the reaction of the adversary.

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