

Firearms Reference Collections—Their Size, Composition, and Use

REFERENCE: Hamby JE, Thorpe JW. Firearms reference collections—Their size, composition, and use. *J Forensic Sci* 1997; 42(3):461–465.

ABSTRACT: It was thought that firearms reference collections in forensic science laboratories are liable to come under scrutiny. A survey was carried out to ascertain how many forensic science laboratories have such collections, what uses are made of them, and the views of examiners about replacing them with images available using modern information technology. It was found that the vast majority of laboratories with a firearms section have a reference collection and virtually all the remaining laboratories have access to one. Although most examiners are prepared to consider using images, the use of collections for such purposes as repairs and research shows that reference collections cannot be completely disbanded.

KEYWORDS: forensic science, firearms, reference collections, existence, uses

Historically the need for operational forensic science laboratories to obtain and maintain firearms for the laboratories' firearms reference collections has been documented in numerous books and articles (1–4). However, none of these publications discussed the reasons for having such a collection, nor did they discuss their size and composition. Many individuals have simply stated that they had a number of firearms available for their work in firearms identification. For example, Robert Churchill stated that he maintained "the thousand odd weapons I have to keep for Police work alone (5) . . .".

Today there is major public concern in many countries, including the United States of America, about the possession of firearms. The majority of forensic science laboratories in the United States possess a firearms reference collection and these collections may come under scrutiny from the public, administrators or laboratory managers. Objections to such collections can include the cost of collecting, the cost of space for storage, and security costs. This is especially so because firearms are bulky and a potential target for criminals and, in addition, modern technology may be held to make such collections redundant.

Consideration of other scientific disciplines shows that reference collections exist outside firearms examination sections and, indeed, outside forensic science. Other areas of work using reference collections include botany, archaeology, anthropology, and industrial

collections, such as those of paint and textile manufacturers. Within forensic science, reference collections are commonly used to assist in, for example, tablet identification and the classification of footwear marks. However, the fact that other branches of science in general, and even of forensic science in particular, have reference collections is of peripheral significance only. The existence of such collections means that reference collections are perceived as being of value but does not justify them. The existence of other reference collections does indicate that the idea of a firearms reference collection is not unreasonable, but even if other reference collections are essential, this does not automatically make firearms reference collections necessary. It could be, for example, that firearms reference collections were never necessary or it could be that they could now be replaced by modern technology such as photographs or "digital images" distributed on CD ROM.

No data presently exists concerning the possession of firearms reference collections, their size and composition, the uses that are made of them or the attitudes of the firearms examiners regarding the use of modern technological aids. An investigation was carried out to determine what firearms reference collections exist, their size and composition and the use that it made of these collections. The investigation also explored the examiners' views on the use of data sources other than their laboratory's reference collection and other than actual firearms.

Method

A survey was carried out by mailing a questionnaire to 650 members of the Association of Firearm and Toolmark Examiners (AFTE) located in forensic science laboratories around the world. The questionnaire was designed to elicit how many laboratories had firearms reference collections, the size of their firearms sections and collections, their composition, and the uses made of the collections. It was also intended to explore the examiners' attitudes towards modern technology. A copy of the survey form is attached as Appendix 1.

Results

Replies were received from 105 different laboratories in 18 countries.

Possession of Reference Collection

Of the 105 laboratories responding, 87 indicated they maintain a collection, 17 indicated that they did not maintain a collection but had access to one. Only one laboratory indicated it neither had a collection, nor had access to one. Interestingly, over 20% of the laboratories did not have a legal basis for their collection.

¹ Laboratory Director, Indianapolis-Marion County Forensic Services Agency, Indianapolis, IN.

² Lecturer, Forensic Science Unit, Strathclyde University, Glasgow, G1 1XW, UK.

Received 1 July 1996; and in revised form 23 Sept. 1996; accepted 30 Sept. 1996.

In order to have a reference collection, it is necessary to obtain the firearms. This can be a potentially expensive process. The sources actually used to obtain collections were diverse and are summarized in Table 1.

Whereas firearms are potentially a target of theft, not only is secure storage necessary, but also some form of inventory control is required which adds to the cost of maintaining such a collection. It was noted that 83 out of 87 laboratories responding had an inventory control procedure. In 80% of these laboratories, the inventory procedure was computerized. However, there was considerable variation in the frequencies with which inventories are carried out, the results are summarized in Fig. 1.

Size and Composition of the Reference Collections

Individual collections ranged in size from 17 to 5250 with a median of 800 and a modal value of between 500 and 1000 firearms. See Fig. 2.

In addition to ascertaining the size and composition of the collection, the questionnaire asked about the type of populations served because this may influence the composition of the collection. The

TABLE 1—Sources of firearms in reference collections.

| Source | No. of Laboratories Using This Source |
|--------------------|---------------------------------------|
| Courts | 60 |
| Donations | 44 |
| Other laboratories | 24 |
| Property rooms | 36 |
| Seizures | 43 |
| Purchase | 14 |
| Other | 11 |

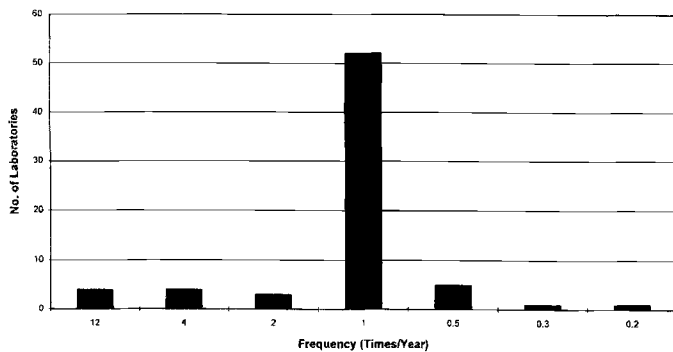


FIG. 1—Inventory frequency.

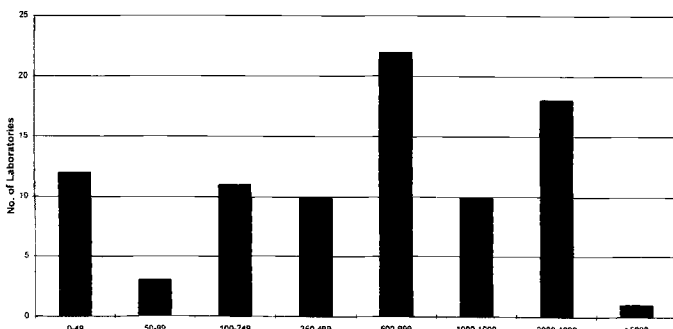


FIG. 2—Size of reference collections.

results are shown in Table 2. The data set is rather unbalanced data in that the numbers of firearms in collections serving different population types differ markedly. Some of the entries are zero which could cause a test for independence between collection composition and type of population served to be seriously misleading when using the chi-square statistic. To avoid this, the data set was reorganized, the category “Other” was omitted and the remaining data reclassified as shown in Table 3.

The chi-square value was calculated to be 890 for 8 degrees of freedom which is considerably greater than the critical value of 23.589 at the 1% confidence level. This suggests that the composition of a collection is not independent of the type of population served. An examination of the residuals showed that urban areas had more than the average number of revolvers and fewer than the average number of rifles and shotguns in their collections. Rural areas had slightly more than average number of rifles and pistols and fewer than average automatic weapons and revolvers. The mixed areas had more than the average number of rifles, shotguns and automatic weapons but fewer than average revolvers.

Use of the Collections

A variety of uses were reported and most laboratories had more than one use, the results are summarized in Table 4. In addition

TABLE 2—Total firearms in reference collections serving different types of population.

| Firearm Type | Urban | Mixed | Rural |
|---------------------|-------|--------|-------|
| No. of laboratories | 19 | 65 | 2 |
| Air guns | 588 | 2,605 | 0 |
| Rifles | 2436 | 15,181 | 25 |
| Machine guns | 129 | 2,030 | 0 |
| Pistols | 5983 | 29,070 | 50 |
| Shotguns | 1250 | 8,978 | 13 |
| Home made | 97 | 506 | 0 |
| Revolvers | 6282 | 23,152 | 35 |
| Submachine guns | 135 | 1,078 | 2 |
| Suppressors | 91 | 288 | 1 |
| Other | 3215 | 2,451 | 0 |

TABLE 3—Data set to test relationship between reference collection composition and type of population served.

| Firearm Type | Urban | Mixed | Rural |
|-------------------|-------|--------|-------|
| Rifles | 2436 | 15,181 | 25 |
| Shot guns | 1250 | 8,978 | 13 |
| Pistols | 5983 | 29,070 | 50 |
| Revolvers | 6282 | 23,152 | 35 |
| Automatic weapons | 264 | 3,108 | 2 |

TABLE 4—The uses made of firearms reference collections.

| Uses | No. of Labs. | Total % |
|-------------------------|--------------|---------|
| Training examiners | 60 | 11 |
| Training others | 58 | 10 |
| Checking functioning | 74 | 13 |
| Checking specification | 84 | 15 |
| Demonstration to police | 74 | 13 |
| Demonstration to courts | 46 | 8 |
| Research | 71 | 12 |
| Repairs | 77 | 14 |
| Other uses | 25 | 4 |

to exploring the variety of uses, the survey also investigated the frequency with which collections are used. These results are summarized in Fig. 3.

Alternative Data Sources

The survey explored the attitude of laboratories regarding the use of data sources other than their own reference collection. One such data source is, of course, borrowing from collections held in other laboratories. Other sources include variants of imaging, for example, photographs or CD ROM. In some circumstances, images may not be adequate and the survey participants were asked about the possible use of a centralized firearms reference collection. The results are shown in Table 5.

The use of other collections and the acceptability of alternative data sources may depend upon the size of the laboratory's own collection. A comparison was made between the replies from laboratories having reference collections containing more than 2000 firearms with the replies from laboratories having less than 500 firearms. The data is summarized in Table 6.

At the 95% confidence interval, the critical value of the chi-squared distribution is 5.02 for one degree of freedom. The results indicate that the size of the laboratory reference collection has no effect upon the need to borrow and although it may affect the frequency of borrowing, this was not investigated. Similarly the

size of the reference collection does not affect the attitude of the examiners pertaining to the use of images. However, the laboratories with the larger collections are less enthusiastic about central reference collections than are the smaller laboratories.

Conclusions

The vast majority of firearms sections have, or have access to, a firearms reference collection. This demonstrates that there is a widely held perception of the need for such a collection and, because the survey was world-wide, this perception cannot be dismissed as a local aberration.

The frequency with which the collections are used is perhaps not a good indicator of their value. If the results are taken at face value, then the collections are, in many instances, subject to little use. However, the data may not be accurate because use is not the type of information that is commonly recorded.

It is the use of the reference collections which demonstrate that there is, indeed, a need for them. The uses are diverse, but perhaps, the most crucial uses are those of repairs and research. Photographs and other representations cannot substitute for the real firearm in these applications. If this is accepted, then a reference collection is essential.

The size and optimum composition of a collection is difficult to define. Logically, there is no upper limit because the laboratories with the larger collections find a need to borrow, just the same as those with smaller collections, though the frequency of borrowing may differ. The composition of the reference collections does seem to vary depending upon the type of population served. This could reflect the fact that the firearms are collected selectively to provide information about firearms encountered in casework. Alternatively, it could be that the firearms are in the collection because they are encountered in casework and therefore available for collection. This was not explored in the survey because it was felt that the answer would be a foregone conclusion. However, the fact that purchase is not a popular method for stocking reference collections suggests that availability could well influence the composition.

The optimum size would be one which provides the samples for the normal operation of the firearms section. This would include not only case work needs, but additional firearms to provide for training and research. However even if a collection were established upon these lines, it would, over a period of time, tend to grow in size and diversity. This increase would arise from changing trends in firearms encountered in case work and could only be counteracted by deliberately disposing of surplus firearms.

Inevitably, there will be occasions when firearms which are unusual to the laboratory will be encountered and it is these which complicate the definition of the reference collection size and composition. Indeed, it is the unusual firearms in which reference material will be most frequently needed. The problems of unfamiliar firearms can be dealt with at present by extensive collections in each laboratory and loans from other laboratories and, perhaps to a greater extent than at present, by some form of imaging and information system. Certainly, the majority of examiners are prepared to consider this. A central reference collection poses financial problems—who pays for it and how? Although a central collection is, in theory, a viable proposition, an alternative would be more diffuse collection in which all laboratories contribute whatever they have to the common pool. However, whether a central collection is established or the system functions as at present, a catalogue of what firearms are located where would be of value.

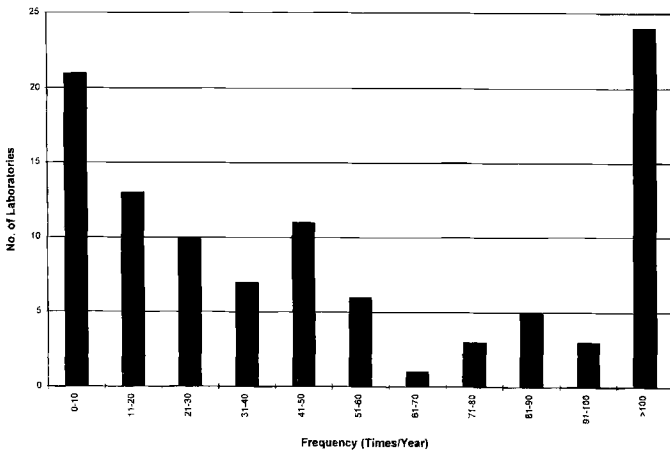


FIG. 3—Frequency of use of reference collections.

TABLE 5—Acceptability of alternative data sources.

| Question | Yes | No |
|---------------------------------------|-----|----|
| Do you borrow | 68 | 19 |
| Would accept photographs | 85 | 17 |
| Would accept a centralized collection | 67 | 36 |

TABLE 6—The use of alternative data sources.

| Question | >2000, Yes | >2000, No | <500, Yes | <500, No | Chi-sq |
|--------------------|------------|-----------|-----------|----------|--------|
| Borrow | 17 | 2 | 41 | 13 | 1.574 |
| Images | 17 | 2 | 45 | 8 | 0.217 |
| Central collection | 9 | 10 | 39 | 14 | 4.07 |

APPENDIX 1

Dear AFTE Colleague,

I am writing to request your assistance with a research project that I am currently conducting concerning firearms reference collections (libraries).¹ Information obtained from my research, to include your comments if desired, will be presented at future AFTE training seminars and/or published in forensic journals. Thank you in advance for your assistance with this project.

A review of historical information (Burrard, Kirk, Hatcher, Goddard, Gunther & Gunther, et al.) reveals little information concerning the acquisition and maintenance of a laboratory firearms collection. While it may be reasonable to you and I that a laboratory have such a collection, it may also be necessary to articulate these thoughts to our supervisors, especially in times of dwindling budgets, lack of space, security considerations, etc. The purpose of this project is to carefully evaluate the requirement for a reference collection and report the results for use within the forensic community.

Firearms Reference Collection (FRC)

Most forensic laboratories maintain a Firearms Reference Collection (library) for use by the firearms unit. Historically, particularly in the United States, these weapons collections were started in the 1930's and 1940's, as departments organized their forensic firearms (ballistics) units. In many instances, firearms for the collection were acquired by the firearms examiner who obtained them from his/her department's property room for use in the laboratory. These acquisitions were normally through court disposition, donations, etc.

Please answer the following questions concerning your collection. The information you provide will be kept confidential (unless you instruct otherwise) and only summarized in general terms without reference to specific laboratories.

1. Does your laboratory currently maintain a FRC? No _____ Yes _____
 - a. If No, please briefly explain what steps you have taken that allow you to have access to firearms for reference purposes?

 - b. If Yes, approximately how many of the following types of firearms are included? (Note: If your laboratory is one of several within a laboratory 'system', please provide answers for each laboratory within your system)
 airguns _____ pistols _____ revolvers _____
 rifles _____ shotguns _____ SMG's _____
 MG's _____ homemade _____ suppressors _____
 other (specify) _____
 - c. If Yes, approximately how many firearms do you acquire per year for inclusion into the FRC?

2. Do you maintain 'multiple' copies of the same firearm

(i.e., 5 or 10 45 Caliber M1911A1 pistols) to provide new examiners in training with a multiple firearm examination (test) and/or training in criteria for identification studies?

- No _____ Yes _____
- a. We do not train new examiners in our laboratory and only hire experienced and qualified personnel.
 No _____ Yes _____
 - b. If No, how do you provide this type of training for new examiners?

c. If Yes, what is the largest number of 'duplicates' that you have available for a 'multiple gun' test. _____

3. Do you maintain 'multiple' copies of the same type of firearm (i.e., Raven 25 ACP pistols) to provide information on rifling changes, serial number changes or ranges, etc.? No _____ Yes _____

a. If No, how do you maintain this type of information within your laboratory?

b. If Yes, what is the largest number of 'duplicates' (same model/type) that you have available for this information? _____ How many different model/types are you maintaining in this manner?

4. How do you obtain weapons for your laboratory collection (please indicate with check mark)
 court disposition _____ other laboratories _____ seizures _____
 donations _____ property room _____ purchase _____
 other (specify) _____

5. Does your laboratory have a 'legal' basis for maintaining a firearms reference collection such as a National law, State law, County ordinance, Department SOP, whatever? (Please briefly describe your organization's basis for having a collection and attach a xerox of the law, ordinance, or SOP if possible).

6. Do you have a procedure for control/inventory of your FRC? No _____ Yes _____
 - a. If No, what method do you use to 'safeguard' the collection?

b. If Yes, what system do you use (i.e., the Frank Cassidy 'random inventory method' as discussed in a previous AFTE Journal article, 100% physical inventory, etc.) and what is the inventory frequency? Is your FRL computerized? (please describe program used)

(system) _____
 (frequency) _____
 (computerized) _____

¹ AFTE Glossary, 2d Ed (1985), pg 58

7. How many times, and for what purpose, have you used your firearms reference library during the past year? (please indicate number of times used and purpose of use)
- 0-10 ____ 41-50 ____ 81-90 ____
 11-20 ____ 51-60 ____ 91-100 ____
 21-30 ____ 61-70 ____ over 100 ____
 31-40 ____ 71-80 ____ (please indicate number)
- use for training new examiners _____
 use for training new attorneys/detectives/police officers _____
 check functioning condition (safeties, trigger pull, etc.) _____
 check rifling specification/serial number characteristics _____
 demonstrative purposes for detectives/attorneys research and/or experimentation _____
 demonstrative purposes for courtroom presentation _____
 use parts for damaged evidence firearm to allow test firing _____
 other (please specify) _____

8. Do you have access to obtaining firearms, on an 'as-required' short term loan basis, from other sources such as another forensic laboratory, museum, gunshop, etc.? No ____ Yes ____
- a. If Yes, please describe what arrangements (formal or informal) you have to obtain firearms on loan for your laboratory.
- _____
- _____

9. Would you 'subscribe' to the concept of having a centralized reference collection (to augment a smaller collection within your laboratory) maintained by someone such as a state laboratory or BATF within the US and at a Country level in Europe or the Pacific? (This question assumes that the firearm(s) would be available to you on a timely basis and be mailed or shipped to you for limited use as requested) No ____ Yes ____
- a. If No, what would your objections be concerning a centralized library?
- _____
- _____

10. Would you 'subscribe' to a service that provided you photographs of firearms (overall view, side views, serial number, manufacturer and proof marks, etc.) using optical disc technology such as one presently being considered in the US by BATF provided it were reasonably priced and updated on a routine basis? No ____ Yes ____
- a. If No, what would your objections be concerning this type of service?
- _____
- _____
- _____

11. What size population does your laboratory serve? ____ Is your service area primarily? urban ____ rural ____ mixed ____ How many firearms examiners are in your laboratory? qualified ____ in training _____

Thank you for taking the time to complete this survey and thereby assist me with this research project. Please contact me if you have any additional questions and/or comments. The completed survey should be sent to the following address: Jim Hamby, I-MC Forensic Services Agency, 40 South Alabama Street, Indianapolis, IN 46204 USA. Our telephone numbers are (317) 327-3670, (317) 327-3693 fax.

Sincerely,
 James E. Hamby

References

1. Gunther JD, Gunther CO. The identification of firearms—from ammunition fired therein with an analysis of legal authorities. New York: John Wiley & Sons, 1935.
2. Hatcher JS. Textbook of firearms investigation, identification, and evidence. South Carolina: Small Arms Technical Publishing Co, 1935.
3. Goddard CH. A history of firearms identification. Chicago Police J. 1936;1-15.
4. Burrard G. The identification of firearms and forensic ballistics. 1st Am ed, New York: AS Barnes, 1962.
5. Hastings M. The other Mr. Churchill—a lifetime of shooting and murder. New York: Dodd, Mead & Co, 1965.

Additional information and reprint requests:
 James E. Hamby
 Laboratory Director
 I-MC Forensic Services Agency
 40 South Alabama Street
 Indianapolis, IN 46204