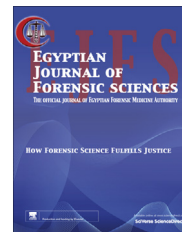




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# Forensic DNA databases: Ethical and legal standards: A global review

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## KEYWORDS

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**Abstract** *Background:* The Forensic Genetics Policy Initiative ([www.dnapolicyinitiative.org](http://www.dnapolicyinitiative.org)) is a civil society-led project which aims to set human rights standards for DNA databases around the world, by establishing best practice and involving experts, policy makers and members of the public in open debate. The authors have collected a comprehensive data set of information on the state of forensic DNA profiling and the development of DNA databases for policing purposes in more than 100 countries. The information is available in wiki which can be expanded, updated or corrected by interested persons (<http://wiki.dnapolicyinitiative.org>).

*Results:* A summary of the current global situation and issues for debate highlights: (1) a growing global consensus on the need for legislative provisions for the destruction of biological samples and deletion of innocent people's DNA profiles, following the European Court of Human Rights' judgement on this issue in 2008; (2) emerging best practice on scientific standards and standards for the use of DNA in court which are necessary to prevent miscarriages of justice; (3) ongoing debate regarding the appropriate safeguards for DNA collection from suspects; restrictions on access, use and data sharing across borders; and data protection standards.

*Conclusion:* There is an ongoing need for greater public and policy debate as DNA databases expand around the world. Some safeguards are implemented at the national or regional level but there is an ongoing lack of global standards and a need for more societal engagement and debate.

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## 1. Introduction

The UK National DNA database was the first forensic DNA database established in the world, established in 1995. Although the criminal DNA database was initially widely supported by the public, a major expansion of the database, which allowed a significant number of innocent people's records to be kept, became highly controversial.<sup>1–3</sup>

Under former UK Prime Minister Tony Blair, legislation was introduced as part of the Criminal Justice and Police Act of 2001 to allow DNA profiles to be kept on the Database

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even when a person was acquitted of a crime. In April 2003, the law was changed again to allow DNA to be taken as soon as a person is arrested, rather than waiting for them to be charged with an offence; this legislation came into effect in England and Wales in April 2004.<sup>4</sup>

These changes to the law allowed more than a million innocent people's DNA profiles to be retained on what was previously a criminal DNA database, overturning the presumption of innocence until proven guilty. Many were young children (arrested in England and Wales from the age of ten) accused of minor offences such as damaging trees or fences, and some were victims of crimes, or people who had intervened to try to stop a fight, but who had been falsely accused by their attacker. In one case a grandmother had her DNA taken when she was arrested for alleged theft when she failed to return a football that some children had kicked into her garden.<sup>5</sup>

As a UK-based civil society organisation with a remit to study and engage the public in debate about social implications of genetic technologies, GeneWatch UK was actively involved in the debate about the National DNA Database expansion, for example by providing evidence to parliamentary committees and to the European Court; publishing briefings and reports; speaking to the media; responding to individuals' concerns about their own DNA records or those of their families. Public concerns, reported directly to us or in the media, included:

- The personal nature of their DNA;
- Being treated like a criminal (unfairness);
- The growth of a 'Big Brother' state and potential misuse of data by government (tracking individuals or groups of people or their families);
- Potential loss of data or misuse of data (including by corrupt police officers, commercial providers or infiltrators);
- The implications of having a 'criminal' record for the rest of their life (including implications for employment, visas or treatment by the police);
- The possibility of being falsely accused of a crime.

DNA evidence can undoubtedly play an important role in solving crimes, but the UK experience also provides important evidence that "widening the net" to include large numbers of innocent people on criminal DNA databases does not help to solve more crimes. Although many countries record DNA matches between crime scene DNA profiles and individuals' DNA profiles stored on a DNA database, only the UK keeps records of DNA detections, which are typically crimes where the match has led to prosecution in a court. Recording detections is important because many matches may be with the victim or a passer-by, not with the perpetrator of the crime. Fig. 1 shows DNA detections from 1st April 1998 to 31st March 2012, alongside the growth in the size of the DNA database. Some of these DNA detections would continue to be made even if the DNA database did not exist, as many individuals are identified as a suspect before their DNA is collected.<sup>6</sup> The proportion of recorded crimes involving DNA detections has remained roughly constant at 0.36% since April 2003, and is driven primarily by the number of crime scene DNA profiles added to the database, not by the number of individuals added. About half of detections lead to a conviction. Since innocent people are unlikely to commit future crimes, expanding the DNA database to include large numbers of innocent

people did not help to solve more crimes than before the law was changed.

In 2006, Tony Blair proposed a universal DNA database to include every citizen and visitor to Britain, sparking further political debate.<sup>7</sup> Criticisms included:

- That building a universal DNA database would be a poor use of resources, since DNA is collected from only 1% of recorded crimes and including innocent people on the criminal DNA database had not helped to solve more crimes;
- The likely loss of public trust and need to criminalise all those members of the population and visitors who might refuse to voluntarily provide their DNA;
- Potential misuse by the police and the state or anyone who might infiltrate the system (allowing tracking and identification of individuals and their family members, including non-paternity);
- Increased risk of errors and false matches with crime scene DNA as the database expands.

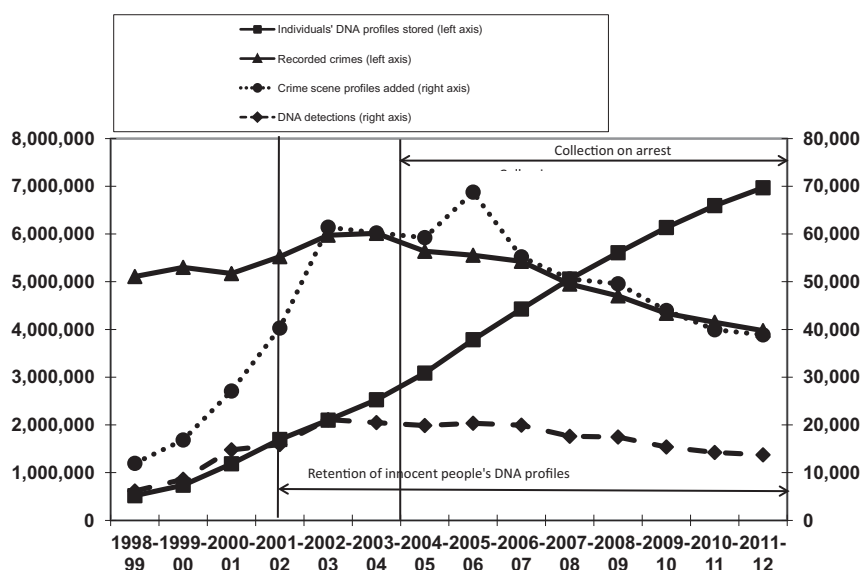
In June 2008, 61% of police chiefs voted against a universal DNA database at their annual conference.<sup>8</sup>

In December 2008, the Grand Chamber of the European Court of Human Rights in the case of *S. and Marper v. the UK* (known as the Marper case) reached a unanimous judgment that the indefinite retention of innocent people's DNA profiles, fingerprints and samples breached Article 8 of the European Convention on Human Rights (the right to privacy).<sup>9</sup> The Grand Chamber concluded that: "*the retention at issue [of DNA profiles, biological samples and fingerprints] constitutes a disproportionate interference with the applicants' right to respect for private life and cannot be regarded as necessary in a democratic society*".

In response to the judgment and to extensive public and parliamentary debate, the Protection of Freedoms Act 2012 came into force in England and Wales in 2013.<sup>10</sup> As a result, over 1.7 million DNA profiles taken from innocent people and from children have been removed from the DNA database and 7,753,000 DNA samples have been destroyed.<sup>11</sup> DNA profiles and fingerprints from innocent people arrested for minor offences must be removed automatically when they are acquitted or proceedings are dropped. For more serious alleged offences, innocent people's DNA profiles can be held for up to 3 years. Biological samples taken from individuals (but not those from crime scenes) must be destroyed within 6 months of collection. The law brings England and Wales into line with the law in Scotland (where the Scottish Parliament rejected proposals to include innocent people on its DNA database in 2006) and similar legislation has been adopted in Northern Ireland.

Events in the UK raise important questions for DNA databases around the world. What safeguards are necessary to protect human rights, prevent miscarriages of justice and maintain public trust? Questions include:

- When should DNA be collected?
- Whose DNA should be stored?
- How should access and uses be restricted?
- What safeguards are needed to prevent miscarriages of justice?
- When should cross-border sharing be allowed?



**Figure 1** Crimes detected involving a DNA match (direct detections), recorded crimes, individuals' DNA profiles stored on the UK National DNA Database (NDNAD) and crime scene DNA profiles added per year from 1st April 1998 to 31st March 2012. Data sources: DNA detection data from NDNAD annual reports since 2002/03. Earlier detections from Hansard 10 Sep 2008: Column 1866 W. Available on: <http://www.parliament.the-stationery-office.com/pa/cm200708/cmhansrd/cm080910/text/80910w0018.htm>; recorded crimes from UK Home Office annual Statistical Bulletins. More details are provided in Ref. 6.

An important lesson is that safeguards and standards require public input and political debate.

The Forensic Genetics Policy Initiative ([www.dnapolicyinitiative.org](http://www.dnapolicyinitiative.org)) is a civil society-led project which aims to set human rights standards for DNA databases around the world, by establishing best practice and involving experts, policy makers and members of the public in open debate. As part of the project, its member organisations (GeneWatch UK, Privacy International and the Council for Responsible Genetics) have conducted a global survey of DNA databases. The survey provides a first step towards an assessment of ethical and legal standards for DNA databases around the world.

## 2. Methods

The international policing agency Interpol conducted a survey of DNA databases in its 172 member countries in 2008, reporting that 120 countries use DNA profiling in criminal investigations, 54 countries have national DNA databases and 26 countries plan to introduce a national DNA database.<sup>12</sup> This survey formed the basis of an extensive initial follow-up study, conducted by the Council for Responsible Genetics, published in 2011.<sup>13</sup> National entries were transferred to an online resource (<http://wiki.dnapolicyinitiative.org>) in 2012. These entries have been considerably expanded and updated by GeneWatch UK to include press articles and links to original information sources, such as forensic laboratories and legislation.

Sources of information include online press searches and published academic reviews. In Europe, useful resources include the EU GeneBanc research project,<sup>14</sup> the European Network of Forensic Science Institutes (ENFSI)<sup>15</sup> and a series of reports by Centre for Ethics and Law in Biomedicine (CELAB) at the Central European University.<sup>16</sup> In the USA, a detailed survey of national and state legislation has been

published by the Urban Institute.<sup>17</sup> US lobby firm Gordon Thomas Honeywell, working with the FBI and funded by DNA testing firm Life Technologies, provides global information from its own perspective on the website DNA resource ([www.dnaresource.com](http://www.dnaresource.com)) and other companies such as Pro-mega publish some resources such as the news blog Forensic Connect<sup>18</sup> and the International Symposium on Human Identification (ISHI) Conference Proceedings (1991 to date).<sup>19</sup> However, until now there has been no comprehensive review of developments regarding forensic DNA databases outside Europe and the USA since the 2008 Interpol report and little attention has been paid to global ethical and legal safeguards.

The process followed by the Forensic Genetics Policy Initiative has resulted in the collection of a comprehensive data set of information on the state of forensic DNA profiling and the development of DNA databases for policing purposes in more than 100 countries. The information is available in wiki which can be expanded, updated or corrected by interested persons. Potential contributors are invited to submit further information on an ongoing basis (by email to: [contact@dnapolicyinitiative.org](mailto:contact@dnapolicyinitiative.org)). The authors conduct ongoing online searches to increase the sources of information available on the wiki and keep it up-to-date and actively seek information from experts and partners on a regular basis, including Privacy International's network of civil society organisations in 17 developing countries across Africa, Asia, and Latin America.

## 3. Results

### 3.1. Provisions for removal of innocent people's records and destruction of biological samples

All countries within the Council of Europe have achieved compliance, or will shortly be legally obliged to achieve compliance, with the Marper judgment.

Within the European Union (EU), a new draft Data Protection Directive is currently under negotiation, covering police collection and use of data for the investigation of crime and counter-terrorism in the EU's twenty-eight member countries.<sup>20</sup> This Directive includes provisions designed to bring EU law into line with the Marper judgment. Whilst the majority of EU states are already compliant with the judgement, some countries, notably Estonia, Latvia and Lithuania, may need to take further steps to ensure compliance in the coming months.

The Portuguese government announced in 2005 that it wished to put its entire population on a DNA database. However, this plan was abandoned due to concerns about costs and human rights, especially the debate about the retention of innocent people's records on the UK National DNA Database. Portugal adopted DNA database legislation in February 2008, which is compliant with the Marper judgment.<sup>21</sup> Suspects' DNA profiles are retained only if convicted and convicted person's DNA profiles are removed a maximum of ten years' after the sentence has been served. Samples are destroyed on collection or at the same time as the profile. Ireland is the only major EU country without DNA database legislation. It proposed new legislation in 2013 which is not yet finalised but which will be required to be compliant with the Marper judgement.<sup>22</sup>

The Marper judgment carries legal weight in all forty-seven Council of Europe member countries, which extend beyond the EU member states. Russia was one of the first Council of Europe member countries to ensure compliance with the Marper decision by restricting its DNA database to convicted prisoners in legislation adopted in December 2008.<sup>23</sup> Many other Council of Europe countries, such as Georgia, Turkey and Ukraine, have yet to establish DNA databases, according to ENFSI data.

Significantly, many countries outside the Council of Europe have also chosen to reconsider plans to retain DNA profiles from innocent people on criminal DNA databases.

South Africa proposed draft DNA legislation in 2009 which was not compliant with the Marper judgment, however concerns were raised in parliament about the implications for human rights. Adoption of the law was suspended whilst parliamentarians undertook a study tour to the UK and Canada to consider human rights safeguards. A new law was adopted in 2013 and signed into force in 2014.<sup>24</sup> Whilst there remain concerns about some aspects of the legislation, it is compliant with the Marper judgment. Convicted persons' DNA profiles are stored indefinitely but innocent people must have their DNA profiles removed on acquittal or if proceedings against them are dropped. Individuals' samples must be destroyed within 3 months of the profile being obtained.

In Asia, Malaysia adopted DNA legislation in 2009 and detailed regulations in 2012.<sup>25,26</sup> Individuals who are acquitted or have proceedings against them dropped must have their DNA profiles removed from the database. Samples must also be destroyed without delay following uploading of the DNA profile. The Republic of Korea (South Korea) adopted DNA legislation in 2010.<sup>27</sup> The law requires the erasure of DNA identification information on acquittal, exoneration, or dismissal of public prosecution and destruction of all biological samples once the relevant DNA profiles have been obtained.

India is considering a draft DNA Bill. Whilst many issues are still being debated, the 2012 draft of the Bill includes provisions for the expungement of innocent people's DNA profiles.<sup>28</sup> Destruction of samples is not included because these are the responsibility of the individual states which collect them.

In Central Asia, Uzbekistan (like Portugal) has backtracked from proposals to put its entire population on a DNA database and intends to focus on convicted persons serving sentences for serious crimes.<sup>29</sup> The details of the legislation are still under discussion.

In Latin America, Brazil adopted DNA legislation in 2012.<sup>30</sup> Removal of DNA profiles from the database is required at the end of the period established by law for the prescription of the offence. A steering committee has been established by decree to work on the details of implementing the law.<sup>31</sup>

In the United States, the picture is more mixed, with some states allowing innocent people's DNA profiles to be retained. In total, 22 states allow DNA collection only post-conviction. Of the 28 states that allow DNA collection prior to conviction, seven have an automatic expungement process for innocent people's records, whilst the remaining 21 allow expungement only on individual application (which is rare).<sup>17</sup> Oklahoma recently rejected a DNA law that lacked automatic expungement for innocent people.<sup>32</sup>

In the Middle East, the United Arab Emirates (UAE) has been criticised for being the only country with a declared policy of including its entire population on a DNA Database.<sup>33</sup> The UAE is beginning DNA collection with the police, military and convicted persons, therefore it remains possible that it will revise its plans to include innocent persons in the light of emerging global standards. New DNA databases are also planned in Qatar, Saudi Arabia, Yemen and reportedly in Algeria, Oman and Kuwait. Reports suggest that these DNA databases are likely to be restricted to convicted persons, however most policies in the region are not publicly available or have not been finalised.

### 3.2. Scientific standards

Although DNA has often played an important role in solving crimes there have also been some well-documented errors and miscarriages of justice, often due to contamination of evidence in the laboratory or at the crime scene.<sup>34</sup> In the EU and the USA, quality assurance for DNA testing laboratories supplying forensic DNA profiles to national databases is now compulsory.<sup>35,36</sup> In addition, the UK has established a Forensic Science Regulator, which monitors compliance, investigates errors and prepares guidance on issues such as the avoidance of contamination.<sup>37</sup> Some US states have similar arrangements, such as the New York Office of Forensic Services<sup>38</sup>, and there is also oversight at federal level.

However, despite an emerging consensus on best practice in this area, many countries have yet to make quality assurance compulsory for laboratories and some lack resources for critical police training to secure traceability of forensic evidence from the crime scene to the court, including necessary safeguards to prevent contamination. So far, most countries have not appointed forensic science regulators.



DNA profiling systems are being upgraded in both the EU and the USA, following increasing recognition that the growing number of DNA database searches, including across borders, could lead to an increasing number of adventitious DNA matches occurring simply by chance.<sup>39,40</sup> However, it is unclear whether the discriminatory power of DNA profiles has been fully considered for large populations (such as India) or countries with much larger average family size and greater inter-relatedness (due to consanguinity and endogamy) than is typical in the EU or the USA.<sup>41</sup>

A further area for consideration is the use of DNA evidence in court, including the presentation of match probabilities, particularly in cases where the crime scene DNA profile is partial, degraded or mixed. In England and Wales, Crown Prosecution Guidelines stipulate that prosecutions should not be made on the basis of a DNA match alone, but should require some corroborating evidence.<sup>42</sup> However, similar safeguards to prevent miscarriages of justice do not appear to have been adopted in many countries using forensic DNA.

### 3.3. Collection from suspects, data protection and other restrictions

Although an emerging trend can be detected in provisions requiring the removal of innocent people's records from DNA databases and the destruction of biological samples, in compliance with the Marper judgment, the picture on other safeguards is more mixed. Many countries have chosen not to follow the UK precedent of routine collection of DNA on arrest, requiring some level of oversight prior to collection, ranging from a decision to charge a suspect to a judicial requirement from a court. This remains the case in most European countries, most US states and throughout Latin America. The June 2013 US Supreme Court judgement in *Maryland v. King* has encouraged more US states to implement pre-conviction DNA testing, as the court ruled in a majority 5–4 decision that this did not breach the US Constitution.<sup>43</sup> However, Idaho has subsequently adopted legislation that requires a court order or conviction before DNA samples are taken.<sup>44</sup> Some new laws elsewhere, most notably in South Africa, allow very expansive collection of DNA from suspects on arrest. Apart from questions about the human rights implications (such as whether police will arrest people simply to obtain their DNA<sup>45</sup>), this practice raises important questions about the best use of police resources. Data from the USA show that analysing a single crime scene DNA sample is 50 times more likely to assist in solving crime than analysing a DNA profile from an individual.<sup>17</sup> This finding is consistent with the UK data (Fig. 1) which show that analysing crime scene DNA should be the top priority, particularly in countries with limited resources.

Other safeguards, including data protection laws, also vary widely. For example, all EU countries must comply with data protection laws (currently being strengthened) which require the uses of data collected by the police to be restricted to the purpose for which the evidence was collected, whereas no such national restrictions exist in the United States and state laws vary widely. In some other countries, such as India, draft privacy legislation has not yet been adopted so it is hard to assess the likely level of protection.

Cross-border sharing of DNA profile matches is also an active topic of discussion, which raises ethical issues regarding the ability of overseas governments to identify and track citizens and their families, as well as concerns regarding potential extradition based on a false match with a crime scene.<sup>46–48</sup> In the EU, all member states are required by the Prüm Decisions to search and share DNA matches automatically across borders. However, by the end of 2013, only 18 EU states had implemented the agreement<sup>49</sup> and the UK Government had decided to opt-out, partly due to concerns about likely large numbers of adventitious matches between individuals' DNA profiles held on the unusually large UK National DNA Database and crime scene DNA profiles stored in other countries. Cross-border sharing is widely recognised to have highlighted the need for compatible DNA profile systems in different countries and greater discriminatory power.<sup>39</sup> Despite these concerns, 16 EU member states have signed bilateral DNA profile sharing agreements with the United States, although not all these agreements have yet been ratified by national parliaments and some (Ireland, Malta) involve DNA databases that do not yet exist.<sup>50</sup> South Korea has also signed a bilateral agreement with the United States and New Zealand is discussing one. In 2010, the Gulf Co-operation Council (GCC) discussed adopting a similar agreement to the EU's Prüm Decisions, although no progress on this idea has been reported.<sup>51</sup>

## 4. Discussion

A global survey of DNA databases has identified:

- 1) a growing global consensus on the need for legislative provisions for the destruction of biological samples and deletion of innocent people's DNA profiles, following the European Court of Human Rights' judgement on this issue in 2008;
- 2) emerging best practice on scientific standards and standards for the use of DNA in court which are necessary to prevent miscarriages of justice;
- 3) ongoing debate regarding the appropriate safeguards for DNA collection from suspects; restrictions on access, use and data sharing across borders; and data protection standards.

There remain some important limitations to our research. In particular, we identified a number of gaps in information and inconsistencies, including: countries which have adopted DNA database legislation which is not yet fully implemented (i.e. where law and policy is ahead of practice); countries which are developing DNA databases with limited or no legislation (i.e. where practice is ahead of law); considerable uncertainties regarding the extent to which important safeguards are (or will be) implemented in practice. For some countries (e.g. Qatar), we have so far been unable to obtain copies of recently adopted legislation and the progress of draft laws in others is unclear (e.g. Bangladesh, Thailand). In some countries, legislation and practice in different regions, cities or states may vary widely and this has not always been comprehensively surveyed. Further, most of (but not all) our online searches were conducted in the English language and this limitation has led to

the omission of some important documents, particularly in non-European languages such as Arabic and Mandarin.

There is an ongoing need for greater public and policy debate as DNA databases expand around the world. Some safeguards are implemented at the national or regional level but there is a lack of global standards and a need for more societal engagement and debate. The authors welcome and encourage input of further information from experts around the world to enable us to improve the resource and encourage further discussion of these important issues.

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### Conflict of interest

None declared.

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