

Socioeconomic impact

Clinical research for
evidence-based care



Steve

Combining multiple
data sources



Rebecca

Data collection in
clinical practice



Heiko

Identification
of individuals



Patricia

Biometrics

Workflow integration



Collection of Longitudinal Research Data Using Biometrics

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Center for Biomedical Informatics

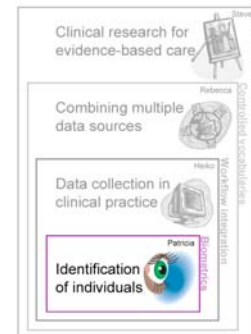
Department of Dental Public Health

University of Pittsburgh, School of Dental Medicine, Pittsburgh, PA

May 3, 2005

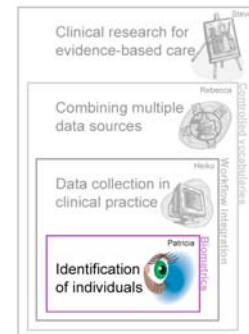
Informatics and Public Health Symposium

American Association of Public Health Dentistry



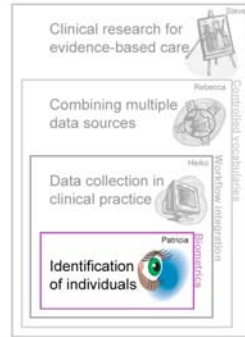
Outline

- Identification of individuals
- Overview of “BIOMETRICS”
- Rationale for the application of iris-based biometrics in a twins study
- Methods: Application of an iris-based biometric system for participant identification in a research study
- Evaluation of the biometric system
- Effectiveness and shortcomings of biometrics



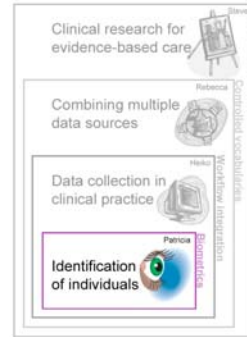
Identification of individuals

- Research practice often requires the acquisition of data on individual participants
- Participants might have to be identified and examined several times during the study
- There are instances where commonly accepted participant identifiers in research studies are either impractical or impossible



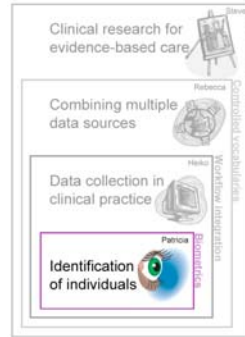
Identification of individuals

- Use of official identification is either absent or uncommon: conducting studies in a foreign country
- longitudinal epidemiological and genetic studies, clinical trials, and multi-center collaborative studies
- Identical twins: common identifiers either do not exist or do not sufficiently discriminate between study participants

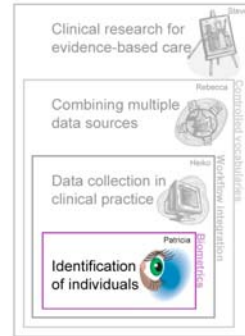


Overview of Biometrics

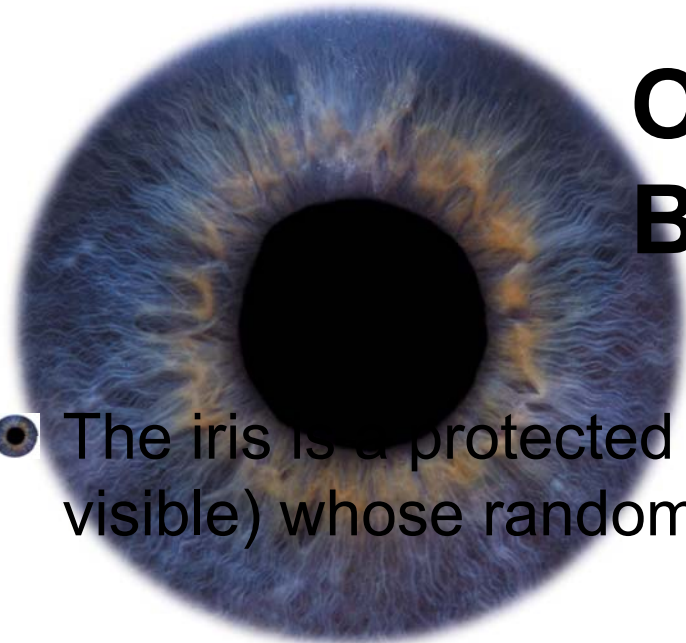
- Biometrics is the science of measuring physical or anatomical characteristics of individuals
- It performs automatic identification of a person based on his/her physiological characteristics
- Common biometric approaches include the recognition of fingerprints, hand or palm geometry, the retina, the iris, or facial characteristics
- It is also used as a collective term for technology that performs such measurements, and it is most commonly used in computer security applications



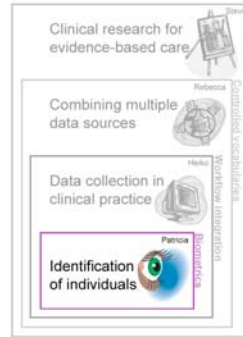
Overview of Biometrics: Biometric system



- Includes all of the hardware, associated software and interconnecting infrastructure to enable end to end biometric process
- Any situation where we would like to verify an individual's identity in respect to a transaction may be a candidate for biometric
- Is not the answer in some cases

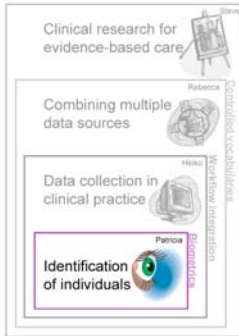


Overview of Biometrics: The iris

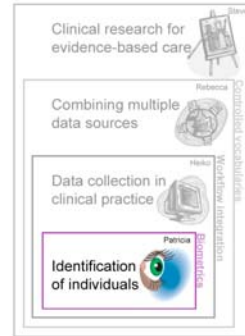


- The iris is a protected internal organ (although externally visible) whose random texture is stable throughout life
- The iris begins to form in the third month of gestation, and the iris patterns are completed by the eighth month, although pigment accretion can continue during the first post-natal year
- The iris is immune to influences from the environment with the exception of light, which causes the pupillary reflex

Rationale for the application of iris-based biometrics in a twins study

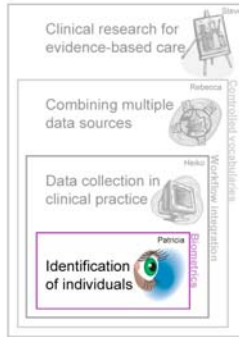


Rationale for the application of iris-based biometrics in a twins study



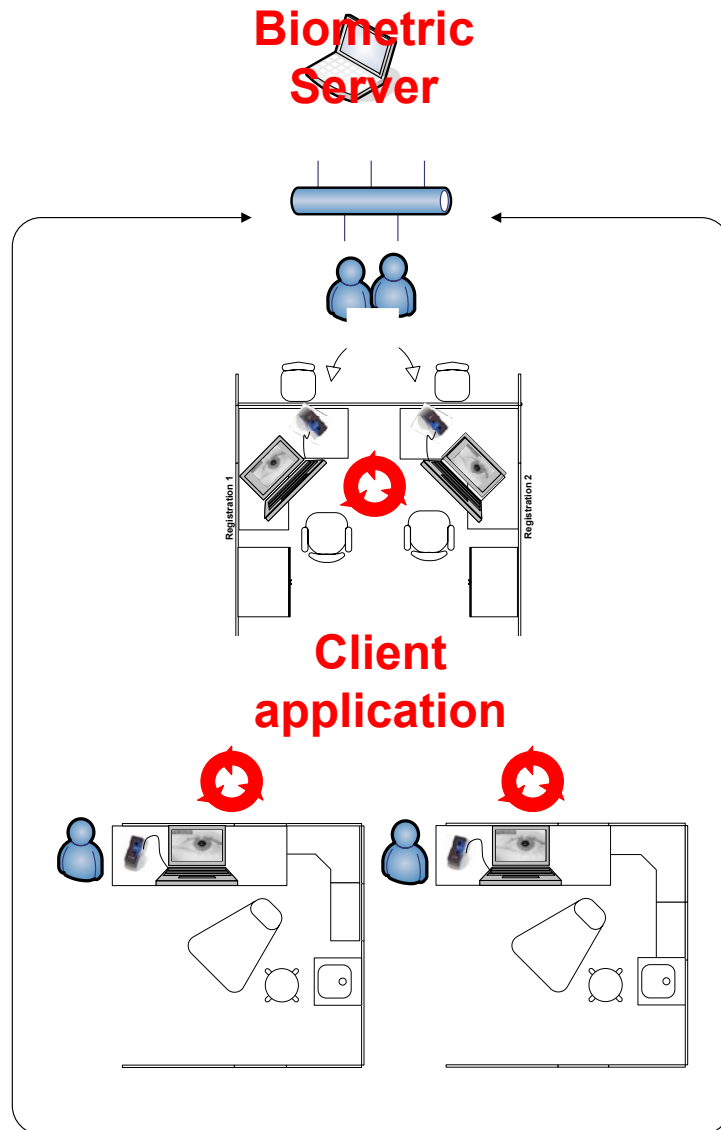
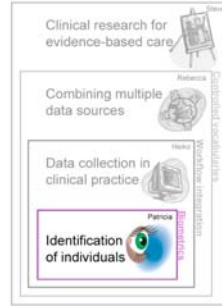
- It is very difficult to distinguish identical twins and parents can not tell them apart for many months and a few continue to confuse them for years
- In our previous studies, during the process of data collection and assessment of the children, it became apparent that misidentification of identical twins had the potential to jeopardize data quality
- Problematic for investigators and twins during data collection

Rationale for the application of iris-based biometrics in a twins study



Although identical twins share all genotypic features such as their entire DNA sequence, their irises are unique even between left and right eye

Methods: System implementation



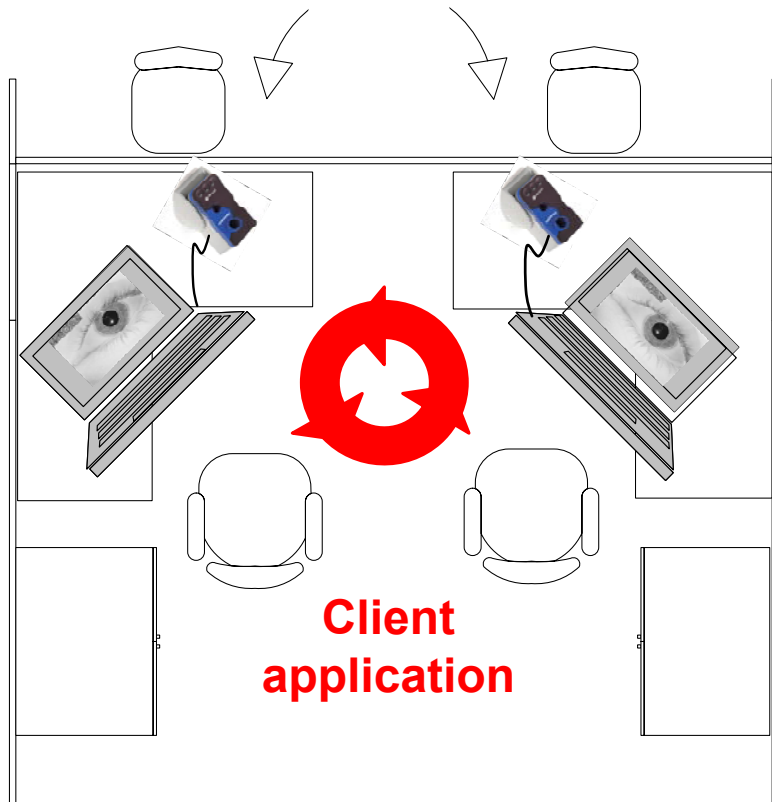
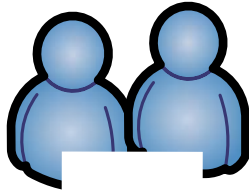
- Research and biometric data were collected on 4 laptops that shared a common database through a local Ethernet network

Biometric Server
KnoWhc[®] Authentication Server
IrisCode[®] Database

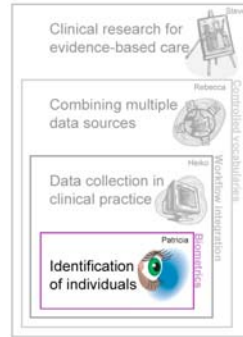
- All laptops had a camera connected to capture iris images

- the images of both eyes were captured for enrollment

Methods: Enrollment/Recognition Stations

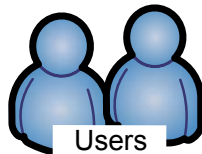
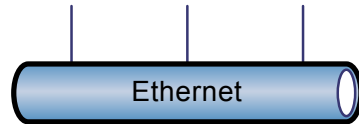


- PrivateID® Image Capture Software capture both the iris and a face image
- PrivateID® Enrollment-Recognition Application Users provide biometric data
- Demographic Database/Personal identification cards were created

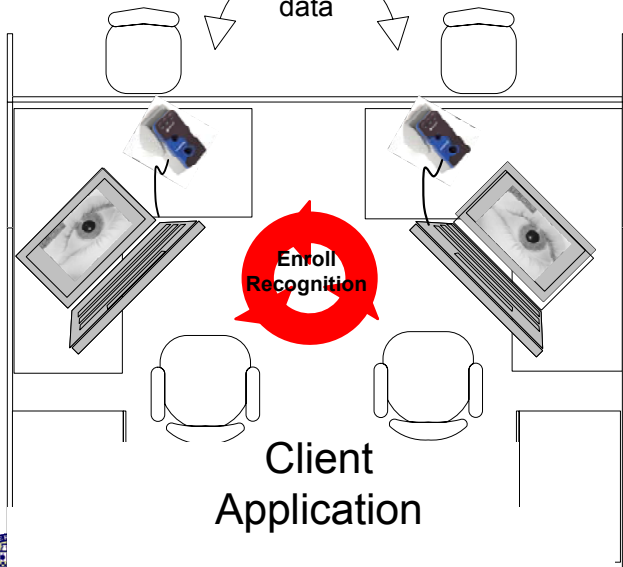




**Biometric
Server**

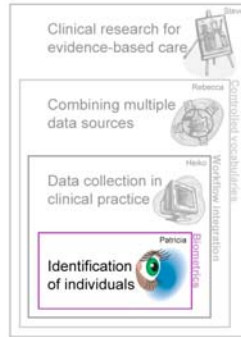


Users
provide
biometric
data

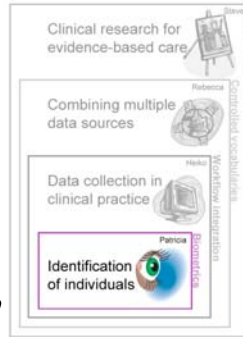


Methods: KnoWho authentication sever

- Received images from the “client”, decrypted and unpacked them, and used them to generate a standard IrisCode template
- Provides feedback on the quality of each captured image on-screen
- An enrollment based on an unacceptable image is never saved by the system



Methods: The iris enrollment process



1

Acquisition of a high-resolution image of the eye, illuminated with infrared light



2

The technology maps the details of the iris and converts them into an IrisCode **template**

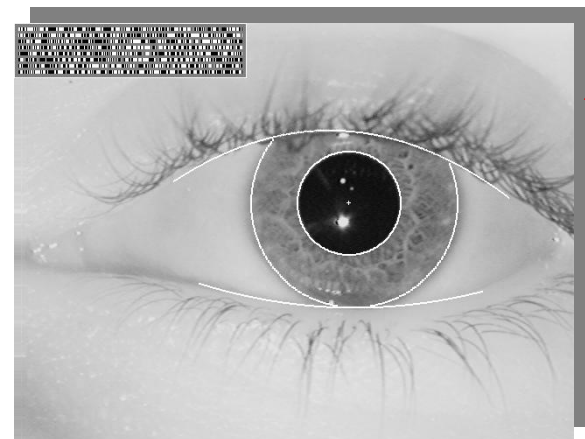
This 512-byte **template** is stored for subsequent comparisons

4

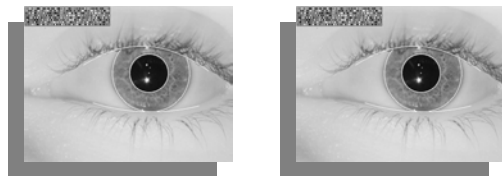
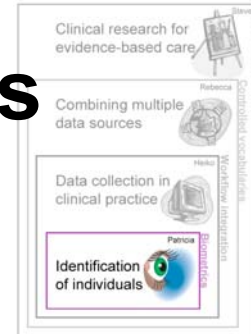


The iris **template** is added to the enrollment database, along with associated identity information

3



Methods: The iris identification process



A

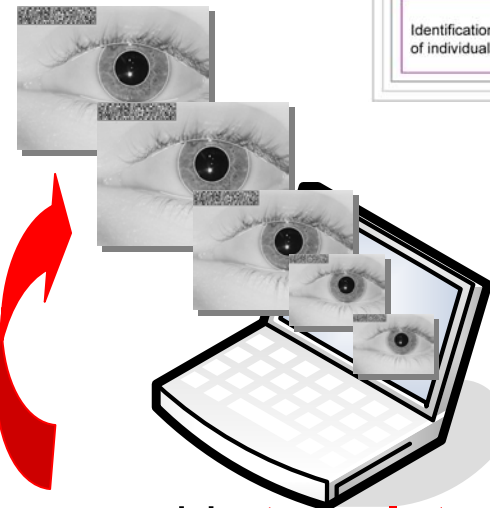
B

The user provides biometric data



A

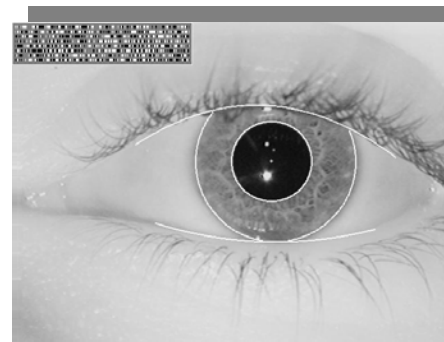
B



The new iris **template** is then compared to one or more templates in the system

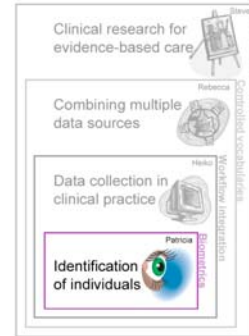
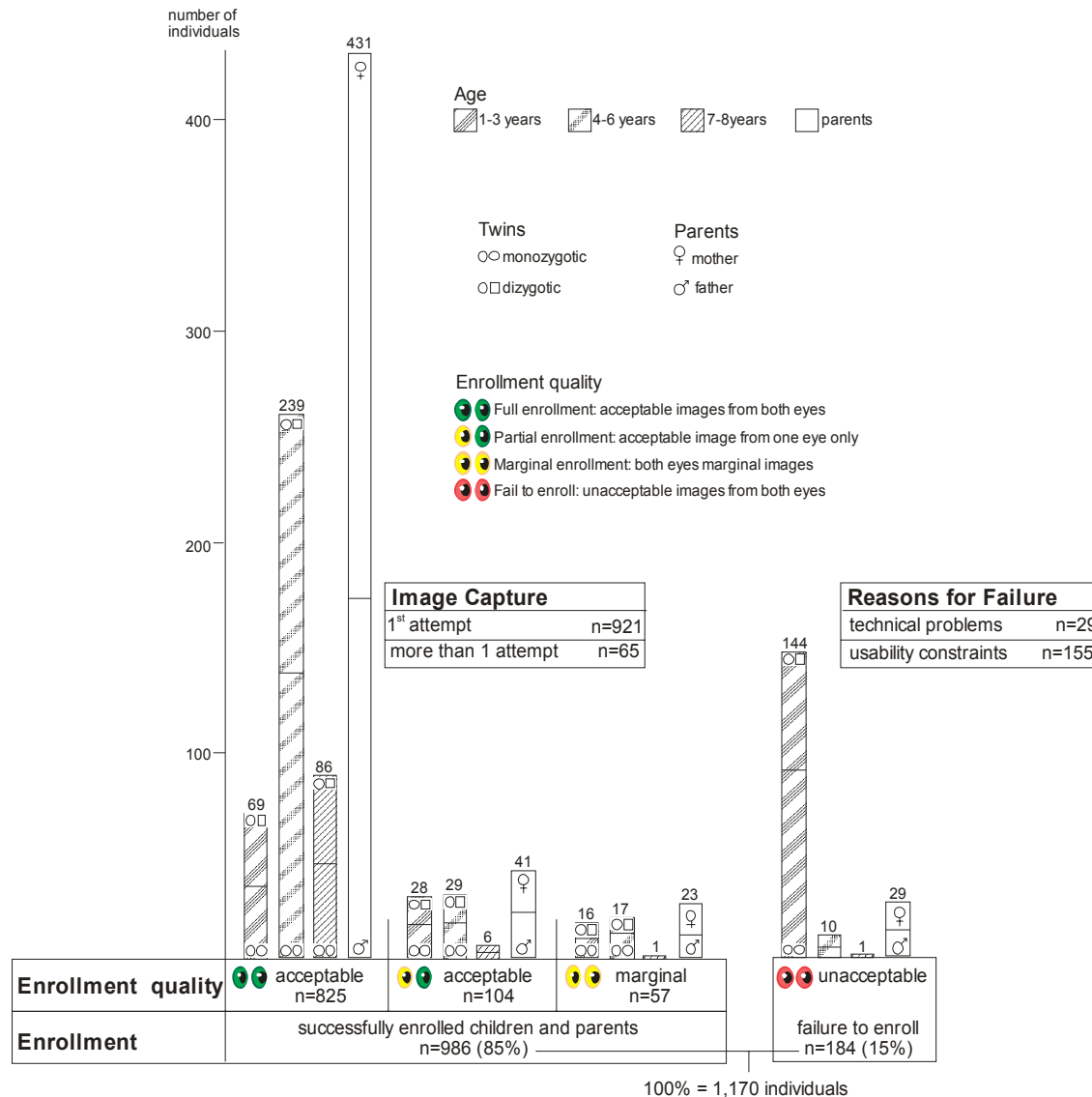


A new **template** is generated



3

Evaluation of the biometric system

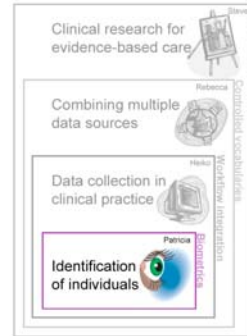


Baseline enrollment

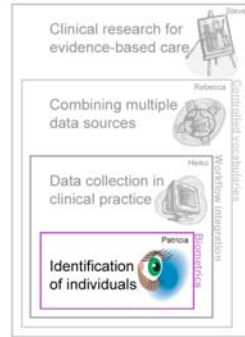


Evaluation of the biometric system: longitudinal analysis

- 646 children seen at baseline
- The biometric system successfully identified 491 children with acceptable enrollment at baseline
- 77 of the 155 children who failed to enroll at baseline were successfully re-enrolled during the second appointment
- Two participants enrolled at baseline could not be identified successfully due to marginal images captured from both irises during the initial enrollment

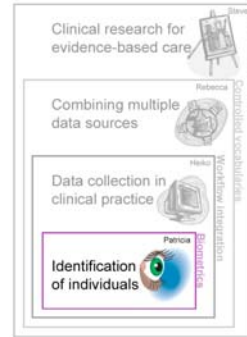


Shortcomings of the iris-based biometric system



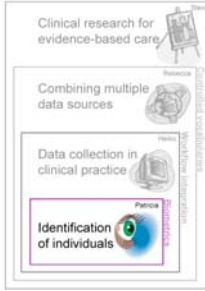
- The system failed to enroll a total of 184 (15%) participants, i. e. 155 children and 29 adults
- Problematic in populations of very young children (fail to enroll 24%), predominantly because of usability problems and lack of cooperation by young children
- Some participants could not open their eyes wide enough and thus the camera could not capture complete images of their irises

Effectiveness of the iris-based biometric system

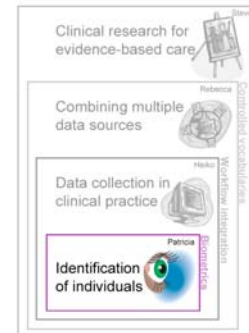


- Outstanding performance during the process of recognition avoiding misidentification with identical twins
- In the longitudinal analysis, the system proved to be a reliable identification tool
- Biometrics can be a valuable aid to ensure correct matching of research data to individuals, and therefore it may potentially elevate research data quality

Effectiveness of the iris-based biometric system



- longitudinal epidemiological and genetic studies, clinical trials, and multi-center collaborative
- Studies where accurate identification of subjects over time can be difficult or the subject may be young or hence an unreliable source of identification information
- Biometrics can automate the process of subject identification thereby reducing the need to depend on subject recall during repeated visits thus helping to reduce misclassification errors or missing data



Thank you!

