

Stored Guthrie Cards as DNA “Banks”

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Summary

Recently there has been much discussion about the possibility of using dried blood spots on Guthrie cards as a source of DNA for research or testing purposes. The collections of Guthrie cards stored by state newborn-screening laboratories can thus be viewed as inchoate “DNA banks.” This has generated concern among some persons who are interested in preserving the privacy of medical records. This study examines the policies of state newborn-screening laboratories in the United States, regarding their retention of Guthrie cards and the degree to which they permit the sharing of those cards with various third parties. We found that although most laboratories retain their cards, if at all, for only a short time, a growing number plan to keep them for an extended period—and, in several cases, indefinitely. We also found that although most laboratories would decline to release individually identifiable blood spots from the cards to third parties without a written release or other explicit authorization, a large number would at least consider sharing *anonymous* cards for research purposes.

Introduction

Recently there has been much discussion about the possibility of using dried blood spots on Guthrie cards as a source of DNA for research or testing purposes (McCabe 1991). The collections of Guthrie cards stored by state newborn-screening laboratories can thus be viewed as inchoate “DNA banks.” This has generated concern among some persons who are interested in preserving the privacy of medical records. This study was undertaken to examine the policies of state newborn-screening laboratories in the United States, regarding their retention of Guthrie cards and the degree to which they permit the sharing of those cards with third parties.

Material and Methods

A survey instrument was developed to elicit information from representatives of state newborn-screening laboratories, on the retention and sharing of Guthrie cards. The questionnaire (a copy of which will be provided on written request) was five pages long and consisted of 19 closed-ended questions, several of which were subdivided. Respondents were also asked to provide a copy of the Guthrie card currently being used in their states. Recipients of the questionnaire were assured confidentiality.

The questionnaire was sent to all newborn-screening program coordinators or laboratory directors listed in the 1990 Council of Regional Networks for Genetic Services (CORN) *Newborn Screening Report* (Council of Regional Networks for Genetic Services 1992). These included those in all 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands. The questionnaire was mailed in September 1993, and a follow-up mailing was conducted several weeks later. Shortly after the second mailing, those who had not yet responded were contacted by telephone.

Results

The two mailings yielded 47 responses, and the telephone contact with those who did not respond to either mailing yielded an additional 6. This resulted in a total of 53 responses, for an overall response rate of 100%. Thirty-eight respondents also provided a copy of the Guthrie card that they currently use. Because of the small sample size, and because some respondents did not answer every question, most of the results here are presented in raw numbers rather than in percentages.

Retention of Cards

Forty (75%) of the 53 survey respondents stated that they retain all the Guthrie cards that they receive through their newborn-screening programs—including those cards that test negative—at least for a short period of time. The other 13 respondents (25%) discard their cards within several weeks or months. Twenty-three of the respondents who indicated that they keep their cards (43% of all respondents) stated that they keep them for a period of ≥ 1 year. Ten of these stated that they plan to keep their cards for 1–5 years, and another 13 said they will keep them for > 5 years. Of this last group, three noted that they save all their cards for periods of 20–25 years. Four others spe-

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cifically said that they plan to keep their cards indefinitely, and several respondents who said that they currently keep their cards only for a short period of time specially commented that they are considering moving to a permanent-retention policy. Eleven (21%) of the 53 respondents indicated that their state departments of public health have issued written regulations on the retention of Guthrie cards; 29 (55%) stated that their laboratories have internal written policies on this matter.

Although most of the 40 respondents who retain all their cards for at least some period of time said that they systematically began to do so only in recent years, 11 have been saving their cards since the 1960s. As a result, eight respondents stated that their laboratories have in their possession cards dating back >10 years; two of these have cards dating from 1967 and 1970. While the majority of laboratories have accumulated <500,000 cards over the years, seven have amassed >500,000—with four of these reporting collections of between 1 and 5 million cards and one reporting a collection of 6 million. The number of cards collected over the past 12 mo alone ranged from <10,000 in four laboratories to >500,000 in two especially populous states.

Twenty-six of the 40 respondents who indicated that they retain their Guthrie cards stated that they store them on the premises of their state newborn-screening laboratory. Asked to describe the conditions under which they store their cards, 14 respondents indicated that they keep their cards in boxes at room temperature; 13 keep them in boxes or folders in a freezer, refrigerator, or climate-controlled room; 7 keep them in boxes or folders in a basement or warehouse; and 2 keep them in a cabinet—either in folders or in biohazard bags. One respondent said that his state keeps some cards refrigerated and some in plastic bags with desiccant at room temperature. Several respondents who keep their cards for a number of years specially pointed out that they store cards in a freezer or climate-controlled room for the first 6–12 mo, but thereafter move them to another location where they are maintained at room temperature. Fourteen respondents said they periodically check the condition of their stored cards. One respondent whose laboratory has cards dating back nearly 20 years reported that the only major problem encountered to date is that the rubber bands holding the cards in packs have degenerated, disrupting the organization of the cards and making it more difficult to find a particular card.

Third-Party Access to Retained Cards

Seven (13%) of the 53 respondents indicated that their state departments of public health have issued written regulations on third-party access to Guthrie cards; 10 (19%) stated that their laboratories have internal written policies on this matter. The number of personnel who have access to cards in the 40 laboratories that retain them varied greatly from state to state. In 27 states, six or fewer persons

have access to the cards, but respondents in many of these states noted that the number of persons who could *potentially* access cards may be significantly greater. Three respondents reported that in their laboratories, >20 people have direct, routine access to retained cards. Slightly over half (22) of the respondents from states that retain their cards reported that the storage facility used for the cards is equipped with a special lock or alarm system.

Asked whether current policy or custom in their laboratories would permit them to share individually identifiable retained Guthrie cards with insurance companies or employers, the vast majority of the respondents in states where cards are kept said that this would not be permitted, although a few thought it would, and a number of others were not sure (see table 1). A number of those who stated that they might consider sharing cards with insurers or employers specially noted that the decision would need to be made on a case-by-case basis and, in some cases, might be contingent on a written release, approval of the state attorney general, and/or approval of an institutional review board. A greater number of respondents, but still a minority, thought that they would be authorized to share cards with law-enforcement agencies or other state agencies (e.g., state child-welfare agencies) other than by subpoena (see table 1). Here again, however, of those who indicated that they might consider sharing cards with such agencies, some remarked that they would need approval of the attorney general or some other form of signed authorization.

Respondents who indicated that they retain their Guthrie cards were also presented with three hypothetical situations and asked whether they thought that they would be free to share the requested Guthrie card(s) in each one. In the first hypothetical situation, respondents were asked to assume that a physician in another state was treating a 3-wk-old child with an undiagnosed, severe metabolic disorder and that he had contacted their laboratory seeking the Guthrie card with the blood spot of the child's brother (who was born in their state but was now deceased). The great majority of the respondents indicated

Table 1
General Views of Laboratory Directors on Release of Guthrie Cards to Various Institutions

Institution	Release Permitted	Release Not Permitted	Don't Know
Insurance company	2	30	7
Employer	3	29	7
Law enforcement agency (other than by subpoena)	4	26	9
Other state agency (other than by subpoena)	6	22	11

NOTE.—n = 39.

that they would be allowed to share the card in this situation (see table 2)—but eight of these specially noted that this could be done *only* if the written consent of the parent or legal guardian had also been obtained. A few others spontaneously volunteered that they might also require a ruling from the state attorney general before releasing the card in this situation.

In the second hypothetical situation, respondents were presented with the situation of a divorced man, presumed to be the father of a child, who contacted them seeking the child's Guthrie card. Respondents were told that the man wanted to have DNA extracted from the card because he suspected that he might not be the child's biological father and sought to resolve the question for himself. Here, only one respondent stated that releasing the card might be permitted—and even in that case, the respondent stated that this could be done only by court order. A substantial minority indicated that they did not know whether sharing the card in this instance would be allowed (see table 2).

Finally, respondents were asked to consider a request by a *researcher* for a large number of *anonymous* cards (cards from which all identifying information had been deleted). Respondents were asked to assume that the researcher requesting the cards was conducting population studies on the racial distribution of a certain allele (the cards used in most states include information on the racial or ethnic background of the child, or at least on the mother) and that she felt that it would be much easier and less invasive to extract the necessary DNA from these existing cards than to subject a large number of people to phlebotomy. Here, only five respondents stated that releasing the cards would *not* be allowed, although again a large number were uncertain about what their policies would dictate (see table 2). Some respondents noted that their cards are routinely used in the national HIV neonate seroprevalence study, but they were not sure whether they would permit the cards to be used in other types of research. Many respondents who indicated that they *might* release the cards in this situation specially pointed out that the request would need to be approved by an institutional review

board or human subjects committee and to meet established protocols on research projects. Several others volunteered that such a request would also require consultation with the attorney general.

Two respondents in laboratories that keep their cards for many years indicated that they would be likely to release the cards in a research situation *only* if a sufficient quantity of the blood sample (i.e., at least one well-saturated spot) would remain after satisfying the request, to meet their minimal standards for permanent retention and to allow for future eventualities. Another respondent who indicated that her laboratory would consider releasing the cards to the researcher in the situation presented nevertheless characterized the scenario as "troublesome"; she wrote that she expected such requests to multiply, forcing her laboratory to allocate limited materials among researchers and to involve itself in judging the relative merit of projects. She said that the laboratory plans to seek additional guidance in this area, from the governing regulatory body in that state.

Asked about the number of *actual* third-party requests, for Guthrie cards, that they had received over the past 5 years (excluding requests by subpoena), 28 of the 40 respondents who retain their cards estimated that they had received either no requests or fewer than six requests. However, seven had received 6-20 requests; two had received 21-100 requests, and one (from a very large state) had received >100 requests. Although respondents were not specifically asked whether they had received from researchers any requests for anonymous cards, four spontaneously volunteered that they had received such requests. One respondent reported that she had recently released a card to the state coroner to use in connection with the investigation of a sudden-infant-death-syndrome death. In addition, one respondent wrote that a Guthrie card from his laboratory had recently been released to a forensic laboratory and been introduced as a critical piece of evidence in a highly publicized murder trial. The forensic laboratory had used DNA analysis to derive a profile of the victim from the blood spot on the card, which had been stored at room temperature for >10 years.

Table 2

Views of Laboratory Directors on Release of Guthrie Cards to Third Parties in Particular Circumstances

Circumstance	Release Permitted	Release Not Permitted	Don't Know
Release to physician treating brother of deceased child who has undiagnosed severe metabolic disorder	24	7	9
Release to divorced man seeking to resolve child's paternity	1	27	12
Release to researcher conducting population studies on racial distribution of allele (anonymous cards only)	17	6	17

NOTE.—*n* = 40.

Discussion

The responses to our survey indicate that a substantial number of states retain Guthrie cards. Given the stability of DNA in dried blood and the impressive advances in our ability to screen such samples for the presence or absence of particular DNA sequences, it is possible that the nascent interest in using Guthrie cards as a resource in genetic research will grow (McCabe 1991). It is also likely that in the future some or all disease-oriented newborn screening may be DNA based, in contrast to today's use of bacterial inhibition assays and automated enzymatic methods. The array of newborn-screening tests will almost certainly expand far beyond the original group of treatable inborn errors of metabolism.

The power of a state to conduct newborn genetic screening and to retain and, possibly, retest samples derived therefrom has never been challenged as an unconstitutional invasion of privacy. The right of a state to act in furtherance of the public health is broad, and there are precedents to suggest that newborn-screening programs for treatable illnesses would probably be upheld by the courts. In *Jacobson v. Massachusetts* (1905), the U.S. Supreme Court held that the state's police power encompasses the power to enact a compulsory-vaccination law. Following this decision, state courts have upheld a variety of laws authorizing coercive state intervention to protect public health—including, for example, compulsory tuberculosis hospitalization and isolation and quarantine statutes.

The scope of a state's right to retain, release, or conduct secondary testing on samples is not so clear. If the decision to retain samples for a reasonable period of time is justified on clinical grounds, courts would probably view it as being rationally related to the intent of the enabling statute and regulations. A protocol to govern the release of aliquots of samples collected pursuant to newborn screening for other purposes would not be particularly difficult to develop. If release were permitted only pursuant to written permission of the individual or a subpoena or as part of an anonymous research project, the privacy interests of the individuals would be accorded essentially the same level of protection as is generally available with respect to medical records. It should be noted that the NIH Office of Protection from Research Risks has recently issued guidelines that endorse anonymously conducted genetic research in stored tissue samples (Office for Protection from Research Risks 1993). A recent report from the Institute of Medicine reached a similar conclusion (Committee on Assessing Genetic Risks, Institute of Medicine 1994).

However, nonanonymous research that is unrelated to the original purpose of the acquisition of the sample would be difficult to justify legally. The application of newly developed tests to stored samples to identify persons who have inherited an allele that causes a treatable, late-onset

disease or who carry an allele that strongly predisposes to a severe disease that may be preventable could possibly be justified under the broad scope of the public-health power that courts have recognized, but it is not likely to be undertaken in the foreseeable future.

The number of state newborn-screening laboratories that retain their Guthrie cards is growing rapidly, as are the practices of tissue banking, DNA banking, and DNA data banking generally. The military now collects and cryopreserves blood on all recruits, mainly to create a resource to resolve the identity of human remains after combat. Nineteen states have enacted laws to mandate the collection of tissue samples from various classes of convicted felons (usually sex offenders) at the time of sentencing or parole. DNA profiles prepared from these samples have already proved in several cases to be a valuable resource in tracing biological material found at crime scenes to felons with prior convictions (McEwen and Reilly 1994). An unknown, but certainly large and growing, number of academic institutions house DNA banks, usually in laboratories involved in the search for disease-related genes. A few biotechnology companies also offer DNA banking services (Reilly 1992).

Perhaps the first proposal to regulate the collection and storage of tissue samples that could be used to derive genetic information about individuals was issued by an ad hoc committee of The American Society of Human Genetics in 1987. It strongly endorsed the principle of autonomy and recommended that the individual from whom a sample was derived should retain control of all but anonymous uses of it (Ad Hoc Committee on DNA Technology, The American Society of Human Genetics 1988). Annas (1993) has more recently suggested that DNA banks should not be permitted to operate until a "privacy impact" statement has been filed with an appropriate public agency. He argues that the burden of proof is on the DNA bank to demonstrate that it plans to achieve an important medical or societal goal, and he advocates the creation of a national board to license all DNA data banks in the United States, pursuant to uniform rules. While it is unlikely that a federal statute to govern DNA banking will be enacted in the near future, it is certainly possible that the NIH, perhaps acting through the Office for Protection from Research Risks, will develop guidelines that require DNA banks and DNA data banks established for research purposes to meet specific criteria and be approved by the local institutional review board.

All states participate in some form of newborn screening, but few have issued regulations that explicitly define the scope of permissible use of Guthrie card samples (Andrews 1985). In light of the growing interest in novel uses of stored Guthrie cards, it may be time to do so. CORN may be the most appropriate group to develop uniform guidelines on this topic.

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References

- Ad Hoc Committee on DNA Technology, The American Society of Human Genetics (1988) DNA banking and DNA analysis: points to consider. *Am J Hum Genet* 42:781–783
- Andrews LB (1985) State laws and regulations governing newborn screening. American Bar Foundation, Chicago
- Annas GJ (1993) Privacy rules for DNA databanks. *JAMA* 270: 2346–2350
- Committee on Assessing Genetic Risks, Institute of Medicine (Andrews LB, Fullerton JE, Holtzman NA, Motulsky AG [eds]) (1994) Assessing genetic risks: implications for health and social policy. National Academy Press, Washington, DC
- Council of Regional Networks for Genetic Services (1992) Newborn screening report: 1990. Council of Regional Genetics Networks, New York
- Jacobson v Massachusetts*, 197 US 11 (1905)
- McCabe ER (1991) Utility of PCR for DNA analysis from dried blood spots on filter paper blotters. *PCR Methods Appl* 1(2): 99–106
- McEwen JE, Reilly PR (1994) A review of state legislation on DNA forensic data banking. *Am J Hum Genet* 54:941–958
- Office for Protection from Research Risks (1993) Protecting human research subjects: institutional review board guidebook. US Government Printing Office, Washington, DC
- Reilly PR (1992) DNA banking. *Am J Hum Genet* 51:1169–1170