UK PASSPORT SERVICE BIOMETRICS ENROLMENT TRIAL

Report

May 2005

Atos Origin

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UK Passport Service

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1.1 Introduction

1.1.1 Background

The Trial, commissioned by UK Passport Service (UKPS) in partnership with the Home Office Identity Cards Programme, Driver and Vehicle Licensing Agency (DVLA) and implemented by Atos Origin, is part of a series of Trials contributing towards the plans for a national identity cards scheme, and the international drive for increased document security. More than 10,000 participants were involved during the Trial period (from April to December 2004). The results from the Trial are intended to help inform the Government's plans to introduce biometrics to support improved identity authentication and help prevent identity fraud.

1.1.2 Objectives

The goal of the UKPS Biometrics Enrolment Trial was to test the processes and record customer experience and attitude during the recording and verification of facial, iris and fingerprint biometrics, rather than test or develop the biometric technology itself – it was not a technology trial. A one-off, integrated solution, which used the latest technologies available at the beginning of the Trial, was designed to address the specific objectives of the Trial.

The Trial covered:

- testing the use of biometrics through a simulation of an application process
- inclusion of exception cases, e.g. people who may have difficulties in enrolment
- measurement of the process times
- assessment of customer perceptions and reactions
- testing fingerprint and iris biometrics for one-to-many identification and testing facial, iris and fingerprint biometrics for one-to-one verification

The purpose of this report is to document the key findings of the UKPS Biometrics Enrolment Trial. The report does not investigate the reasons behind the findings, nor does it suggest technology fixes for any of the issues encountered – these may be addressed in further trials.

Evidence contained within the report has demonstrated that the above objectives have been successfully achieved.

1.1.3 Trial Conduct

The Trial prime contractor was Atos Origin whose responsibilities included the overall project management including the design, build and support of the Trial equipment and software, and analysis of data collected during the Trial. UKPS, Home Office Identity Cards Programme, DVLA and Atos Origin would like to thank all contributors to the Trial especially the participants, the staff from UKPS, DVLA, the Post Office, Newcastle Registrar's Office, MORI, Disability Matters Limited (DML) and the technology partners of Atos Origin.

The Trial had originally been scheduled to run for 6 months starting on the 2nd February 2004, but actually began on the 14th April 2004. Testing the enrolment system outside of ideal laboratory conditions, with people unaccustomed to interacting with biometric devices identified some technical / interaction problems. Such problems are not unusual when using emerging technology, but had to be overcome before the Trial of 10,000 people could commence. The Trial ran for 8 months instead of the scheduled 6 months. This was due to the difficulty of recruiting the required diversity of people for the biometric sampling.

At the end of the Trial, all personal biometric data was destroyed.

1.1.3.1 Trial Samples and Recruitment

The participants were recruited in three different sample groups with10,016 participants being recruited against an original target of 10,000.

The three sample groups recruited were:

- a Quota sample of 2,000;
- an Opportunistic sample of 7,266 (original target 7,000) and
- a Disabled participant sample of 750 (original target 1000).

Each of the three sample groups had a different recruitment strategy.

A nationally representative quota sample of 2,000 participants was chosen to match the population. A 2,000 sample is commonly used in survey research as it provides robust data (accurate to within +/- 2.2 percentage points) at the aggregate level while also allowing for robust demographic and other sub-group analysis of the results. As a result, for this survey, a sample of 2,000 was considered the optimum.

The Opportunistic sample was recruited from the area around the centres and within the centres themselves. Recruitment of Opportunistic participants was not based on any demographic factors.

Although, initially a target of 1,000 members of the disabled community were to be invited to participate in the Trial, this was reduced to 750 part-way through. A sample size of 750 is sufficient to undertake major demographic and other sub-group analysis. The impact of this reduction on the accuracy of the results provided by this group is marginal. The level of accuracy in the results among the achieved sample of 750 participants is +/- 3.6%, compared to +/- 3.1% for 1,000 participants. Disability Matters Limited are satisfied with the approach taken and have stated "The biometrics trial has taken comprehensive

consideration of the needs of the disabled community by encompassing a pan-impairment approach. We have been impressed with the way that disabled people have been actively involved in this project. Now there is only a small amount of further work needed to implement the final approach necessary to ensure a barrier free service to the UK's 9 million disabled citizens".

All of the data has been analysed by a range of socio-demographic and other factors. This analysis is presented, in full, within the charts in the report. Where comparisons have been drawn in the report between population groups, they are statistically significant. Some sample sizes for sub-groups were not statistically significant and no comparisons have been drawn between them, nor should those results be used for comparative purposes.

The Trial participants consisted of volunteers and are therefore self-selected so their expressed views may not be wholly representative of the UK population.

1.1.3.2 Enrolment Process

Enrolment initially took place at four fixed centres: London, Leicester, Newcastle and Glasgow and one mobile enrolment centre which visited 23 different locations. Towards the end of the Trial, two further enrolment centres were established at Swansea and Newcastle (Longbenton).

The biometrics booth was a purpose built oval booth containing the biometric enrolment devices. The camera was mounted on the wall of the booth above a desktop surface. On top of the desktop was an electronic signature pad and sunk into the desktop was the fingerprint device. The participant sat on a standard office chair within the booth while being enrolled, or in the case of wheelchair users in their wheelchair in the booth. The operator sat just outside the booth, but still maintained visual contact.

The enrolment process covered the following stages: Registration; Photograph participant (head and shoulders); Record facial biometric; Record iris biometric; Record fingerprint biometric; Record electronic signature; Print card; Post-enrolment questionnaire; Verification; Post-verification questionnaire.

1.1.4 Terminology

This report recognises that people who comply with the Disability Discrimination Act (1995) definition of disability prefer to be called either a "person with a disability" or a "disabled person". This report has adopted the term "disabled people" or "disabled participants" as it mirrors the terminology used in the Cabinet Office Strategy Unit publication "Improving the life chances of disabled people" www.strategy.gov.uk published in 2005. The term "person with a learning disability" has also been used. However this could equally be interchanged with "learning difficulty". In some tables and graphs it has been necessary to make an abbreviation where BME has been used for Black and Minority Ethnic People and "disabled" for disabled people without any intention of causing offence.

Throughout this report, where a difference is stated (e.g. those aged 18 - 34 against those aged 35 - 54), the differences are statistically significant, unless stated otherwise. In this case, statistically significant means that 95 times in 100, the results compared represent a true difference between the two groups and are not simply the effect of enrolling and interviewing a sample of, rather than the whole, population.

Where an observation is stated it is not implying a causal relationship but it is nevertheless a valid finding.

1.2 Key Findings

1.2.1 Biometrics Process Findings

1.2.1.1 Introduction

The testing of the biometric technology itself was not one of the objectives of the Trial, rather the Trial aimed to test and measure the processes around the recording and verification of biometrics through a simulation of an application process. The Trial results quoted below are a sample of the key findings and many more findings are described in the body of the report. They are specific to the particular software and hardware configurations used in the Trial. The Trial databases were pre-loaded with 118,000 irises and 1 million fingerprints. Although the findings give results for each of the three biometrics, comparisons should be made within each biometric and not between biometrics. The Trial was set up with no attempt to compare the accuracy of the different biometrics.

1.2.1.2 Enrolment & Verification Timings

Enrolment times

- Overall enrolment times were calculated from the point at which the operator retrieved the participant's details from the system in order to start enrolment, to the point at which the operator accepted the participant's signature. The enrolment times that follow also include the time taken for a one-to-many database search which took on average 90 seconds.

- For Quota participants, successful enrolment on all three biometrics took on average 7 minutes 56 seconds. All attempted enrolments took on average 8 minutes and 15 seconds.

- For Disabled participants, successful enrolment on all three biometrics took on average 9 minutes and 43 seconds. All attempted enrolments took on average 10 minutes and 20 seconds.

Verification times

- The average times for Quota participants were 39 seconds for facial verification, 58 seconds for iris verification and 1min 13 seconds for fingerprint verification. The average times for Disabled participants were 1min 3 seconds for facial verification, 1min 18 seconds for iris verification and 1min 20 seconds for fingerprint verification.

1.2.1.3 Enrolment Success Rates

General

- The majority of participants from all sample groups successfully enrolled on all three biometrics. The success rate was higher for Quota participants than Disabled participants. All Quota participants were able to enrol successfully on at least one biometric. A small percentage (0.62%) of Disabled participants failed to enrol on any of the biometrics.

Facial enrolment success

- The majority of participants in all sample groups successfully enrolled their facial biometric, with success rates of nearly 100% for Quota participants and 98% for Disabled participants. Analysis showed that the factors which most affect the success rate are environmental, in particular the lighting conditions at different locations.

- The enrolment success rate for Disabled participants was much lower than the enrolment success rate for the Quota participants.

- Maintaining the correct position for facial biometric enrolment was a problem for some Disabled participants with a physical impairment or with learning disabilities.

Iris enrolment success

- The majority of participants in all sample groups successfully enrolled their irises. There were success rates of around 90% for Quota participants and 61% for Disabled participants. Enrolment operators felt that the lack of feedback from the iris camera made it difficult for them to establish reasons for enrolment failure and to advise corrective action.

- The enrolment success rate for Disabled participants was much lower than the enrolment success rate for Quota participants.

- Iris enrolment success varied according to the participant's ethnic group and age. Asian and White participants had higher success rates than Black participants. Participants that were aged under 60 had higher success rates than participants that were aged 60 or over.

Fingerprint enrolment success

- The majority of participants in all sample groups successfully enrolled their fingerprint biometric, with success rates of nearly 100% for Quota participants and 96% for Disabled participants.

- The enrolment success rate for Disabled participants was much lower than the enrolment success rate for Quota participants.

- Participants with a learning disability and participants with a physical impairment had lower fingerprint success rates than other Disabled participants and than Quota participants.

1.2.1.4 Verification Success Rates

Facial verification success

- Of the three biometrics, the lowest verification success rate occurred with the face. The success rates were 69% for Quota participants, and 48% for Disabled participants, however disability was not a factor. The majority of Disabled participant verifications took place in the mobile enrolment centre where lighting conditions adversely affected all facial verifications.

- Changes in the participant's appearance also caused verification to fail.

- The facial verification success rate was higher for participants aged under 60 than it was for those aged over 60.

Iris verification success

- The majority of participants who verified on iris were successful, however the success rate for Quota participants (96%) was significantly higher than that for Disabled participants (91%).

- It was observed that although many participants who wore glasses and who verified on iris did not have a problem, a small number of participants with glasses failed verification when they wore their glasses and passed when they took their glasses off.

- The iris verification success rate was higher for younger participants than it was for older participants.

Fingerprint verification success

- The majority of participants achieved successful verification on fingerprint, with rates of 81% for Quota participants and 80% for Disabled participants. One of the factors influencing failure was that the single fingerprint device used for verification occasionally did not record sufficient detail from the fingers.

- Younger participants had a higher fingerprint verification success rate than older participants.

1.2.2 Customer Perceptions and Reactions

1.2.2.1 Introduction

A key objective of the Trial was to assess customer perceptions and reactions. The aim was to understand areas such as *how comfortable* or *how private* participants felt and *how quick* the process was compared to expectations. The Trial results quoted below are a sample of the key findings and many more findings are described in the body of the report.

They are largely a feedback of a participant's direct experience of the process and 'user friendliness' of the enrolment and verification stages - but also their experience of the whole process and its individual components.

The opinions expressed by the participants may not be wholly representative of the UK population.

1.2.2.2 Customer Experience

All Participants

- In general the experience results from all groups follow very similar patterns in the balance of positive responses to negative responses for all of the main questions.
- Across all three biometrics, the vast majority of participants found their expectations of the overall experience to have been either met or bettered.
- Given the Trial booth locations and environments, generally booth privacy was not an issue
- The level of intrusion across all three biometrics, in relation to participant expectations, was not an issue.
- Across the three biometrics, participant experience of 'positioning' for iris enrolment was the only concern – with 31% of Disabled participants finding the positioning for the iris recording 'very' or 'fairly' difficult.
- Iris was selected as their preferred biometric by Quota participants. The iris biometric was tied first choice – with the fingerprint biometric – for Disabled participants.

Quota Participants

- In general the younger age groups had a better than expected 'level of intrusion' experience of enrolling their biometrics.
- The 55+yr age group found it more difficult to position themselves for the fingerprint biometric than the 18-34yr and 35-54yr age groups.
- The top two reasons for a participant's overall experience of the iris enrolment being worse than expected are 'time taken to record' and 'the need to stay still'.
- Iris was the preferred biometric for both males and females. For males this was a clear preference, but for females, many also preferred fingerprints. The two sectors were closely tied on their preference for the facial biometric.

Disabled Participants

- The recording of the iris biometric scored lowest, compared with the other biometrics, for participant experience of 'time taken' (against expectations).
- The iris biometric scored lowest for the participant booth positioning experience being 'very' or 'fairly' easy.
- The iris biometric scored lowest for 'overall experience' being 'much' or 'a little better' than expected. Hearing impaired participants gave the least positive response to the question about iris biometric overall experience.
- Participants with three of the four impairment types, visual and hearing impaired and learning disability, opted for the fingerprint biometric as their preferred biometric.

1.2.2.3 Customer Attitude

As a follow up to their experience of the Trial, participants were asked about their attitude towards the concept of biometrics as part of an individual's passport, as well as the general concept of biometrics and their potential contribution to key national questions.

All Participants

- Whilst the majority of participants were 'not very' or 'not at all' concerned about having their biometrics recorded prior to enrolment, there was more concern felt within Disabled participants and in particular for the iris biometric.
- Across all three biometrics and all three groups, the total number of participants 'fairly' or 'very' concerned about having their biometrics recorded after enrolment dropped when compared with pre-enrolment.
- The majority of participants felt biometrics would help with passport security, preventing identity fraud, preventing illegal immigration and are not an infringement on their civil liberties.

Quota Participants

- The BME and the 18-34yr sectors were most concerned about having their biometrics recorded prior to enrolment.
- Post enrolment the level of concern in the BME and 18-34yr sectors fell but was still higher than for other sectors.

Disabled Participants

- Prior to enrolment, of the four impairment types, participants with visual, learning or hearing impairments scored iris as the biometric they were most concerned about.

- Post enrolment, the level of concern amongst those with a visual impairment has dropped most dramatically across the three biometrics when compared with pre-enrolment levels.

1.2.3 Process and Environment Findings

- While booth design permitted all wheelchair users to enter the booth, it did not allow large wheelchairs to get close enough to the camera.

- Environmental design is a factor in successful facial enrolment. Lighting needs to be bright enough that the face is evenly lit but must not be reflected from the skin or glasses.

- Lack of feedback from the iris camera to the operators made it difficult for them to establish the reason for enrolment failure, and to take corrective action.

- The process did not allow successful fingerprint enrolment for participants who had some fingers that passed the quality checks within fingerprint enrolment and some that failed the quality checks.

- The enrolment failure of some participants could have been a temporary one e.g. where the participant had an eye infection or had a bandaged finger.

- Facial verification was affected by location because of the different environmental conditions in each enrolment centre.

- The actual time taken to go through the enrolment process and the customer perception of whether the process was quick or slow did not always correspond.

1.3 Recommendations

Valuable lessons have been learned from the Trial and there are some specific recommendations which need further consideration:

Recommendation 1 The camera should be manoeuvrable enough to allow it to be positioned to accommodate wheelchair users and others for whom the current arrangements limit access. Environment design needs to ensure that the camera height can cater for full height range found in the UK population

Recommendation 2 Applicants need to remove any headwear before facial biometric enrolment. If removal is unacceptable, then the applicant must arrange the headwear so that it does not obscure the face or forehead.

Recommendation 3 Consideration needs to be given to the process for enrolment where one of the biometrics may not be fully available but only on a temporary basis e.g. the applicant could have a bandaged finger or an eye infection.

Recommendation 4 A number of measures need to be put in place for the enrolment of disabled people. Operators need to receive disability awareness training and an understanding of assessment techniques as they impact upon disabled people. Consideration needs to be given to having some specially trained operators to enrol certain disabled people. It would not be immediately apparent when someone is attempting enrolment that they need a specially trained operator. A management plan is required to ensure that the service being offered is not a lower standard service for disabled people by requiring them to visit again for assessment to meet a specially trained operator, as this is liable to contravene Part III of the Disability Discrimination Act 1995.

Recommendation 5 A further trial is needed specifically targeted towards those non-disabled groups where enrolment difficulties occurred because of environment design. The targeted groups should include participants of differing heights, and for lighting issues, those participants where lighting seemed to affect facial biometric enrolment.

Recommendation 6 In the same way as applicants can enrol on fingerprints even though some fingers are missing, applicants need to be able to enrol even though some fingers may provide unacceptable prints, for example because of scarring.

Recommendation 7 The verification process should allow a limited number of further attempts to pass verification when the first attempt fails.

Recommendation 8 A large single fingerprint scanner platen for verification is required. It was observed that the single fingerprint scanner platen used in the Trial was at times too small to scan a sufficient area of fingerprint from participants with large fingers.

Recommendation 9 A test rig should be developed to allow different biometric devices to be tested to ensure effective and efficient biometrics enrolment and verification. It is important that tests are performed in laboratory conditions prior to commencing further trials.

Recommendation 10 Consideration needs to be given to targeted education initiatives to address some of the specific results from the customer experience and attitude questions.

1.4 Areas for Further Investigation

The Trial results have highlighted several issues that require further investigation or work, which will further inform Government plans to introduce biometrics.

- Further trials are needed, specifically targeted towards those disabled groups where enrolment difficulties occurred because of environment design, or because of the ergonomics of the biometric device design. These trials should test out different types of environment design (from recommendation 1) and different designs of biometric device. The trials need to capture the participants' experience and feedback, possibly through the use of focus groups.

- Further trials are needed, specifically targeted towards those groups where enrolment difficulties occurred but they did not appear to be related to ergonomic factors. For example, black participants and participants aged over 59 had lower iris enrolment success rates. Further work is needed in this area to identify the reasons for this, and to identify solutions. This may then lead to further trials of the identified solutions which could entail using a range of different devices.

- A further trial is required to determine the effect of glasses on iris and facial verification – whether the failures are due to reflections or due to lens prescription. There were indications in the Trial that glasses, particularly those with vari-focal or bi-focal lenses, could cause iris verification to fail. However, this needs to be confirmed by a specifically designed trial.

2 Trial Process

2.1 Trial Process Overview

The Trial process can be broken down into three major components: Recruitment, Enrolment and Data Analysis (see Figure 1). These components are described briefly below.

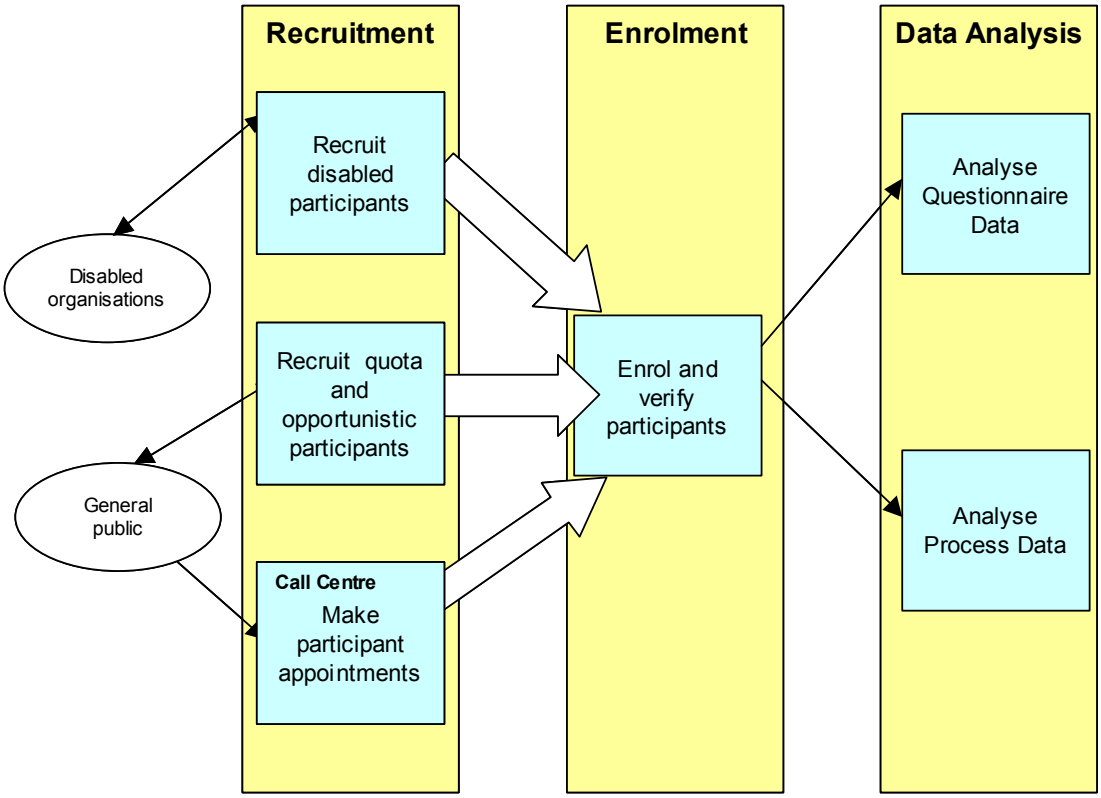


Figure 1 - Trial process overview

2.1.1 Recruitment

10,016 participants were recruited to take part in the Trial against an original target of 10,000. The 10,000 target group was split into three different sample groups, each of which had a different recruitment strategy.

2.1.1.1 Quota

MORI's stated reasoning behind the chosen sample sizes is "As we are making inferences about the population of the United Kingdom we need to make sure our sample is not only

representative of the UK population but also large enough for us to be sure about the results we get. A sample of 2,000 respondents taken from a infinite population (circa 47 million aged 16+) will give us results that we can be sure (19 out of 20 times or 95% of the time) lie within +/- 2.2% of the actual population result(s). By making this assumption we are assuming that the survey was random when in fact it was a quota sample, however it is generally accepted in Market Research that one can use the same statistical formula for quota samples as random samples. At MORI, this is ensured by matching the sample profile as far as possible, to the detailed Census profile population, by a number of demographic variables to avoid biases. This is done through setting tight quota controls. With sub samples of fewer than 2,000 respondents we cannot be so sure that the results we find are close to the actual results in the population. However it is only when the sample size gets fairly small that the Confidence Intervals become very large. This effectively constitutes the law of "diminishing returns", as there will come a point, where increasing the sample size will not lead to a suitably large enough reduction in the Confidence Intervals for the cost of the extra interviews to be warranted. For example with a sub-sample of 500, the 95% Confidence Interval is slightly wider (than for a sample of 2,000) at +/- 4.4%. However, if we reduce the sub-sample further, to say 90, (under 100), then the Confidence Interval increases sharply to +/- 10.3%. For this reason samples or sub-samples of 100 or less are considered too small from which to draw valid quantitative conclusions".

The 2,000 Quota respondents were proactively recruited from locations surrounding the enrolment centres by MORI interviewers. As part of the recruitment process, the MORI interviewer completed a recruitment questionnaire containing demographic questions. This allowed Quota sample participants to be recruited to quotas set on different demographics based on the last census so that they would be close to a representative sample of the adult UK population. Due to the location of the enrolment centres, in order to make the Quota sample fully representative of the population, MORI have applied weightings to the participants. A demographic breakdown of the Quota sample can be found in Appendix D - Demographics of Sample Groups.

As well as recruiting against demographic targets, the 2000 were recruited against three other targets. A target of 1,000 was set for participants who attempted enrolment on all three biometrics. A target of 500 was set for participants who attempted enrolment on the face and iris biometric only, and a further target of 500 was set for participants who attempted enrolment on the face and fingerprint biometric only. These two groups of 500 participants were control groups. The first control group was designed to see if participants' questionnaire responses to iris biometric questions seemed to be affected by having experienced the fingerprint biometric. Similarly, the second control group was designed to see if participants' questionnaire responses to fingerprint biometric questions seemed to be affected by having experienced the iris biometric.

Once the interviewers found a participant who was willing to take part and who fitted the profile, they accompanied them to the enrolment centre where they went through the enrolment process.

2.1.1.2 Opportunistic

The 7,266 Opportunistic participants were recruited against an original target of 7,000. They were recruited in two different ways. Some were recruited from the area around the centres and within the centres themselves. These participants were then escorted to the enrolment centre where they would go through the enrolment process. Others, having seen some of the publicity about the Trial, registered interest either by phone, letter or email, and were subsequently given appointments by a call centre. These participants

then turned up at the enrolment centre at the appointed date and time, and went through the enrolment process.

Recruitment of Opportunistic participants was not based on any demographic factors. A demographic breakdown of the Opportunistic sample can be found in Appendix D - Demographics of Sample Groups.

2.1.1.3 Disabled Participants

Seven hundred and fifty (750) Disabled participants were recruited in order to test the effect of exception cases. The Trial worked with Organisations of / for disabled people to find willing participants and made appointments for them. Appendix D contains a breakdown of this group by impairment type (visually impaired, physically impaired, learning disability and hearing impaired). For completeness Appendix D also contains a demographic breakdown of the Disabled participants.

N.B. The original target for Disabled participant recruitment was 1,000. This target was reduced part-way through the Trial as it became clear that the overall 10,000 target would be exceeded before the full 1,000 disabled people had been recruited and as the required diversity of Disabled participants had been recruited to enable a robust analysis to be performed. The impact of this reduction on the accuracy of the results provided by this group is marginal. The level of accuracy in the results among the achieved sample of 750 participants is +/- 3.6%, compared to +/- 3.1% for 1,000 participants. A sample size of 750 is also sufficient to undertake major demographic and other sub-group analysis (such as by gender, age and type of disability). In addition to the 750 disabled people recruited specifically to test exception cases, there were a number of disabled people amongst the participants of the quota and opportunistic groups. The precise number is hard to calculate but it is estimated as being more than 250.

2.1.2 Enrolment

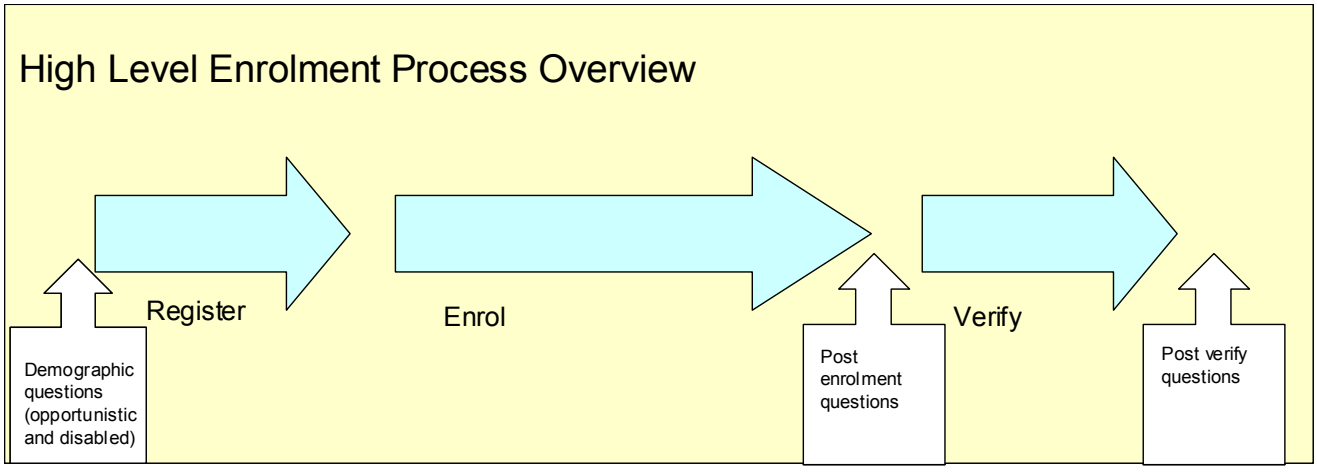


Figure 2 - High level enrolment process overview

Initially all participants went to the Reception area where Opportunistic and Disabled participants provided demographic data. Quota participants did not have to do this as

MORI had collected this information as part of the recruitment process. All participants then had their details registered on the Trial system by the receptionist. The participant then went into the enrolment area where they sat in a biometrics booth to provide their biometrics. There was an operator to explain the process to them and to operate the system. At the end of enrolment a card was produced for the participant. This card was used in a single step verification process using the participant's chosen biometric.

Immediately after the enrol step and the verify step the participants answered questions about their experience. For Quota participants this was via an interview with a MORI researcher. For Disabled participants this was via an interview with an operator, and Opportunistic participants completed a self-completion questionnaire.

If there was any issue during enrolment or verification the operators noted this on a process exception form.

The enrolment and verification process is described in more detail in Section 2.4 Enrolment and Verification Process Detail.

2.1.3 Data Analysis

The questionnaires were sent to MORI where they were analysed. The results of this analysis can be found in Sections 5 Participant Experience and 6 Participant Attitude. The data that the system automatically collected about the enrolment and verification process, and the exception forms completed by the operators were also analysed. The results can be found in Sections 3 Enrolment and 4 Verification.

2.2 Biometrics Booth

The biometrics booth was a purpose built oval booth containing the biometric enrolment devices (see Figure 3). The camera was mounted on the wall of the booth above a desktop surface. On top of the desktop was an electronic signature pad and sunk into the desktop was the fingerprint device. (See Appendix C - Technology for further information about the devices used). The booth contained angled halogen lights in the ceiling that could be adjusted by hand.

The participant sat on a standard office chair within the booth while going through the enrolment, or in the case of wheelchair users in their wheelchair in the booth. The operator sat just outside the booth, but still maintained visual contact.

Figure 3 - Enrolment booth

The booth was solid most of the way round, and the remaining part had a curtained opening. This curtained opening allowed for wheelchair access and could, if necessary, be closed to give the participant greater privacy.

2.3 Enrolment Centres

Initially there were four fixed biometric enrolment centres: London (Globe House), Leicester, Newcastle and Glasgow and one mobile enrolment centre. Towards the end of the Trial two further enrolment centres were established to assist with the recruitment of disabled people. These were in Swansea and Newcastle (DWP Longbenton).

The number of participants who were processed through each of the Trial locations was as follows:

Enrolment Centre	Quota (target 2000)	Disabled (target 750)	Opportunistic (target 7000)	Total (target 10,000)
London	289	71	1597	1957
Leicester	642	69	2281	2992
Newcastle	502	32	1456	1990
Glasgow	473	111	1062	1646
Mobile Unit	94	425	870	1389
Newcastle (Lbtn)		18		18
Swansea		24		24
TOTALS	2000	750	7266	10016

Table 1 - Number of participants by sample group and enrolment centre

Figure 4 – Example of an enrolment centre

2.3.1 Globe House

This enrolment centre was located within the London Passport office and it became operational on the 14th April 2004.

The environment within Globe House for the enrolment was good. The room containing the enrolment booth was in the corner of a large public waiting area. The room was sufficiently spacious and private, it was maintained at a comfortable temperature and had plenty of natural light. The verification was performed out in the public area – however it was deemed as sufficiently 'cornered off'.

In order to gain access to the enrolment centre participants had to pass through the security checkpoint. The impact of waiting in the security line had an effect on recruitment. This, and the 'transient' nature of the Globe House external area (i.e. people rushing to get to work) made recruitment of the London Quota sample very difficult.

Although there has been a core team of UKPS staff running the enrolment centre throughout the Trial, Globe House has been the centre where UKPS staff from the other enrolment centres have been trained. The core team participated in the initial testing of the system and were the most experienced of all of the staff in the Trial.

2.3.2 Leicester

This enrolment centre was located within the Bishop Street Post Office in Leicester and it became operational on the 6th May 2004.

The enrolment and verification areas were right next to each other in a small area within the Post Office. There were two issues with environment that needed to be overcome. Firstly, the Reception area faced out into the Post Office making it possible for the movement of Post Office customers to affect the camera when it was being used for face verification. To prevent this happening a screen was built. Secondly, the Post Office had very high windows which during the afternoons let in a great deal of sunlight which the operators found affected face and iris verification. They overcame this by making use of a

lightweight screen containing information about the Trial and moved this screen around during the day to block out the sunlight.

The location of the enrolment centre made it highly visible to the customers of the Post Office, and for this reason recruitment in Leicester was highly successful.

For the majority of the Trial, Leicester had a core team of operators from UKPS. Additional UKPS operators came from other centres when cover was required.

2.3.3 Newcastle

This enrolment centre was located within the Registrar's Office at Newcastle Civic Centre and it became operational on the 28th April 2004.

The enrolment booth was in its own room which was spacious and well-lit and the reception area was at a counter out in the public area. There were issues with the lighting around the Reception area. To remove the effect of these lights a Whiteboard was placed in front of Reception, and the participants sat with their backs to this. Although this helped reduce the effect of the wall-lights, it did place a constraint on the distance between the participant and the camera.

Although the centre was easily accessible, its visibility was low and so the recruiter had to go out onto the street around the Civic Centre to find participants.

For the majority of the Trial Newcastle had a core team of operators from UKPS. Additional UKPS operators came from other centres when cover was required.

2.3.4 Glasgow

This enrolment centre was located within the DVLA office in Glasgow and it became operational on the 13th May 2004.

The enrolment booth and reception area were next to each other in the public area. No environmental issues were identified.

The recruiter went to the streets around the office and the surrounding businesses to recruit participants.

Glasgow had teams of operators from DVLA, and these teams ran the enrolment centre on a rotational basis.

2.3.5 Newcastle (Longbenton)

This enrolment centre was located within the Department for Work and Pensions Benton Park View site at Longbenton, Newcastle, and became operation on 10th December 2004.

The enrolment booth was in its own room within a new un-populated building. The room was well lit by overhead lighting even though the booth was positioned in front of the room's windows.

For the short period of time that the site was operation, it was manned by two UKPS operators.

2.3.6 Swansea

This enrolment centre was located at the main DVLA site at Swansea and became operational on 14th December 2004.

The enrolment booth was located on an empty floor within one of the side buildings adjacent to the main DVLA building. The area around the booth had been partitioned off, but lighting was still very good with wide windows both sides of the floor and good overhead lighting.

2.3.7 Mobile Unit

This enrolment centre was in a specially converted vehicle and became operational on the 12th July 2004.

Figure 5 - Mobile enrolment unit

Figure 6 - Rear of mobile enrolment unit with ramp & lift for wheelchair access

The following shows the locations visited up to and including the 17th December.

Week Number	Week Dates	Location
10	14th June to 18th June	Queen Anne's Gate
12	28th June to 2nd July	Queen Anne's Gate
13	5th July to 9th July	House of Commons
14	12th July to 16th July	Peterborough
15	19th July to 23rd July	Sheffield
16	26th July to 30th July	Middlesborough
17	2nd August to 6th August	Macclesfield
18	9th August to 13th August	Birmingham
19	16th August to 20th August	Swansea
20	23rd August to 27th August	Taunton
21	31st August to 3rd September	Torquay
22	6th September to 10th September	Belfast
23	13th September to 15th September	Harrogate
24	16th September to 24th September	Chalfont St Peter
25	27th September to 1st October	Redhill & Chalfont St. Peter
26	4th October to 15th October	Portsmouth
27	18th October to 19th October	FCO
27	21st to 22nd October	Royal Hospital, Chelsea
28	25th October to 29th October	Dunfermline
29	8th November to 19th November	Enham Alamein, Andover
30	22nd November to 26th November	Chalfont St Peter
31	29th November to 3rd December	Methil, Scotland
32	6th to 10th December	Royal Hospital, Chelsea
33	13th December to 17th December	St Loye's Foundation, Exeter

The enrolment and verification areas were next to each other. The Reception area was affected by two lighting issues. Firstly, the area was next to the van door which was kept open and so let light in. Secondly, the angle of the overhead lights was such that the participant's face was not evenly lit. Both of these issues affected facial verification.

The Mobile had one operator from UKPS for the whole of the Trial and additional UKPS operators came from other centres for varying periods.

2.4 Enrolment and Verification Process Detail

2.4.1 Register Participant

Opportunistic and Disabled participants began by providing their demographic details. Quota sample participants had already provided this information as part of the recruitment process. The Receptionist then registered the participant on the Trial system and the participant would go through to enrolment if the booth was ready or else wait in the waiting area until called.

2.4.2 Enrol Participant

The participant entered the enrolment booth where the operator retrieved the participant's record from the system, checked the details were correct and then went through the following stages:

- Photograph participant;
- Record facial biometric;
- Record iris biometric (omitted for the second control group);
- Record fingerprint biometric (omitted for the first control group);
- Record electronic signature;
- Print and encode card.

The operators were asked to note any relevant information on an exception form where the participant failed biometric enrolment.

2.4.2.1 Photograph Participant

The participant looked straight ahead at the camera while the system took a photograph. He/she would raise or lower the chair as required by the operator to ensure that the whole head was recorded.

As the photograph was to be printed on the card, the operator would show the participant the photograph on the screen and would take a new one if the participant was unhappy with the image.

The system automatically recorded the length of time taken for this step.

2.4.2.2 Record Facial Biometric

The participant looked straight ahead at the camera while the system recorded the facial biometric and created a facial biometric template[1]. If the system was able to create a valid template then the operator would check the template. If the system was unable to create a valid template then facial biometric enrolment failed, and the operator would have the

[1] A template is a mathematical representation of the biometric measurements.

option of trying again or of moving on to the next step. If a retry was needed then the operator would take corrective action, usually by adjusting the participant's position.

The operator checked the template by prompting the system to record the facial biometric again. The system then compared this against the template just created and assigned a score to the match. Provided the score reached a threshold value then the operator saved the template and facial enrolment was successful. If the score was below the threshold level then the operator would retake the facial biometric.

The system automatically recorded the length of time taken for this step, the outcome, and the number of facial biometric attempts.

2.4.2.3 Record Iris Biometric

The participant sat centrally in front of the camera and looked into the mirror above the camera, while the system recorded the left eye. The camera prompted the participant to move left, right, backwards or forwards as necessary. If the system successfully recorded the left eye, it then went on to record the right eye. If any eye was not recorded successfully the operator had the option of retrying.

The guidance given to the operators was that they should make a total of 3 attempts to take irises, either three attempts on one eye or one attempt on eye and two attempts of the other eye. However, the operators exercised their discretion and if the participant was willing to continue then repeated attempts were made. If the participant was unhappy, or the operator believed that repeated attempts would be unsuccessful then they made less than three attempts.

If the system was able to record two iris images, it generated a biometric template and the template was sent to the central system. At the central system the new iris biometric template was compared with those already stored (one to many matching). Provided it did not match, the iris biometric was stored in the system and iris biometric enrolment was successful. If it did match, then this was treated as a duplicate enrolment attempt.

The system automatically recorded the length of time taken for this step, the outcome, and the number of iris biometric attempts.

For reference the iris database was pre-loaded with 118,000 iris templates.

2.4.2.4 Record Fingerprint Biometric

The participants placed their fingers on the fingerprint reader in the following sequence: left hand four fingers, left hand thumb, right hand four fingers and right hand thumb. If the participant had any missing fingers the operator recorded which finger was missing on the system. The "slap" method of fingerprinting was used i.e. the fingers were placed and not rolled. As the fingers were placed the images were displayed to the operator who could check the positioning and do an initial visual check of the quality. After each thumb or set of four fingers the system did a quality check and if the quality was too low that set was taken again. Once the complete set of fingerprints had been taken they were sent to the central system where there was a back-end quality check. If any fingers failed this check the operator was prompted to take only the prints of those fingers again, one at a time. This retake facility was known as single finger retry. Once a valid set of fingerprints had been obtained, they were compared with those already stored (one to many matching). Provided they did not match, the fingerprint biometric was stored in the system and fingerprint biometric enrolment was successful. If they did match, then this was treated as

a duplicate enrolment attempt. During the Trial a total of 16 false matches were recorded.

The system automatically recorded the length of time taken for this step, the outcome, and the number of fingerprint biometric attempts.

For reference the fingerprint database was pre-loaded with 1 million fingerprint templates.

2.4.2.5 Record Signature

The participant wrote his/her signature on an electronic signature pad and then left the enrolment booth.

The system automatically recorded the length of time taken for this step.

2.4.2.6 Print Card

The biometric details were recorded on the chip within the card and the card was printed. Enrolment finished once the operator confirmed that the card had printed satisfactorily.

The system automatically recorded the length of time taken for this step.

2.4.3 Post-enrolment Questionnaire

While the card was being printed, participants answered questions about their enrolment experience. Quota and Disabled participants were interviewed, Opportunistic participants completed a questionnaire.

Once the questions had been answered, the participant went on to verify.

2.4.4 Verify Identity

The participant's card was placed into a card-reader and the participant was asked which biometric they would like to use to verify themselves i.e. confirm they were the person who to whom the card belonged. The participant could choose any biometric which had been successfully enrolled. The chosen biometric was recorded and compared only with the one that the participant gave during enrolment (one to one matching). If they matched the verification was successful.

The system automatically recorded the length of time taken for this step, the outcome, and the type of biometric used for verification.

2.4.5 Post-verification Questionnaire

Participants then answered questions about the verification experience. As before, Quota and Disabled participants were interviewed, Opportunistic participants completed a questionnaire. Once this was complete the participant was given the card and the process was complete.

3 Enrolment

WARNING - This report uses colour in its analysis results. These results may be misinterpreted if the report is printed in black and white

3.1 Enrolment Process Times

3.1.1 Overall Enrolment Times

Overall enrolment times have been calculated from the point at which the operator enters the participant's enrolment reference into the system, to the point at which the operator accepts the participant's signature. Enrolments have been categorised as:

- All Face/Iris/Fingerprint – where the participant attempted face, iris and fingerprint enrolment, regardless of the success of each enrolment;
- Successful Face/Iris/Fingerprint – where the participant successfully enrolled on face, iris and fingerprint biometrics;
- 1st Time Successful Face/Iris/Fingerprint – where the participant successfully enrolled on face, iris and fingerprint biometrics at the first attempt on each.

From Figure 7 it can be seen that average enrolment times for Quota and Opportunistic participants were similar to each other, and were shorter than the average enrolment times for the Disabled participants. One factor affecting the length of the enrolment time is the number of attempts to record each biometric which is why the average time for all enrolments is higher than that for successful enrolments. Normally any failed biometric enrolment will have entailed several attempts to record that biometric. Further overall enrolment data can be found in Appendix A (see A1.1 Overall Enrolment Times).

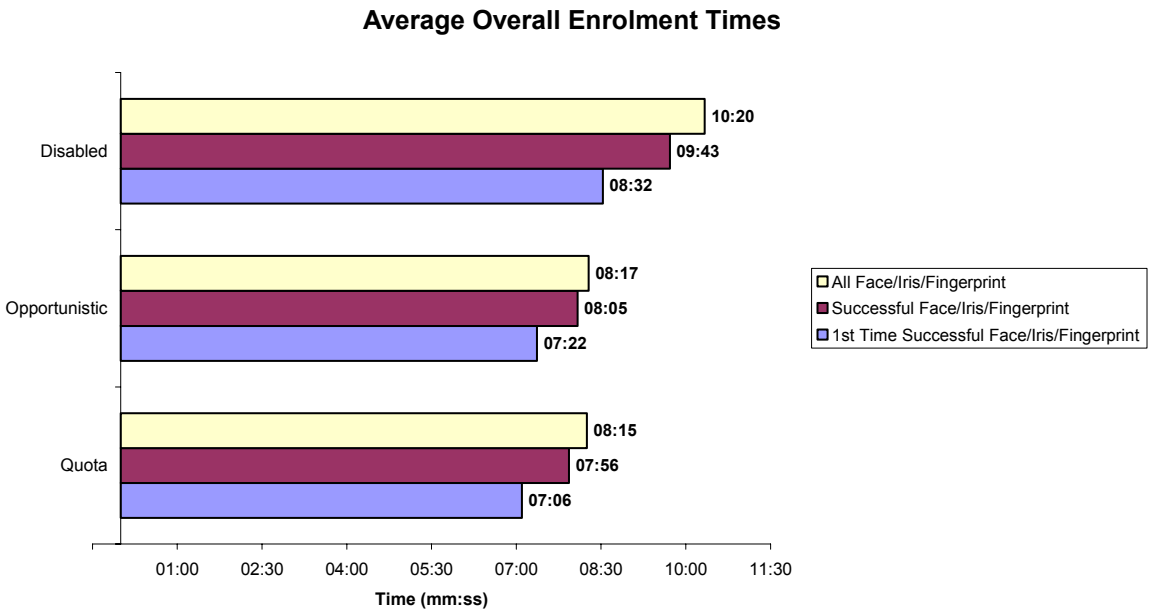
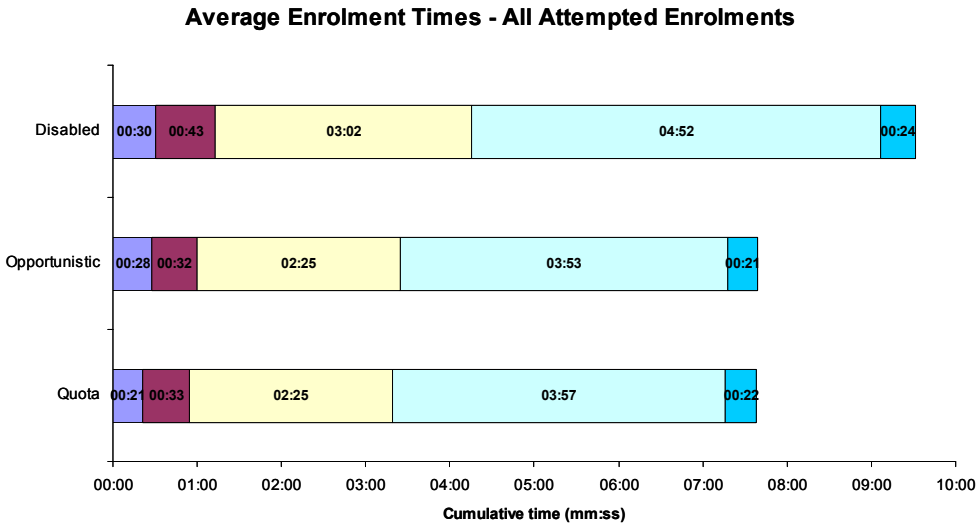


Figure 7 - Average overall enrolment times for each sample group

Key Observation:
Enrolment, including failed enrolments, took on average 8 minutes and 15 seconds for the Quota sample. Opportunistic enrolments took a similar amount of time but, with an average of 10 minutes 20 seconds, Disabled participants took significantly longer. Even where enrolment was successful on each of the three biometrics at the first attempt, the Quota and Opportunistic participants took less time than Disabled participants.

3.1.2 Individual Step Times

The contribution that each enrolment step makes to the overall enrolment time can be seen from Figure 8.



	Quota	Opportunistic	Disabled
Record signature	00:22	00:21	00:24
Record fingerprint biometric	03:57	03:53	04:52
Record iris biometric	02:25	02:25	03:02
Record facial biometric	00:33	00:32	00:43
Retrieve participant record	00:21	00:28	00:30

Figure 8 - Average enrolment step times for each sample group

The longest step in the enrolment process was the fingerprint enrolment step. This includes the one-to-many matching of each fingerprint against those already stored in the enrolment database. This one-to-many matching took approximately 1 minute 30 seconds. Although the iris enrolment step also includes the one-to-many matching of each iris, this is not a significant element. For each of the three biometrics, enrolment of the Disabled participants took longer than the Quota and Opportunistic sample.

Weekly biometric enrolments have been analysed to see if they became quicker over time as the operators became more experienced. No such trend is evident, suggesting that the training initially given to the operators was sufficient for the Trial.

Further analysis of the process times for the individual enrolment steps can be found in Appendix A (see A1.2 Individual Step Times)

Key Observation:

- ***Face, iris and fingerprint enrolment was quicker for the Quota and Opportunistic samples than the Disabled participants.***
- ***Facial biometric enrolment was the quickest of the three biometrics, with enrolment taking a little over 30 seconds for the Quota and Opportunistic samples, and a little over 40 seconds for the Disabled participants.***
- ***Fingerprint biometric enrolment was the slowest of the three biometrics taking a little under 4 minutes for the Quota and Opportunistic participants, and a little under 5 minutes for the Disabled participants. However, a significant proportion (approximately 1 minute 30 seconds) was taken up by the one-to-many matching.***

3.2 Facial Biometric Enrolment

3.2.1 Facial Enrolment Success

The majority of participants in all sample groups successfully enrolled their face biometric, however the success rate was higher for the Quota and Opportunistic sample groups than for the Disabled participant group (see Figure 9[2]).

The data excludes 8 facial enrolments where a participant attempted a duplicate enrolment. These facial enrolments were successful because no one-to-many matching occurred during facial biometric enrolment. The duplicate enrolments were detected during iris enrolment, which was the first point in the process where a duplicate could be detected. The data from the original enrolments are included.

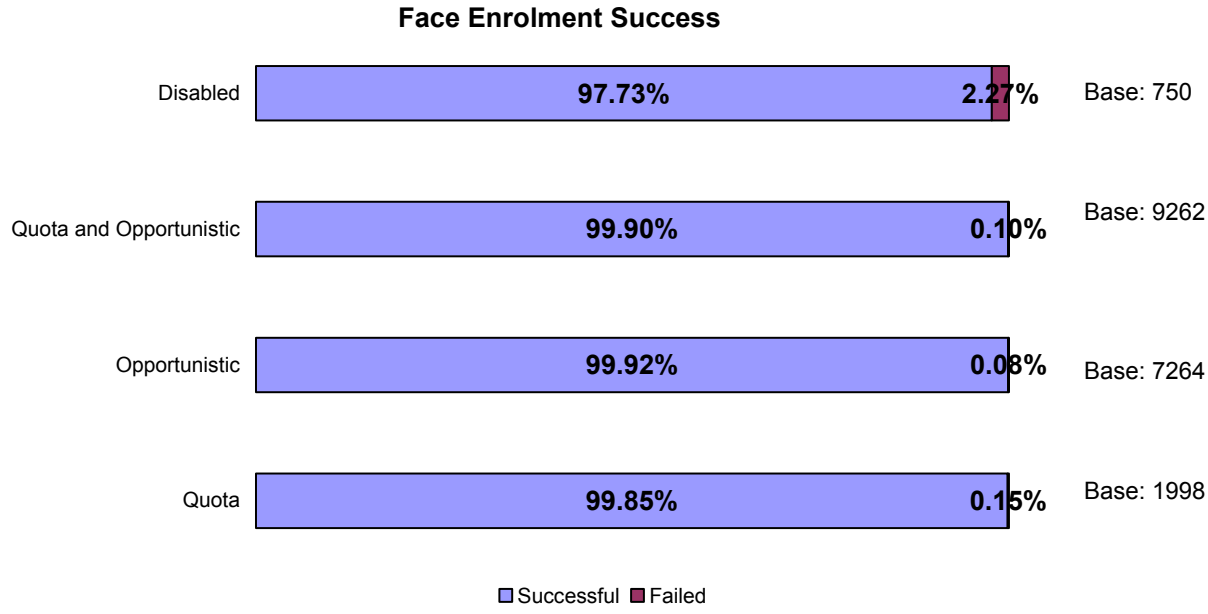


Figure 9 - Facial enrolment success by sample group

Key Observation:
The vast majority of participants in each sample group successfully enrolled on the facial biometric. However, the failure rate for the Disabled participant group was significantly higher than the failure rate for the Quota and Opportunistic groups.

[2] Any facial biometric enrolment where there was a technical problem has been excluded, and so the base data for each sample can be less than the total number of participants in that sample).

3.2.2 Facial Enrolment Failures

The operator observations for the failed enrolments have been analysed and categorised. The results of this are presented in the tables below. The Disabled participant group has been shown separately because of its significantly higher failure rate. A general explanation of the categories used follows the tables, and further information about the individual failures can be found in Appendix A (see A2.1 Facial Enrolment Failure Operator Observations).

Operator observations for facial enrolment failures (Quota and Opportunistic)	
Observation	**Volume**
Lighting problems	3
Behavioural	1
Participant exception	1
Unspecified	4

Table 2 - Summary of operator observations for Quota and Opportunistic facial enrolment failures

Operator observations for facial enrolment failures (Disabled)	
Observation	**Volume**
Positioning	4
Behavioural/participant exception[3]	1
Participant exception	7
Participant appearance	1
Unspecified	4

Table 3 - Summary of operator observations for Disabled participant facial enrolment failures

Lighting problems: where light was reflected from the participant's head or glasses, or the face was not fully illuminated. Environment design needs to ensure that the face is evenly lit regardless of the skin tone and that there are no reflections from glasses or the skin, particularly the top of the head in the case of people with receding hairlines.

Positioning: where the design of the booth prevented the participant getting to the correct distance from the camera. Although many wheelchair users successfully enrolled their facial biometrics, some wheelchairs could not get close enough. Environment design needs to ensure that an alternative mechanism is developed to enable the camera to get close enough to wheelchair users and other participants.

[3] Participant refused to remove helmet. No information is available as to whether the participant needed the helmet because of his impairment in which case this would count as a participant exception or whether the participant just didn't want to (behavioural).

Behavioural: where the participant did not follow operator instructions and remove their headwear. Headwear was not always a problem, many participants who wore headwear for religious reasons were able to enrol their facial biometrics successfully. Where it became a problem was when it obscured the face, or caused part of the face to be in shade.

Participant exception: where an impairment of the participant prevented enrolment. If the participant was unable to hold their head up, keep still and look straight at the camera then facial enrolment failed.

Participant appearance: where a feature of the participant's appearance prevented enrolment. In this case the participant had a heavy fringe. In other instances where it was suspected that a participant's fringe was causing a problem, the participant was requested to move the fringe back and subsequently enrolment was successful.

Key Observation:

- ***Environmental design is a factor in successful facial enrolment. Lighting needs to be bright enough that the face is evenly lit but must not be reflected from the skin or glasses.***
- ***While booth design permitted all wheelchair users to enter the booth, it did not allow large wheelchairs to get close to the camera.***
- ***The majority of participants with headwear were able to enrol their facial biometric. If the face or forehead were significantly obscured facial biometric enrolment would fail.***

3.2.3 Facial Enrolment Attempts

As can be seen from Figure 10, the majority of participants were enrolled at the first attempt. Quota and Opportunistic participants were more likely to be successful at the first attempt than Disabled participants.

Where more than one attempt was required this was for one of the following reasons:

- Behavioural: the participant moved or looked away during facial enrolment;
- Lighting problems: light was reflected from the participant's forehead or glasses;
- Positioning: the participant was too far away from the camera;
- Participant appearance: the participant had a heavy fringe.

One participant required 21 attempts before she was able to enrol successfully on the facial biometric. She was only able to enrol when she pushed her fringe back.

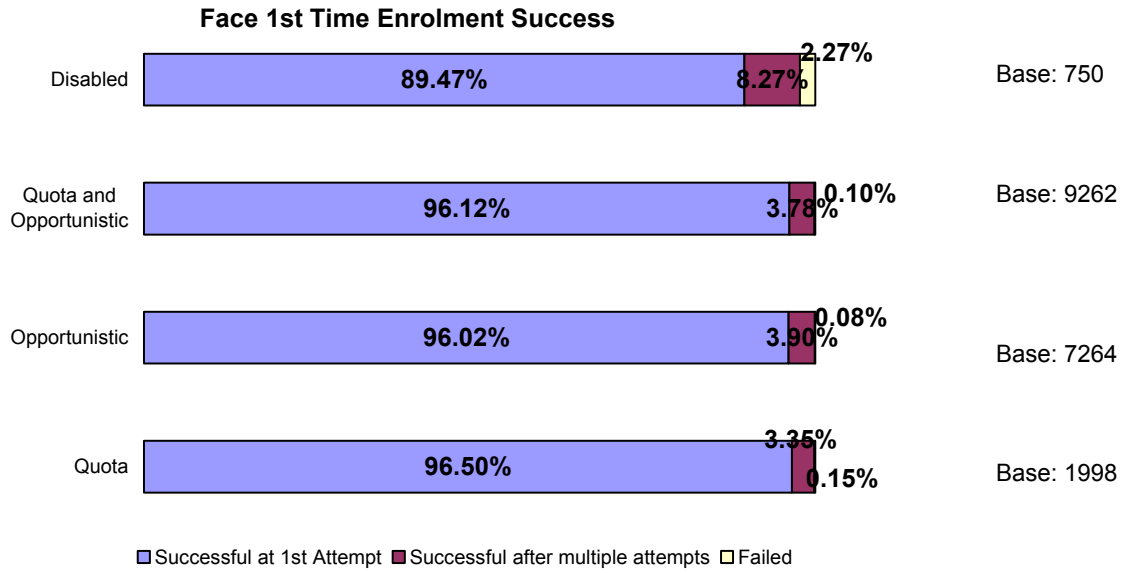


Figure 10 - Facial enrolment success at the first attempt by sample group

Key Observation:
The majority (96%) of Quota and Opportunistic participants successfully enrolled on the facial biometric at the first attempt. The majority of Disabled participants also successfully enrolled at the first attempt but the success rate was lower (89%).

3.2.4 Factors Affecting Facial Enrolment

3.2.4.1 Quota and Opportunistic

For Quota and Opportunistic participants, facial enrolment success at the first attempt rates have been analysed to identify any potential links with location, ethnicity, age, and gender. This analysis has shown that the participant's ethnic group is linked with success at the first attempt, but the relationship is not a straightforward one, as location seems to be the main factor.

Within the enrolment centre with the lowest first attempt success rate (Globe House), the first attempt success rate for White participants was significantly higher than that for Black participants. Within the enrolment centre with the highest first attempt success rate (Leicester), the success rate for White participants is still higher than that for Black participants but the difference is less pronounced. This suggests that environmental factors are the main cause of a failure to enrol at the first attempt. Although an enrolment booth was used at each enrolment centre in an attempt to optimise and standardise environmental conditions, the booth was not completely self-contained and could be affected by external conditions, particularly light.

1st Time Success Face Enrolment Rates per Centre (Quota and Opportunistic)		
Centre	**Sample size**	**% Success at 1st Attempt**
Globe House	1886	94.43%
Leicester	2922	97.02%
Newcastle	1957	96.93%
Glasgow	1533	95.69%
Mobile	964	95.75%

Table 4 - Facial Enrolment success at the first attempt by enrolment centre

1st Time Success Face Enrolment Rates at Globe House by Ethnic Group (Quota and Opportunistic)		
Ethnic Origin	**Sample size**	**% Success at 1st Attempt**
Asian	168	95.24%
Black	113	87.61%
Chinese/East Asian	16	93.75%
Other	77	94.81%
White	1508	94.96%

Table 5 - Facial enrolment success at the first attempt at Globe House by ethnic group

Although Table 5 shows that at Globe House the first time face enrolment success rate is significantly higher for Asian participants than for Black participants, this is not supported by the results from Leicester. From Table 6, the first time face enrolment success rate is higher for Asian participants than for Black participants, but the difference is not statistically significant, and so the apparent link is not one that can be made with confidence.

1st Time Success Face Enrolment Rates at Leicester by Ethnic Group (Quota and Opportunistic)		
Ethnic Origin	**Sample size**	**% Success at 1st Attempt**
Asian	522	96.93%
Black	237	94.94%
Chinese/East Asian	14	92.86%
Other	135	96.30%
White	2013	97.27%

Table 6 - Facial enrolment success at the first attempt at Leicester by ethnic group

Key Observation:

- ***Environmental factors appear to affect the ability to enrol the facial biometric at the first and subsequent attempts.***
- ***White participants had a higher first attempt facial enrolment success rate than Black participants.***

3.2.4.2 Disabled Participants

Facial enrolment success at the first attempt data has been analysed to ascertain whether the type of impairment affected the first attempt success rate for the facial biometric. Figure 11 shows the results for participants that only had one type of impairment.

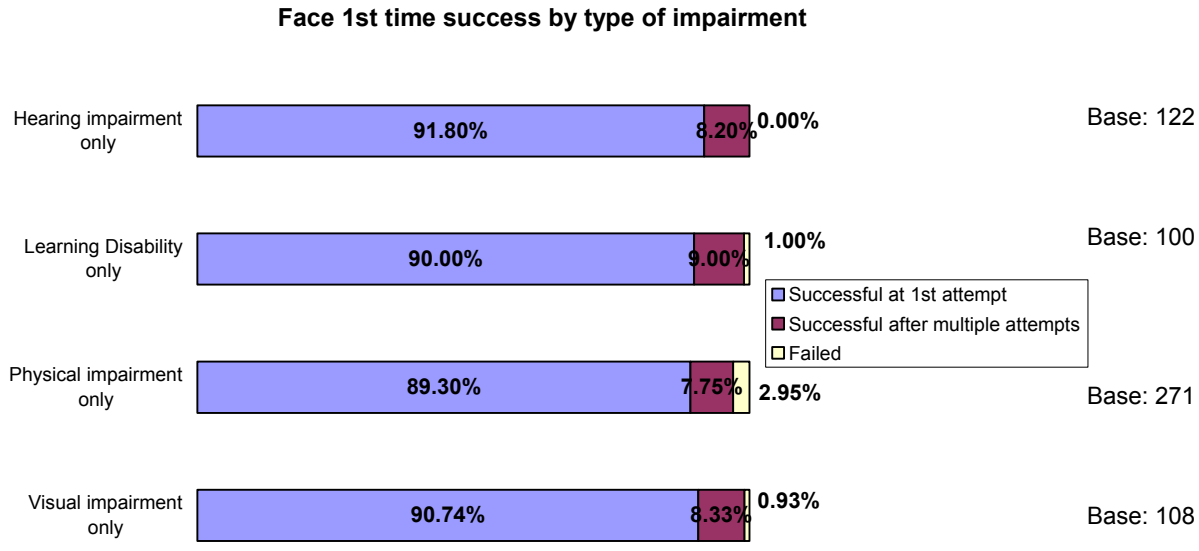


Figure 11 - Facial enrolment success at the first attempt by type of impairment

All impairment types tended to decrease the likelihood of the participant enrolling successfully on face at the first attempt. The operators have not always noted the reasons for retries being necessary and so the following suggested causes are based on informal operator feedback:

- For participants with learning disabilities, a likely cause of retries is difficulty in keeping still and looking ahead at the camera.
- For participants with a physical impairment, likely causes of retries are difficulty in holding the head in the required position and wheelchairs making it harder for the

operator to position the participant correctly.

- For participants with a hearing impairment it is likely that retries are a result of the operator finding it hard to communicate with the participant and correct positional problems during the first attempt.

Key Observation:
Maintaining the correct position for facial biometric enrolment was a problem for some Disabled participants with a physical impairment or with learning disabilities.

3.3 Iris Biometric Enrolment

3.3.1 Iris Enrolment Success

Figure 12 shows the success rate for iris biometric enrolment. The majority of participants successfully enrolled their irises, but the success rate was lower for the Disabled participants than for other participants.

The data excludes 8 iris enrolments where a participant attempted a duplicate enrolment. These attempts failed because the irises matched the original enrolment. These have been excluded because although enrolment failed, enrolment failure was the correct outcome.

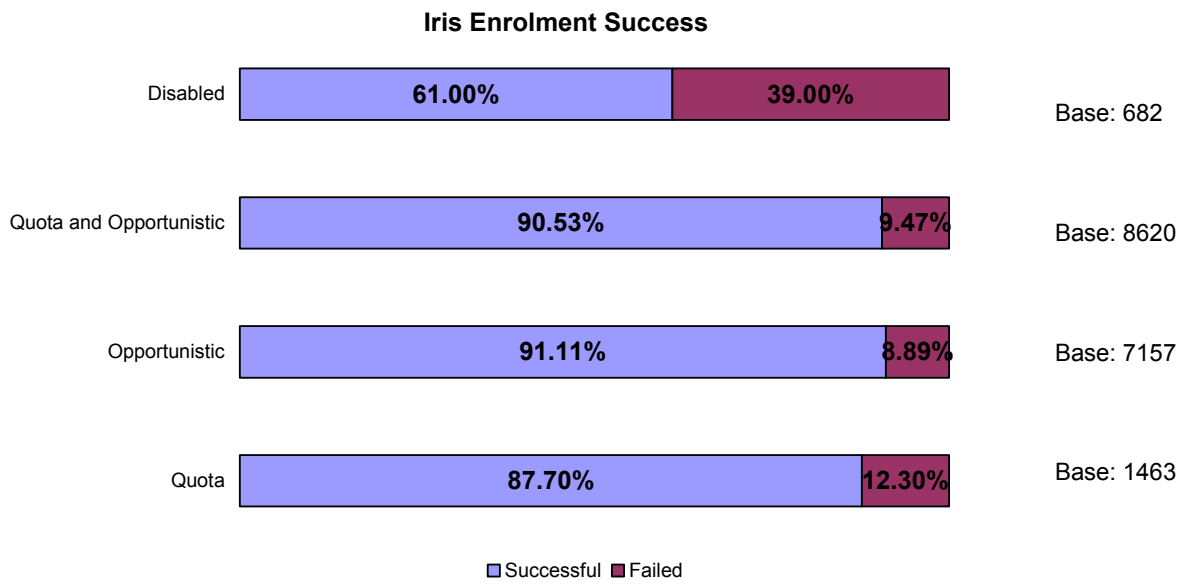


Figure 12 - Iris Enrolment Success by Sample Group

Key Observation:
The majority of participants in each sample group successfully enrolled on the iris biometric. However, the failure rate for the Disabled participant group was significantly higher than the failure rate for the Quota and Opportunistic groups.

3.3.1.1 Iris Enrolment Failures

For any iris enrolment failure the operators were instructed to note anything about the participant or the enrolment that could explain why it has failed. An analysis of these operator observations is presented in the tables below. The Disabled participant group has been shown separately because of its significantly higher failure rate. This analysis of operator observations needs to be treated with a certain amount of caution for the following reasons:

- The observation by itself does not prove a link;
- Operators respect the participant's privacy and so do not ask personal questions. As a result they do not necessarily uncover all relevant factors.

From the tables it can be seen that the majority of iris failures have been categorised as undetermined. The only information available to the operators to help them diagnose the cause of the failure was their own observations of the participant, and the prompts being given by the camera.

More information is available on some individual failures. This can be found in Appendix A (see A3.1 Iris Enrolment Failure Operator Observations).

Key Observation:
Lack of feedback from the iris camera to the operators made it difficult for them to establish the reason for enrolment failure, and to take corrective action.

Operator observations for iris enrolment failures (Quota and Opportunistic)	
Observation	**Volume**
[4]*Positioning*	29
Behavioural	55
Medical Condition	78
Participant didn't want to continue	29
Eyelashes	4
Hard contact lenses	1
Small/narrow eyes	36
Droopy eyelids	25
Couldn't hear instructions	2
Heavy eye make-up	11
Lazy eye	6
Deep-set eyes	1
Eyes not level	4
Van rocking	3
Turn in eye	3
English not 1st language	13
Wandering eye	6

[4] Where the observation is in italics this indicates that there is a brief definition of the observation following the tables.

Operator observations for iris enrolment failures (Quota and Opportunistic)	
Lighting	1
Large pupils	1
Coloured contact lenses	1
Contact lenses of unknown type	3
Squint	1
Close set eyes	1
Undetermined	502

Table 7 - Summary of operator observations for quota and opportunistic iris enrolment failures

Operator observations for iris enrolment failures (Disabled)	
Observation	**Volume**
Positioning	81
Behavioural	27
Medical Condition	17
Participant didn't want to continue	7
Operator didn't want to continue	2
Small/narrow eyes	5
Droopy eyelids	5
Couldn't hear instructions	7
Lazy eye	1
Deep-set eyes	1
Watery eyes	1
Turn in eye	2
Undetermined	110

Table 8 Summary of operator observations for Disabled participant iris enrolment failures

Positioning: where the participant could not be positioned at the correct height or could not get close enough to the camera.

Behavioural: where the participant couldn't or wouldn't follow the camera and operator instructions.

Medical condition participants volunteered information about conditions that affected their eyes. Potentially these conditions could affect the ability to obtain images of their irises.

Participant didn't want to continue: normally the operators made several attempts to obtain iris images. However, if the participant felt uncomfortable or simply didn't want to retry then no further attempts to record the iris were made.

Operator didn't want to continue: as stated previously, unless the participant was unwilling, the operators would normally make several attempts to obtain iris images. This category applies where the operator was unwilling to ask the participant to make further

attempts.

Couldn't hear instructions: these participants went through the Trial without a sign language interpreter being present. They couldn't hear the instructions and so were dependent on the flashing arrows on the front of the camera unit to position themselves.

Undetermined: there are three groups within this category: cases where no observation was recorded by the operators, cases where the camera did not take any shots even after the participant was repositioned by the operator and cases where the camera took shots but was unable to obtain an acceptable iris image.

3.3.2 Iris Enrolment Attempts

As with the overall iris success rate, there are significant differences between the first attempt success rates attained for the Quota/Opportunistic and Disabled participants (see Figure 13). With the Quota and Opportunistic samples, the majority of participants were successful at the first attempt but a number required multiple attempts. The majority of participants from the Disabled participant group were unsuccessful at the first attempt.

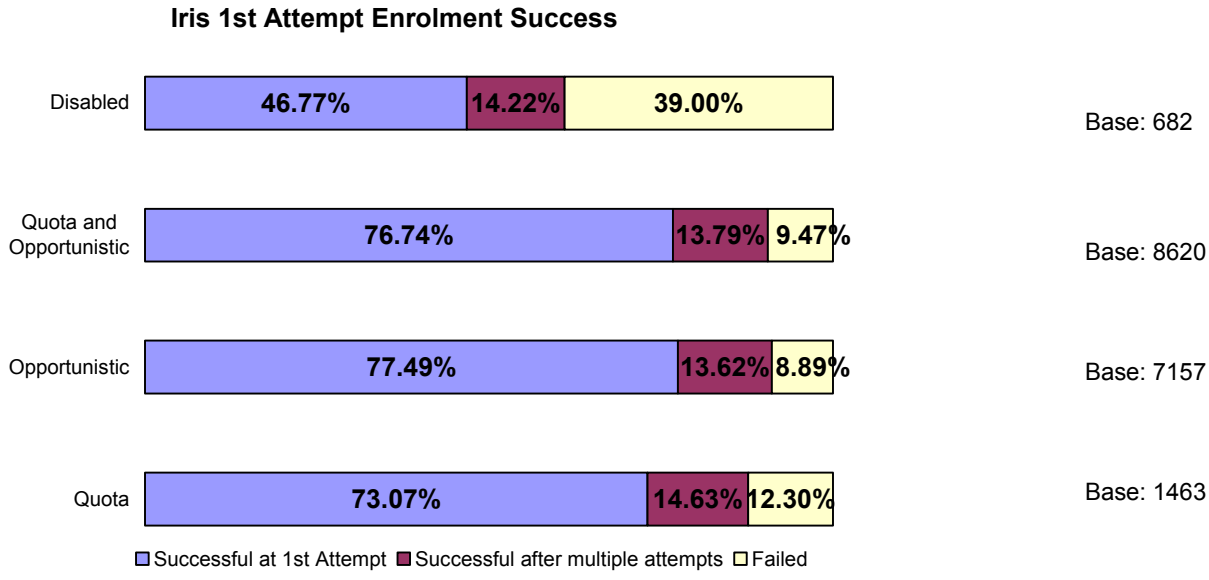


Figure 13 - Iris Enrolment Success at the First Attempt by Sample Group

The reason why multiple attempts were required for some participants tended to be one of the following:

- Positioning: In some cases individuals were not positioned centrally and the operator had to assess this by standing directly behind them and repositioning

them. Alternatively the participant was looking up instead of straight ahead and the operator had to change the height of the chair or change the angle of the mirror.

- Behavioural: in some cases the participants found it difficult to follow the camera or operator instructions, in some cases making exaggerated movements instead of the small movements needed, not moving at all or moving in the wrong direction.

Key Observation:
The majority (77%) of Quota and Opportunistic participants successfully enrolled on the iris biometric at the first attempt. Less than half (46%) of Disabled participants were successful at the first attempt.

3.3.3 Factors Affecting Iris Enrolment

3.3.3.1 Quota and Opportunistic

For Quota and Opportunistic participants, iris enrolment success and iris enrolment success at the first attempt data has been analysed to identify any potential links with location, ethnicity, age, and gender. This analysis has shown that the participant's ethnic group and age were linked with iris enrolment success and success at the first attempt.

Iris Enrolment Success Rates by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	781	88.09%
Black	358	81.01%
Chinese/East Asian	43	86.05%
Other	263	90.11%
White	7164	91.33%

Table 9 - Iris Enrolment Success by Participant Ethnic Group

1st Attempt Iris Enrolment Success Rates by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	781	70.93%
Black	358	59.22%
Chinese/East Asian	43	67.44%
Other	263	73.76%
White	7164	78.43%

Table 10 - Iris Enrolment Success at the First Attempt by Participant Ethnic Group

Both the iris enrolment success rate and the first attempt success rate were lower for Black participants than for Asian and White participants.

Iris Enrolment Success Rate by Age Range (Quota and Opportunistic)		
Age Range	**Sample Size**	**Iris Success Rate**
18-24	966	90.89%
25-34	1673	93.48%
35-44	1683	94.41%
45-54	1699	92.23%
55-59	875	91.31%
60-64	675	86.81%
65+	1049	78.27%

Table 11 - Iris Enrolment Success by Participant Age Group

1st Attempt Iris Enrolment Success Rate by Age Range (Quota and Opportunistic)		
Age Range	**Sample Size**	**1st time success as % of overall enrolments**
18-24	966	78.57%
25-34	1673	81.59%
35-44	1683	83.07%
45-54	1699	79.40%
55-59	875	74.29%
60-64	675	69.63%
65+	1049	59.49%

Table 12 - Iris Enrolment Success at the First Attempt by Participant Age Group

Iris enrolment success rate and the first attempt success rate varied according to the participant's age. On the whole the rates were higher for younger participants than older participants.

Key Observation:
Iris enrolment success and success at the first attempt varied according to the participant's ethnic group and age. Asian and White participants had higher success rates than Black participants. Participants that were aged under 60 had higher success rates than participants that were aged 60 or over.

3.3.3.2 Disabled Participants

For Disabled participants, iris enrolment success and iris enrolment success at the first attempt data has been analysed to identify whether the type of impairment affected the iris enrolment outcome. Figure 14 and Figure 15 show the results for participants that only had one type of impairment.

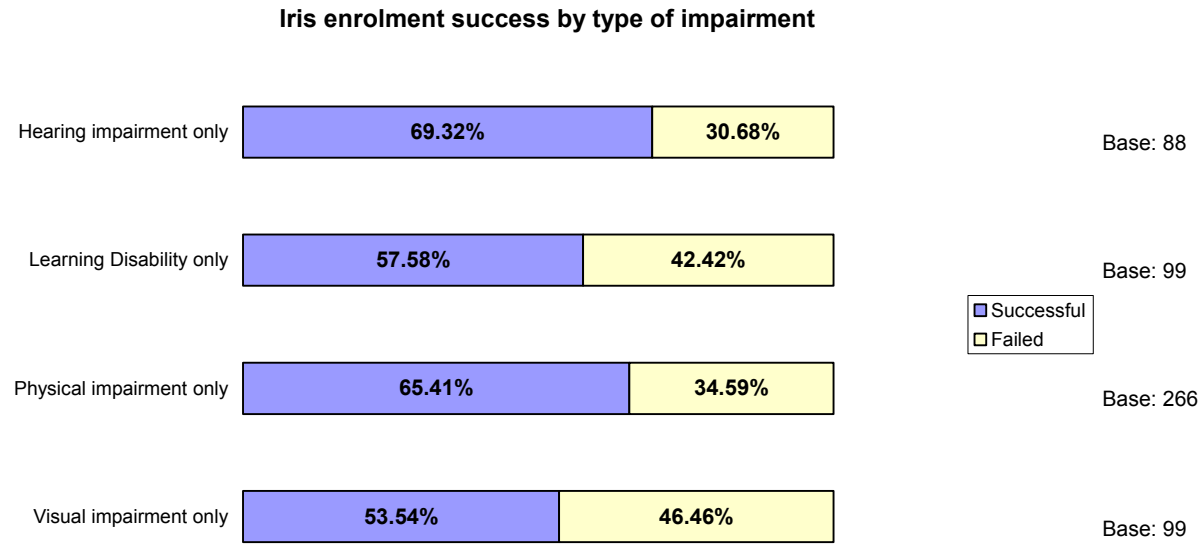


Figure 14 - Iris Enrolment Success by Type of Impairment

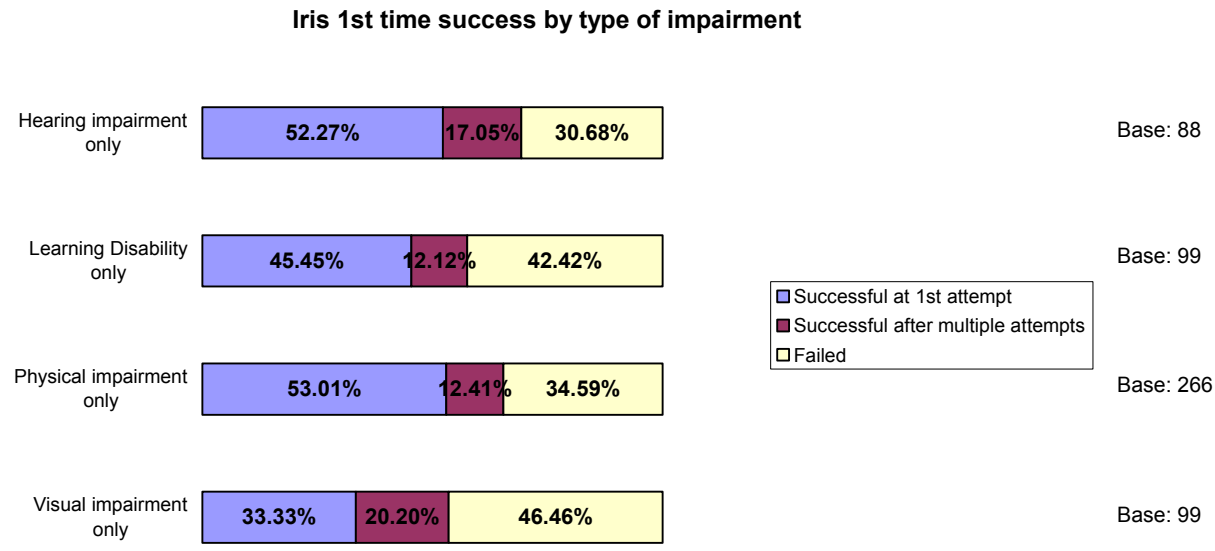


Figure 15 - Iris Enrolment Success at the First Attempt by Type of Impairment

For all types of impairment the iris enrolment success rate and the first attempt success rate were lower than the rates found with the Quota and Opportunistic samples. There were specific issues associated with each type of impairment and these could explain the lower success rates:

- Hearing impaired participants could not hear the camera instructions and needed to rely on the camera visual prompts that were not as easy to follow. Even where Sign Language Interpreters were provided, they could only communicate with the participant before and after each enrolment attempt;
- For people with learning disabilities there were three particular issues that came up:
  - Some participants could not look into the mirror. Iris enrolment with the system being used requires participants to look into the mirror.
  - Some operators were not able to provide instructions in an accessible format to some participants with learning disabilities and some who were sign-language users.
  - the assessment system required participants to sit still and look ahead for longer than they were used to in their normal day to day lives.
- it was not possible to move the camera into a suitable position to use with some participants in wheelchairs and others.
- it was not possible to position the camera to accommodate the needs of visually impaired participants who were not able to see.

It should be noted that some of these issues also affected Quota and Opportunistic sample participants.

Key Observation:

- ***The Disabled participant success rates associated with each impairment type were lower than for the Quota and Opportunistic samples.***

3.4 Fingerprint Biometric Enrolment

3.4.1 Fingerprint Enrolment Success

Figure 16 shows the success rate for fingerprint biometric enrolment. The majority of participants successfully enrolled their fingerprints but the success rate was higher for Quota and Opportunistic participants than for Disabled participants.

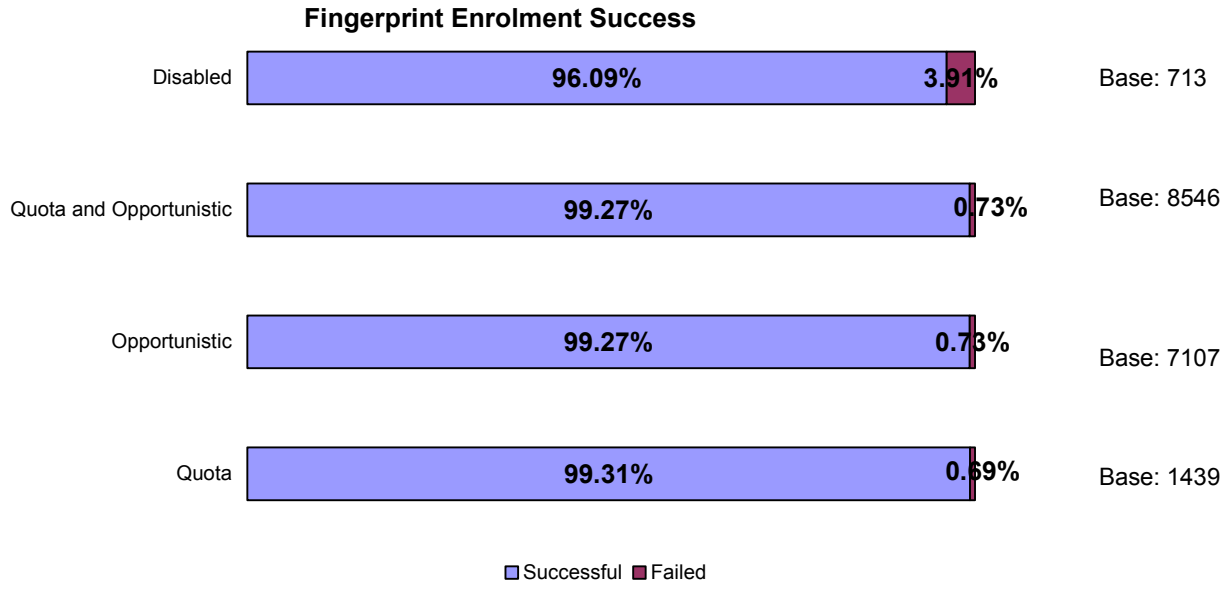


Figure 16 - Fingerprint enrolment success by sample group

In order to enrol successfully some participants were recorded as having missing fingers:

- A small number of successful participants (0.14% of Quota and 0.1% of Opportunistic) were temporarily unable to enrol some of their fingers. More detail can be found in Appendix A (A4.1 Reasons for Recording Fingers as Missing) but these varied from a short–term problem such as a sticking-plaster over a finger, or a longer term problem such as a broken fingers. Where this occurred the affected fingers were treated as missing, and the participant successfully enrolled the unaffected fingers.

- A small number of successful participants (no Quota but 0.08% of Opportunistic) genuinely had missing fingers or missing fingertips. Again, the fingers were recorded as missing and the participant enrolled successfully. More detail can be found in Appendix A (A4.1 Reasons for Recording Fingers as Missing).

- Some participants in all sample groups were unable to place **some** of their fingers on the fingerprint reader because of physical impairment. Full details can be found in Appendix A (A4.1 Reasons for Recording Fingers as Missing). Problems occurred where the participant was unable to straighten one or more fingers,

couldn't apply pressure, or couldn't keep their fingers still. . Where this occurred the affected fingers were treated as missing, and the participant successfully enrolled the unaffected fingers.

Key Observation:
The majority of participants in each sample group successfully enrolled on the fingerprint biometric. However, the failure rate for the Disabled participant group was significantly higher than the failure rate for the Quota and Opportunistic groups.
Not all successful participants could enrol on all ten fingers and one or more fingers had to be recorded as missing. The main reasons for this were:

- ***Fingers were broken or had a sticking plaster;***
- ***Fingers or fingertips were missing;***
- ***Participant could not straighten their fingers or keep them still.***

3.4.1.1 Fingerprint Enrolment Failures

The fingerprint enrolment failures have been analysed in conjunction with the operator observations. The results are summarised in Table 13 and Table 14. An explanation of the categories used follows the tables, and more detail about the individual failures can be found in Appendix A (see A4.2 Fingerprint Enrolment Failure Reasons).

Reasons for fingerprint enrolment failure (Quota and Opportunistic)	
Reason	**Volume**
False Match	14
Behavioural	1
Couldn't pass front-end quality check	7
Some fingers could have enrolled	39
Unspecified	1

Table 13 - Summary of Reasons for Quota and Opportunistic fingerprint enrolment failures

In a real application process the enrolment would be confirmed once a match was established as false – i.e. a false match would not necessarily prevent a person from being enrolled.

Reasons for fingerprint enrolment failure (Disabled)	
Reason	**Volume**
False Match	2
Behavioural	3
Some fingers could have enrolled	14
Positioning	9
Unspecified	1

Table 14 - Summary of Reasons for Disabled participant fingerprint enrolment failures

False Match: fingerprints falsely matched with fingerprints obtained earlier in the Trial

Behavioural: the participant was unwilling to follow the operator instructions.

Couldn't pass front-end quality check: as described in Appendix C - Technology, initial quality checks are applied and the fingerprints have to pass these before they can be submitted to the back-end system.

Some fingers could have enrolled: although the prints from some fingers were acceptable, the prints of one or more fingers could not pass the quality checks at the back-end (see Appendix C - Technology). N.B. a participant could enroll on less than 10 fingers provided the operator recorded the participant as having missing fingers at the outset. Once the fingerprints passed the front-end quality check, all fingers had to be acceptable for enrolment to occur.

Positioning: the participant had difficulty in placement of fingers for either the initial attempt or subsequent retries.

Key Observation:
In over half (62%) of the Quota and Opportunistic failures and just under a half (48%) of the Disabled participant failures, the participants had some fingers that could have enrolled.
In 31% of failures in the Disabled participant group the participant had difficulty positioning their fingers.

3.4.2 Fingerprint Enrolment Attempts

There are significant differences (see Figure 17) between the first attempt success rates attained for the Quota/Opportunistic samples and the Disabled participants. With the Quota and Opportunistic samples, the majority of participants were successful at the first attempt but a number required multiple attempts as shown in the chart below. The majority of participants from the Disabled participant group were also successful at the first attempt, but the proportion that succeeded at the first attempt was lower than for the Quota and Opportunistic samples.

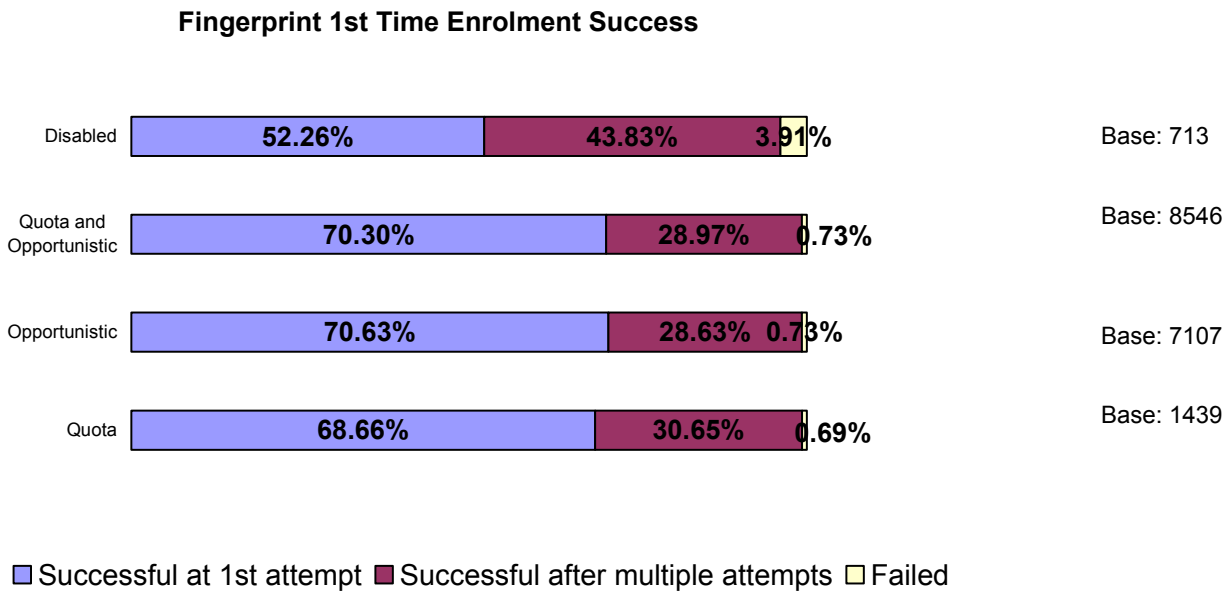


Figure 17 - Fingerprint enrolment success at the first attempt by sample group

Key Observation:
The majority of participants successfully enrolled on the fingerprint biometric at the first attempt. The rate was higher for Quota and Opportunistic participants than for Disabled participants.

3.4.3 Factors Affecting Fingerprint Enrolment

3.4.3.1 Quota and Opportunistic

For Quota and Opportunistic participants, fingerprint enrolment success and fingerprint enrolment success at the first attempt data has been analysed to identify any potential links with location, ethnicity, age, and gender. This analysis has shown that the participant's ethnic group was a factor in both the overall success and success at the first attempt. The success rate and the first attempt success rate were lower for Black participants. Gender was also a factor in the ability to enrol at the first attempt although not in the overall success rate. The first attempt success rate was higher for male participants than for female participants.

Fingerprint Enrolment Success Rate by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Fingerprint Success Rate**
Asian	756	99.07%
Black	351	97.72%
Chinese/East Asian	44	100.00%
Other	267	99.25%
White	7117	99.37%

Table 15 - Fingerprint enrolment success by participant ethnic group

1st Time Fingerprint Enrolment Success Rate by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**1st time success as % of overall enrolments**
Asian	756	70.90%
Black	351	54.70%
Chinese/East Asian	44	65.91%
Other	267	74.91%
White	7117	70.86%

Table 16 - Fingerprint enrolment success at the first attempt by participant ethnic group

Fingerprint Enrolment Success Rate by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**Fingerprint Success Rate**
Female	3091	99.09%
Male	5455	99.38%

Table 17 - Fingerprint enrolment success by participant gender

1st Time Fingerprint Enrolment Success Rate by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**1st time success as % of overall enrolments**
Female	3091	64.90%
Male	5455	73.36%

Table 18 - Fingerprint enrolment success at the first attempt by participant gender

Key Observation:
Fingerprint enrolment success and success at the first attempt was lower for Black participants. Male participants had higher first time enrolment success rate than female participants.

3.4.3.2 Disabled Participants

For Disabled participants, fingerprint enrolment success and fingerprint enrolment success at the first attempt data has been analysed to determine whether the type of impairment affected the fingerprint enrolment outcome. Figure 18 and Figure 19 show the results for participants that only had one type of impairment.

The fingerprint enrolment rate and the first attempt enrolment rate were lower for participants with a learning disability or a physical impairment than for other participants from the Disabled participants.

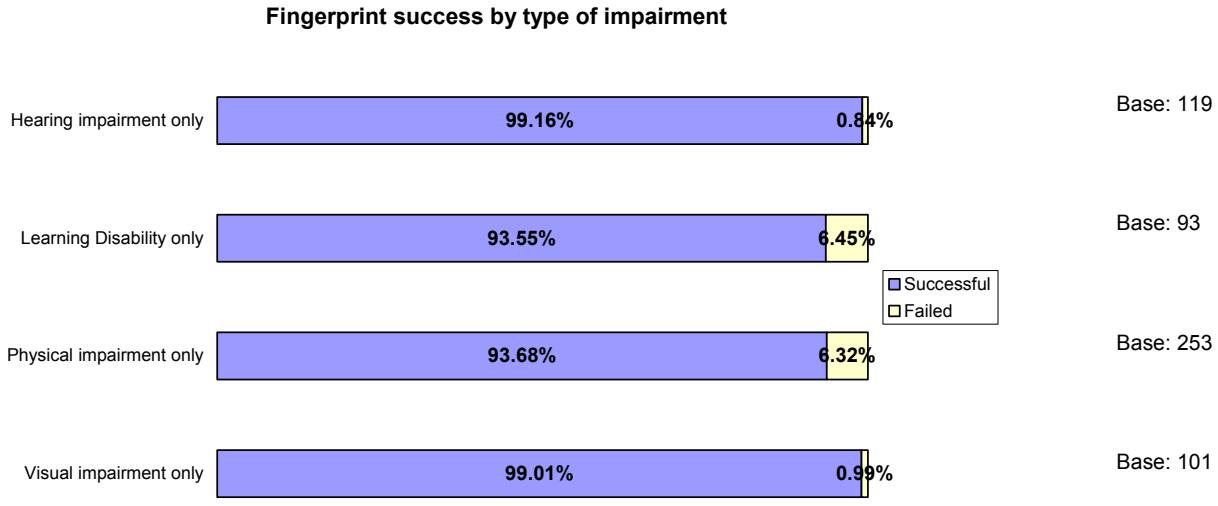


Figure 18 - Fingerprint enrolment success by type of impairment

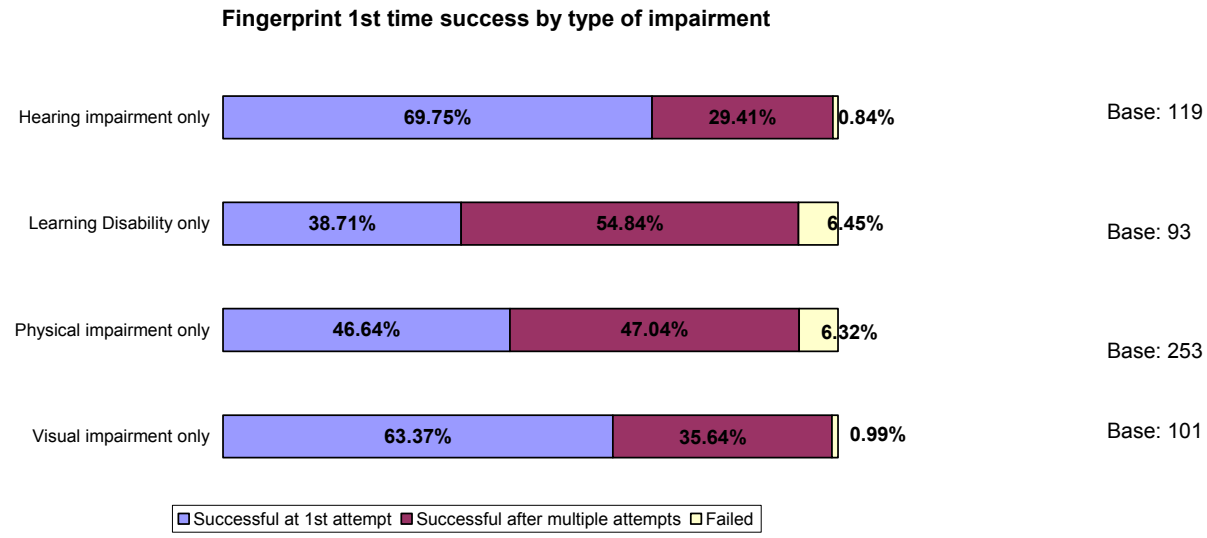


Figure 19 - Fingerprint enrolment success at the first attempt by type of impairment

Key Observation:
Participants with a learning disability and participants with a physical impairment had lower fingerprint success and first time success than other Disabled participants, and than Quota and Opportunistic participants.

3.5 Enrolment on all Three Biometrics

Table 19 - Enrolment success rates on combinations of biometrics by sample group shows the enrolment success rates for participants who **attempted enrolment on all three biometrics**. This excludes any attempted enrolment where there was a technical issue or operator error.

Success rate on combinations of biometrics						
	Sample size	Successfully enrolled on all three	Successfully enrolled on face and 1 other biometric	Successfully enrolled on face and failed both other biometrics	Failed on face and succeeded on at least 1 other biometric	Failed on all 3
Quota	935	89.09%	10.27%	0.32%	0.32%	0.00%
Opportunistic	7013	90.53%	9.31%	0.11%	0.04%	0.00%
Quota and Opportunistic	7948	90.36%	9.42%	0.14%	0.08%	0.00%
Disabled	645	60.78%	34.73%	2.17%	1.71%	0.62%

Table 19 - Enrolment success rates on combinations of biometrics by sample group

Key Observation:
The majority of participants from all sample groups successfully enrolled on all three biometrics. The success rate was higher for Quota and Opportunistic participants than Disabled participants.
All Quota and Opportunistic participants were able to enrol successfully on at least one biometric. A small percentage (0.62%) of Disabled participants failed to enrol on any of the biometrics.

4 Verification

4.1 Verification Process Times

From Figure 20 it can be seen that average verification times for Quota and Opportunistic participants were similar to each other, and were shorter than those for the Disabled participants. For facial and iris verification the time taken for Disabled participants was significantly longer than that for Quota and Opportunistic participants. For fingerprint verification the time taken for Disabled participants was significantly longer that for Opportunistic participants. Although the time taken for Disabled participants was not significantly longer than that for Quota participants[5] the difference is such that when taken in conjunction with the Opportunistic results, it can be concluded that fingerprint verifications took longer for Disabled participants.

Face verification was quicker than iris verification, which in turn was slightly quicker than fingerprint verification.

Further verification process time data can be found in Appendix B (see B1 Process Times).

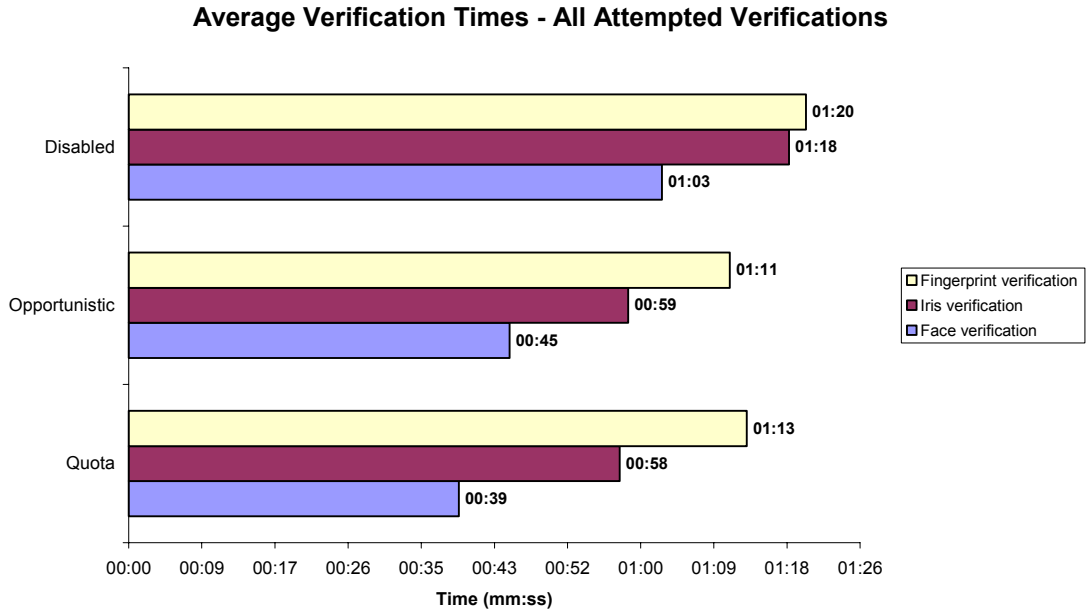


Figure 20 - Average verification times for each biometric type and sample group

Key Observation:
Overall, verification times for Quota and Opportunistic participants were shorter than for Disabled participants.

[5] Not significant in the sense used throughout this report i.e. the 95% confidence level. It is significant at a 90% confidence level.

4.2 Facial Biometric Verification

4.2.1 Facial Verification Success

Of the three biometrics, the highest verification failure rate occurred with the face. The percentages of participants that have passed and failed face verification can be seen from the chart below.

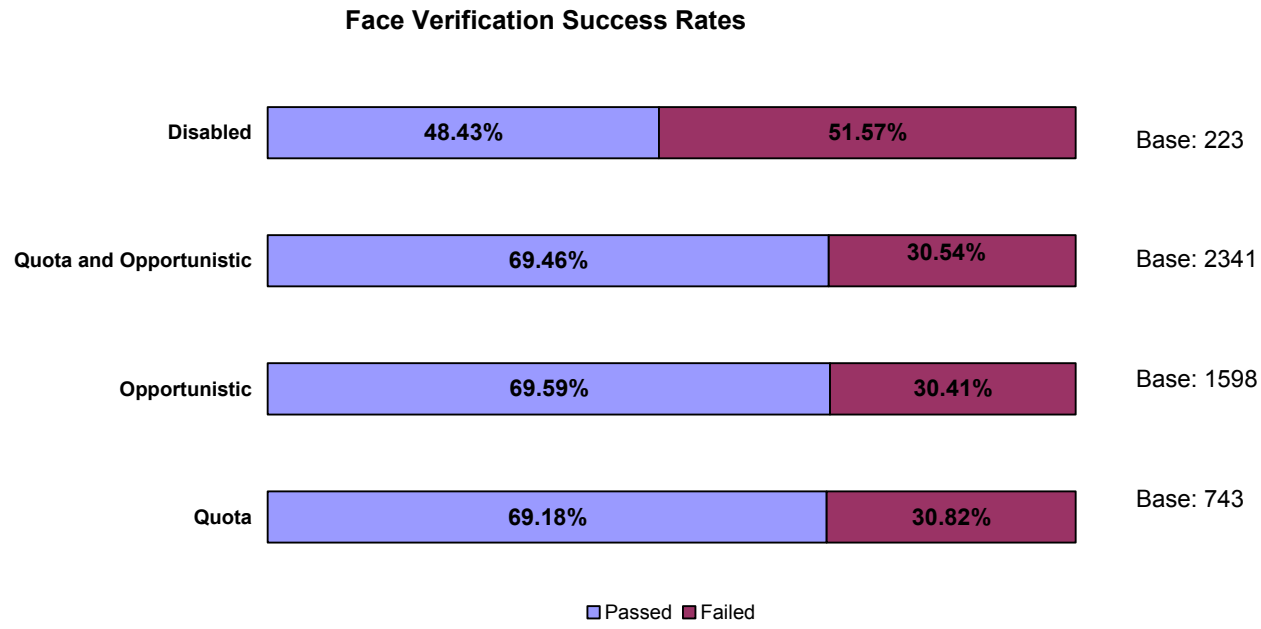


Figure 21 - Facial verification success by sample group

Although Figure 21 shows a higher failure rate for the Disabled participant group than for the Quota and Opportunistic sample groups, disability does **not** seem to be a factor. As will be seen from Section Factors Affecting Facial Verification, location had a major effect on facial verification.

Key Observation:
Although the 69% facial verification success rate of the Quota and Opportunistic samples is higher than that of the Disabled participants (48%), there is no evidence that disability is a factor.

4.2.2 Facial Verification Failures

The operator observations for the failed verifications have been analysed and categorised. The results of this are presented in the table below. A general explanation of the categories used follows the table, and further information about the individual failures can be found in Appendix B (see B2.1 Facial Verification Failure Operator Observations).

As can be seen, most face verification failures have been categorised as undetermined. This is partly because face verification takes a short time, and as the operator cannot retry a face verification, there is little opportunity for the operator to assess the problem and take corrective action. It is partly because in some locations the operators recognised that the environment was an issue and so ceased to comment on every single failure.

Operator observations for failed face verifications (all sample groups)	
Observation	**Number**
Environmental	112
Positioning	59
Behavioural	30
Participant exception	9
Appearance change	23
Skin Tone	10
Potential enrolment problem	4
Undetermined	593

Table 20- Summary of operator observations for all groups' facial verification failures

Environmental: reflection from glasses or from the skin, in particular the forehead has caused face verification to fail. Also a background disturbance could affect the verification. Where the layout of the enrolment centre permitted, a screen was placed behind the participant to prevent any background disturbance affecting the camera.

Positioning: Where the participant was positioned too low or too high then the angle of the face relative to the camera was different from that at enrolment and caused verification to fail. Some of these could actually be environmental failures. For example if a participant was positioned with the chair at its lowest but was still too high for the camera, the operator would ask the participant to move further back. However, in some enrolment centres there was insufficient space for the participant to move back very far.

Behavioural: this is a failure to keep still as requested or an inability to follow the operator's instructions.

Appearance change: where participants changed their appearance slightly between enrolment and verification, verification failed. These are participants who wore their glasses during enrolment but not verification, or vice versa or who made a slight change to their hair e.g. pushing it back.

Potential enrolment problem: where the operator suspected that the original facial enrolment had not generated a template of adequate quality.

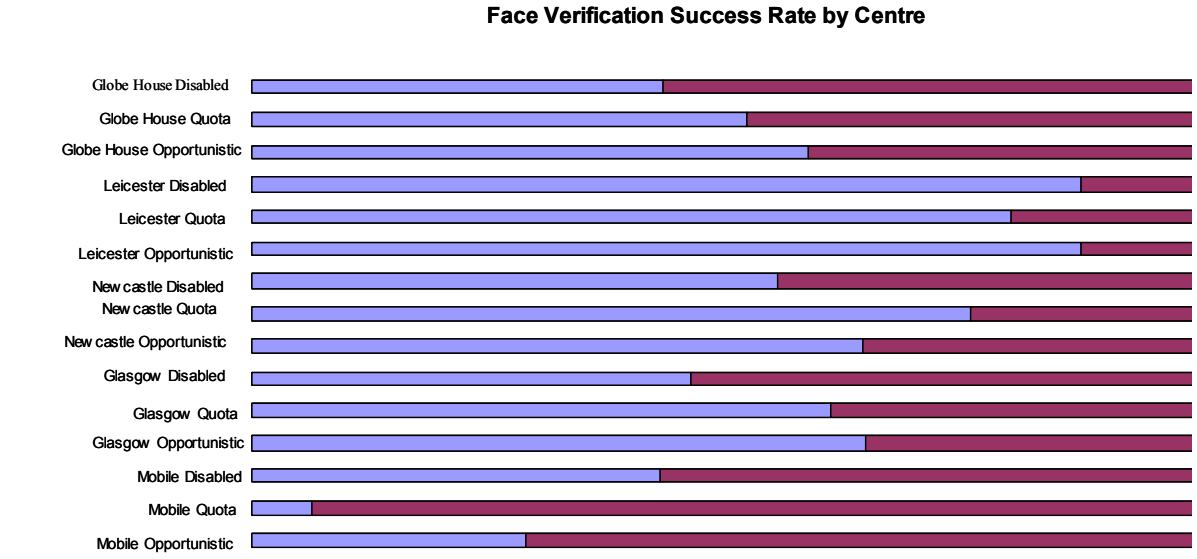
Participant exception: because of impairment, some participants found it difficult to hold the correct position while face verification was completed. Although, as these participants managed to hold position long enough to complete facial biometric enrolment, this observation may be unrelated to the cause of failure.

Key Observation:

- ***Lighting appears to be the main reason why facial verification failed.***
- ***Changes in the participant's appearance also caused verification to fail.***

4.2.3 Factors Affecting Facial Verification

For Quota and Opportunistic participants, facial verification data has been analysed to identify any potential links with location, ethnicity, age and gender. Location and age were factors in facial verification success and there is also some evidence that ethnicity was a factor, however this evidence is not conclusive.



	Globe House Disabled	Globe House Quota	Globe House Opportunistic	Leicester Disabled	Leicester Quota	Leicester Opportunistic	Newcastle Disabled	Newcastle Quota	Newcastle Opportunistic	Glasgow Disabled	Glasgow Quota	Glasgow Opportunistic	Mobile Disabled	Mobile Quota	Mobile Opportunistic
Passed	43.48%	52.44%	58.94%	87.50%	80.24%	87.69%	55.56%	76.06%	64.56%	46.43%	61.24%	64.98%	43.08%	6.25%	28.95%
Failed	56.52%	47.56%	41.06%	12.50%	19.76%	12.31%	44.44%	23.94%	35.44%	53.57%	38.76%	35.02%	56.92%	93.75%	71.05%

Figure 22 - Facial verification success by sample group and location

N.B. Swansea and Newcastle (Longbenton) are not included in the above chart as the volume of face verifications is too low for meaningful statistical analysis. Although the Mobile has been included, the Quota sample verification figures are for one week only and so are also too low for any analysis.

The analysis of face verification in Figure 22 shows different rates between enrolment centres but there is consistent pattern to the rates for different sample groups at the same enrolment centre. The difference between the rates at different centres is due to environmental factors.

At Leicester the overhead ceiling light tended to reflect from the participant's face. As a potential preventative measure, a sheet of tracing paper was placed on this light in an attempt to diffuse it. This seemed to improve the face verification success rate. At Newcastle the light caused a reflection on the board behind the participant. An attempt was made to lessen the impact of this by placing paper over the board. Initially this seemed to improve the success rate but later on when Newcastle Civic Centre carried out work on the ceiling, this affected the lighting and the rate dropped. Appendix B contains weekly trend charts for both Newcastle and Leicester which show when the events mentioned occurred (see B2.3 Trend over time). The highest failure occurred on the mobile unit where the lighting conditions were such that the participant was not evenly lit. The operators at Globe House also felt that, for some participants, the face was not sufficiently illuminated.

Face Verification Success at Globe House by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Verification Success Rate**
Asian	34	58.82%
Black	22	22.73%
Chinese/East Asian	3	66.67%
Other	13	53.85%
White	312	59.94%

Table 21 - Facial verification success at Globe House by participant ethnic group

Face Verification Success at Leicester by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Verification Success Rate**
Asian	209	89.47%
Black	96	83.33%
Chinese/East Asian	5	100.00%
Other	52	98.08%
White	535	83.18%

Table 22 - Facial verification success at Leicester by participant ethnic group

Although within Leicester and Globe House there are differences between the facial verification success rates for participants from different ethnic groups, no clear pattern is evident. This suggests that the environmental factors at each enrolment centre may be affecting ethnic groups differently.

Face Verification Success by Age Range at Globe (Quota and Opportunistic)		
Age Group	**Sample Size**	**Verification Success Rate**
18-24	20	65.00%
25-34	89	64.04%
35-44	106	60.38%
45-54	93	54.84%
55-59	26	53.85%
60-64	30	46.67%
65+	20	40.00%

Table 23 - Facial verification success at Globe House by participant age

Face Verification Success by Age Range at Leicester (Quota and Opportunistic)		
Age Group	**Sample Size**	**Verification Success Rate**
18-24	139	92.09%
25-34	174	90.23%
35-44	122	84.43%
45-54	152	88.16%
55-59	77	84.42%
60-64	67	77.61%
65+	167	77.84%

Table 24 - Facial verification success at Leicester by participant age

Leicester and Globe House both have significantly different rates for different age groups, although the centres show slightly different patterns. However, both centres show that face verification is less likely to succeed where participants are aged 60 and over.

Key Observation:
Facial verification was affected by location because of the different environmental conditions in each enrolment centre.
Environmental conditions seemed to have a greater impact on some other ethnic groups than others.
The facial verification success rate was higher for participants aged under 60 than it was for those aged over 60.

4.3 Iris Biometric Verification

4.3.1 Iris Verification Success

There are three possible outcomes from iris verification: passed, failed and cancelled. The iris camera attempts to take up to 4 shots of each eye. If unable to capture an image of sufficient quality, the iris verification system notifies the operator. The operator may then continue to retry and capture the iris images or cancel the verification. Once images of both irises have been obtained, the operator submits them for verification and the system returns either a passed or failed result.

The percentages of participants that have passed and failed iris verification can be seen from the following chart. This shows a higher rate of iris verification failure for the Disabled participant group than for the Quota and Opportunistic sample groups.

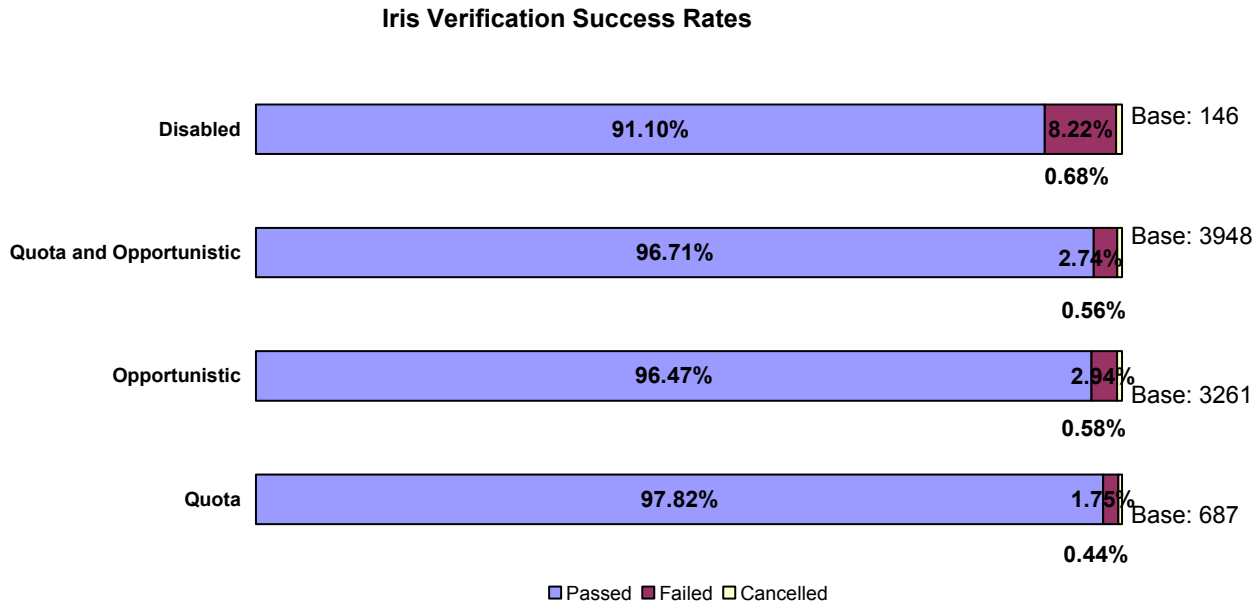


Figure 23 - Iris verification success by sample group

Key Observation:
The majority of participants who chose to verify on iris were successful, however the success rate for the Quota and Opportunistic participants (96%) was significantly higher than that for Disabled participants (91%).

4.3.2 Iris Verification Failures

The operator observations for the failed verifications have been analysed and categorised. The results of this are presented in the tables below. Further information about the individual failures can be found in Appendix B (see B3.1 Iris Verification Failure Operator Observations). As always these observations have to be treated with a certain amount of caution as the observation may be unrelated to the reason for failure.

Operator observations for failed iris verifications (Quota and Opportunistic)	
Observation	**Number**
Participant glasses[6]	15
Environmental	3
Positioning	4
Behavioural	3
Tinted glasses	2
Coloured contact lenses	1
Prosthetic eye	1
Undetermined	79

Table 25 - Summary of operator observations for Quota and Opportunistic iris verification failures

Operator observations for failed iris verifications (Disabled)	
Observation	**Number**
Participant glasses	1
Tinted glasses	1
Undetermined	10

Table 26 - Summary of operator observations for Disabled participant group iris verification failures

Participant glasses: the failure appeared to be due to the type or strength of lens in the participant's glasses

Environmental: reflected light in the participant's glasses

Behavioural: the participant did not follow camera or operator instructions.

Key Observation:
Many participants who wore glasses and who verified on iris did not have a problem. A small number of participants with glasses failed verification when they wore their glasses and passed when they took their glasses off.

[6] Where the observation is in italics this indicates there is a brief definition of the observation following the tables

4.3.3 Factors Affecting Iris Verification

For Quota and Opportunistic participants, iris verification data has been analysed to identify any potential links with location, ethnicity, age and gender. This has shown that there is a link between the participant age and the verification success rate. The verification success rate tended to be higher for participants who were aged under 55 than it was participants aged 55 or over.

Iris Verification Success by Age Range (Quota and Opportunistic)			
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Success Rate (ignoring cancellations)**
18-24	369	98.10%	98.91%
25-34	747	97.99%	98.39%
35-44	850	97.29%	97.87%
45-54	819	97.31%	97.79%
55-59	439	94.53%	94.75%
60-64	330	95.45%	96.33%
65+	394	93.91%	94.63%

Table 27 - Iris verification success by participant age group

Key Observation:
The iris verification success rate was higher for younger participants than it was for older participants.

4.4 Fingerprint Biometric Verification

4.4.1.1 Fingerprint Verification Success

There are three possible outcomes from fingerprint verification: passed, failed and cancelled. The operator uses the single fingerprint reader to take images of two fingers. Firstly the operator assesses the quality of the images on the screen and if the operator deems the image of low quality the images are retaken. Second, the system checks the quality of the images. If the images are not of sufficient quality, the system notifies the operator that the quality is too low. The operator may then continue to retry and recapture those fingerprint images, try different fingers or cancel the verification. Once images of two fingers have been obtained, the operator submits them for verification and the system returns either a passed or failed result.

The percentages of participants that have passed and failed fingerprint verification can be seen from the following chart.

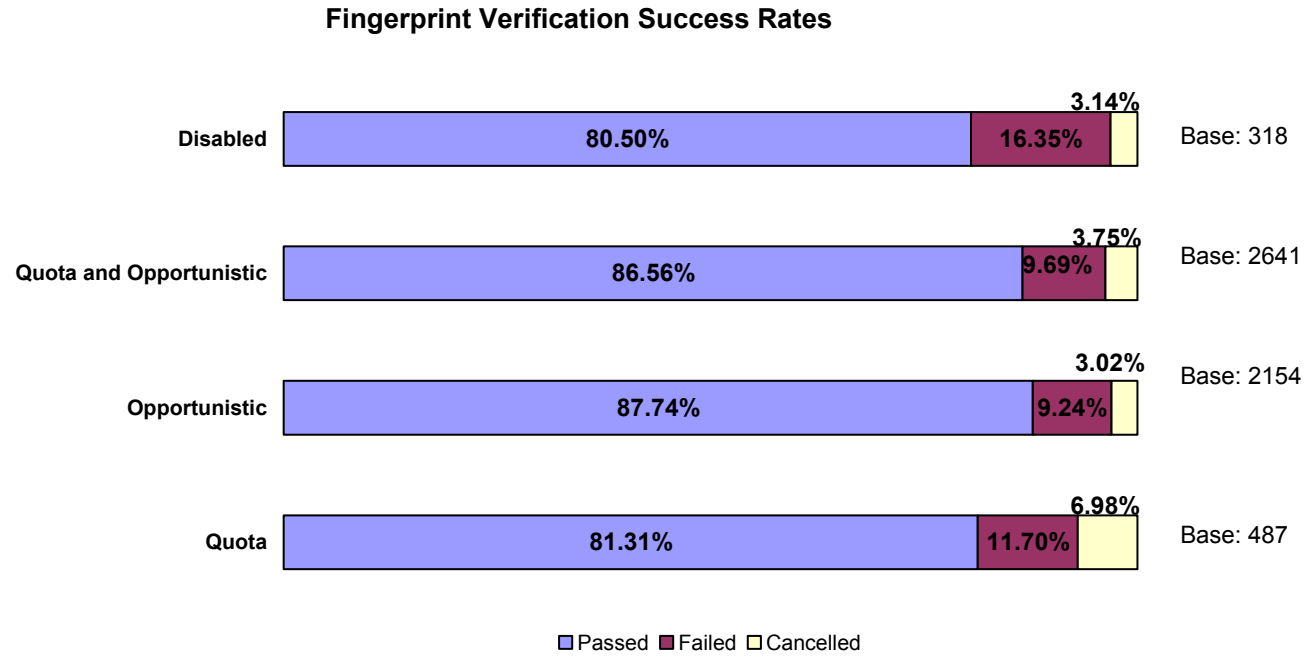


Figure 24 - Fingerprint verification success by sample group

Key Observation:
The majority of participants from all sample groups were successful on fingerprint verification. Quota and Opportunistic participants had a higher success rate (86%) than Disabled participants (80%)

4.4.2 Fingerprint Verification Failures

Subsets of fingerprint verification failures and cancellations have been investigated. Fingerprint images were sent to NEC and their explanation was that the issue was the single fingerprint device. The area of this device is small meaning that only a small part of each finger is recorded and it may not contain enough information to be used for matching.

Key Observation:
The single fingerprint device used for verification did not always record sufficient detail from the fingers.

4.4.3 Factors Affecting Fingerprint Verification

4.4.3.1 Quota and Opportunistic

For Quota and Opportunistic participants, fingerprint verification data has been analysed to identify any potential links with location, ethnicity, age and gender. A full analysis can be found in Appendix B (see B4.1 Analysis of Factors Affecting Fingerprint Verification (Quota and Opportunistic). This has shown that the verification success rate is linked with participant age.

Fingerprint Verification Success by Age Range at Globe House (Quota and Opportunistic)				
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
18-24	37	100.00%	0.00%	0.00%
25-34	128	94.53%	2.34%	3.13%
35-44	134	95.52%	0.75%	3.73%
45-54	79	96.20%	2.53%	1.27%
55-59	38	94.74%	0.00%	5.26%
60-64	29	82.76%	17.24%	0.00%
65+	33	66.67%	30.30%	3.03%

Table 28 - Fingerprint verification success at Globe House by participant age

Fingerprint Verification Success by Age Range at Leicester (Quota and Opportunistic)				
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
18-24	119	89.08%	5.88%	5.04%
25-34	178	88.76%	6.18%	5.06%
35-44	95	89.47%	5.26%	5.26%
45-54	126	84.92%	8.73%	6.35%
55-59	75	77.33%	18.67%	4.00%
60-64	57	71.93%	22.81%	5.26%
65+	122	71.31%	24.59%	4.10%

Table 29 - Fingerprint verification success at Leicester by participant age

Key Observation:
Younger participants had a higher fingerprint verification success rate than older participants

4.4.3.2 Disabled Participants

For Disabled participants, fingerprint verification data has been analysed to determine whether the type of impairment affected the fingerprint verification outcome.

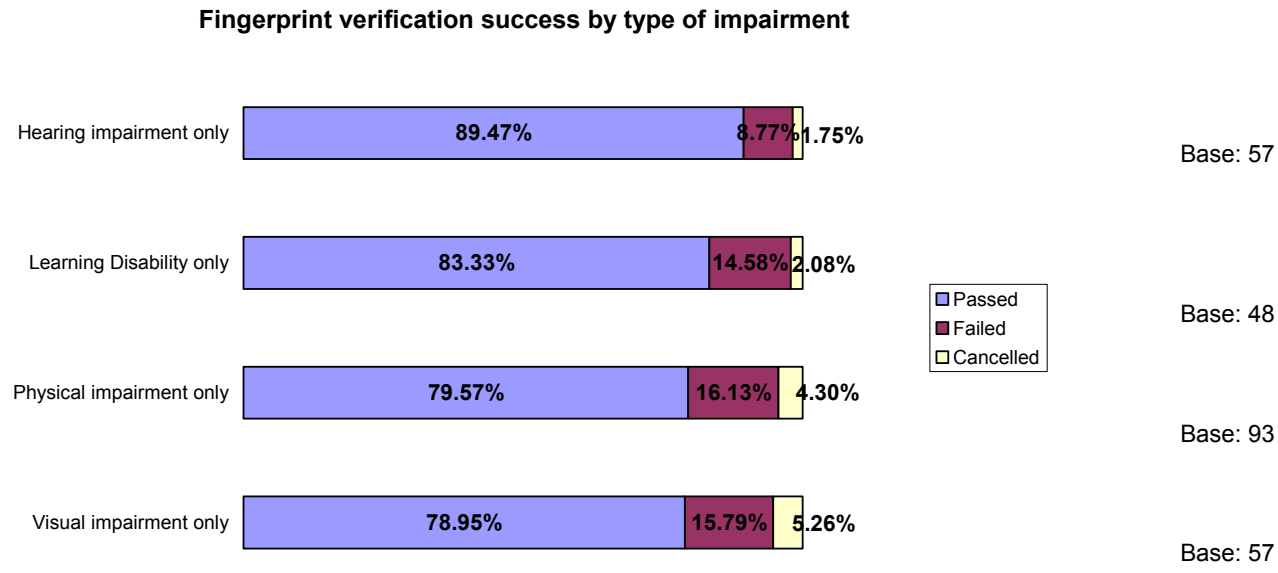


Figure 25 - Fingerprint verification success by type of impairment

Participants with a hearing impairment had the highest verification success rate, one that was similar to that for the Opportunistic sample.

Key Observation
Fingerprint verification success for participants with a hearing impairment was similar to that for the Opportunistic sample. The success rate was lower for participants with other impairment types.

5 Participant Experience

5.1 Comment

The following section details the Quota, Opportunistic and Disabled participant groups' 'experience' results that were obtained from participant interviews completed during and after enrolment / verification in the Biometrics Trial.

The section has been organised by the questions used in the questionnaire. Each question has been listed, followed by the Quota, the Opportunistic and then the Disabled participant results to allow a direct comparison, with associated comments.

Each set of results will also highlight a key observation relating to that question; these are not meant to be the only learning or definitive observations from the respective analysis, but rather something worth bringing to the fore. A summary of the key observations from the 'experience' question responses can be found below.

Further analysis follows the main question results and comments. The Quota and Opportunistic groups will have further sub-group breakdowns, which include age, gender, ethnicity, religion and location. The further analysis of the Disabled participant results include gender, age, location and impairment type, where the impairment types are 'visually impaired', 'physically impaired', 'learning disability' and 'hearing impaired'. The reader will also see two additional Disabled participant categories new to this report, those of 'other disability' (impairment type) and 'Swansea' (fixed location). The 'other disability' category identifies Disabled participants who felt their disability type could not be captured by any of the four main impairment types; Swansea was a fixed site used at the latter stages of the Trial. However, because the total number of participants of 'other disability' and those who participated in Swansea are both very low (44 and 24 out of a total of 750 respectively) the results should be treated with caution and are largely not commented upon.

A direct comparison between the Quota, Opportunistic and Disabled participant sub-group results is considered to be less relevant than comparing the aggregate (main question) results; thus the sub-group results of each group have been left as 'stand-alone'.

For key questions, the Quota results also show how participants who took two of the three biometrics (a control group) compare with those who took all three biometrics. This analysis allows us to observe the impact upon a biometric when the Trial introduced a third biometric (i.e. the one the control group did not participate in).

The 'experience' results are largely a feedback of a participant's direct experience of the process and 'user friendliness' of the enrolment and verification stages. The Trial has tried to understand areas such as *how comfortable* or *how private* participants felt and *how quick* the process was compared with expectations. On occasion the reader may read comments such as "a particular group…had the 'worst' experience". A 'worse' experience has been inferred if those participants have scored lowest for a positive response, i.e. lowest score for an experience being 'much' or 'a little better' than expected.

The Quota participants were recruited using random selection methods around each of the fixed enrolment sites, and they were recruited to a strict demographic profile thus ensuring UK-wide representation. The Disabled participants, too, were randomly recruited, but unlike the Quota group not to a strict demographic profile – although there has been an attempt to secure significant participation of those across the four different impairment types.

The Disabled participants came from a number of sources ranging from direct volunteering to fixed periods of exclusive use of the mobile unit by organisations of / for disabled people or colleges. All participants of both the Quota and Disabled participant groups have been individually interviewed.

The Opportunistic group were recruited randomly with no attempt to meet particular demographic sub-group numbers. The Opportunistic group had largely been sourced through proactive participants who had heard of the Biometrics Trial through the media and volunteered to take part – they were thus given an appointment; these participants were supplemented by random 'off-the-street' recruitment. All Opportunistic participants were asked to self-complete the questionnaire.

5.2 Summary of Overall Key Observations - Participant Experience

In general the 'experience' results from the three main groups – Quota, Opportunistic and Disabled - all follow very similar patterns in the balance of 'positive' responses to 'negative' responses for all of the main questions. The overall positive results do need to be treated with a degree of caution. Not all questions compared participant actual experience with their expected experience, and it is not known how good or bad their expectation was.

Highlighting some of these commonalities between the groups, **booth privacy** and the **level of intrusion** is, in general, not an issue across each of the three main groups. Going beyond the aggregate results, the **BME** (Black and Minority Ethnic) and **other religion** sub-groups are a little more concerned about booth privacy (across both the Quota and Opportunistic groups), however these two sub-groups do have a better then expected level of intrusion experience for the facial biometric (Quota and Opportunistic). **Level of intrusion** is of a little more concern for the **iris** biometric and for those Disabled participants who are **hearing impaired**.

The **iris** biometric also comes off worst – across all three groups – for **time taken, positioning** and the **overall experience** where it scores the highest number of 'worse than expected' responses. Interestingly, however, it is the iris biometric that is the **preferred process** for both the Quota and Opportunistic aggregate results and joint first amongst the Disabled participant group. Looking at the demographic results for **process preference**, across both the Quota and Opportunistic groups, **males** have a clear preference for the **iris** biometric – and whilst this is also the first choice for **females,** the **fingerprint** biometric runs it a close second for females (and in fact is first choice for female Disabled participants). It is the **BME** sub-group that is least likely to state a process preference (after stating a first choice).

Going back to **time taken**, it is the **fingerprint** biometric which scores the highest for the participant experience being 'much / a little' better than expected, and this is true across Quota, Opportunistic and Disabled participant groups. The 'time taken' question does also throw up a difference between the main groups' responses – in that amongst the Quota group, the **White** sub-group have a 'better than expected' experience compared with the **BME** sub-group, whereas amongst the Opportunistic group this result is reversed.

Verification speed, as with **verification ease**, is not an issue across the three groups. The **fingerprint** biometric scores, relatively, the highest number of 'negative' responses for both 'speed' and 'ease' (although still low).

Encouragingly, it should be noted that across all three groups, aggregate results show the vast majority of participants found their expectations of the **overall experience** of enrolling their biometrics to have been either met or bettered. A couple of notable results within the detail of overall experience are the **BME** sub-group scored significantly higher than the **White** sub-group for the experience being 'much / a little' better than expected (true across all Opportunistic and for Quota / facial); secondly, only 37% of **hearing impaired**

participants within the Disabled participant group found the experience of enrolling their **iris** biometric 'much / a little' better than expected (far lower than the average of 51% across Disabled participants for iris).

The key observations below (a copy of those found in the results detail) relate to the main 'experience' question responses across the Quota, Opportunistic and Disabled participant groups. They can thus be taken as observations which are applicable to all biometric enrolment participants. The observations relating to the respective Quota / Opportunistic / Disabled participant groups are shown in separate boxes below.

- ***Given the Trial booth locations and environments, booth privacy is not an issue across all three groups.***
- ***Across all three groups, the level of intrusion across all three biometrics, in relation to participant expectations, is not an issue.***
- ***Within a generally positive outcome, the iris biometric, across the Quota, Opportunistic and Disabled participant groups, had the greatest number of participants who found the experience slower than expected.***
- ***The preferred biometric process experienced, for both the Quota and Opportunistic groups, is the iris biometric and this is the tied first choice – with the fingerprint biometric – for the Disabled participant group.***
- ***Across the three biometrics, and the Quota, Opportunistic and Disabled participant groups, participant experience of 'positioning' for iris enrolment is the only concern – with 31% of the Disabled participant group finding the positioning for the iris recording 'very' or 'fairly' difficult.***
- ***Across all three biometrics, the vast majority of participants in the Quota, Opportunistic and Disabled participant groups found their expectations of the overall experience to have been either met or bettered.***
- ***The speed of verification, across the Quota, Opportunistic and Disabled participant groups, is not a concern.***
- ***The ease of verification, across the Quota, Opportunistic and Disabled participant groups, is not a concern.***

5.3 Summary of Quota Key Observations - Participant Experience

- ***The BME sub-group and members of the Other Religion sub-group are slightly more concerned about booth privacy.***
- ***Compared with the White sub-group, the BME sub-group had a better than expected 'level of intrusion' experience of enrolling their facial biometric.***
- ***In general the younger age groups had a better than expected 'level of intrusion' experience of enrolling their biometrics.***
- ***Participants in Leicester, Newcastle and Glasgow had a quicker (than expected) experience of enrolment across all three biometrics compared with their London counterparts.***
- ***The BME sub-group found positioning for the fingerprint biometric enrolment easier than the White sub-group and those in Newcastle and Glasgow found iris enrolment positioning easier than those in Leicester and London.***
- ***The 55+yr age group find it more difficult to position themselves for the fingerprint biometric than the 18-34yr and 35-54yr age groups.***
- ***Quota participants in Glasgow and Newcastle found the overall experience of giving their biometrics better than expected compared with participants within London.***
- ***The top two reasons for a participant's overall experience of the iris enrolment being worse than expected are 'time taken to record' and 'the need to stay still'.***
- ***Regarding process preferences, more females than males prefer the fingerprint biometric (still 2nd to iris); males clearly prefer the iris biometric and the two sub-groups are closely tied on their preference for the facial biometric.***

5.4 Summary of Opportunistic Key Observations - Participant Experience

- ***As with the Quota group, the BME and Other Religion sub-groups are more concerned about booth privacy.***
- ***The BME (compared with White) and Other Religion (compared with Christian and No Religion) sub-groups had a better than expected 'level of intrusion' experience of enrolling their three biometrics.***
- ***The BME (compared with White) and Other Religion (compared with Christian and No Religion) sub-groups had a better than expected 'time taken' experience across all three biometrics.***
- ***Booth positioning is not a concern across all demographic sub-groups.***
- ***The Other Religion and BME sub-groups had the best overall biometric enrolment experience (against expectations). London participants had the least positive experience (against expectations).***
- ***The Male and White sub-groups have a stronger preference for the iris biometric compared with Female & BME – although the latter two sub-groups do still score the iris biometric as their number 1 choice.***

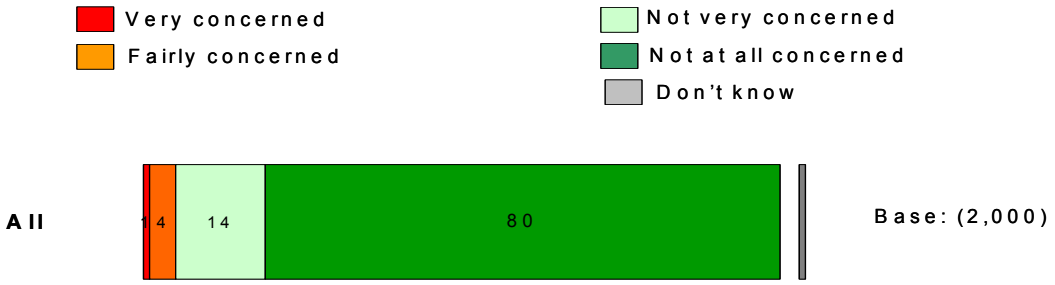
5.5 Summary of Disabled Participant Key Observations - Participant Experience

- ***Across the Disabled participant group there are no particular sub-groups who are concerned about booth privacy.***
- ***Regarding location, the mobile unit (excluding Swansea) had the highest number of participants scoring the experienced intrusion as being 'much / a little better' than expected. Those who are 'hearing impaired' scored the lowest, across the impairment types, for intrusion experienced across all three biometrics.***
- ***Across all sub-groups, the recording of the iris biometric scored lowest, compared with the other biometrics, for participant experience of 'time taken' (against expectations).***
- ***Across all sub-groups, the iris biometric scored lowest for the participant booth positioning experience being 'very' or 'fairly' easy.***
- ***The iris biometric scored lowest for 'overall experience' being 'much' or 'a little better' than expected with participants in Glasgow, Female participants and those who were hearing impaired – who had the worst iris experience.***
- ***Participants with three of the four impairment types, visual and hearing impaired and learning disability, opted for the fingerprint biometric as their first choice process preference.***

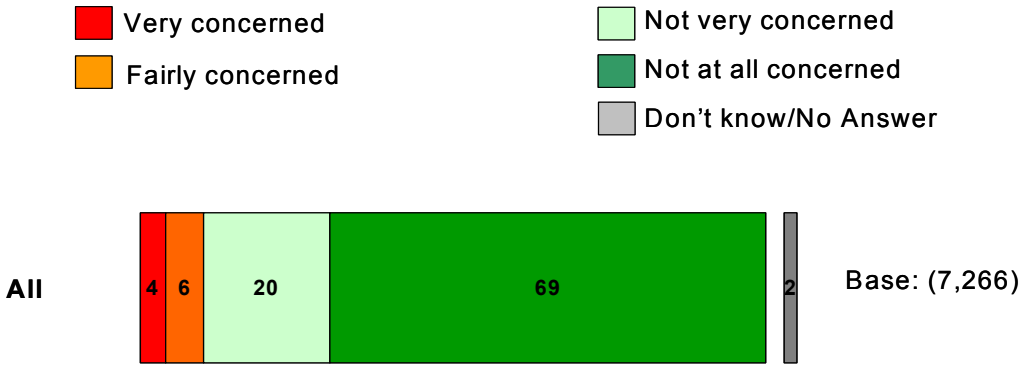
5.6 Participant Experience – 'Booth privacy' (Section 2; Q1)

How concerned were you about privacy in the booth during the enrolment process?
(The end block refers do those stating 'don't know' – in this case 1%. Figures given are percentages).

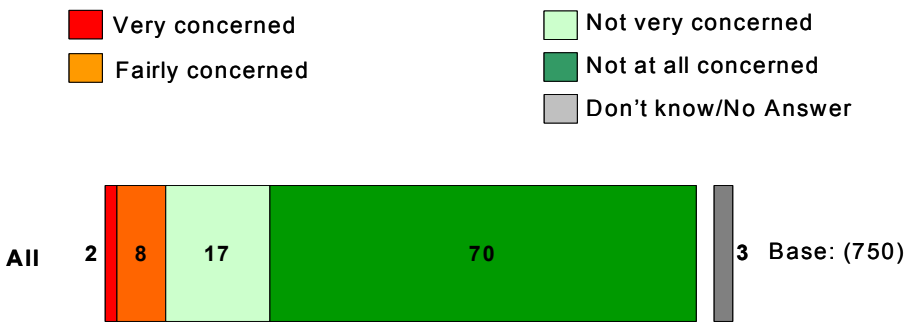
5.6.1 Quota Group Result



5.6.2 Opportunistic Group Result



5.6.3 Disabled Participant Result



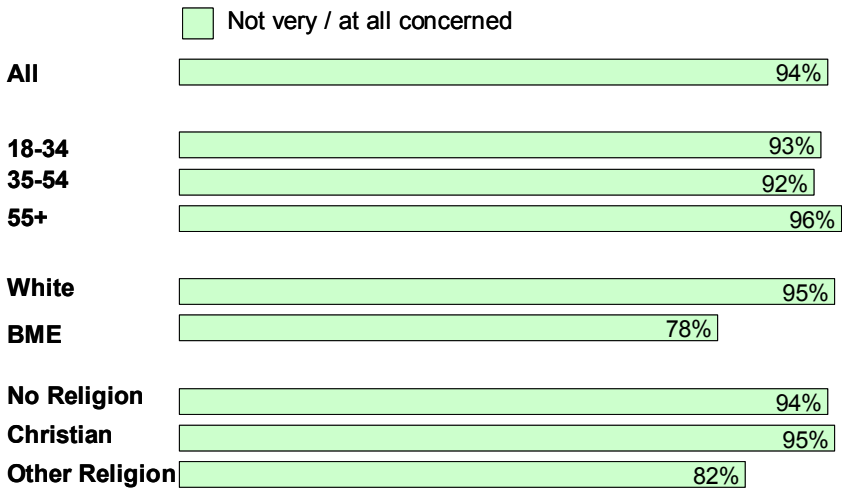
It can be observed that the vast majority of participants, approximately 90% of respondents across the Quota, Opportunistic and Disabled participant groups are either 'not very' or 'not at all concerned' with the privacy in the booth during their enrolment. It can be inferred, therefore, that the positioning and design of the booths at the fixed / mobile sites had participants feeling at ease with regards to their privacy. The booth 'environment' may therefore look to be replicated for future biometric enrolments.

Key Finding
Given the Trial booth locations and environments, booth privacy is not an issue across the Quota, Opportunistic and Disabled participant groups.

5.6.4 Further Analysis - Quota

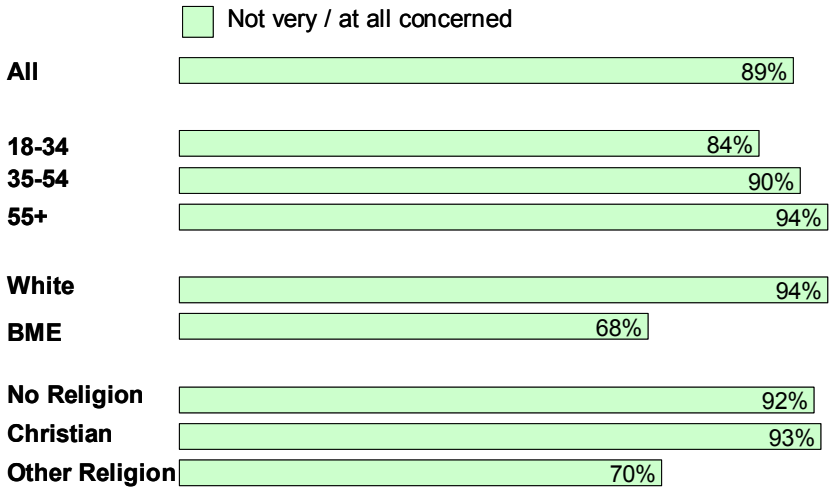
The ***Quota analysis*** illustration below shows how the experience of ***booth privacy*** differs across age, ethnic and religious groups.

The results show that there are significant differences between White vs BMEs (Black and Ethnic Minority) and between No religion vs Other Religion and Christian vs Other Religion.



Key Observation
(Quota) The BME sub-group and members of the Other Religion sub-group are slightly more concerned about booth privacy.

5.6.5 Further Analysis – Opportunistic



The ***Opportunistic analysis*** illustration below shows how the experience of ***booth privacy*** differs across age, ethnic and religious groups.

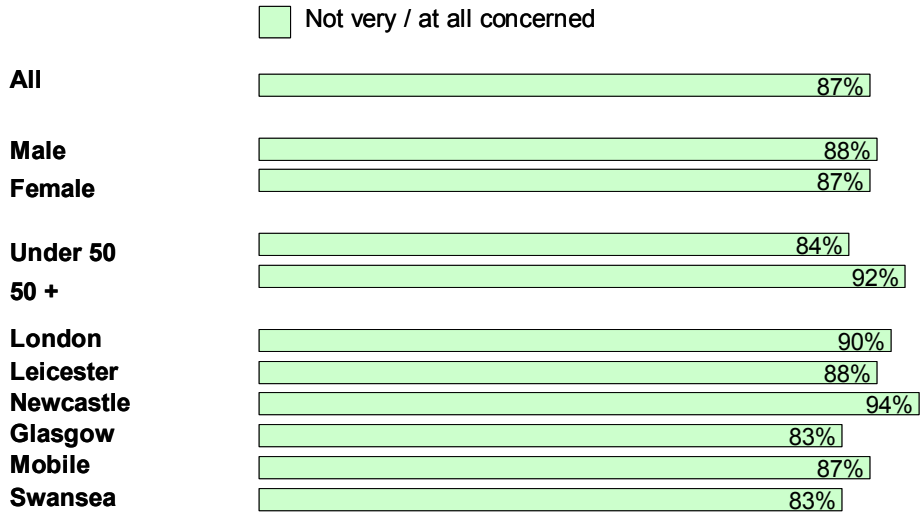
The results show that most Opportunistic sub-groups scored very highly about being 'not very / not at all' concerned about booth privacy with only the BME and Other Religion sub-groups scoring relatively lower than their comparative sub-groups.

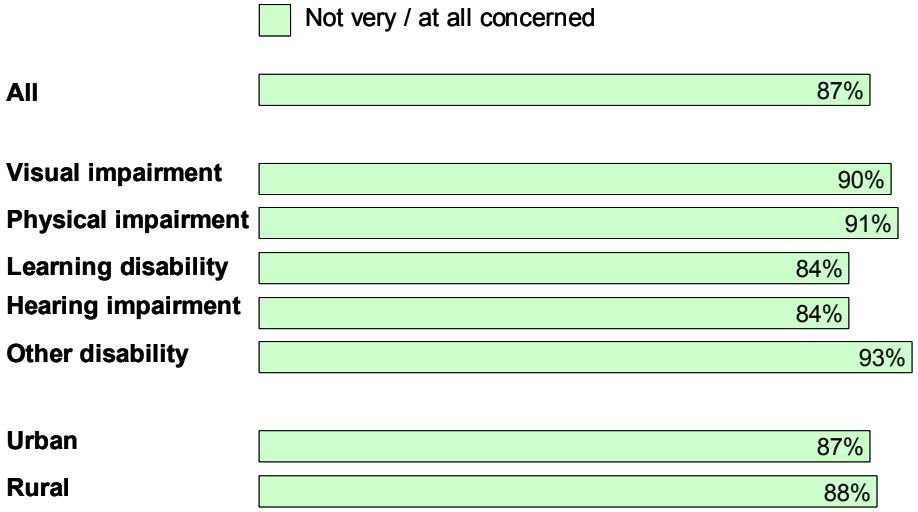
Key Observation
(Opportunistic) As with the Quota group, the BME and Other Religion sub-groups are more concerned about booth privacy.

5.6.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** illustrations below show how the experience of ***booth privacy*** differs across gender, age, location and impairment type.

The results show that no particular group have concerns about booth privacy.



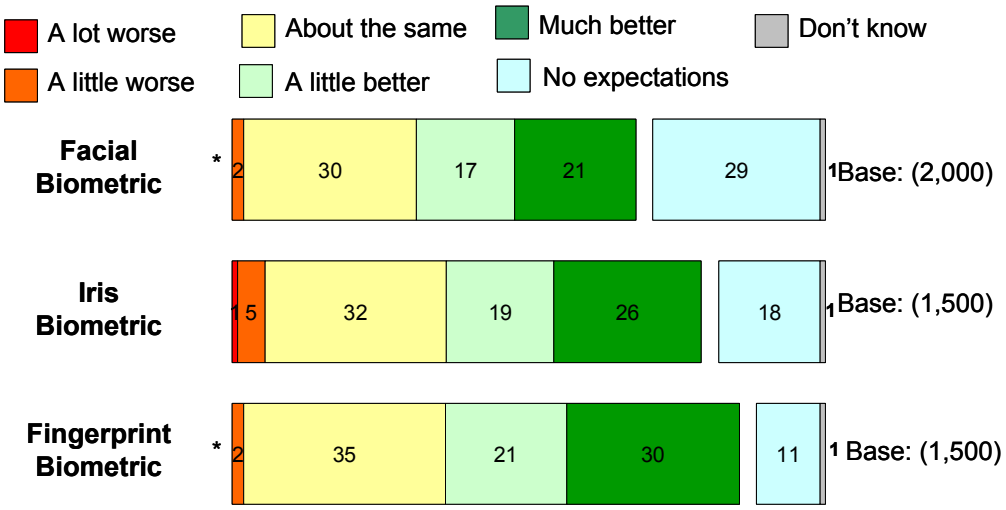


Key Observation
(Disabled) Across the Disabled participant group there are no particular sub-groups who are concerned about booth privacy.

5.7 Participant Experience – 'Level of Intrusion' (Section 2; Q3, Q11, Q19)

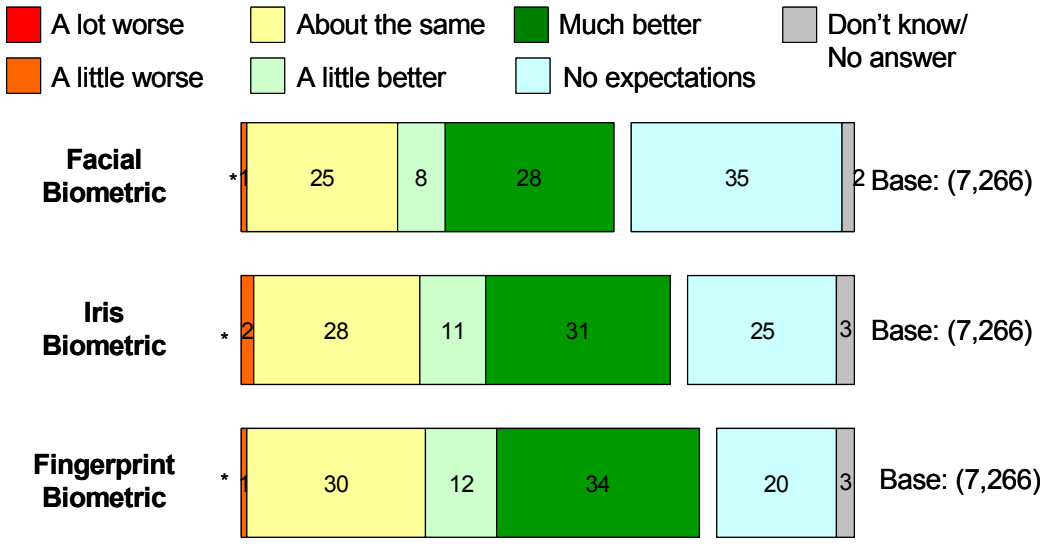
Was the level of intrusion (physical contact) experienced during recognition[7] *better or worse than you expected?* *(Note *% a number indicates between 0.5% - 1%)*

5.7.1 Quota Group Result

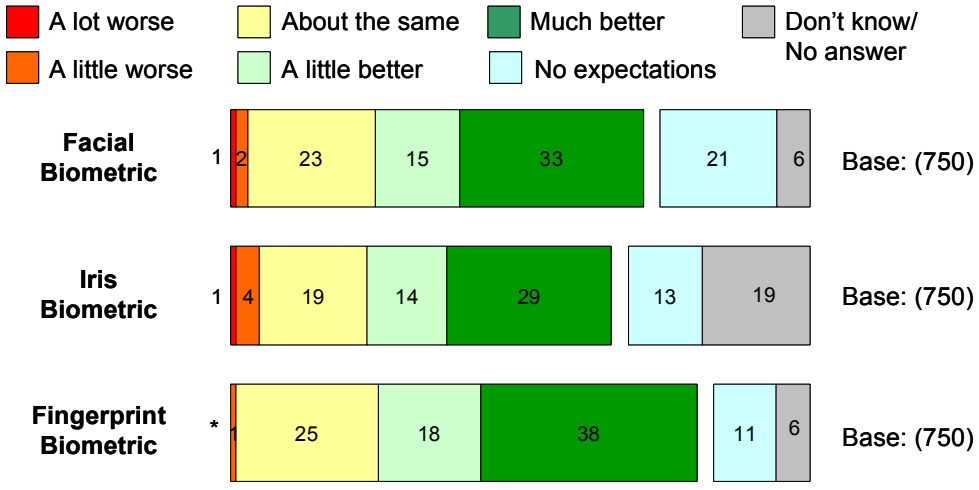


[7] The term recognition as used here means enrolment and the term has been retained here because it was used in the question answered by the participant. Elsewhere in this document the term enrolment has been used instead of recognition.

5.7.2 Opportunistic Group Result



5.7.3 Disabled Participant Result



Across the Quota, Opportunistic and Disabled participant groups, and for all three biometrics, there were very low percentages of participants who felt the level of intrusion

during enrolment was either ‘a little’ or ‘a lot worse’ than expected.

In fact, despite the question explaining that ‘intrusion’ should be judged as ‘physical contact’, the Disabled participant group results, compared with Quota and Opportunistic, are slightly more positive in respect of the number of participants scoring a ‘much better’ than expected experience across all three biometrics.

Less than half of Quota participants for iris and facial, and just over half for fingerprints, found the intrusiveness ‘much’ or ‘a little better’ than expected. However there were high levels of Quota participants who felt the level of intrusion to be ‘about the same’ as expected or who had ‘no expectations. A similar pattern can be observed in the Opportunistic group.

The iris biometric, across both Quota and Disabled participant groups shows the highest level of a ‘worse than expected’ experience, yet this is still only 5-6% and even less so within the Opportunistic group at 2%.

Key Observation
Across the Quota, Opportunistic and Disabled participant groups the level of intrusion, across all three biometrics, in relation to a participant expectations, is not an issue.

5.7.4 Further Analysis – Quota

The ***Quota analysis*** diagrams below show how the ***level of intrusion*** experience differs across ethnicity, location, gender, age and religion.

It can be observed that there are significant differences between the White and BME sub-groups for the facial biometric in that the BME sub-group had a better (than expected) experience compared with their White counterparts; between Urban vs Rural and London vs Leicester / Newcastle for the fingerprint biometric, with the Urban and Leicester / Newcastle participants experiencing a better (than expected) fingerprint enrolment compared with Rural and London participants.

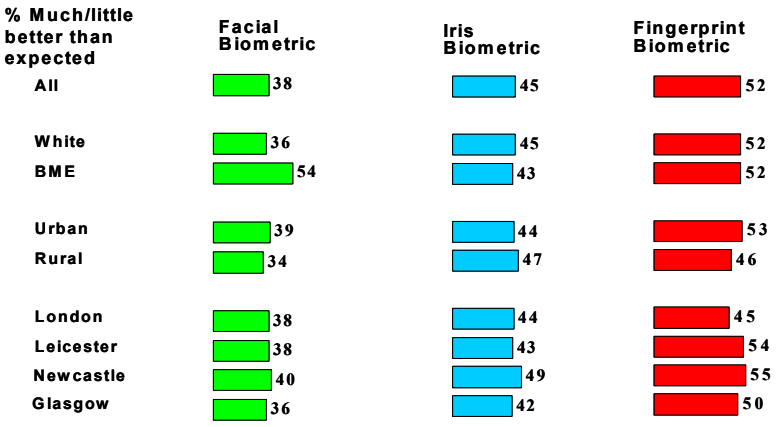
Key Observation
(Quota) Compared with the White sub-group, the BME sub-group had a better than expected ‘level of intrusion’ experience of enrolling their facial biometric.

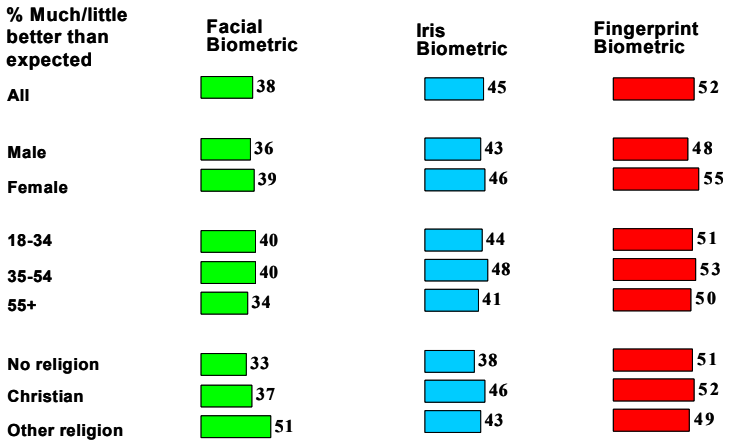
The second illustration shows differences in the age category between 18-34yr old vs 55+yr old and 35-54yr old vs 55+yr old for facial and iris biometrics, and between 35-54yr old vs 55+yr old for the iris biometric in that, in general, the younger sub-groups had a better (than expected) experience of biometric enrolment.

Regarding gender, the Female sub-group had a better than expected experience than the

Male sub-group in enrolling their fingerprint biometric and regarding religion the Other Religion sub-group had a better (than expected) experience of facial enrolment compared with the No Religion and Christian sub-groups.

Key Observation
(Quota) In general the younger age groups had a better than expected 'level of intrusion' experience of enrolling their biometrics.



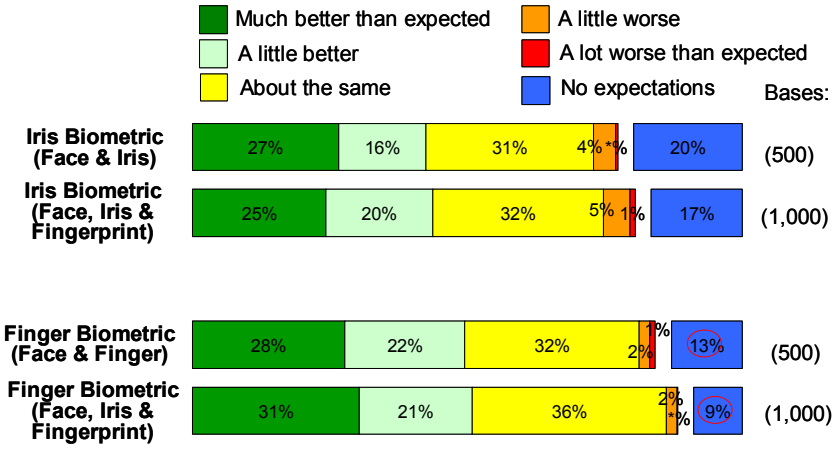


The analysis below allows a ***comparison of two sample Quota groups*** in considering the ***level of intrusion:***

- participants who enrolled with two biometrics (the control group);
- participants who enrolled with all three biometrics.

The purpose of this comparison is to observe the potential impact of the one biometric the control group did not experience.

The results show that there are no significant differences, within the Quota group, when looking at the impact on the iris biometric when the fingerprint biometric was introduced and also with the fingerprint biometric when the iris biometric was introduced (except for those results which have been circled). Note all participants enrolled their facial biometric.



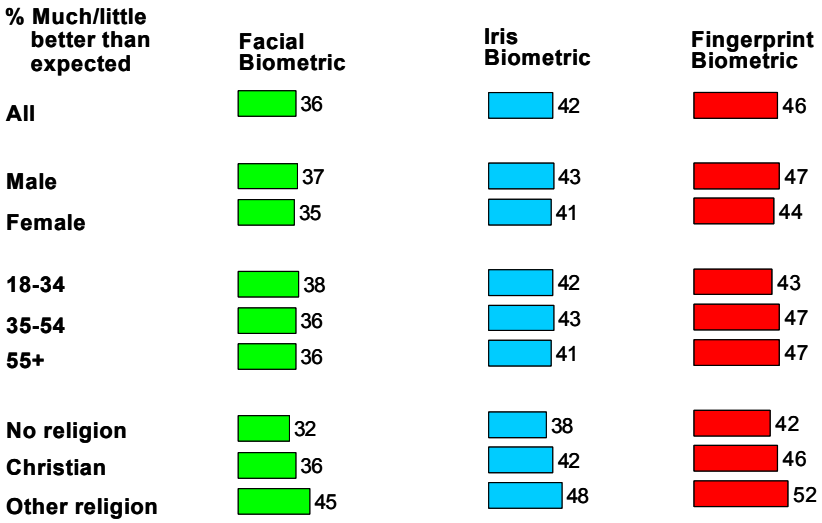
Key Observation

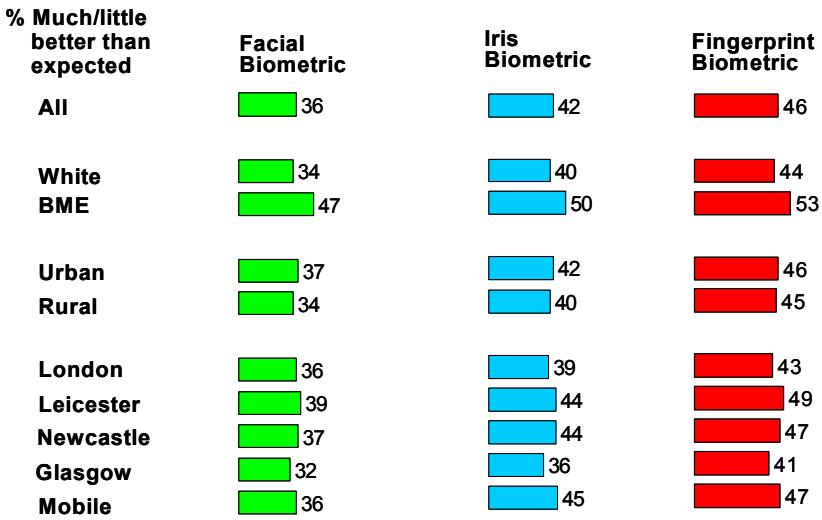
The level of intrusion experienced, by the Quota group, in the enrolment of the iris and the fingerprint biometrics is not significantly affected by the introduction of the third biometric.

5.7.5 Further Analysis – Opportunistic

The ***Opportunistic analysis*** illustrations below show how the experience of ***level of intrusion*** differs across age, ethnic and religious groups, location and gender.

The results across the different Opportunistic sub-groups do not show any significant differences when comparing sub-groups, with the exception of the BME sub-group scoring notably higher than their White counterparts for the 'level of intrusion' being 'much / a little better' than expected – across all three biometrics. Additionally, participants of Other Religion, i.e. not Christian or No Religion, score higher than these two sub-groups, once again across the three biometrics. Other than these two exceptions, all other Opportunistic sub-groups reflected the results seen in the main question aggregated results.



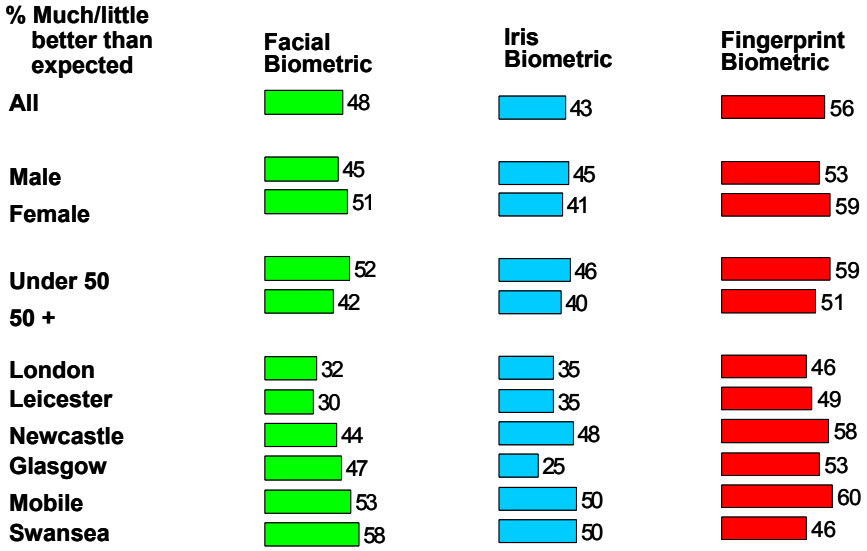


Key Observation
(Opportunistic) The BME (compared with White) and Other Religion (compared with Christian and No Religion) sub-groups had a better than expected 'level of intrusion' experience of enrolling their three biometrics.

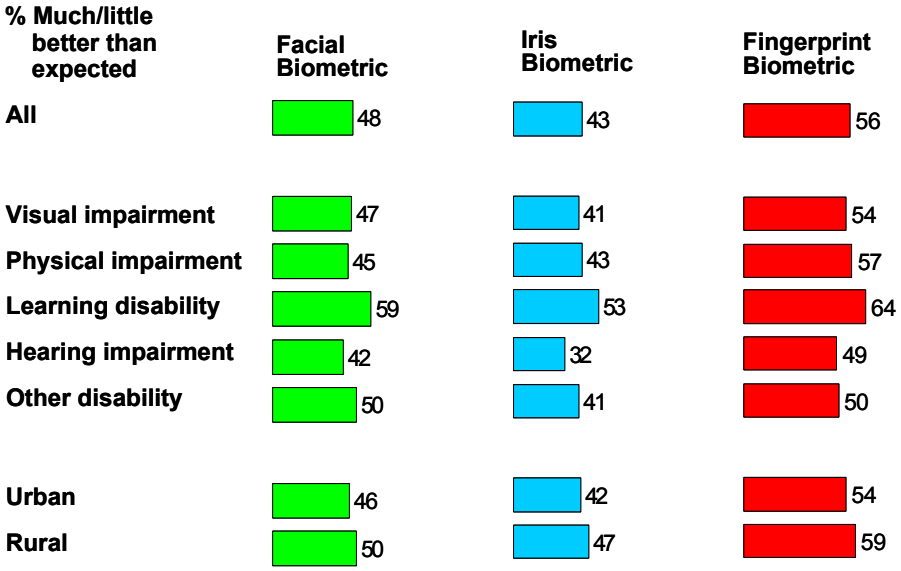
5.7.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** illustrations below show how participants who had a ***level of intrusion*** experience 'much' or 'a little better' than expected, differ across gender, age, location and impairment type.

The results show that the London and Leicester participants were less impressed with the level of intrusion in recording their facial biometric than their Newcastle, Glasgow and Mobile counterparts. However the Glasgow participants scored very low (25%) for their iris enrolment 'intrusion' experience as being 'much' or 'a little better' than expected – this is half the figure compared with the mobile unit participant experience (50% for the iris biometric).



Regarding type of impairment, on average the iris biometric level of intrusion experience came out worse, with, interestingly, those who are 'hearing impaired' scoring the lowest for the iris experience being 'much' or 'a little better' than expected (a low 32%).



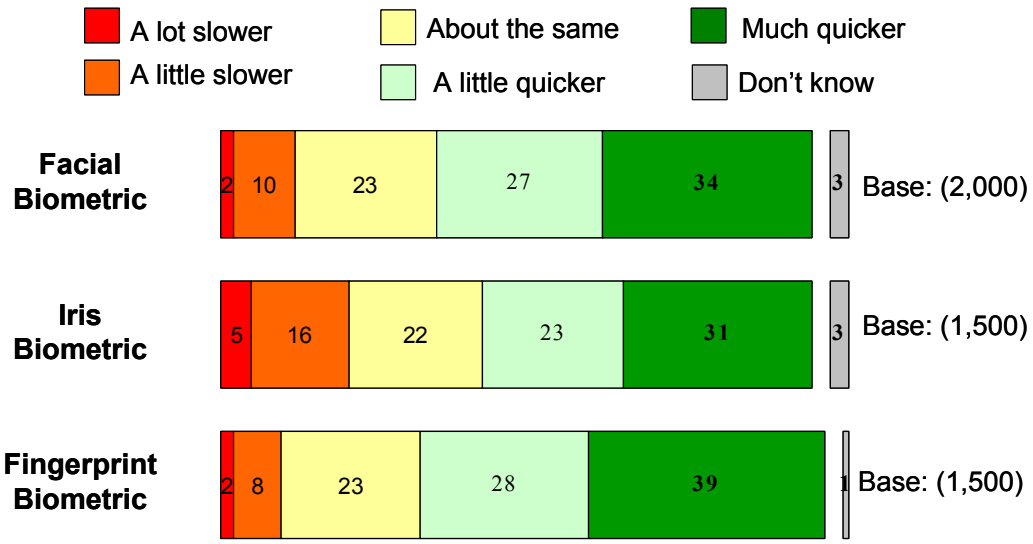
Key Observation

(Disabled) Regarding location, the mobile unit (excluding Swansea) had the highest number of participants scoring the experienced intrusion as being 'much / a little better' than expected. Those who are 'hearing impaired' scored the lowest, across the impairment types, for intrusion experienced across all three biometrics.

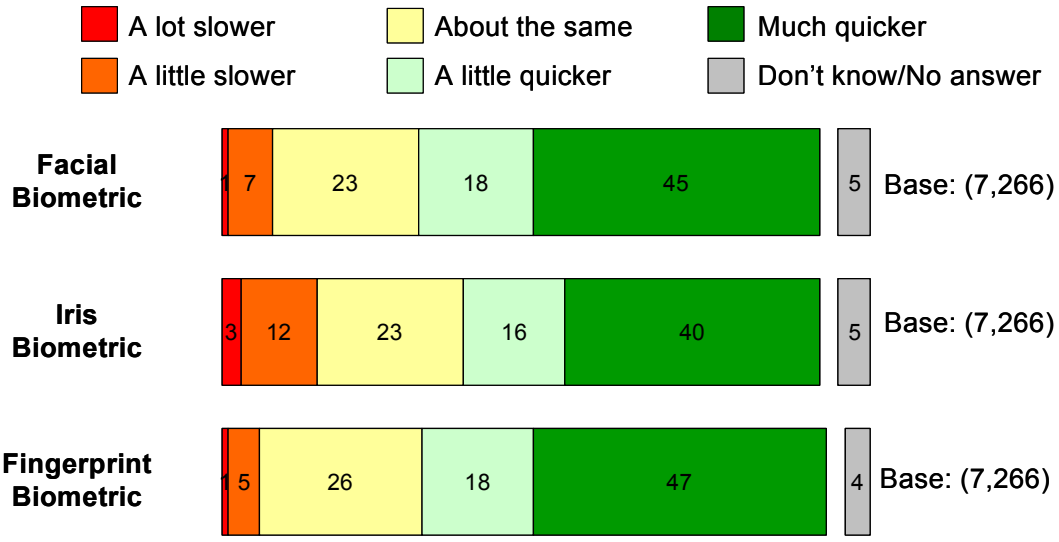
5.8 Participant Experience – 'Time Taken' (Section 2; Q4, Q12, Q20)

How did the time it took to take your recognition biometric compare with what you expected?

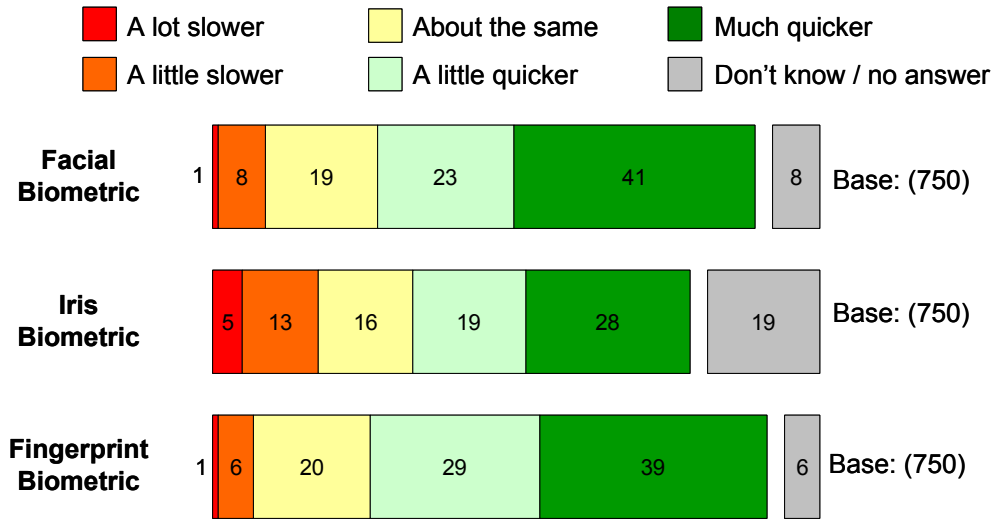
5.8.1 Quota Group Result



5.8.2 Opportunistic Group Result



5.8.3 Disabled Participant Result



It can be observed that over half of all participants across the Quota, Opportunistic and Disabled participant groups had an experience which was 'much quicker' or 'a little quicker' than expected across each of the three biometrics; the Opportunistic group scored particularly well for those participants who felt the biometric enrolment experience was 'much quicker' than expected. The exception to this result is the Disabled participant group in response to the iris biometric – although, in this group, there are a large number of 'don't know / no answer' responses (19%).

Approximately a quarter of participants in the Quota and Opportunistic groups and approximately a fifth in the Disabled participant group felt the time taken met their expectations. However, some participants did find the enrolment experience was 'a little slower' or 'a lot slower' than expected, with the iris biometric showing the largest number of 'dissatisfied' participants – 21%, 15% and 18% of the Quota, Opportunistic and Disabled participant groups respectively.

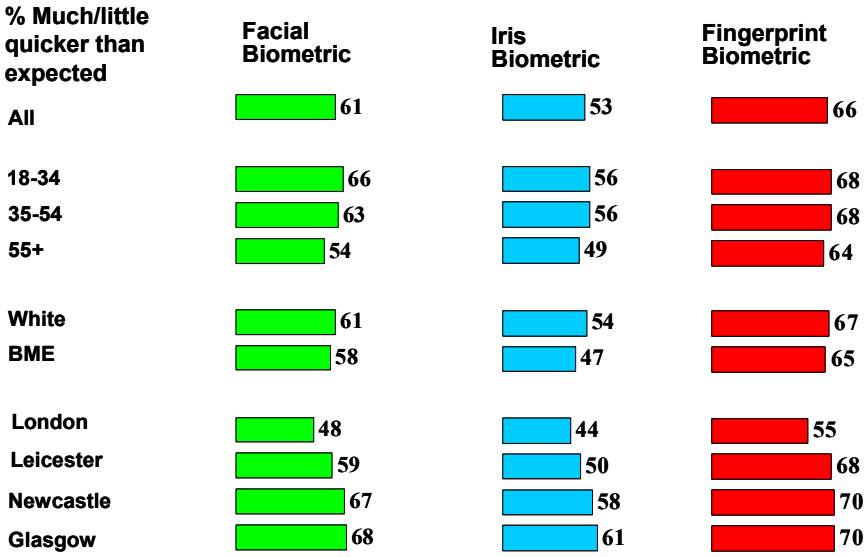
The participant responses to the questions about time taken have been compared with the actual time taken. No strong relationship has been found between the time actually taken and the participant's perception of that time as longer than expected (see Appendix E - Trial Results – Process and Experience Correlation.)

Key Observation
Within a generally positive outcome, the iris biometric, across the Quota, Opportunistic and Disabled participant groups, had the greatest number of participants who found the experience slower than expected.

5.8.4 Further Analysis – Quota

The ***Quota analysis*** below shows how the experience of ***time taken*** *(against expectations)* differs across age, ethnicity and location.

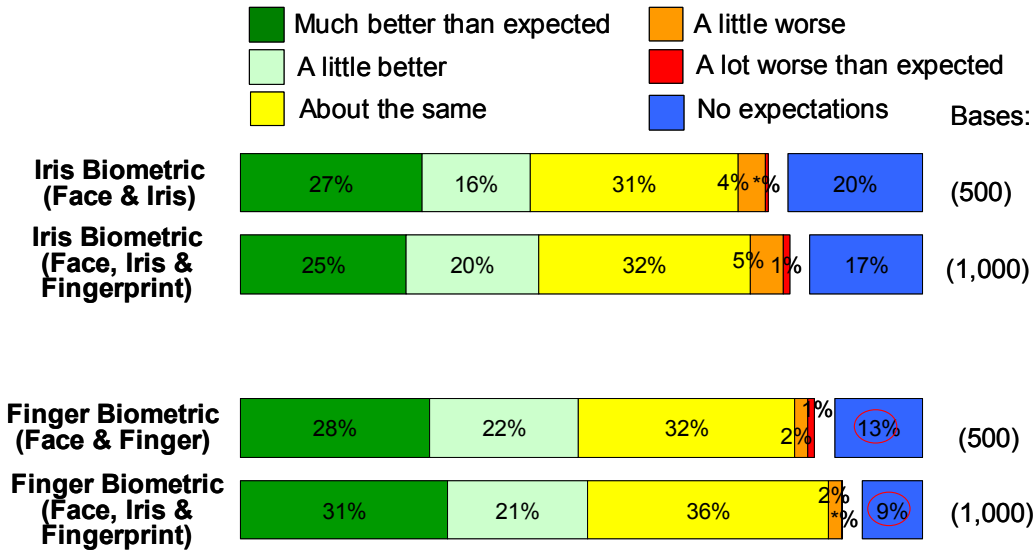
The results show the White sub-group having a quicker (than expected) experience of the iris enrolment compared with the BME sub-group.



Key Observation
(Quota) Participants in Leicester, Newcastle and Glasgow had a quicker (than expected) experience of enrolment across all three biometrics compared with their London counterparts.

The analysis below allows a ***comparison of two sample Quota groups***, in considering the experience of ***time taken*** against expectations. The results show that there are no

significant differences (except the ones circled) to a participants view of time taken when considering the iris biometric as a result of introducing the fingerprint biometric or when focussing on the fingerprint biometric and introducing the iris biometric.



Key Observation

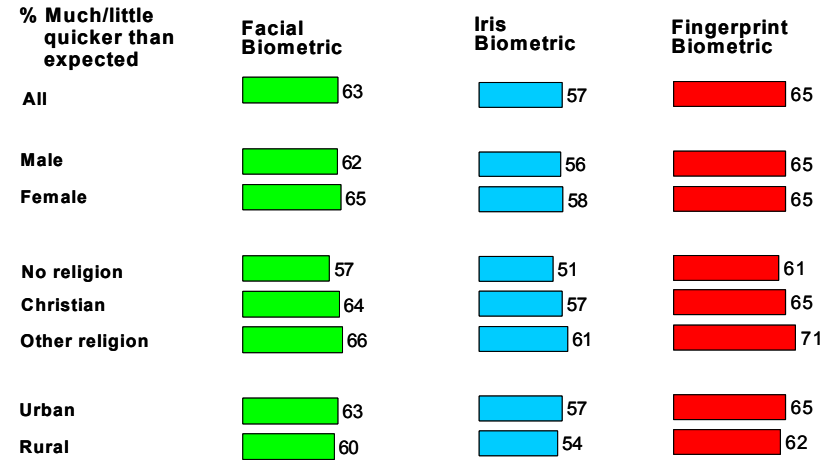
The experience of the Quota group (against expectations) of time taken in the enrolment of the iris and the fingerprint biometrics are not significantly affected by the introduction of the third biometric (fingerprint and iris respectively).

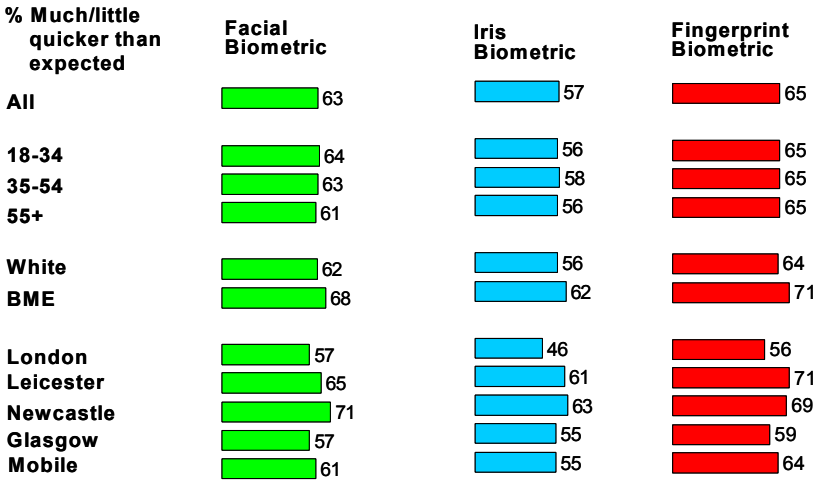
5.8.5 Further Analysis – Opportunistic

The Opportunistic analysis illustrations below show how the experience of time taken differs across age, ethnic and religious groups, location and gender.

The results show that the Other Religion sub-group and the BME sub-group score higher than their respective comparator sub-groups in having an experience which was 'much / a little better' than expected – across all three biometrics. Participants in London (followed by Glasgow) scored lowest for time taken being 'much / little better' than expected. No other sub-groups are significant in indicating different results across the three biometrics.

It is also interesting to note that the fingerprint biometric scored highest for 'time taken' being 'much / a little better' across every one of the sub-groups.



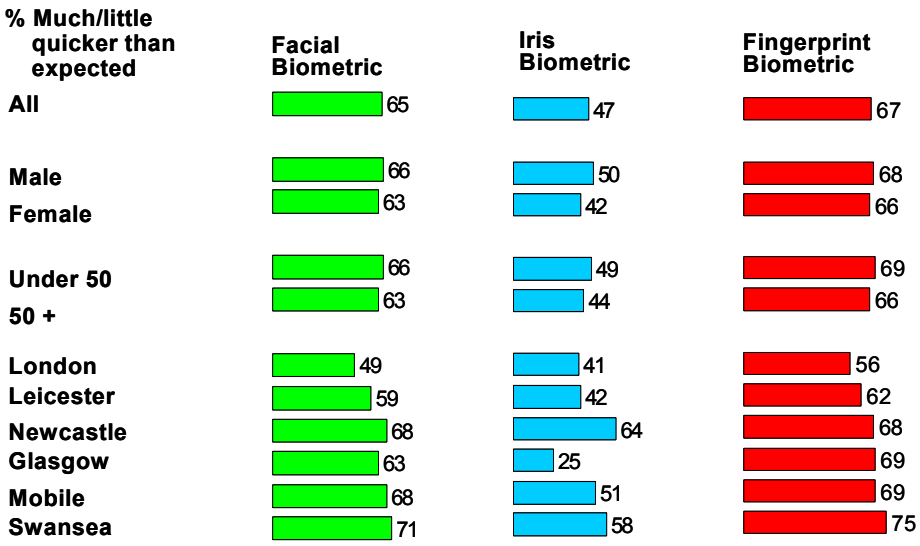


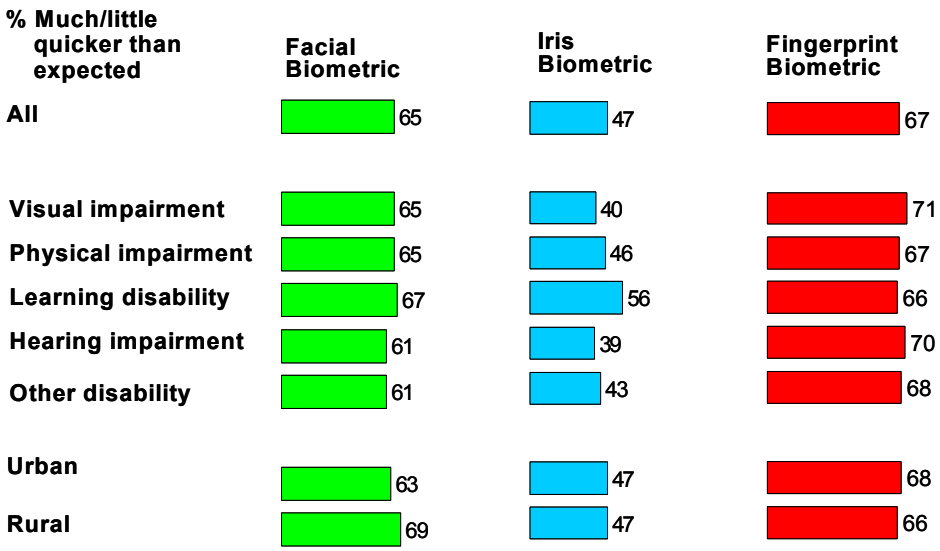
Key Observation
(Opportunistic) The BME (compared with White) and Other Religion (compared with Christian and No Religion) sub-groups had a better than expected 'time taken' experience across all three biometrics.

5.8.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** illustrations below shows how the experience of ***time taken*** *(against expectations)* differs across gender, age, location and impairment type.

The results show the iris biometric – for all sub-groups - as the slowest biometric experienced (against expectations). Like the 'level of intrusion', the Glasgow participants scored significantly lower for their 'time taken' experience being 'much' or 'a little better' than expected compared with the other locations. Additionally there was a notable difference between males and females for the iris biometric with males having the better 'time taken' experience.





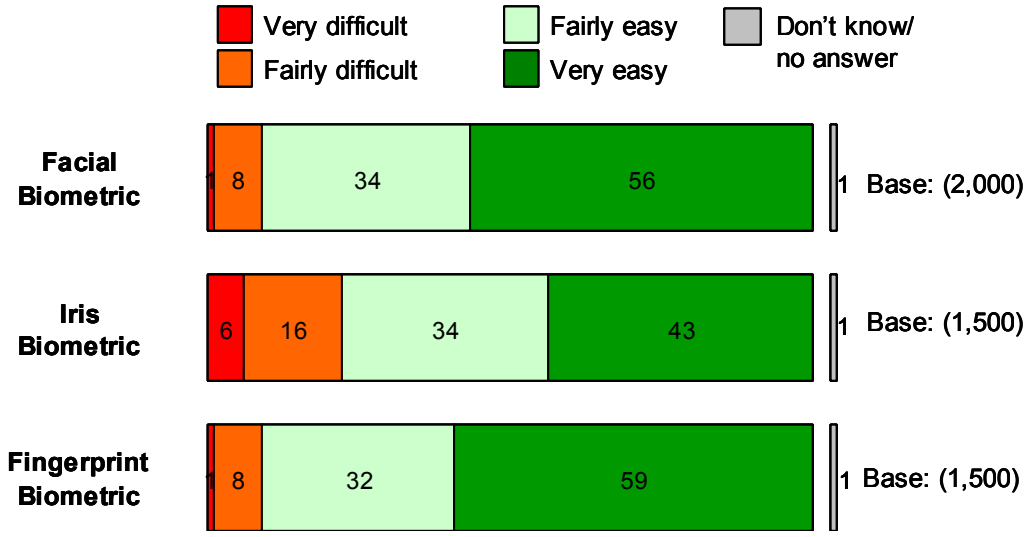
Key Observation

(Disabled) Across all sub-groups, the recording of the iris biometric scored lowest, compared with the other biometrics, for participant experience of 'time taken' (against expectations).

5.9 Participant Experience – 'Positioning' (Section 2; Q5, Q13, Q21)

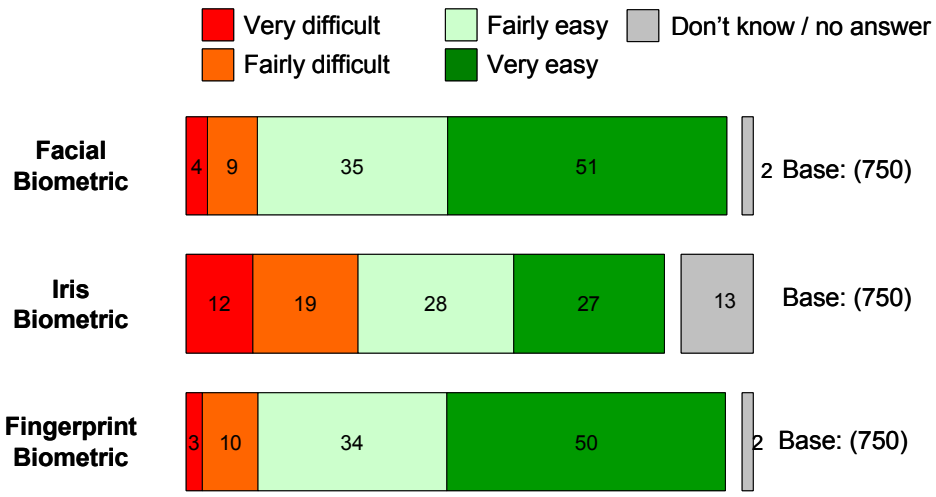
How easy or difficult did you find it to position yourself in the booth? (The 'right' block refers to 'don't knows' and *% indicates a number above zero but below 0.5%)

5.9.1 Quota Group Result



5.9.2 Opportunistic Group Result

5.9.3 Disabled Participant Result



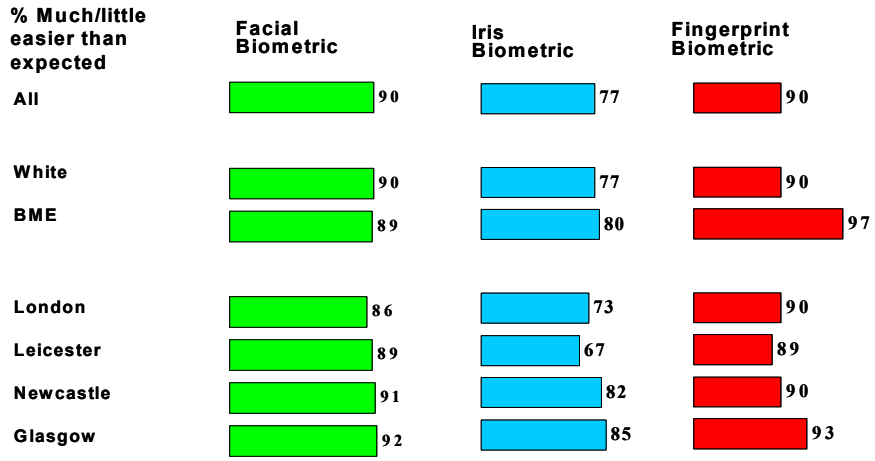
The results for the facial and fingerprint biometrics across the Quota and Disabled participant groups show that the majority of participants – 80%+ found booth positioning either 'fairly easy' or 'very easy'. However, 22% of the Quota group and a very significant 31% of the Disabled participant group found booth positioning for the iris biometric either 'very' or 'fairly' difficult. The results for the Opportunistic group are better still and follow a similar pattern, here 85%+ of participants found the booth positioning 'very / fairly easy' and once again the iris biometric scored the highest number of 'very / fairly difficult' positioning experiences (13%).

Key Observation
Across the three biometrics, and the Quota, Opportunistic and Disabled participant groups, participant experience of 'positioning' for iris enrolment is the only concern – with 31% of the Disabled participant group finding the positioning for the iris recording 'very' or 'fairly' difficult.

5.9.4 Further Analysis - Quota

A significant difference can be observed below regarding how the experience of ***participant positioning*** within the booth differs across ethnicity, location, gender, age and religion.

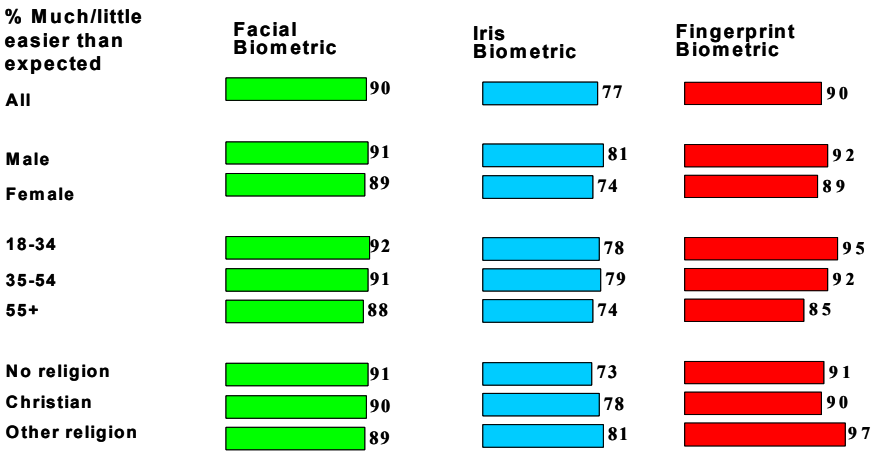
It can be observed below a significant difference regarding ethnicity on the fingerprint biometric with the BME sub-group finding the positioning easier than the White sub-group (which still scores 90%). Also the London/Leicester participants found positioning for the iris biometric more difficult than the Newcastle and Glasgow participants.



Key Observation

(Quota) The BME sub-group found positioning for the fingerprint biometric enrolment easier than the White sub-group and those in Newcastle and Glasgow found iris enrolment positioning easier than those in Leicester and London.

The illustration below shows significant differences regarding gender for the iris biometric with males finding it easier to position themselves than females. Additionally the 55+yr old sub-group finds it more difficult to position themselves for the fingerprint enrolment then the 18-54yr old sub-group.



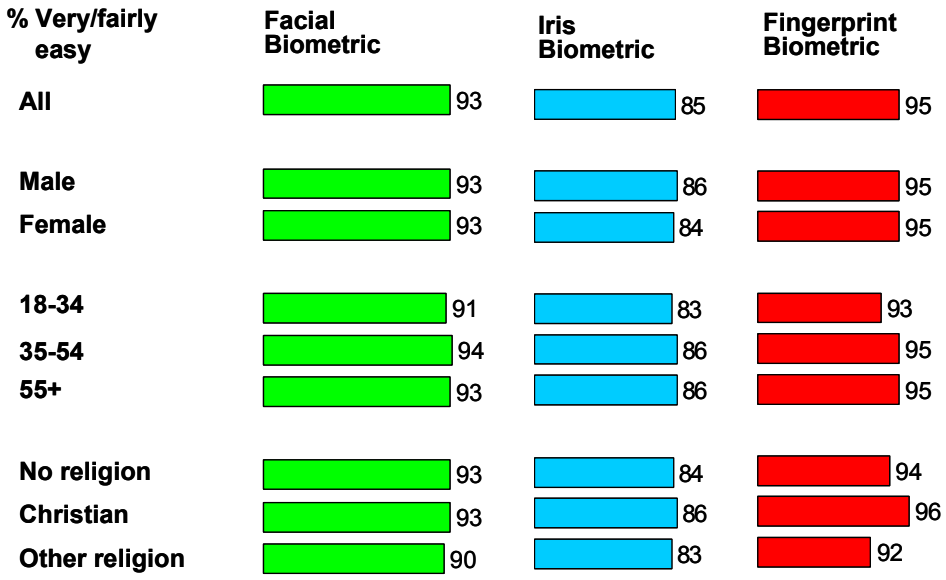
Key Observation

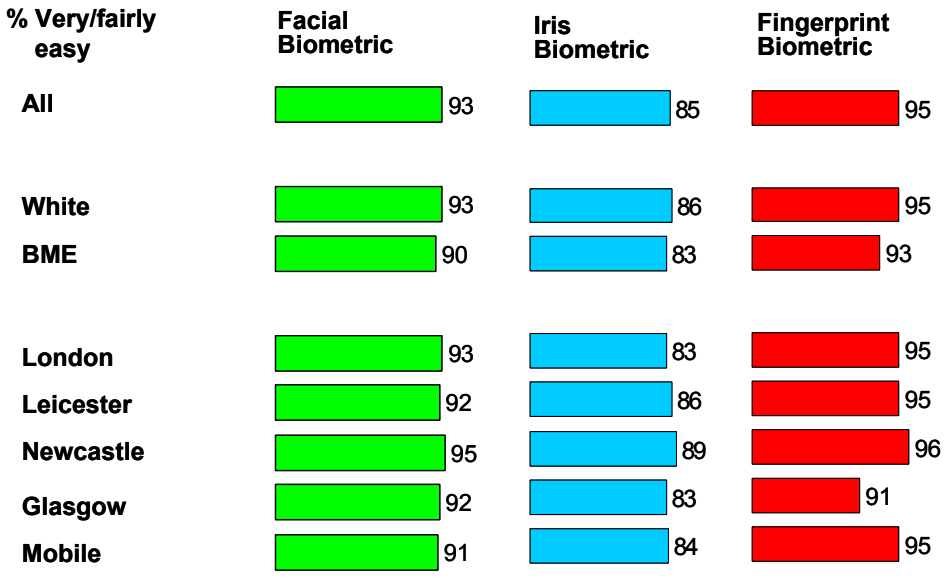
(Quota) The 55+yr age group find it more difficult to position themselves for the fingerprint biometric than the 18-34yr and 35-54yr age groups.

5.9.5 Further Analysis – Opportunistic

The ***Opportunistic analysis*** illustrations below show how the experience of ***enrolment booth positioning*** differs across age, ethnic and religious groups, location and gender.

The results – as with the main question aggregate results – show the iris biometric scoring lowest for booth positioning being 'very / fairly' easy, although even these results are 80%+ across each sub-group. All sub-groups for the facial and fingerprint biometrics score 90%+ and are therefore not a cause for concern.



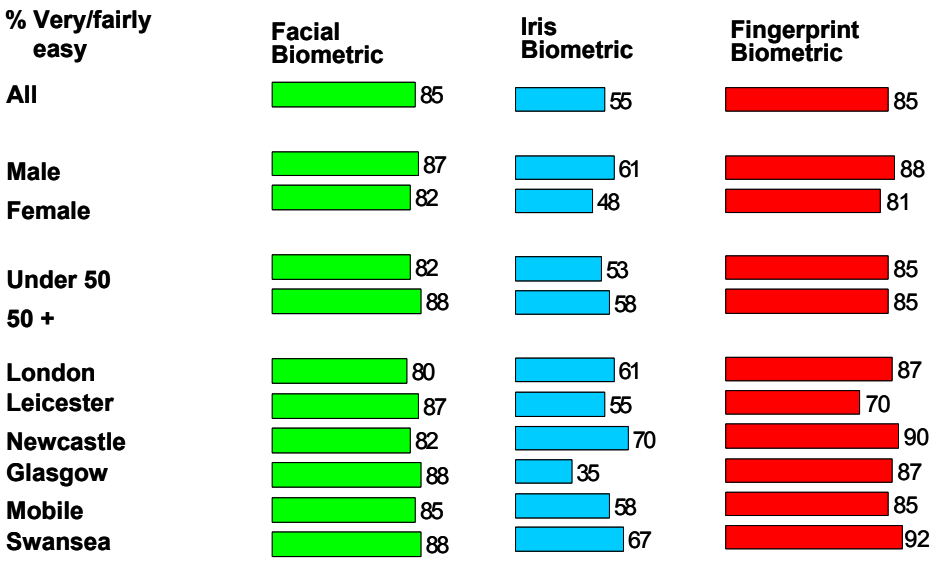


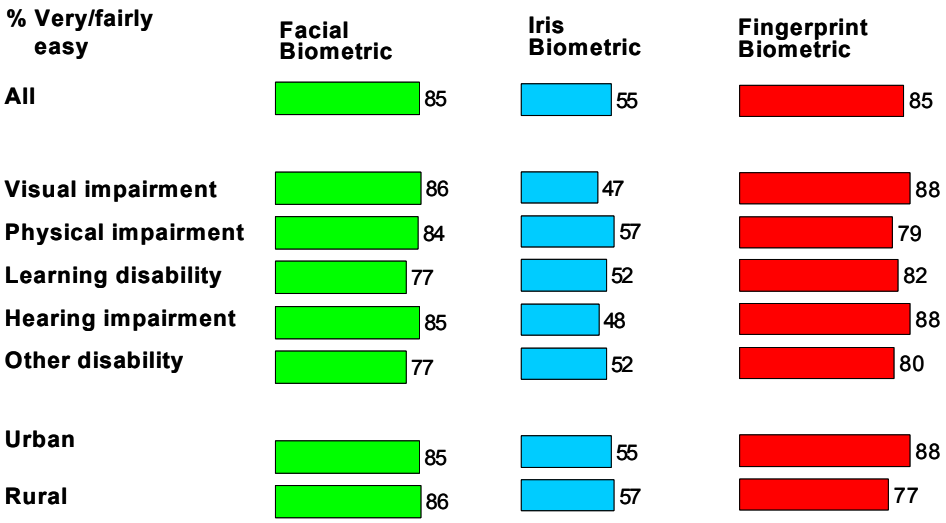
Key Observation
(Opportunistic) Booth positioning is not a concern across all sub-groups.

5.9.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** illustrations below show how the experience of ***participant positioning*** within the booth differs across gender, age, location and impairment type.

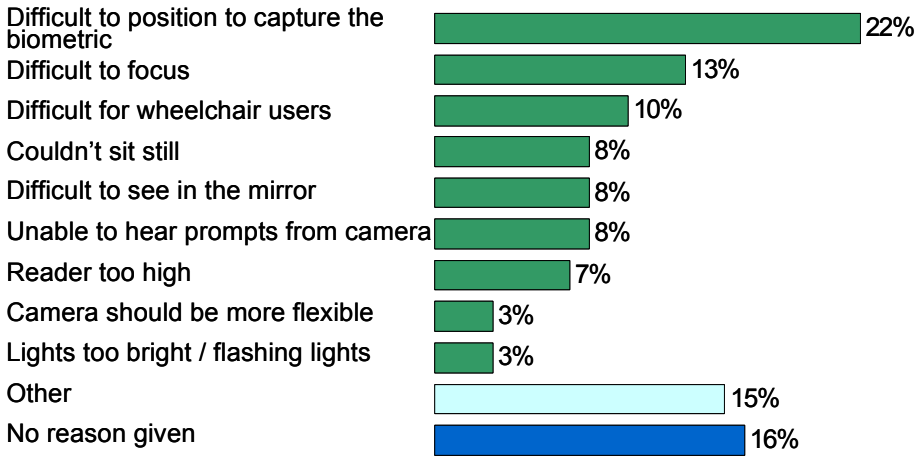
Similar to the level of intrusion and time taken, the results show that across every Disabled participant sub-group, the iris biometric scored lowest for participant booth positioning experience being 'very' or 'fairly' easy. Although not significantly so, once again the Newcastle participants seemed to have had the best (iris) experience compared with other locations.





Because of the high number of Disabled participants who found the iris positioning difficult, it is worth taking a closer look at the reasons why, below.

What made positioning yourself so that the iris image could be recorded difficult?



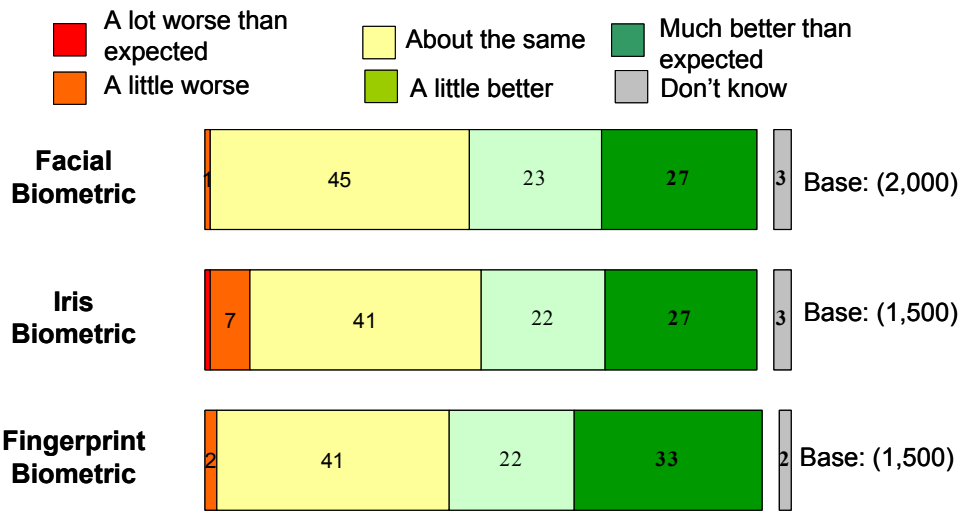
Key Observation

(Disabled) Across all sub-groups, the iris biometric scored lowest for the participant booth positioning experience being 'very' or 'fairly' easy.

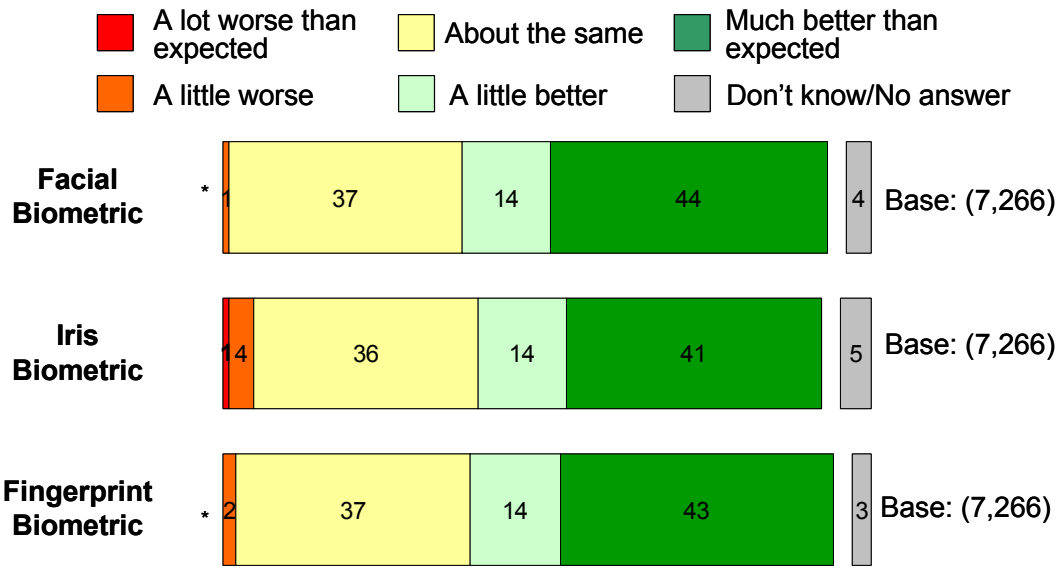
5.10 Participant Experience – 'Overall experience' (Section 2; Q6 & Q7, Q14 & Q15, Q22 & Q23)

And overall, how did you feel about the experience of giving your biometrics?

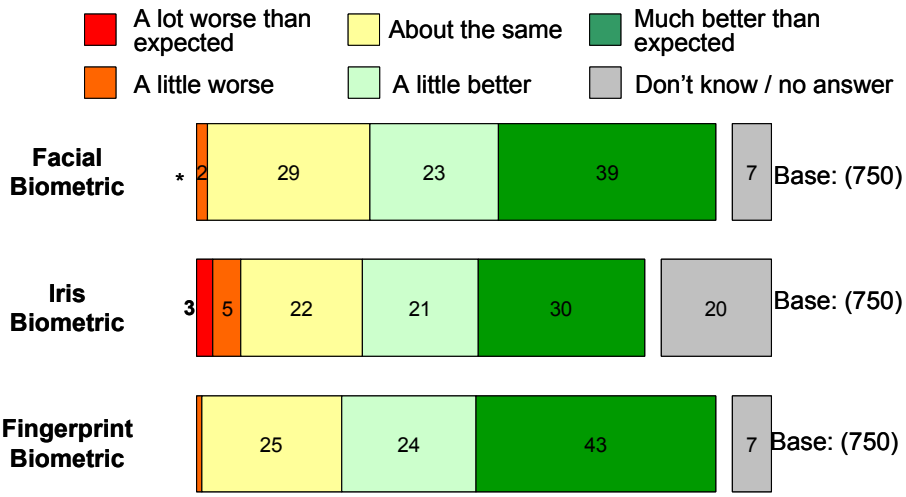
5.10.1 Quota Group Result



5.10.2 Opportunistic Group Result



5.10.3 Disabled Participant Result



Amongst the Quota group almost half of participants stated that their overall experience of providing their biometrics met their expectations and encouragingly approximately half of the Quota group had their expectations 'bettered'. A similar percentage of 'overall experience bettered' results can be observed within the Opportunistic group – but here, encouragingly, the largest portion of participants stated that their overall experience was 'much better' than expected.

These results have been improved on further amongst the Disabled participant group where 62% and 67% of participants had their expectations 'bettered' for the facial and fingerprint biometrics respectively and over half for iris.

Across all three groups only a small number of participants found the overall experience of providing their biometrics a worse than expected experience; with most negative experience surrounding the enrolment of the iris biometric.

The participant responses to the questions about overall experience have been compared with the time taken and the enrolment result. No strong relationship has been found between the responses to the questions about overall experience and enrolment outcome (see Appendix E - Trial Results – Process and Experience Correlation.)

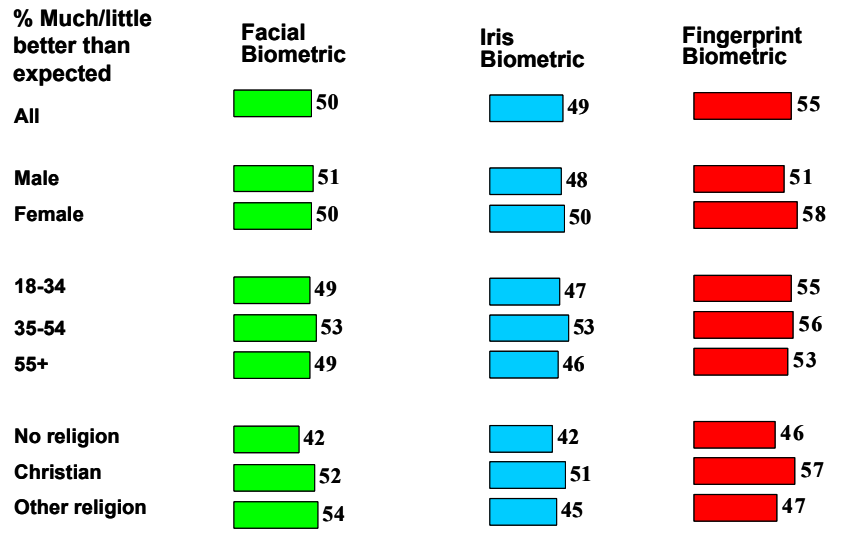
Key Observation
Across all three biometrics, the vast majority of participants in the Quota, Opportunistic and Disabled participant groups found their expectations of the overall experience to have been either met or bettered.

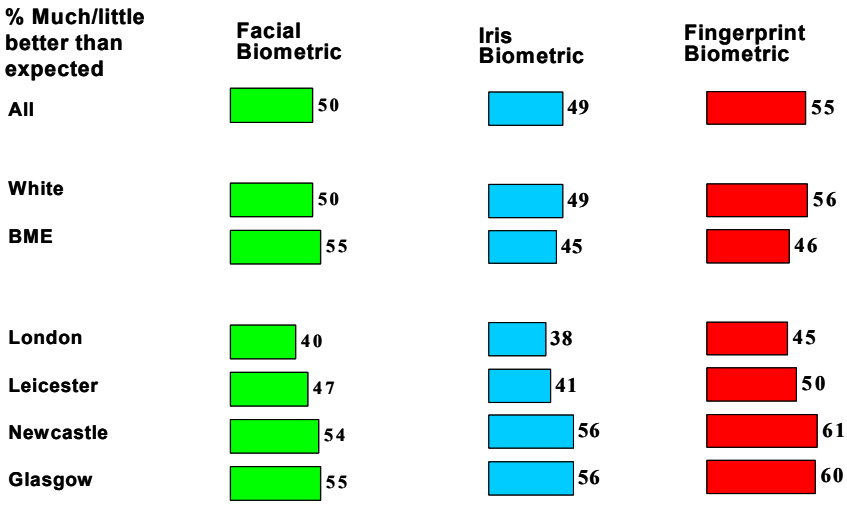
5.10.4 Further Analysis – Quota

The ***Quota analysis*** below shows how the participants' ***overall experience of enrolling their biometrics*** differs across gender, age and religion (first illustration) and against ethnicity and location (second illustration below).

The first illustration below shows differences in the results concerning gender for the fingerprint biometric (females had a better experience than males); and between Christian/Other vs No Religion for the facial biometric (Christian and Other Religion had a better experience than No Religion).

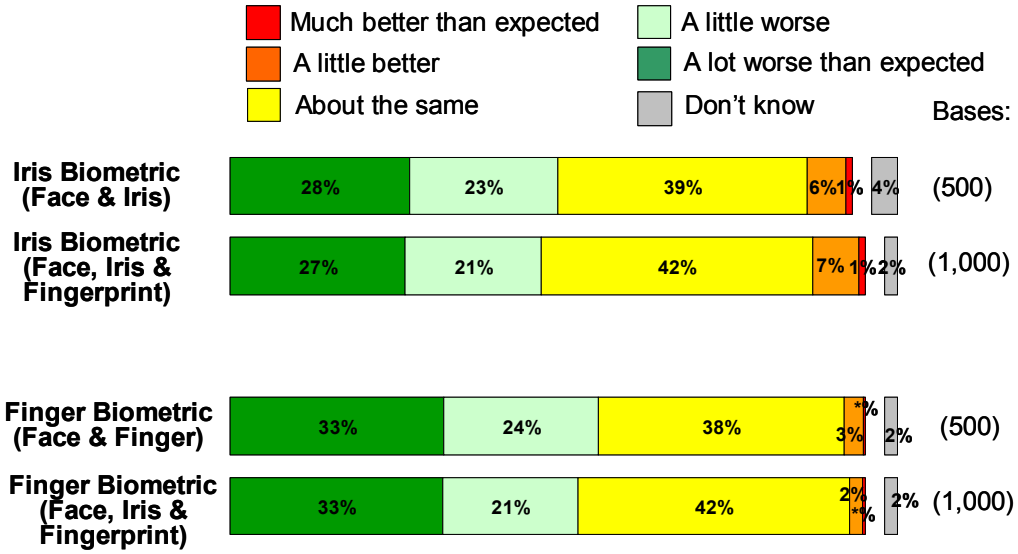
The second illustration below shows differences between the White sub-group who found their overall experience of the fingerprint biometric better than the BME sub-group. Also, in general, across all three biometrics, participants in Glasgow and Newcastle found their overall experience better than those in London.





Key Observation
(Quota) Quota participants in Glasgow and Newcastle found the overall experience of giving their biometrics better than expected compared with participants within London.

The analysis below shows the ***comparison of two sample Quota groups***, in considering the participants ***overall experience*** of giving their biometrics. The results show that there are no significant differences to a participants overall experience of the iris biometric as a result of introducing the fingerprint biometric or when focussing on the fingerprint biometric and as a result of introducing the iris biometric.

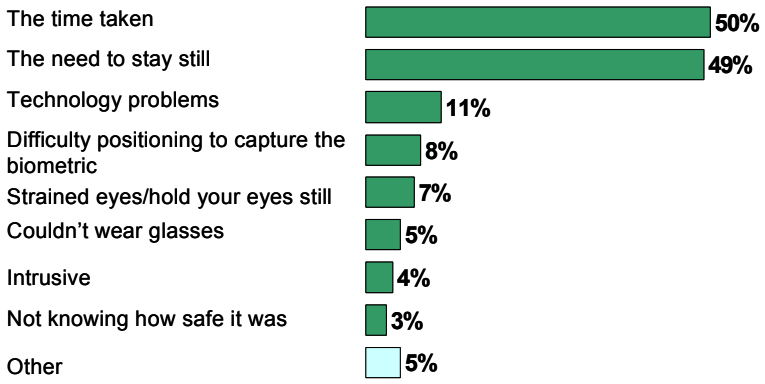


Key Observation
Quota participants' overall experience in the enrolment of the iris and the fingerprint biometrics are not significantly affected by the introduction of the third biometric (fingerprint and iris respectively).

The Quota results to this section's key question (*And, overall how did you feel about the experience of giving your biometric?)* does show a comparatively negative experience of having the iris biometric recorded – in that 8% of Quota people found their overall experience to be 'a little' or 'a lot worse' then expected. It is therefore worth taking a closer look at the free text follow-up responses relating to the iris biometric recording participant experience for further investigation. The results are below:

What was it that made the experience of having your iris image recording worse than you had expected? – Quota Group

Note the base of those who found iris image recording worse than expected is 121 and the small base size means these results should be treated as indicative only.



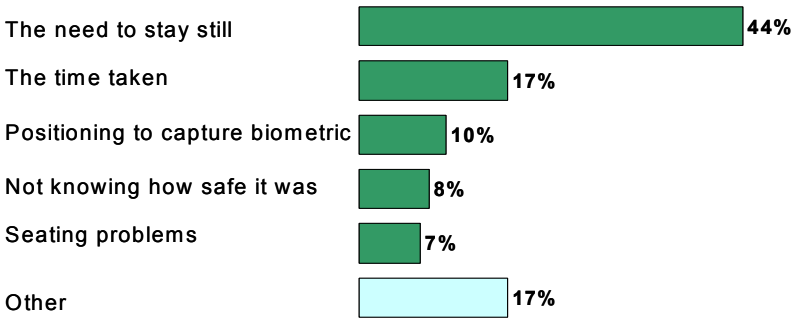
The two key reasons for participants finding the experience worse than expected are 'the time taken' to record the iris and 'the need to stay still'. This feedback also seems to be backed up by the 'Time Taken' results, where 21% of participants found the iris recording to be 'a little' or 'a lot' longer than expected and the 'Positioning' results where 22% of participants found the booth positioning for iris recording to be 'fairly' or 'very' difficult.

Key Observation
(Quota) The top two reasons for a participant's overall experience of the iris enrolment being worse than expected are 'time taken to record' and 'the need to stay still'.

To complete the analysis of the free text responses, below are the results for the facial and fingerprint biometrics respectively.

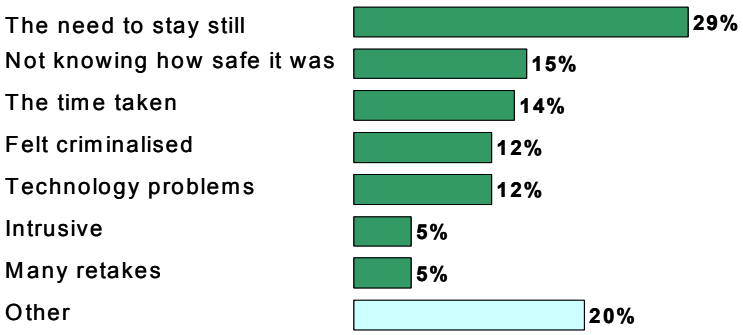
What was it that made the experience of having your facial image recording worse than you had expected? – Quota Group

The very small base size of those who found facial image recording worse than expected (30) means these results should be treated as indicative only.



What was it that made the experience of having your fingerprint image recording worse than you had expected? – Quota Group

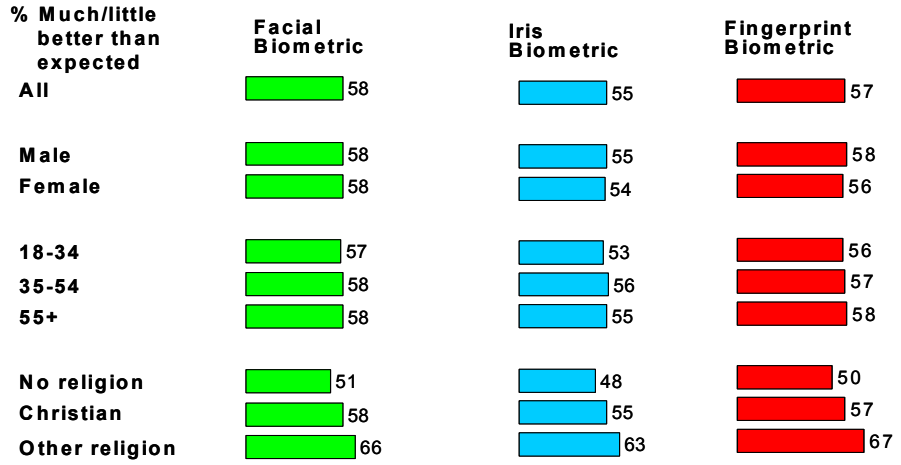
Once again the small base size of those who found fingerprint image recording worse than expected (42) means these results should be treated as indicative only.

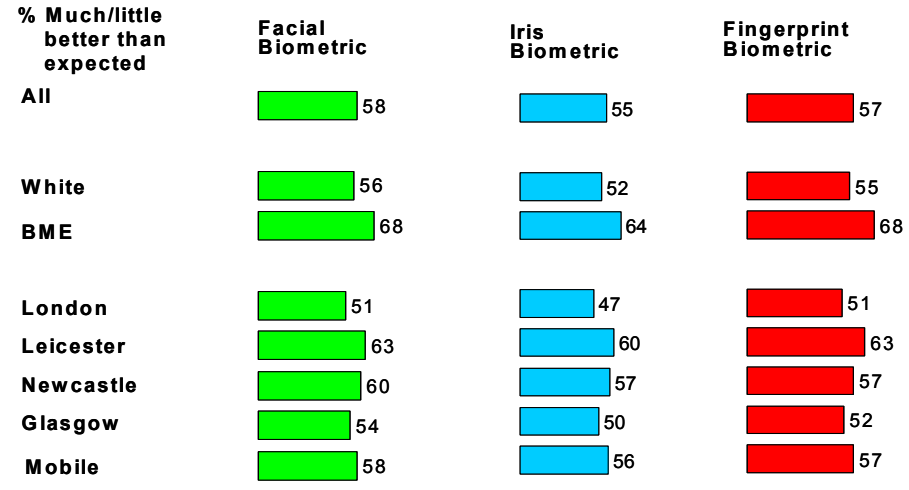


5.10.5 Further Analysis – Opportunistic

The ***Opportunistic analysis*** illustrations below show how the ***overall experience*** differs across age, ethnic and religious groups, location and gender.

The most significant results by sub-group show that those of the Other Religion sub-group (compared with No Religion and Christian) and the BME sub-group (compared with the White sub-group) scored highest for their overall experience being 'much / a little' better than expected. Regarding location the Leicester participants had the 'best' overall experience (against expectations) and the London participants had the worst. There are no significant sub-group differences by gender or age across the biometrics.





Key Observation

(Opportunistic) The Other Religion and BME sub-groups had the best overall biometric enrolment experience (against expectations). London participants had amongst the least positive experience (against expectations).

For the Opportunistic group a further breakdown of responses from participants whose 'overall experience' for the iris biometric was 'worse than expected' is available (as has been highlighted for the Quota results above). However because this result is very low (5%) a breakdown of these numbers is not considered necessary, and potentially misleading, and thus not included in this report.

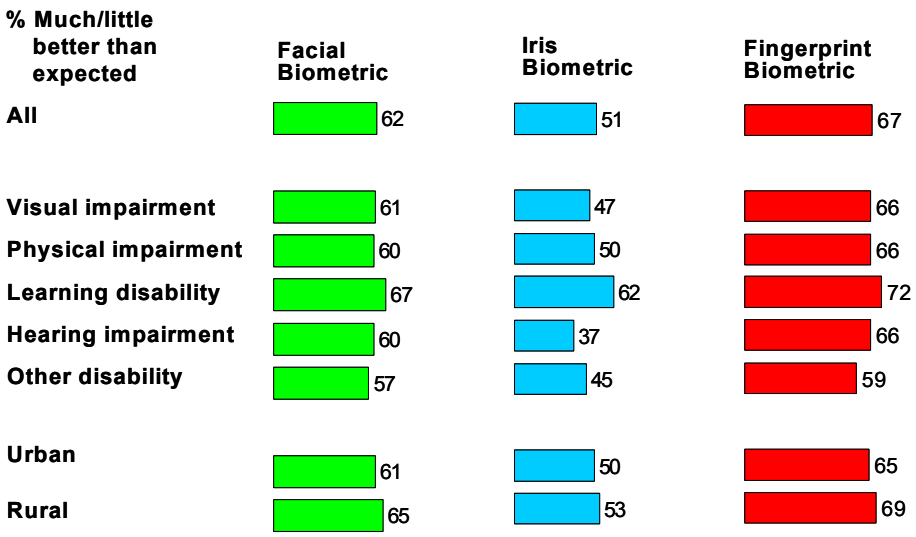
5.10.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** below shows how the participants' ***overall experience of enrolling their biometrics*** differs across gender, age, location and impairment type.

The results show that the iris biometric scored lowest, amongst the Disabled participant group, for 'overall experience' being 'much' or 'a little better' than expected; and as with previous responses, this result is particularly exaggerated in Glasgow and with Female participants. Additionally, in line with other 'experience' type responses, the mobile site scored highest for a better than expected experience compared with any of the fixed sites (bar Swansea). In considering the impairment type, the iris biometric scored lowest for 'overall experience' being 'bettered' with those who are hearing impaired (a low 37%).

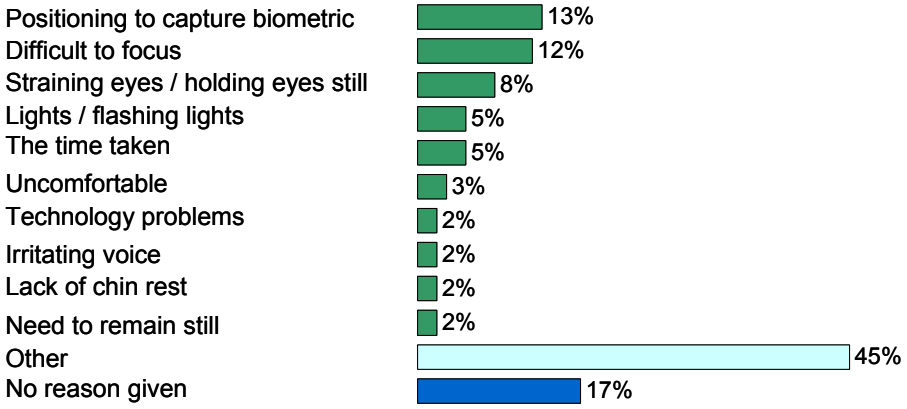
The facial and fingerprint overall experience scores are encouraging, with only those in London and Leicester scoring sub 60% (three biometrics average) for their experience being 'much' or 'a little better' than expected. It is worth including a breakdown of responses from those Disabled participants who did find their iris recording worse than expected, below. However these results must be treated as indicative only

% Much/little better than expected	Facial Biometric	Iris Biometric	Fingerprint Biometric
All	62	51	67
Male	63	56	68
Female	62	43	65
Under 50	65	54	70
50 +	58	47	62
London	51	45	52
Leicester	48	45	57
Newcastle	66	54	66
Glasgow	65	26	63
Mobile	65	58	72
Swansea	75	54	58



Eight percent of the overall Disabled participant group found the recording of the iris biometric 'a lot / a little' worse than expected. Whilst this is a small number – 60 people, because some of the reasons may be different to those likely within the Quota / Opportunistic group, it is worth including a breakdown of responses from those Disabled participants who did find the iris recording worse than expected, below.

What was it that made the experience of having your iris image recorded worse than you had expected? - Disabled Participants.



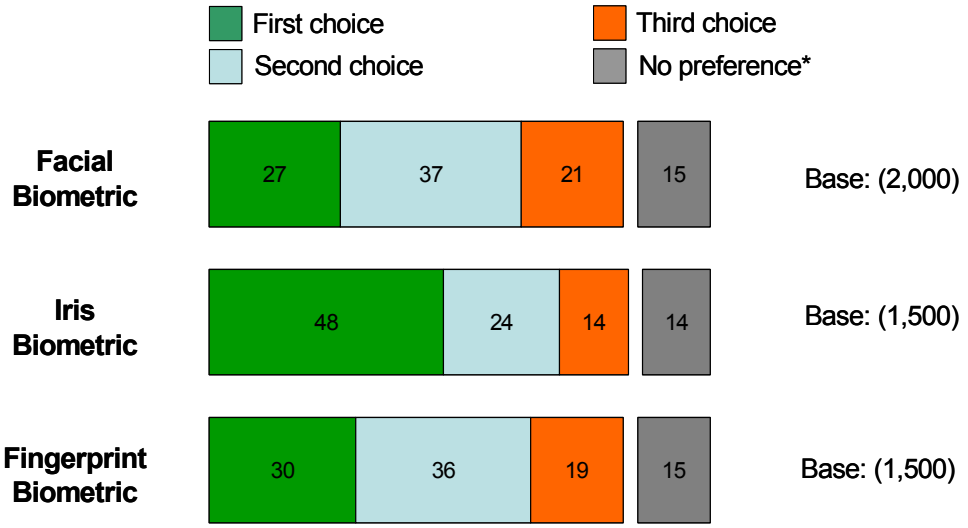
Key Observation

(Disabled) The iris biometric scored lowest for 'overall experience' being 'much' or 'a little better' than expected with participants in Glasgow, female participants and those who were hearing impaired – who had the worst iris experience.

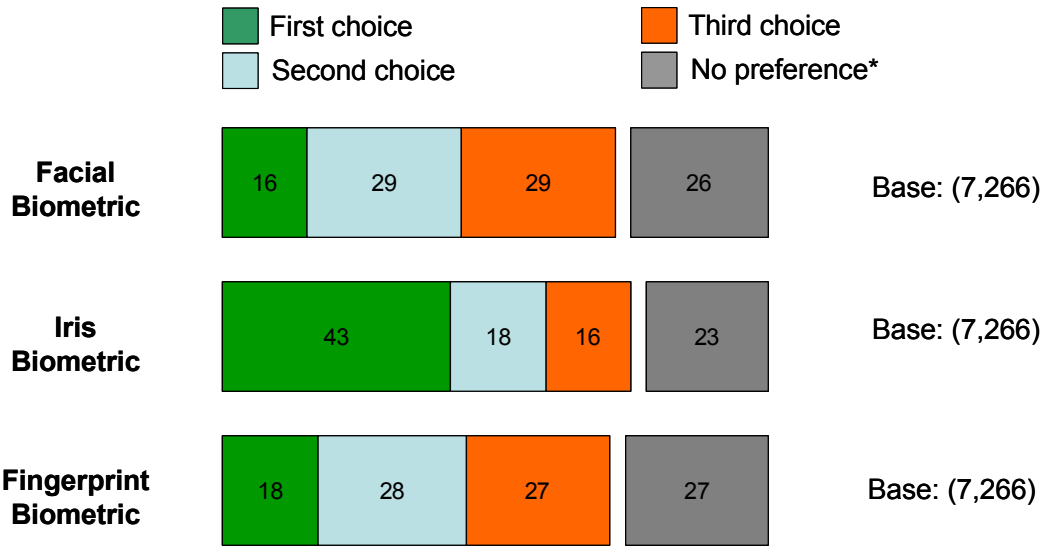
5.11 Participant Experience – 'Process Preference' (Section 2; Q26)

Please could you rank, in order, of preference, the biometric identification processes that you experienced?

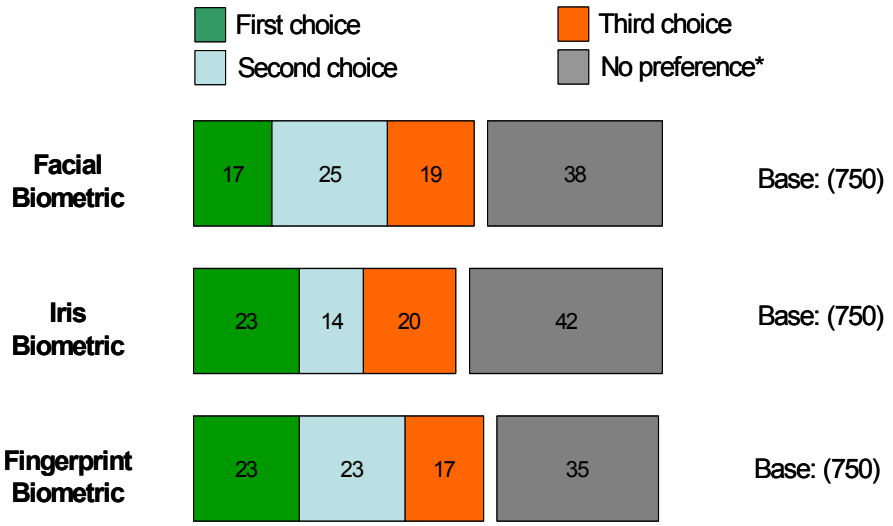
5.11.1 Quota Group Result



5.11.2 Opportunistic Group Result



5.11.3 Disabled Participant Result



The Quota and the Opportunistic groups reflect a similar pattern, with the iris biometric clearly scoring highest as the first choice process preference and the facial and fingerprint biometrics running close second. The Opportunistic group does have a higher proportion of 'no preference' scores.

The emergence of the iris biometric as the clear preferred choice may seem to be somewhat contrary to other Quota and Opportunistic results whereby the iris biometric experience scores comparatively worse, i.e. 'time taken', 'positioning', 'level of intrusion' (not Opportunistic) and 'overall experience'; this may be explained in that participants who had 'worse than expected' experiences with the iris enrolment have simply scored the overall iris experience (above) as their third choice. Alternatively some participants may have interpreted the overall experience question as 'what they believe to be the best biometric identifier' (rather than their own personal process experience), in which case their personal experience becomes less important.

The iris enrolment 'experience questions' are also the least best received amongst the Disabled participant group – but within this group there is less to choose for first choice process preference between the three biometrics with iris and fingerprint level first place. Additionally, across all three biometrics, the 'no preference' option is the highest scorer, within the Disabled participant group.

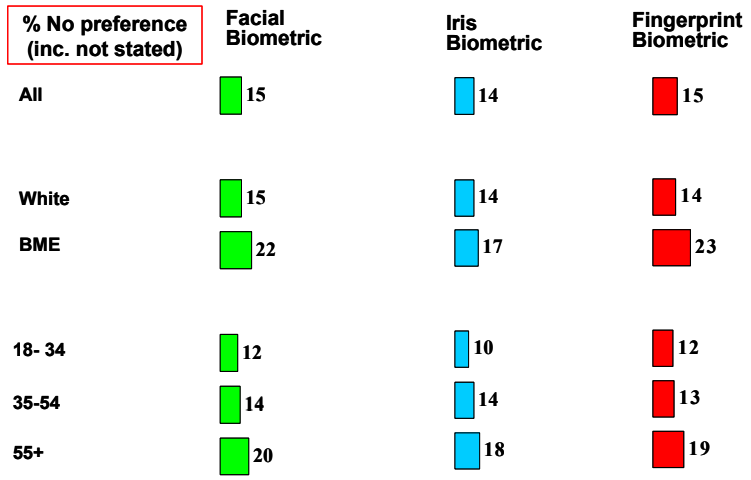
The participant preferred biometric has been compared with the enrolment outcome for that biometric (see Appendix E - Trial Results – Process and Experience Correlation.)

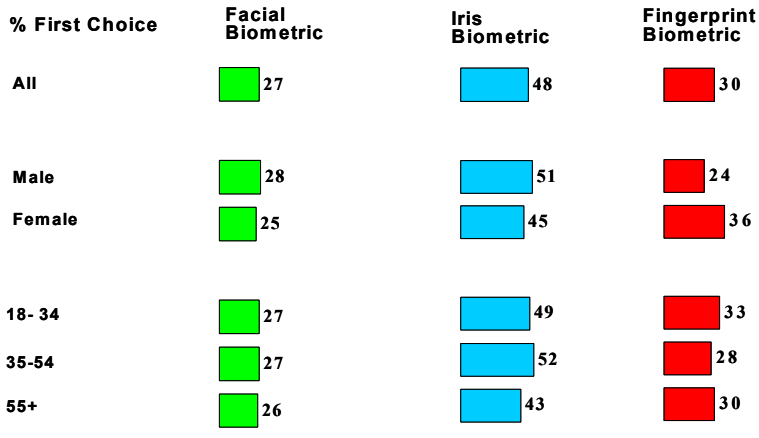
Key Observation
The preferred biometric identification process experienced, for both the Quota and Opportunistic groups, is the iris biometric and this is the tied first choice – with the fingerprint biometric – for the Disabled participant group.

5.11.4 Further Analysis – Quota

The ***Quota analysis*** below shows how the participants' ***first choice process preference*** differs across gender and age and how results differ across ethnicity and age for those participants who stated a preference (e.g. the facial biometric) for their first choice but then stated ***no preference*** for other choices.

The results show females had a significant first choice preference for the fingerprint biometric compared with males and, in general, the BME sub-group and the older age group (55+yr) were the most likely sub-groups to state no preference (after stating a first choice).





Key Observation

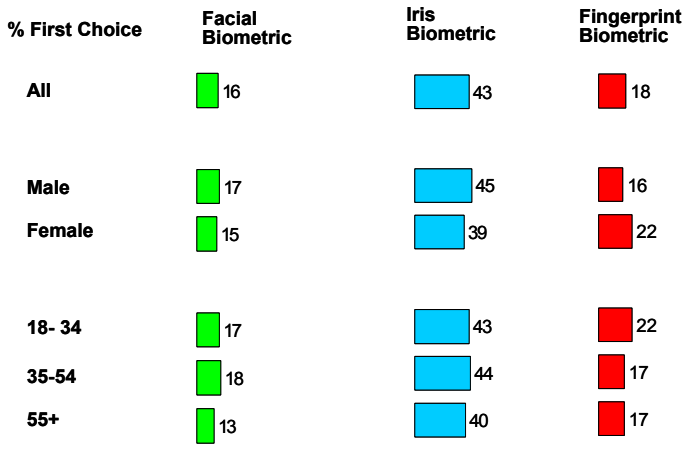
(Quota) Regarding process preferences, more females than males prefer the fingerprint biometric (still 2nd to iris); males clearly prefer the iris biometric and the two sub-groups are closely tied on their preference for the facial biometric.

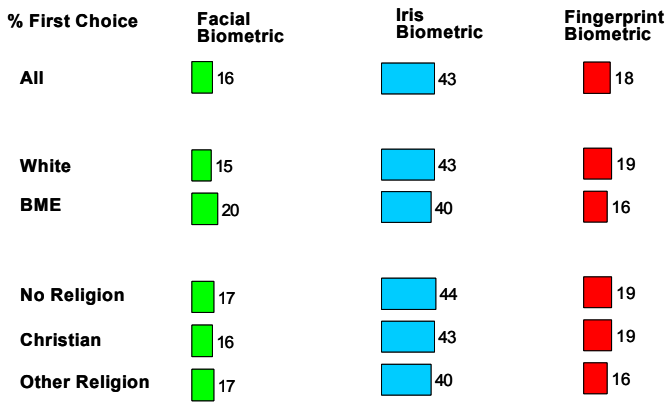
5.11.5 Further Analysis – Opportunistic

The ***Opportunistic analysis*** illustrations below show how the ***preferred biometric process*** first choice differs across age, ethnic and religious groups, location and gender.

The results do not show major differences for the first choice amongst the sub-groups. Differences can be found when comparing the genders, where males have a stronger preference for the iris biometric and more females than males prefer the fingerprint biometric (although overall females do still prefer the iris biometric).

The most preferred biometric process overall – the iris biometric – is least preferred by females (compared with males); by those over 55 years; by the BME sub-group (compared the White); and those of Other Religion (compared with Christians or No Religion).



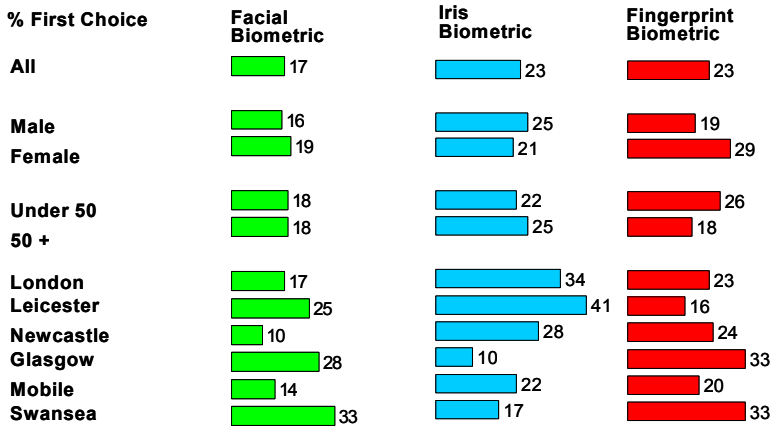


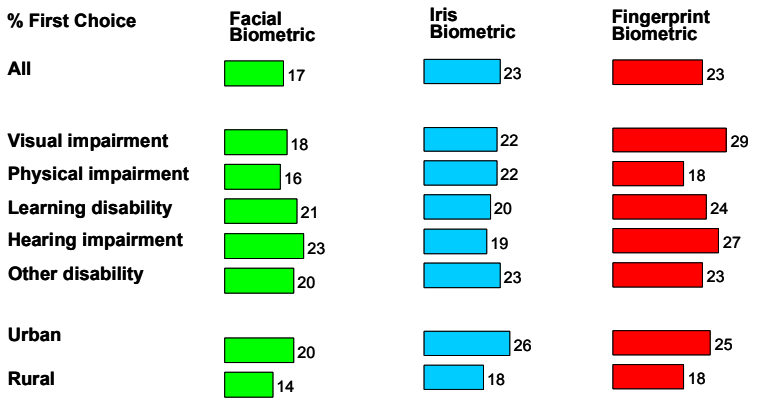
5.11.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** below shows how the participants' ***first choice process preference*** differs across gender, age, location and impairment type.

The results show female participants and under 50's have a strong first choice preference for the fingerprint biometric and the iris biometric is preferred by male participants and over 50's. Unsurprisingly, only 10% of Glasgow participants – given some of the other experience responses – state the iris biometric as their first choice.

Regarding impairment type, three of the types, visually impaired, learning disabilities and hearing impaired participants have opted for the fingerprint as their first choice with only the physically impaired preferring a different first choice – the iris biometric.





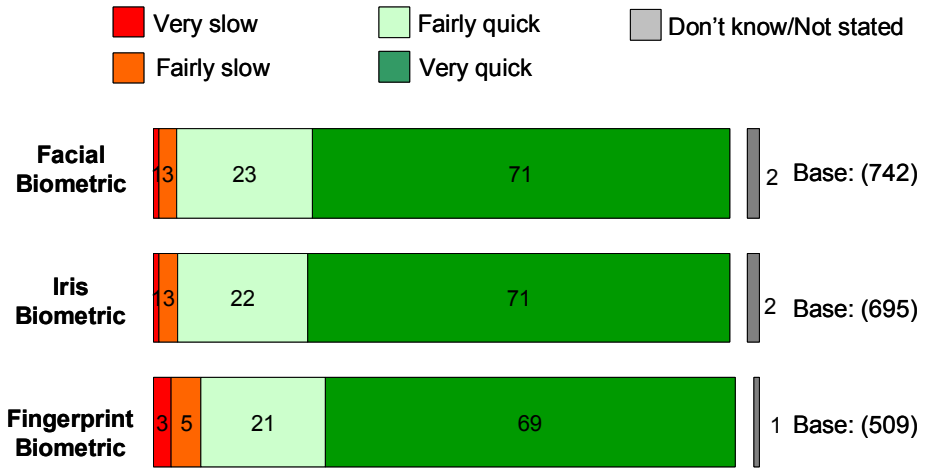
Key Observation

(Disabled) Participants with three of the four impairment types, visual and hearing impaired and learning disability, opted for the fingerprint biometric as their first choice process preference.

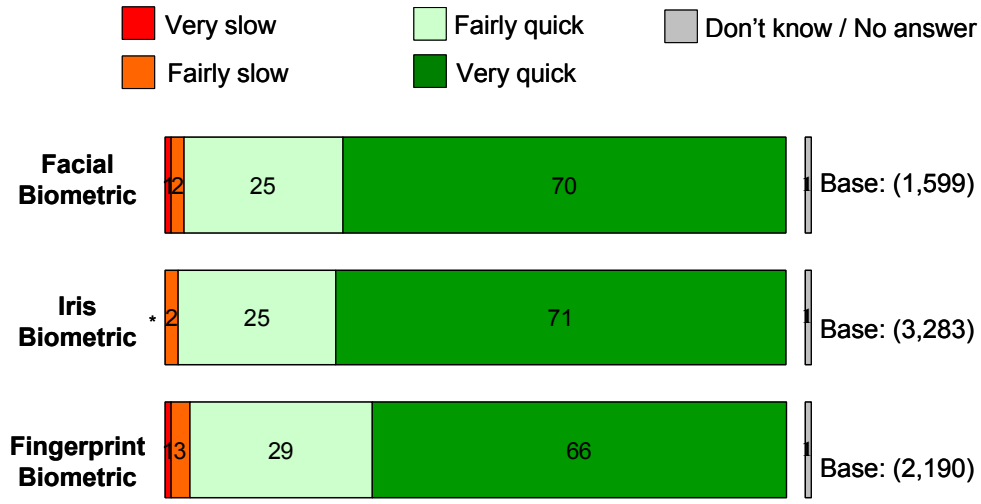
5.12 Participant Experience – 'Verification Speed' (Section 3;Q27)

Thinking now about the verification process which you have just undertaken, how quick would you say the verification process was?

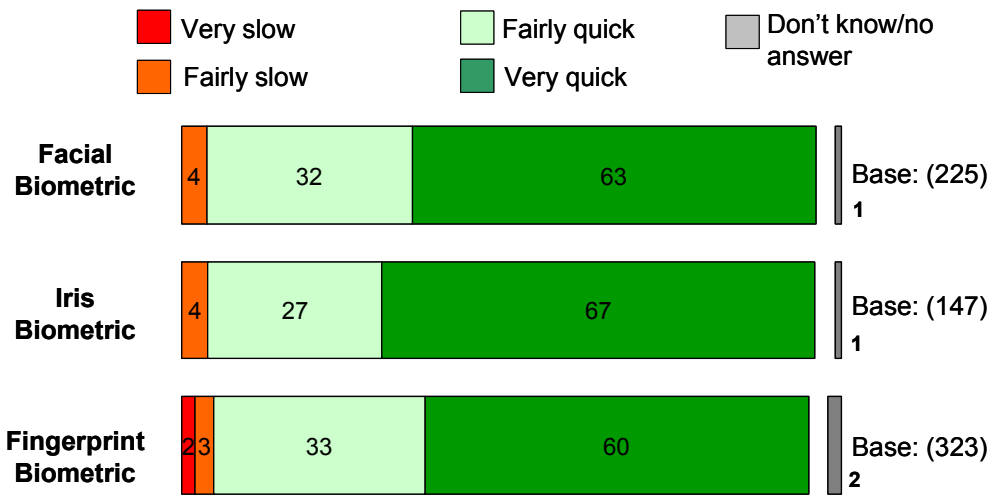
5.12.1 Quota Group Result



5.12.2 Opportunistic Group Result



5.12.3 Disabled Participant Result



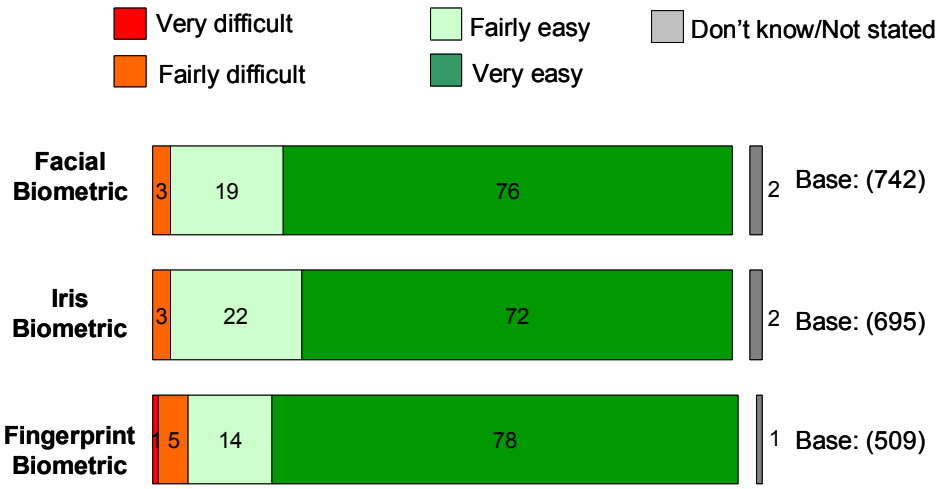
The results are similar across the Quota, Opportunistic and Disabled participant groups, in that the vast majority of participants found the speed of verification to be either 'fairly' or 'very' quick. It was the fingerprint biometric which scored the highest number of 'fairly / very slow', nevertheless, the speed of verification does not seem to be a concern.

Key Observation
The speed of verification, across the Quota, Opportunistic and Disabled participant groups, is not a concern.

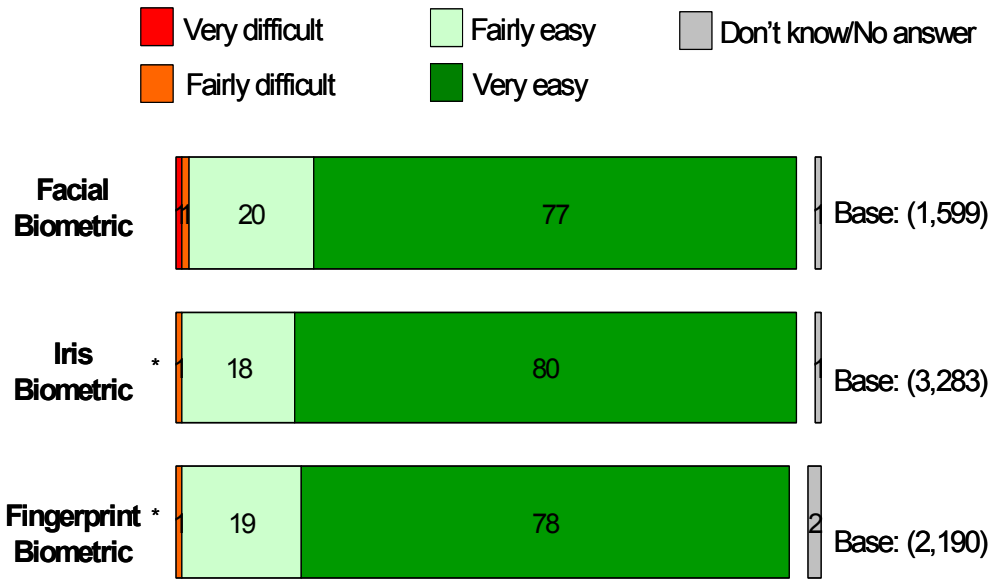
5.13 Participant Experience – 'Ease of Verification' (Section 3; Q28)

And how easy or difficult would you say the verification process was?

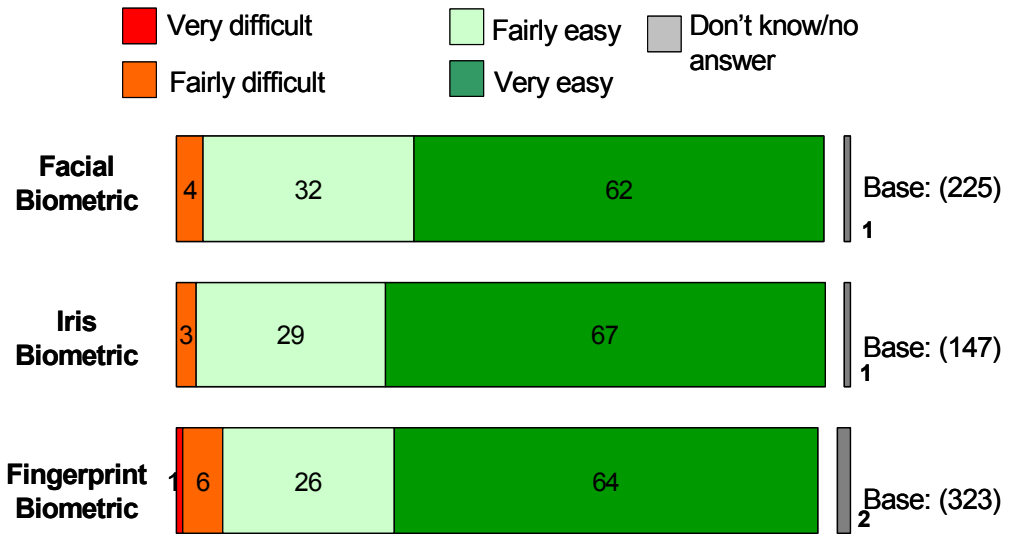
5.13.1 Quota Group Result



5.13.2 Opportunistic Group Result



5.13.3 Disabled Participant Result



The results for the Disabled participant group are a little less encouraging than those for the Quota group, with a higher percentage of people finding the ease of verification 'fairly' as opposed to 'very' easy compared with the Quota group. Additionally, 7% of the Disabled participant group found the fingerprint biometric ease of verification to be 'difficult'. Nevertheless, across both groups (Quota and Disabled participants), the Trial still has 90%+ participants responding positively.

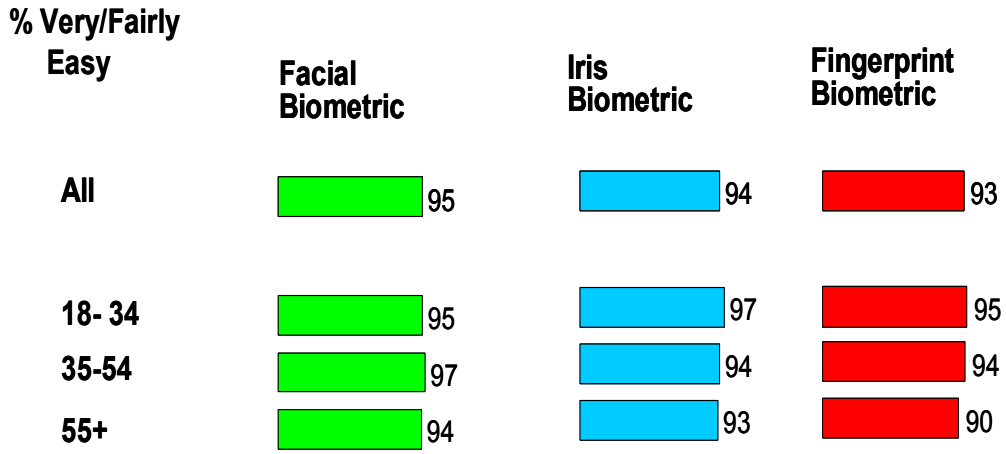
The Opportunistic group has the most encouraging results with a big majority finding the ease of verification 'very easy' across all three biometrics and a minimal number finding verification ease to be 'fairly / very difficult'. Therefore, overall, ease of verification does not seem to be a concern across the Quota, Opportunistic or Disabled participant groups.

Key Observation
The ease of verification, across the Quota, Opportunistic and Disabled participant groups, is not a concern.

5.13.4 Further Analysis – Quota

The ***Quota analysis*** below shows how a participant's experience of ***ease of verification*** differs across age.

The results show that participants in the 18-54 age range find verification easier than the 55+yr age group – although all results are very positive.



For both verification speed and ease, all of the Opportunistic sub-group results are very high (90%+) and there are no significant differences between the sub-groups; given this, the Opportunistic charts are not included in this report.

6 Participant Attitude

6.1 Comment

The following section details the Quota, Opportunistic and Disabled participant groups' attitude results obtained from the participant interviews completed during and after enrolment / verification in the Biometrics Trial.

The 'attitude' results relate largely to how participants feel about the concept of biometrics as part of an individual's passport, as well as the general concept of biometrics and their potential contribution to key national questions.

This section has been organised in the same way as the Participant Experience section, in that the question asked is shown followed by the results and comments from the Quota, Opportunistic and then Disabled participant groups to allow for direct comparison on the main questions.

As with the Participant Experience section the Quota and Opportunistic groups will have further sub-group breakdowns by age, gender, ethnicity and location. The further analysis of the Disabled participant results include gender, age, location and impairment type, where the impairment types are 'visually impaired', 'physically impaired', 'learning disability' and 'hearing impaired'. As with the Experience section, the 'other disability' and 'Swansea' sub-groups are included in the Disabled participant results breakdown but not commented upon due to their low representations (44 and 24 participants respectively).

Once again key observations to all results are included and the main question observations are summarised below.

When considering the results it has to be remembered that although the Quota group is representative of the population in demographic terms, it may not be representative in attitude. People who were strongly opposed to the concept of biometrics could have been reluctant to take part in the Trial.

6.2 Summary of Overall Key Observations - Participant Attitudes

As with the participant 'experience' results, in general responses from the three main groups – Quota, Opportunistic and Disabled people all follow very similar patterns for the main question aggregate scoring. And once again the Opportunistic results follow the Quota results very closely on many questions.

Some of the attitude results worth summarising include the **level of concern prior** to enrolment; this was not an issue at the aggregate level for the Quota and Opportunistic groups, however the sub-groups **18-34yr olds, BME** and **Other Religion** did show much more concern compared with the average scores. The general Disabled participant group also indicated more concern (compared with aggregate Quota and Opportunistic scores) prior to the Trial, in particular of the **iris** biometric.

Encouragingly the **level of concern post** enrolment fell from the 'prior to Trial' numbers, although once again the aforementioned sub-groups (**18-34, BME, Other Religion**) showed the greatest levels of concern post enrolment.

The vast majority of Quota, Opportunistic and Disabled participants would be in favour of adopting biometric recognition as a means of establishing passport identity. Within the Opportunistic group there is slightly less enthusiasm shown by the **18-34 yr old, BME** and **Other / No Religion** sub-groups – a pattern seen within the Quota group for the 18-34 and other / no religion sub-groups.

As for the **type of locations** participants would favour enrolments to be conducted in, the more 'institutional' locations are the highest scorers, i.e. post offices, passport offices, banks, police stations and town halls. The least 'liked' locations are the 'open spaced' venues for example community centres and supermarkets. Compared with the **White** sub-group, the **BME** sub-group prefers post offices, with the former showing more preference for passport offices and police stations.

The majority of Quota, Opportunistic and Disabled participants strongly agree that biometrics will **strengthen passport security**, help **prevent identity fraud**, help **prevent illegal immigration** and are **not an infringement on their civil liberties**. There does, however, remain differences, in particular between the **18-34yr olds** and elder sub-groups, between those of **Other Religion** and the **Christian / No Religion** sub-groups and between the **BME** and **White** sub-groups.

Note, the key observations below relate to results to the main 'attitude' questions across the Quota, Opportunistic and Disabled participant groups (as found in the subsequent results detail). The observations relating to the respective Quota / Opportunistic / Disabled participant analysis are in separate boxes below.

- ***Whilst the majority of participants were 'not very' or 'not at all' concerned about having their biometrics recorded prior to enrolment there was more concern felt within the Disabled participant group and in particular for the iris biometric.***

- ***Across all three biometrics and all three groups, the total number of participants 'fairly' or 'very' concerned about having their biometrics recorded after enrolment dropped when compared with pre-enrolment.***

- ***Across the Quota, Opportunistic and Disabled participant groups and each of the three biometrics, over 80% of participants were in favour (50%+ strongly) of the adoption of biometrics as a means of passport identification. (The only exception being Disabled participant's group / iris biometric where 77% were in favour).***

- ***Quota, Opportunistic and Disabled participants prefer 'official' type buildings (e.g. passport offices, post offices) as the most suitable locations for passport biometric enrolment.***

- ***The majority of participants, in the Quota, Opportunistic and Disabled groups, strongly agree biometrics will help with passport security, preventing identity fraud, preventing illegal immigration and are not an infringement on their civil liberties.***

6.3 Summary of Quota Key Observations - Participant Attitudes

- ***The BME and the 18-54yr sub-groups were most concerned about having their biometrics recorded prior to enrolment.***
- ***Post enrolment, it is the BME sub-group and London participants who are most concerned about having their biometrics recorded.***
- ***When comparing all sub-groups, the youngest age group (18-34yr) and London participants have a slightly lower number of participants who are 'strongly in / in favour' of the use of biometrics for passport identity – although numbers are still high.***
- ***In considering favoured locations for biometric enrolment, post offices are favoured by the BME and the C2DE sub-groups when compared with the White and ABC1 sub-groups who prefer passport offices. Police stations are more favoured by the 18-54 year age group when compared with the over 54 year olds. Similarly more males than females favour police stations.***
- ***A greater number of participants from the White sub-group believe biometrics will help prevent identity fraud compared with participants from the BME sub-group.***
- ***The sub-groups who are most likely to believe that biometrics will help prevent illegal immigration working are 55+yrs, White, Unemployed, Christian and the C2DE sub-group.***
- ***The sub-groups most likely to believe biometrics are an infringement on their civil liberties are 18-34yrs, the C2DE sub-group, Other Religion and the BME sub-groups.***
- ***The sub-groups most likely to believe the benefits of introducing biometrics outweigh the costs are the 35-54yrs, sub-group ABC1, the White sub-group, the Christian sub-group and the Employed.***
- ***The sub-groups most likely to believe their biometric data may not be stored securely are the Male, BME, Other Religion and the ABC1 sub-groups.***

6.4 Summary of Opportunistic Key Observations - Participant Attitudes

- ***As with the Quota group those most concerned prior to biometric enrolment were the 18-34 yr old and the BME sub-groups. Participants of Other Religion also indicated significantly more concern than Christians or those of No Religion.***

- ***Post enrolment the 18-34 yr, the BME and the Other Religion sub-groups remain the most concerned about having their biometrics enrolled – with approximately one quarter of the BME sub-group remaining 'very / fairly' concerned.***

- ***All demographic sub-groups score 80%+ 'strongly in / in favour' of the use of biometrics as a means of passport identification.***

- ***The White and No Religion / Christian sub-groups prefer passport offices compared with the BME and Other Religion sub-groups respectively.***

- ***All demographic groups score highly for believing biometrics will strengthen passport security.***

- ***At least 85% of every demographic sub-group believes biometrics will help prevent identity fraud. There are, however, 7%+ point differences between 18-34yr vs 55+yrs; Other Religion vs Christian; BME vs White with the latter sub-groups scoring the higher.***

- ***At least 70% all demographic sub-groups believe biometrics will help prevent illegal immigration / working. The most significant sub-group differences are the 18-34yr olds (72%) vs 55+yr olds (86%) and No Religion (71%) vs Christian (83%).***

- ***Although 68% of the overall group do not believe biometrics are an infringement on their civil liberties, this falls to 51% for 18-34 yr old, 40% for the Other Religion and 38% for the BME sub-groups.***

- ***The demographic sub-groups who are most likely to believe the costs of introducing biometrics outweigh the benefits are the 18-34yr old, the Other Religion and the BME sub-groups.***

- ***The sub-groups most likely to be concerned over the secure storage of their biometrics are the 18-34 yr old, the Other Religion and the BME sub-groups.***

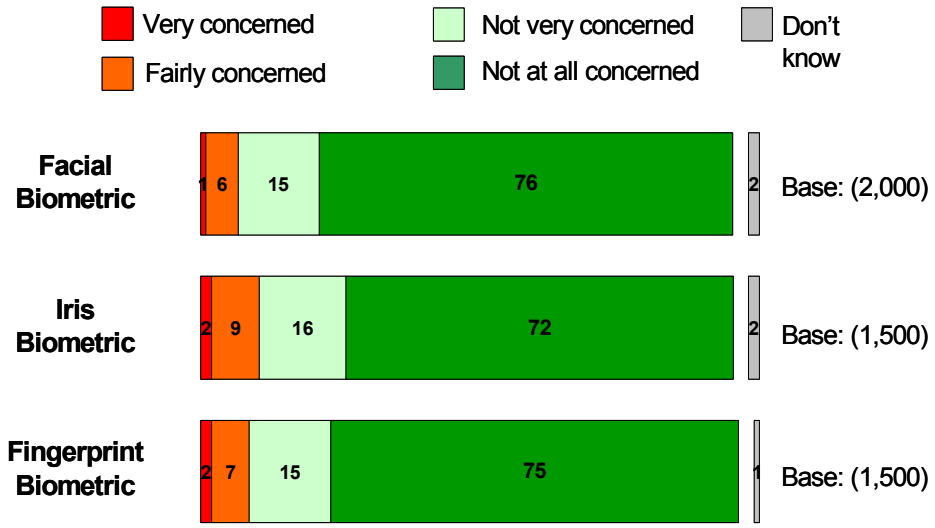
6.5 Summary of Disabled Participant Key Observations - Participant Attitudes

- ***Prior to enrolment, of the four impairment types, participants with visual, learning or hearing impairments scored iris as the biometric they were most concerned about.***
- ***Post enrolment, the level of concern amongst those with a visual impairment has dropped across the three biometrics when compared with pre-enrolment levels.***
- ***Participant attitude to the use of biometrics across nearly all sub-groups is very strong.***
- ***Those with a learning disability showed the least inclination for preferring any of the top three locations (post offices, passport offices, banks).***
- ***All sub-groups score high in believing biometrics will strengthen passport security, the only slight dip being amongst those with a learning disability (78%).***
- ***All sub-groups score highly in agreeing that biometrics will help prevent identity fraud, the only slight dip being amongst those with a learning disability (73%).***
- ***Three quarters of participants with visual, physical or hearing disabilities agree that biometrics will help prevent illegal immigration working; this drops to 60% for those with a learning disability.***
- ***The sub-groups most likely to believe biometrics are an infringement on their civil liberties are the under 50 yrs old and those with a learning disability.***
- ***The sub-groups most likely to believe the benefits of introducing biometrics outweigh the costs are the 50+yrs, males and Leicester participants. Those with a learning disability are the most likely to believe the costs outweigh the benefits.***
- ***The sub-groups most likely to believe their biometric data may not be stored securely are the under 50yrs and those with a learning disability.***

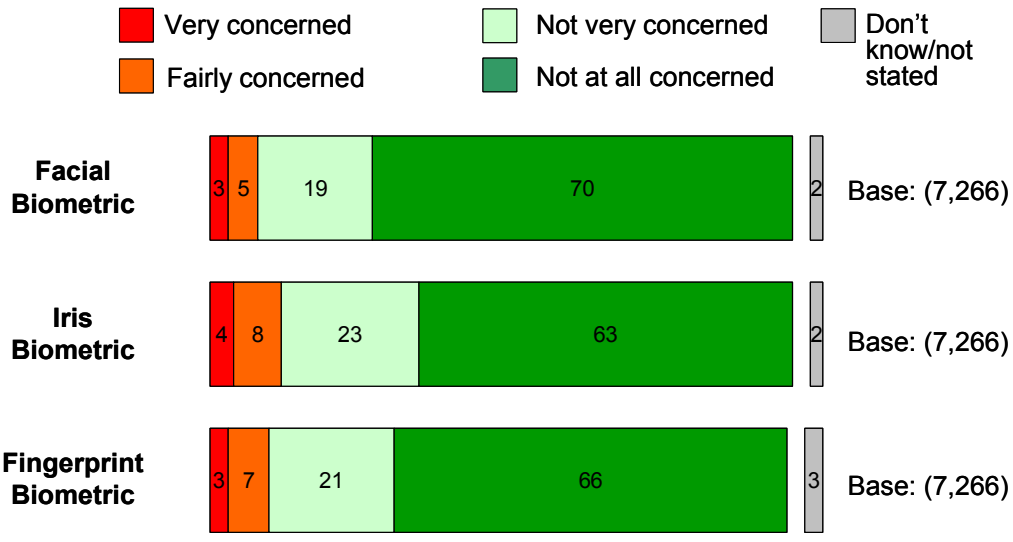
6.6 Participant Attitude – 'Before/After Concern' (Section 2: Q2 & Q8, Q10 & Q16, Q18 & Q24)

Before you took part in the Trial, how concerned were you about having your biometrics recorded?

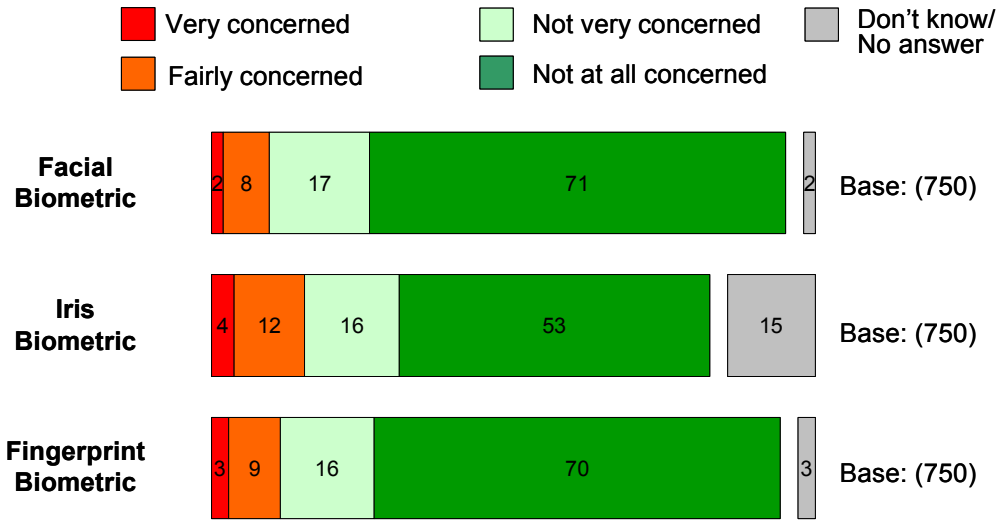
6.6.1 Quota Group Result



6.6.2 Opportunistic Group Result



6.6.3 Disabled Participant Result



The majority of participants in the Quota and Opportunistic groups were 'not very' or 'not at all' concerned about having their biometrics recorded prior to enrolment. There is a smaller proportion of those within the Opportunistic group who were 'not at all concerned' compared with the Quota group – although this difference has been taken up by those who stated they were 'not very concerned' as opposed to adding any further to those who were 'very / fairly' concerned. There is also no significant difference across the three biometrics, with the iris biometric having the slightly larger number of 'very' and 'fairly' concerned participants across both the Quota and Opportunistic groups.

Although, once again the majority of participants within the Disabled participant group are 'not very' or 'not at all' concerned, there were a greater number of participants who before the Trial were 'very' or 'fairly' concerned and once again this is most obvious for the iris biometric where 16% of participants felt 'very' or 'fairly' concerned.

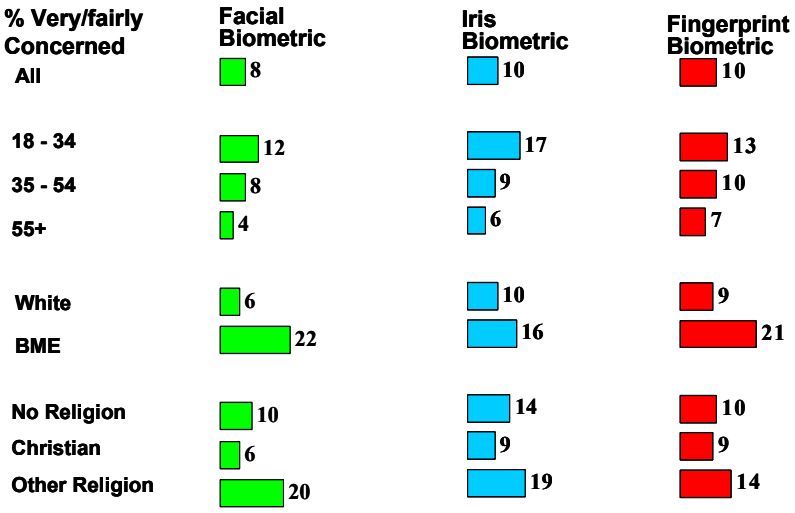
Key Observation
Whilst the majority of participants were 'not very' or 'not at all' concerned about having their biometrics recorded prior to enrolment there was more concern felt within the Disabled participant group and in particular for the iris biometric.

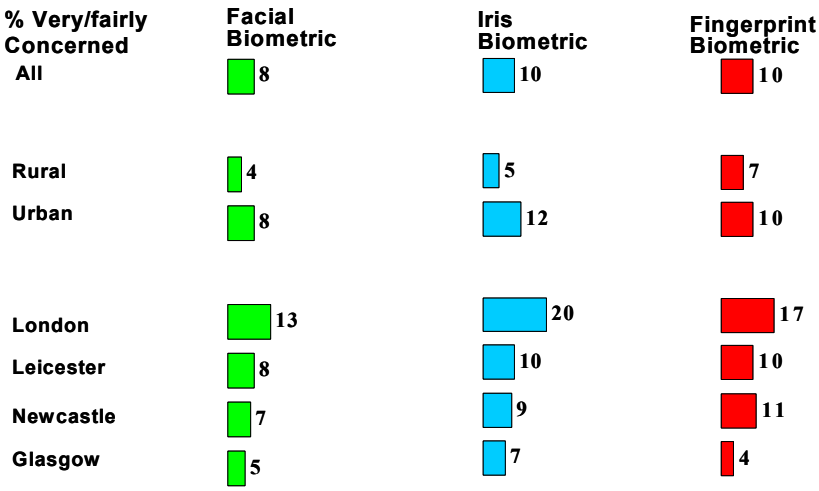
6.6.4 Further Analysis – Quota

The ***Quota analysis*** below takes a closer look at the greater than 10% or so of participants who were 'fairly' or 'very' ***concerned about having their biometrics recorded*** prior to enrolment. The first illustration below shows those concerned participants across age, ethnicity and religion and the second illustration shows the concerned participants across location.

In general the results show that the younger age groups, the BME sub-group and Other Religion (i.e. non Christian or No Religion) are the most likely to be concerned about having their biometrics recorded prior to participation. Also, the second illustration shows, in general, that London and urban participants are more concerned than Leicester, Newcastle and Glasgow and Rural participants. These results are similar across all three biometrics.

Key Observation
(Quota) The BME and the 18-54yr sub-groups were most concerned about having their biometrics recorded prior to enrolment.

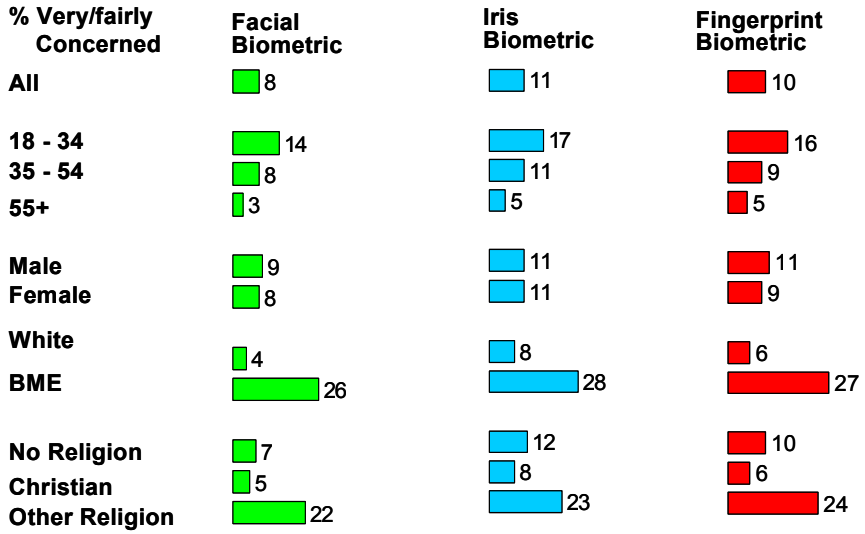


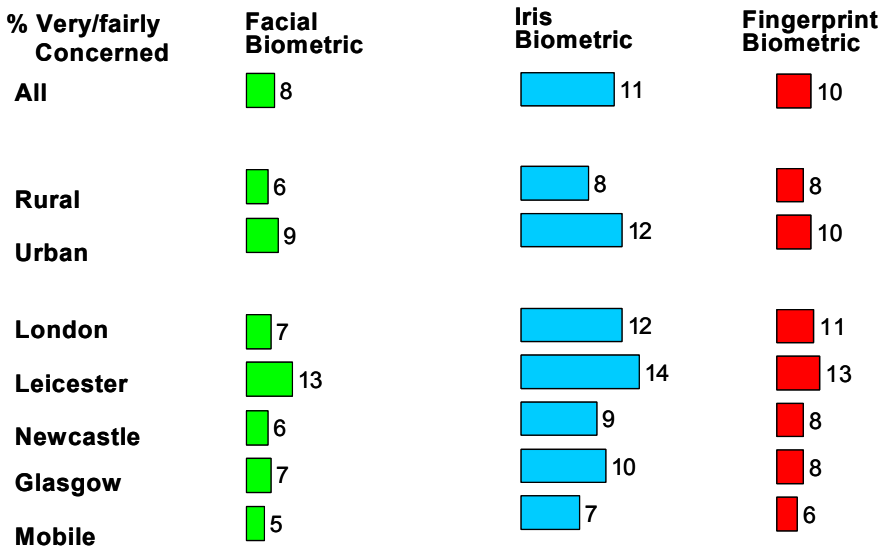


6.6.5 Further Analysis – Opportunistic

The ***Opportunistic analysis*** illustrations below take a closer look at the participants who were 'fairly' or 'very' ***concerned about having their biometrics recorded*** prior to enrolment and how they differ across age, ethnic and religious groups, location and gender.

The results show a number of sub-group based differences. It seems that the older participants showed less concern (scoring lowest for 'very /fairly' concerned) prior to Trial as Rural participants compared with Urban. The biggest differences were seen between the White / BME sub-groups and the No Religion / Christian / Other Religions with the latter sub-groups showing significantly more concern prior to having their biometrics enrolled.





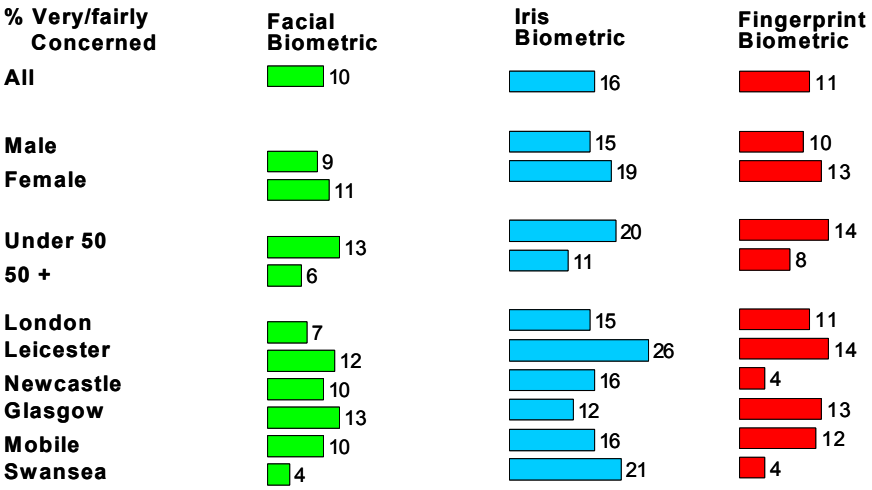
Key Observation

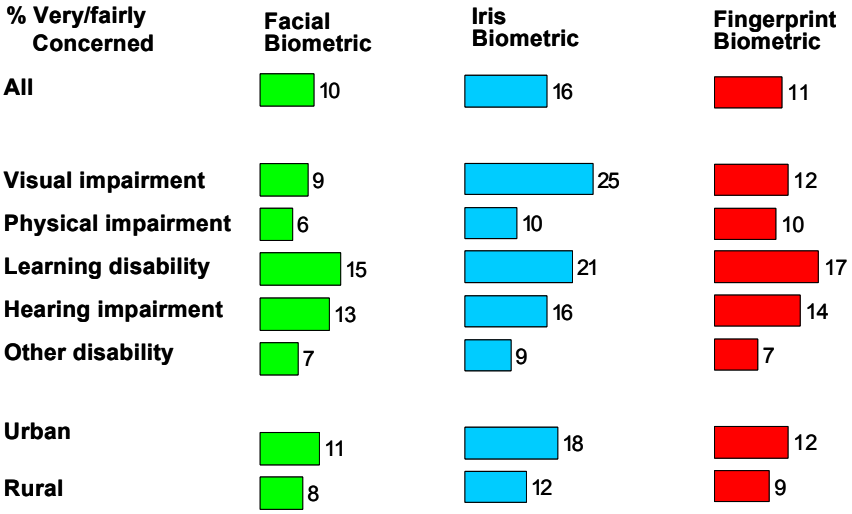
(Opportunistic) As with the Quota group those most concerned prior to biometric enrolment were the 18-54 yr old and the BME sub-groups. Participants of Other Religion also indicated significantly more concern than Christians or those of No Religion.

6.6.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** below shows how the participants who were 'very' or 'fairly' concerned about having their ***biometrics recorded prior to enrolment*** differs across gender, age, location and impairment type.

The results show that the under 50's were considerably more concerned than the over 50's across all three biometrics. Participants with visual, hearing or learning impairment types were significantly more likely to state that it was the iris biometric that they had most concern about prior to enrolment with, unsurprisingly, those participants who were visually impaired the most likely to register concern.

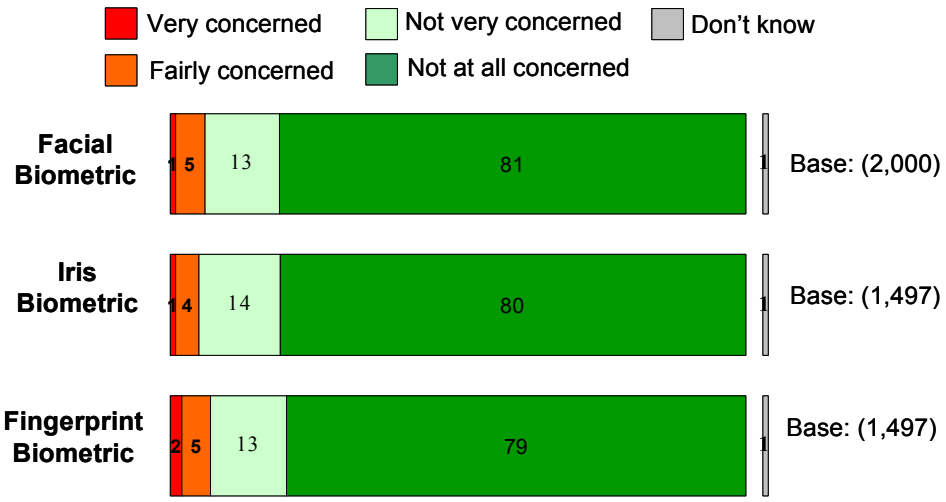




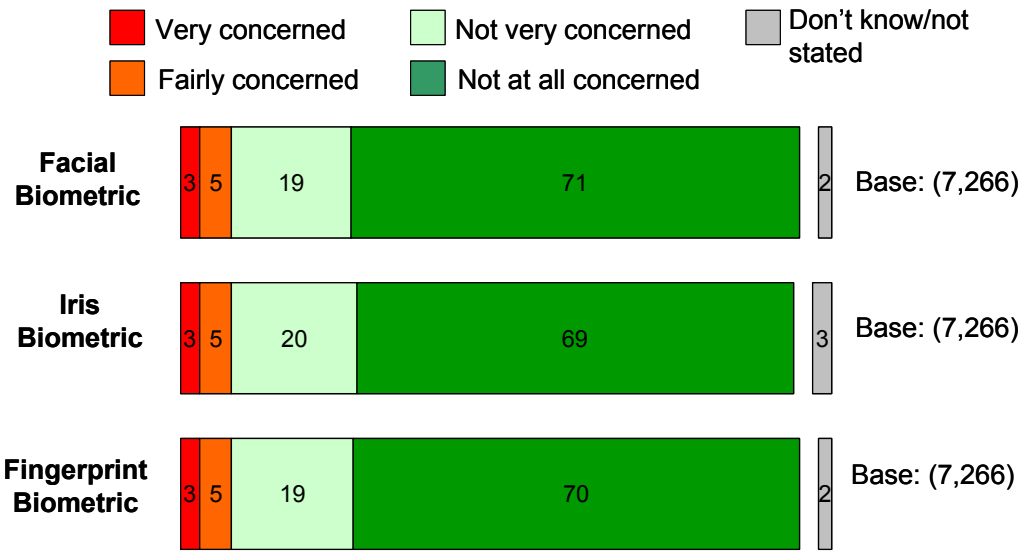
Key Observation
(Disabled) Prior to enrolment, of the four impairment types, participants with visual, learning or hearing impairments scored iris as the biometric they were most concerned about.

*Now having gone through the process, how concerned are you **now** about having your biometrics recorded?*

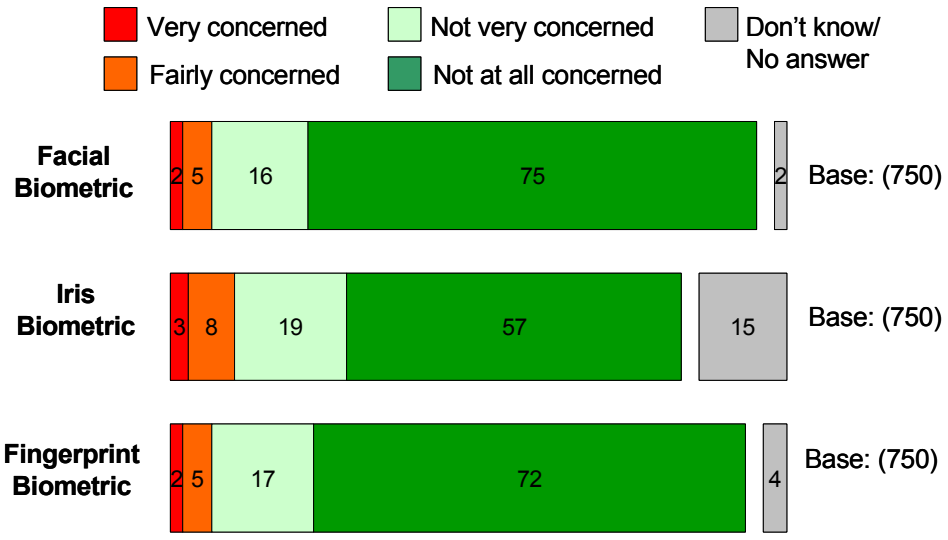
6.6.7 Quota Group Result



6.6.8 Opportunistic Group Result



6.6.9 Disabled Participant Result



Once again, the majority of participants across all groups, now having gone through the Trial, were 'not very' or 'not at all' concerned across all three biometrics.

Additionally, and encouragingly the total number of participants who were 'fairly' or 'very' concerned reduced after the Trial compared with prior to the Trial. This is true across all three biometrics and across all three groups (note those 'very concerned' regarding the facial or fingerprint biometric within the Opportunistic group remained consistent before and after the Trial).

This positive change in those concerned after the Trial is particularly encouraging within the Disabled participant group – although this could be due to the greater number of those 'very' and 'fairly' concerned pre-Trial in this group. Nevertheless those concerned about the iris biometric did drop from 16% to 11% pre / post Trial.

Key Observation
Across all three biometrics and all three groups, the total number of participants 'fairly' or 'very' concerned about having their biometrics recorded after enrolment dropped when compared with pre-enrolment.

6.6.10 Further Analysis – Quota

The ***Quota analysis*** below shows how ***participant concern to having their biometrics recorded having gone through the process*** differs across age, ethnicity and location.

The results show, as with attitudes prior to going through the process, that the BME sub-group and London based participants seem to have a higher level of concern compared with the White sub-group and non London participants respectively.

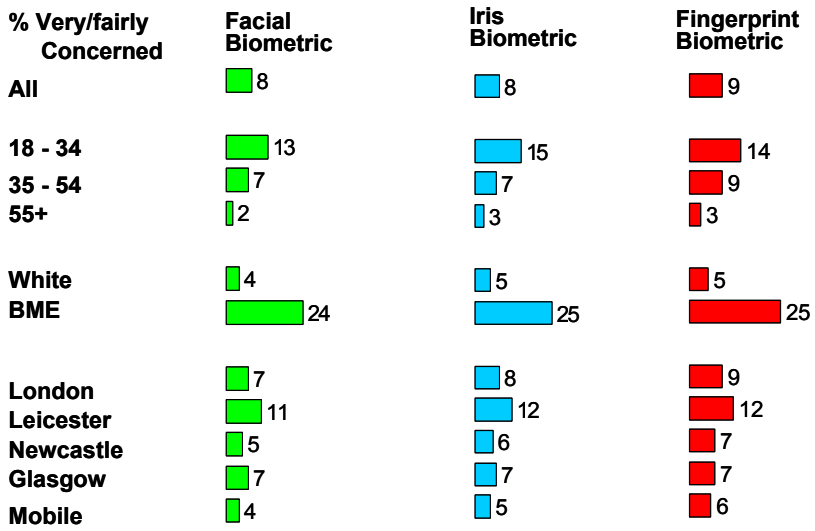
% Very/fairly Concerned	Facial Biometric	Iris Biometric	Fingerprint Biometric
All	5	5	7
18 - 34	8	8	9
35 - 54	6	5	8
55+	2	2	4
White	5	4	6
BME	14	12	16
London	10	8	14
Leicester	5	3	6
Newcastle	5	4	6
Glasgow	4	6	5

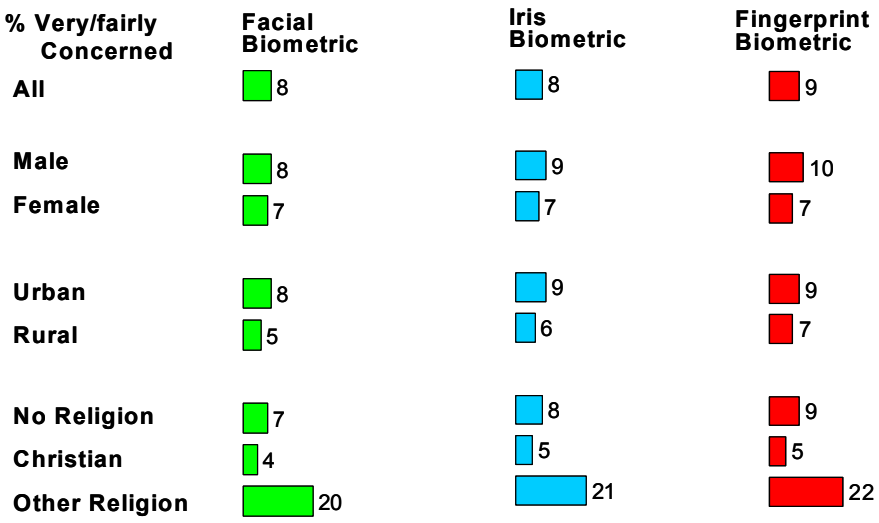
Key Observation
(Quota) Post enrolment, it is the BME sub-group and London participants who are most concerned about having their biometrics recorded.

6.6.11 Further Analysis – Opportunistic

The ***Opportunistic analysis*** below shows how ***participant concern to having their biometrics recorded having gone through the process*** differs across age, ethnic and religious groups, location and gender.

The 'level of concern' prior to enrolment results showed the highest levels of concern was felt amongst the 18-34 yr old, the BME and the 'Other Religion' sub-groups. Encouragingly, the results below show that each of these sub-groups are less 'very / fairly' concerned after they have had their biometrics enrolled; and this is true across each of the three biometrics. However the 'improvement' is only marginal and these three sub-groups continue to represent, comparatively, the most 'concerned' groups of people. Notably a quarter of the BME sub-group participants remain 'very / fairly' concerned.





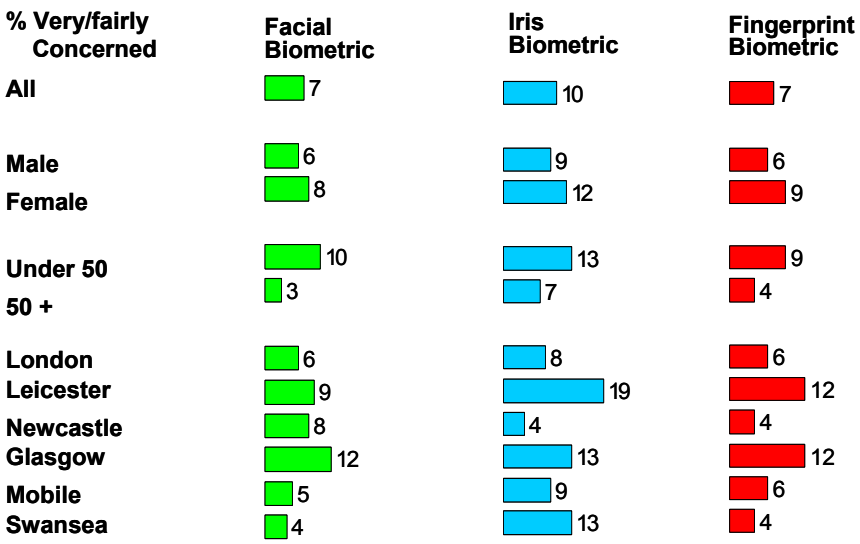
Key Observation

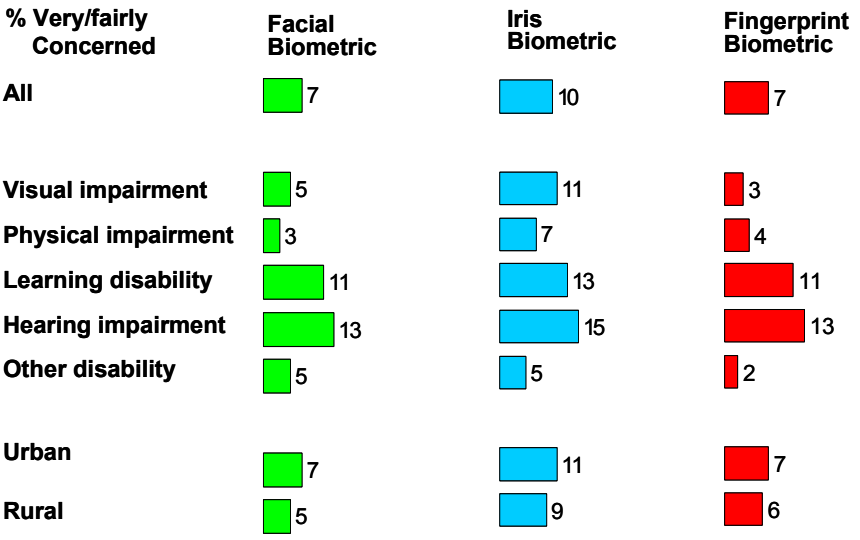
(Opportunistic) Post enrolment the 18-34 yr, the BME and the Other Religion sub-groups remain the most concerned about having their biometrics enrolled – with approximately one quarter of the BME sub-group remaining 'very / fairly' concerned.

6.6.12 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** below shows how participants who were 'very' or 'fairly' concerned about having their biometrics recorded after having gone through the process differs across gender, age, location and impairment type.

The results indicate, although not significantly so, that as with pre-enrolment, participants under 50 and participants based in Leicester remain the most concerned post Trial. Interestingly, when considering the impairment types, those who have either a learning disability or are hearing impaired continue to be, on average, highly concerned (particularly little change for those with a hearing impairment), however the level of concern amongst those with a visual impairment has dropped significantly, i.e. by 14% for the iris biometric and by 9% for the fingerprint biometric.





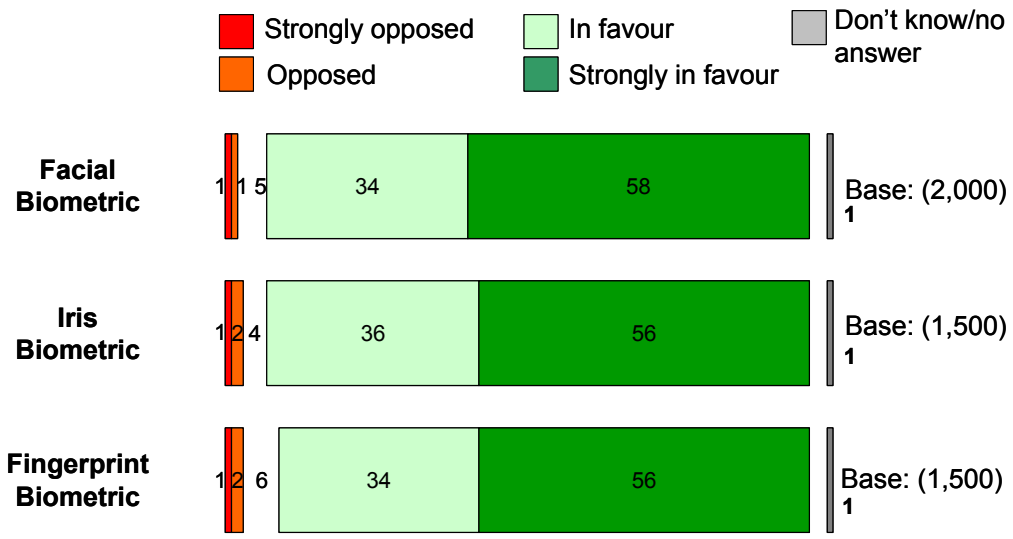
Key Observation

(Disabled) Post enrolment, the level of concern amongst those with a visual impairment has dropped most dramatically across the three biometrics when compared with pre-enrolment levels.

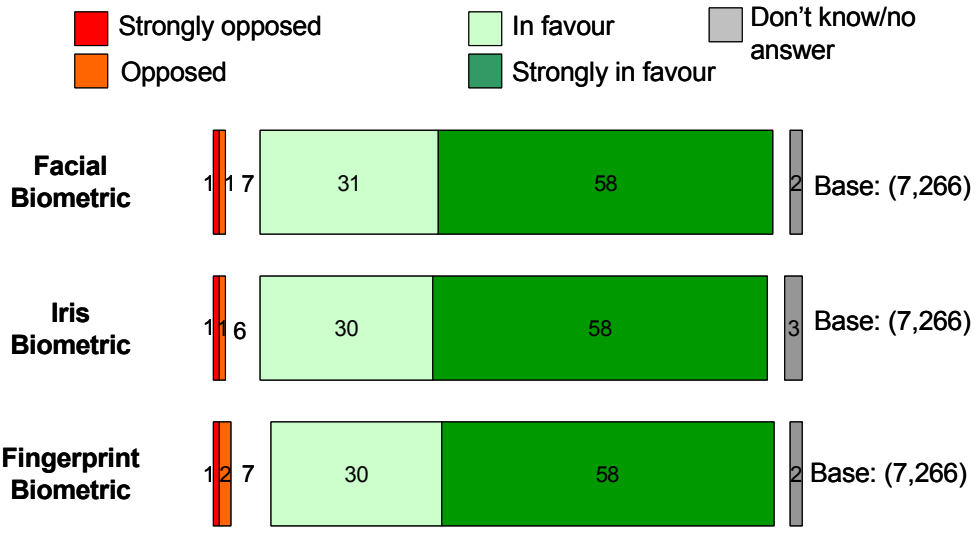
6.7 Participant Attitude – 'In Favour or Not' (Section 2: Q9, Q17, Q25)

Would you be in favour or opposed to biometric recognition being adopted as a means of establishing identity for passport purposes? Middle block refers to those who 'neither favour nor oppose'. Don't knows have been excluded. Figures given are in %.

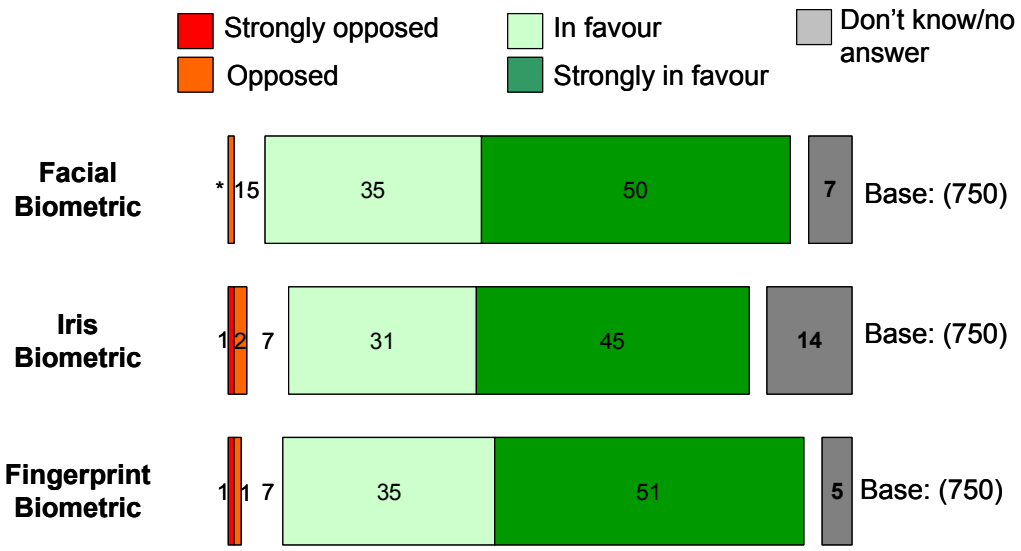
6.7.1 Quota Group Result



6.7.2 Opportunistic Group Result



6.7.3 Disabled Participant Result



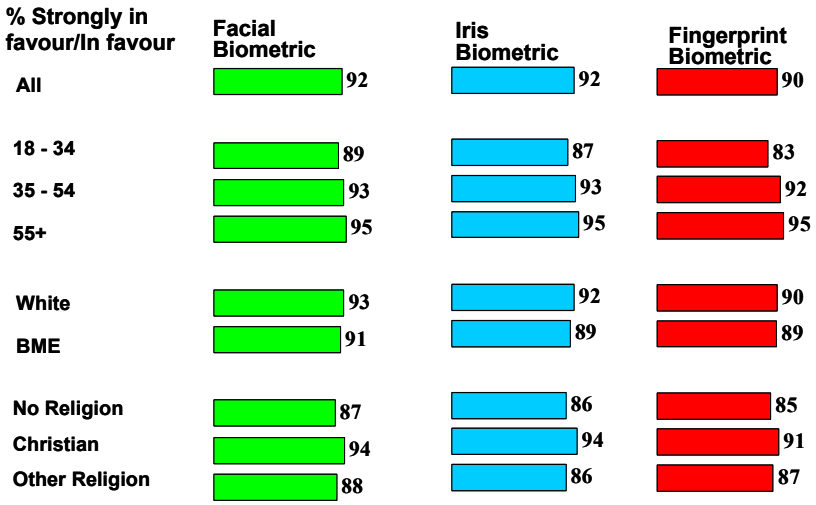
The results across both the Quota and Opportunistic groups and across the three biometrics are very similar and very positive. Within these two groups, almost 60% of respondents are 'strongly in favour' of biometric recognition being adopted as a means of identity for passport purposes with a further 30%+ 'in favour' of biometric adoption.

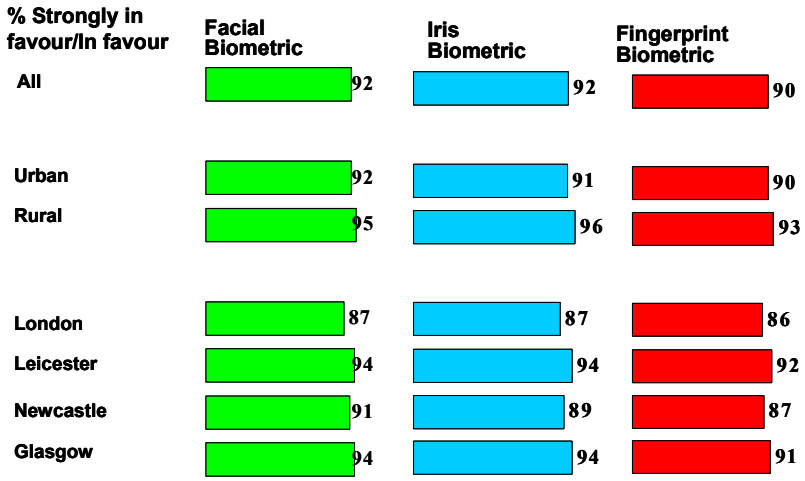
Within the Disabled participant group each biometric sees 45%+ of participants 'strongly in favour' of the adoption of biometrics, with another approx 30%+ being 'in favour'. A very small percentage of participants in any of the three groups are opposed to the use of biometric identification in passports.

Key Observation
Across the Quota, Opportunistic and Disabled participant groups and each of the three biometrics, over 80% of participants were in favour (45%+ strongly) of the adoption of biometrics as a means of passport identification. (The only exception being Disabled participant group / iris biometric where 77% were in favour).

6.7.4 Further Analysis – Quota

The ***Quota analysis*** below shows how ***participant attitudes to biometric recognition being adopted for passport purposes*** differs across age, ethnicity and religion (first illustration) and across location (second illustration). The results show high numbers of participants across all sub-groups being 'in favour' or 'strongly in favour' of biometric passport adoption with the only comparatively lower numbers being seen in the younger age group (18-34) and London based participants.



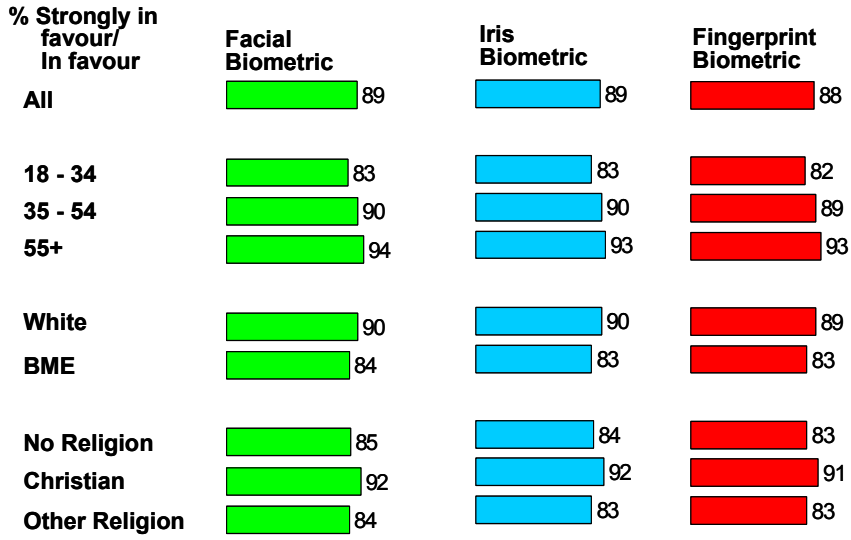


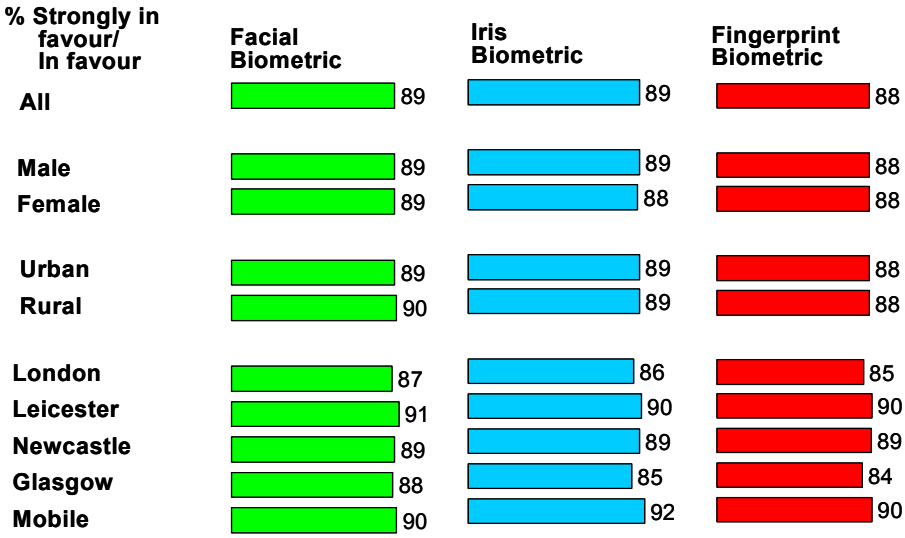
Key Observation
(Quota) When comparing all sub-groups, the youngest age sub-group (18-34yr) and London participants have a slightly lower number of participants who are 'strongly in / in favour' of the use of biometrics for passport identity – although numbers are still high.

6.7.5 Further Analysis – Opportunistic

The ***Opportunistic analysis*** below shows how ***participant attitudes to biometric recognition being adopted for passport purposes*** differs across age, ethnic and religious groups, location and gender.

As with the main question aggregated results, all results are very positive with no sub-group scoring below 80% for the combined 'Strongly in / In' favour response to the use of biometrics in passports. There are consistent sub-group differences with the 18-34yr olds scoring 5%+ points lower than 35-54yr olds and 10%+ points lower than 55+yr olds across all three biometrics; the BME sub-group scores 5%+ lower than the White sub-group across all biometrics and Christians score 7%+ higher than either the 'No Religion' or 'Other Religion' sub-groups across all three biometrics.
Whilst this indicates that the 18-34yr old, the BME and the No / Other Religion (i.e. non-Christian) sub-groups are less enthusiastic about the use of biometrics, it is worth reiterating that these respective sub-groups, as stated above, do still score 80%+ for being 'Strongly in / In' favour.





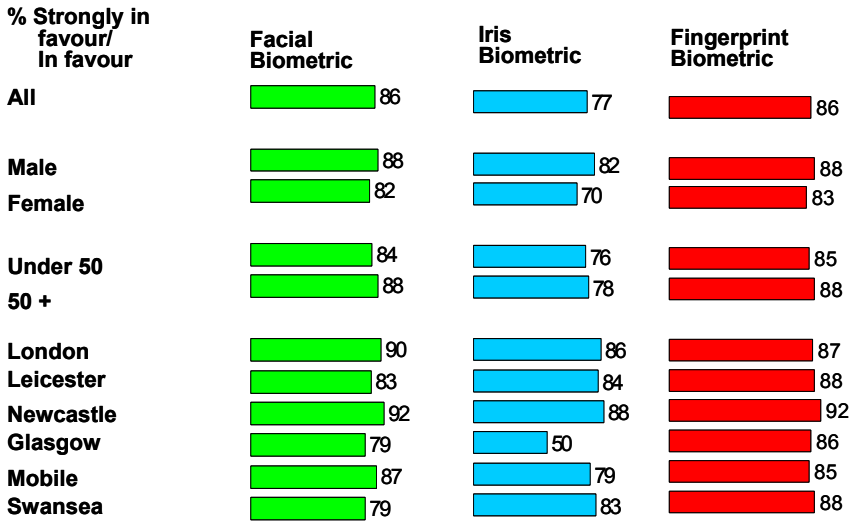
Key Observation

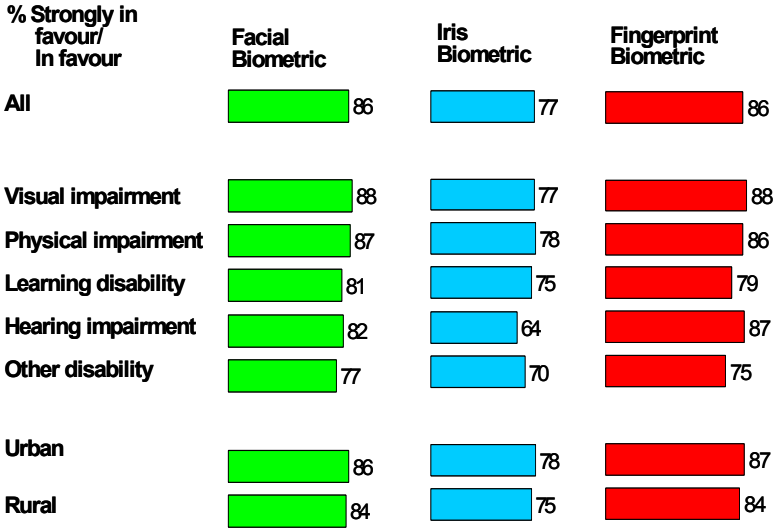
(Opportunistic) All sub-groups score 80%+ 'strongly in / in' favour of the use of biometrics as a means of passport identification.

6.7.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** below shows how participants who are 'strongly in favour' or 'in favour' to biometric recognition being adopted for passport purposes differ across gender, age, location and impairment type.

The results show that nearly all sub-groups presented have a 70%+ scoring 'strongly in / in favour' to the use of passport biometric identification with the only two exceptions being Glasgow participants (50%) and hearing impaired participants' (64%) attitude to the iris biometric.





Key Observation

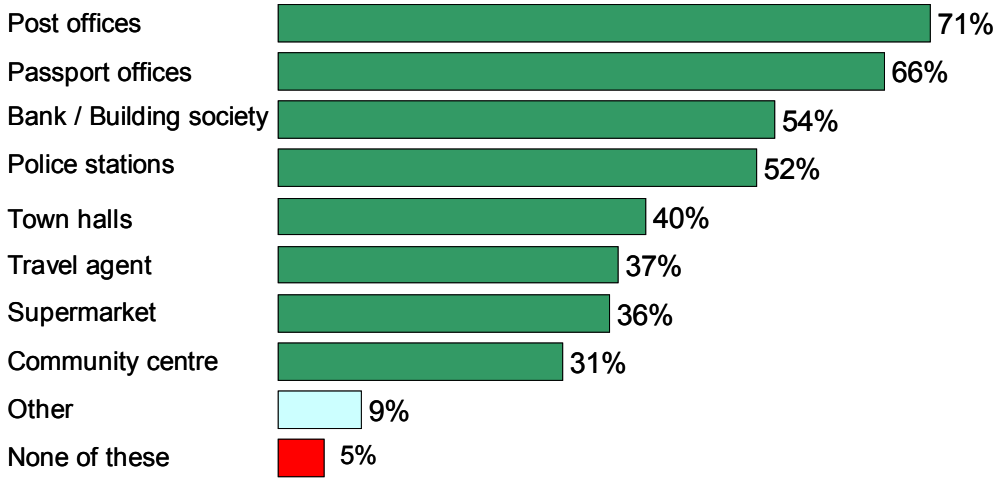
(Disabled) Participants with three of the four impairment types, visual and hearing impaired and learning disability, opted for the fingerprint biometric as their first choice process preference.

6.8 Participant Attitude – 'Type of Location' (Section 3: Q30)

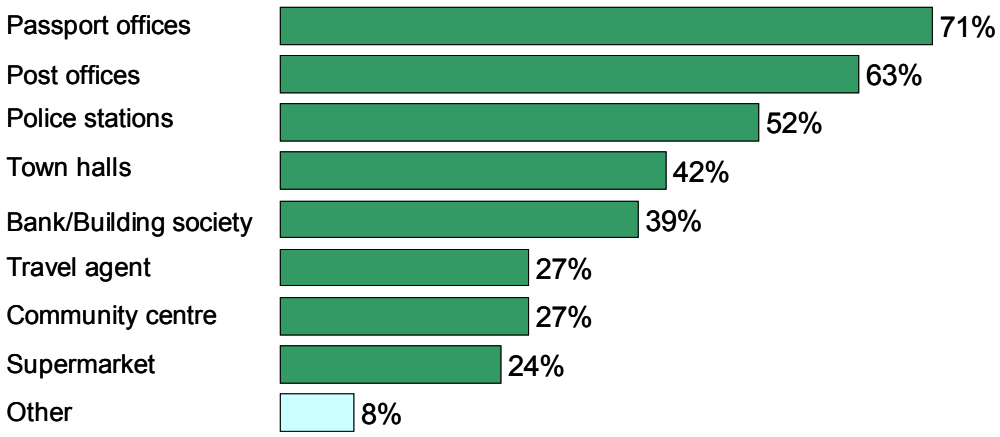
Which of these types of locations, if any, do you feel would be suitable for biometric passport enrolment in the way that you have just done?

6.8.1 Quota Group Result

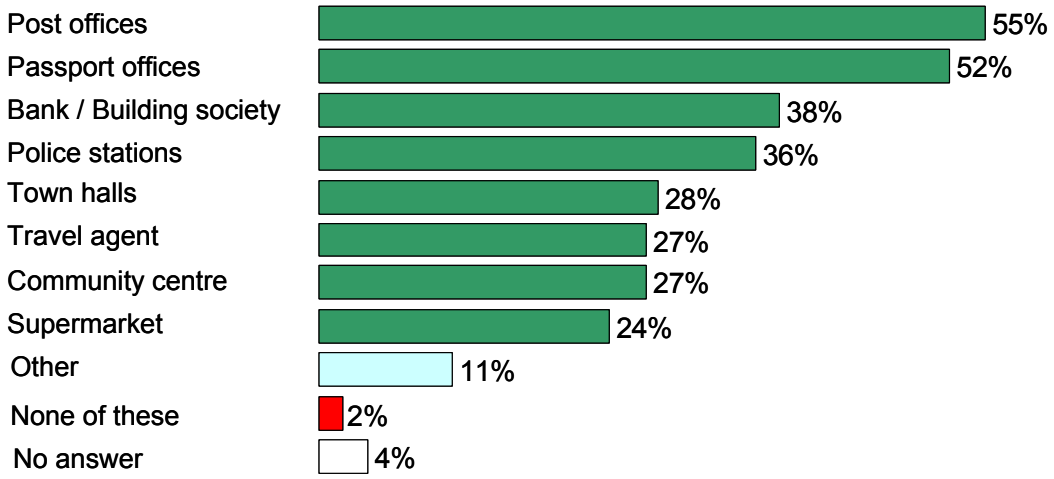
Base: All verified Quota sample (1,944). Participants were able to choose more than one location.



6.8.2 Opportunistic Group Result



6.8.3 Disabled Participant Result



The top four most suitable locations, according to the Quota group, are the 'official' public institution type locations – post offices and passport offices, followed by banks and police stations. These are also the top four preferred locations for the Disabled participant group. The Opportunistic group also has a similar top four with the only exception of Town Halls replacing Banks / Building Societies. A passport office and a major post office were two of the fixed enrolment sites and these two location types share the two top places across each of the three groups.

Across the Quota, Opportunistic and Disabled participant groups the lowest scores were given to general 'open spaced' public areas, i.e. community centres and supermarkets.

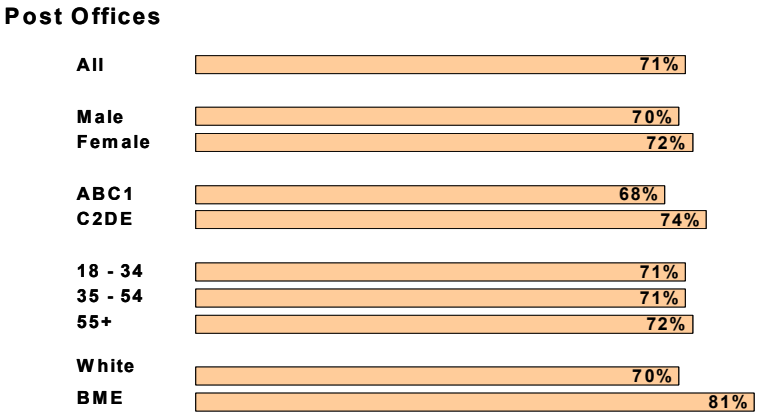
Key Observation
Quota, Opportunistic and Disabled participants prefer 'official' type buildings (e.g. passport offices, post offices) as the most suitable locations for passport biometric enrolment.

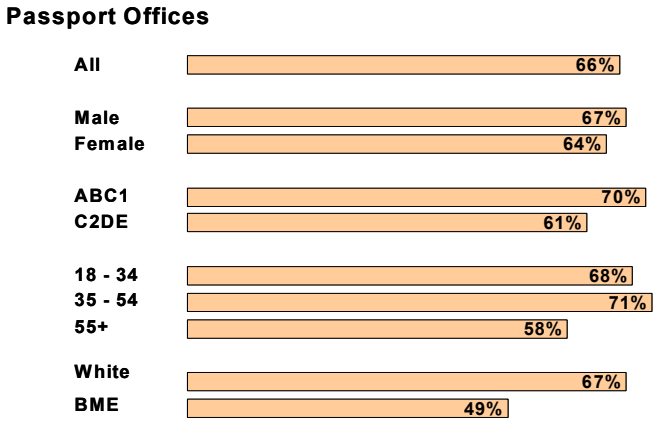
6.8.4 Further Analysis – Quota

Given that three of the more popular responses have been **Post Offices**, **Passport Offices** and **Police Stations**, the Quota breakdown of these locations are given below across gender, social grouping, age and ethnicity.

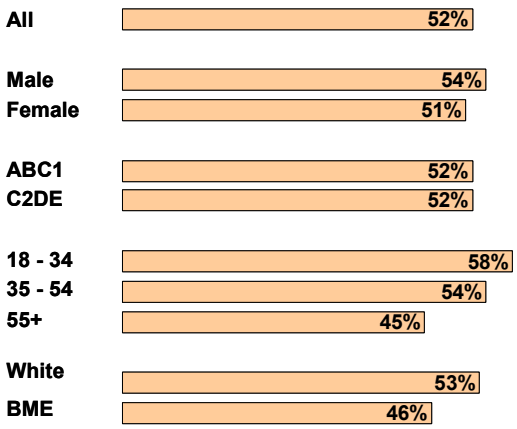
The base for all the location charts below is the verified Quota sample. It should be remembered that participants in answering the preferred location question were able to tick as many locations as desired – this should be considered when looking at all of the breakdowns below, as certain sub-groups may have felt more inclined to tick several locations and thus look to prefer certain locations far stronger than their immediate sub-group comparison.

It can be seen that the BME and C2DE sub-groups have a strong preference for post offices, compared with the White and ABC1 sub-groups respectively – which in turn have a far stronger preference for passport offices. Police stations are also preferred by the White sub-group compared with BME participants, and police stations are less favoured by 55+ yr olds compared with the younger age groups.





Police Stations



Key Observation
(Quota) In considering favoured locations for biometric enrolment, post offices are favoured by the BME and the C2DE sub-groups when compared with the White and ABC1 sub-groups who prefer passport offices. Police stations are more favoured by the 18-54 year age group when compared with the over 54 year olds. Similarly more males than females favour police stations.

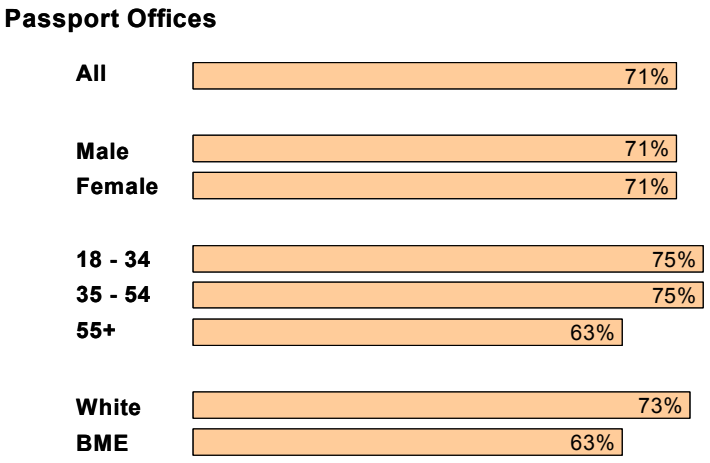
6.8.5 Further Analysis – Opportunistic

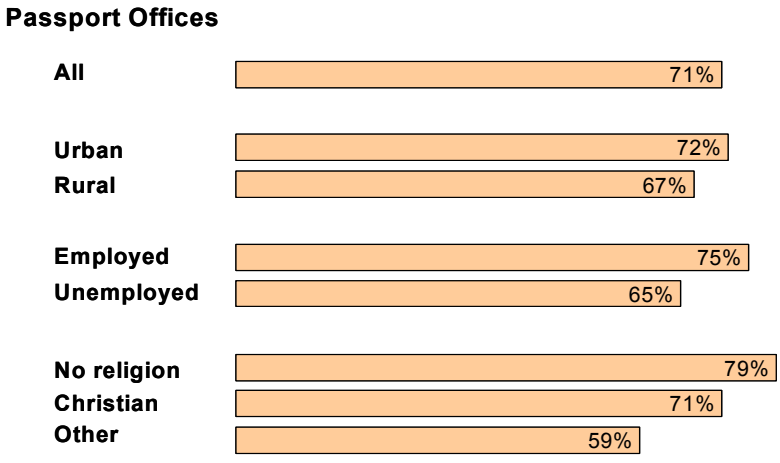
The top three location scores within the Opportunistic group were given to **Passport Offices**, **Post Offices** and **Police Stations**, the breakdown of these locations are given below across age, ethnic and religious groups, location and gender. It should be noted that of the 7266 Opportunistic respondents, the two most popular sites were Leicester (2,281 respondents) and London (1,597 respondents) which were a post office and passport office respectively.

With the aforementioned locations being the top overall scored, in general most of the individual sub-groups also score them highly. It is worth, however, comparing the sub-groups, and the results show the least enthusiastic sub-groups for the top location - passport offices - are 55+yr olds (compared with the younger age sub-groups), the BME sub-group (compared with White), those of 'Other Religion' (compared with Christians / No Religion) and the Unemployed (compared with the Employed).

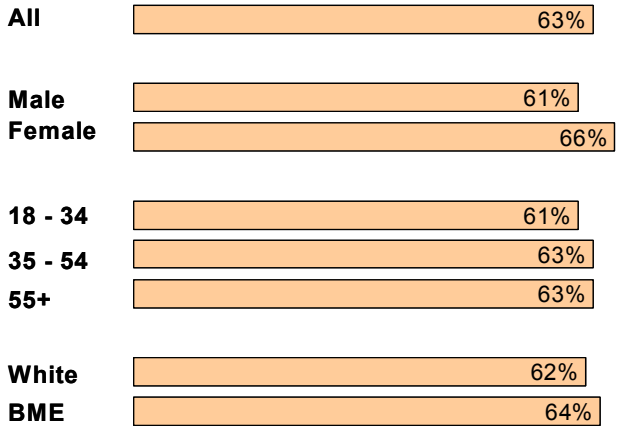
The comparisons for the second most popular location – post offices – almost reversed those mentioned above. Post offices were more favoured by the Unemployed (compared with the employed), by participants of Other Religion (compared with Christians / No Religion), by 55+ yr olds (compared with younger participants) and by the BME sub-group (compared with White). Although it should be pointed out that some of the sub-group comparison differences are not significant.

As for police stations, despite being the third most popular choice, there are sub-groups with a sub 50% scoring. Only 37% of the BME sub-group nominated police stations, compared with 56% of the White sub-group and only 36% of the Other Religion sub-group compared with No Religion (57%) and Christians (55%).

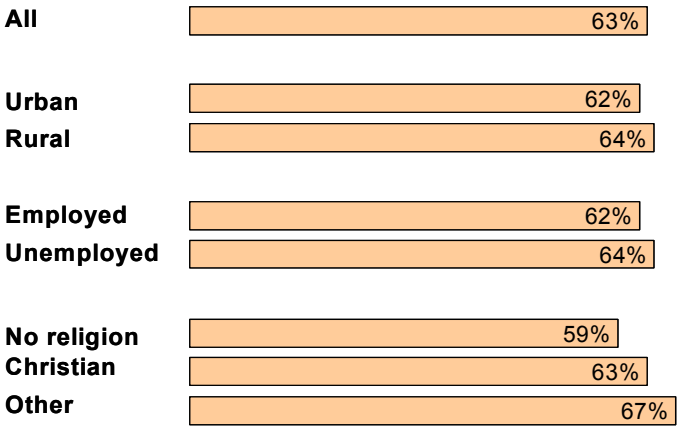




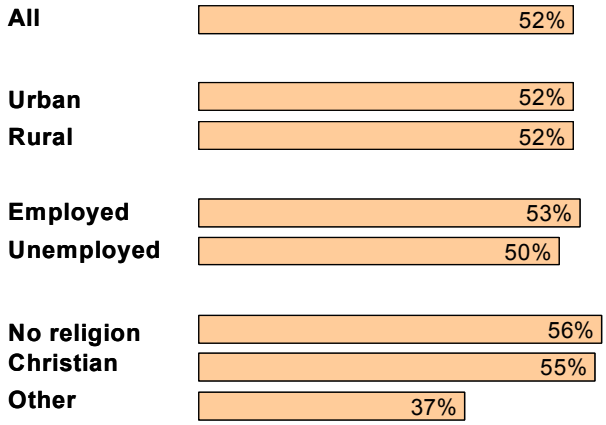
Post Offices



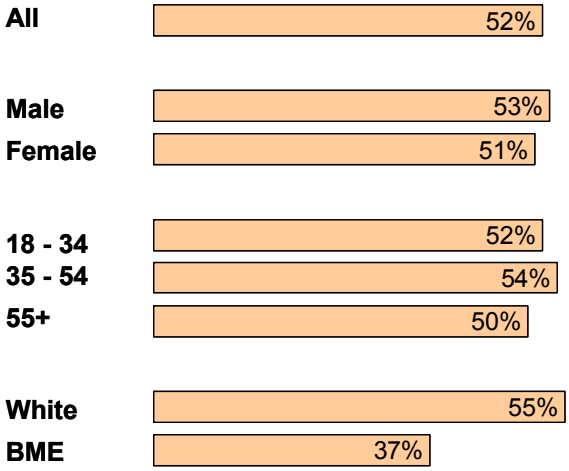
Post Offices



Police Stations



Police Stations



Key Observation

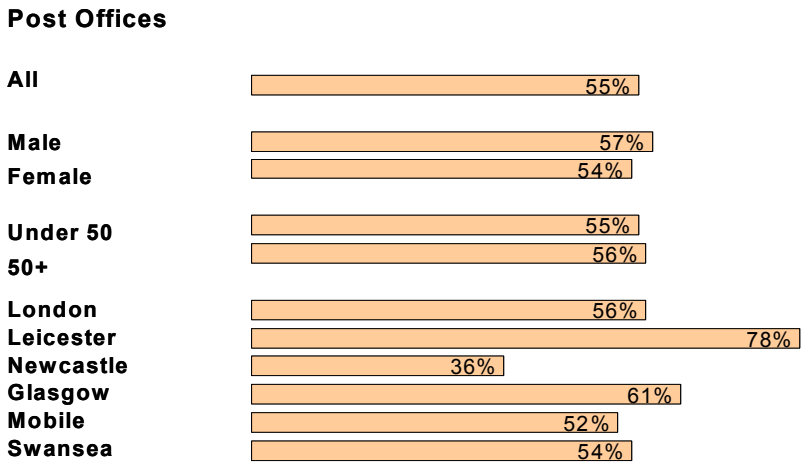
(Opportunistic) The White and No Religion / Christian sub-groups prefer passport offices and police stations compared with the BME and Other Religion sub-groups respectively. These sub-group preferences are reversed for post offices.

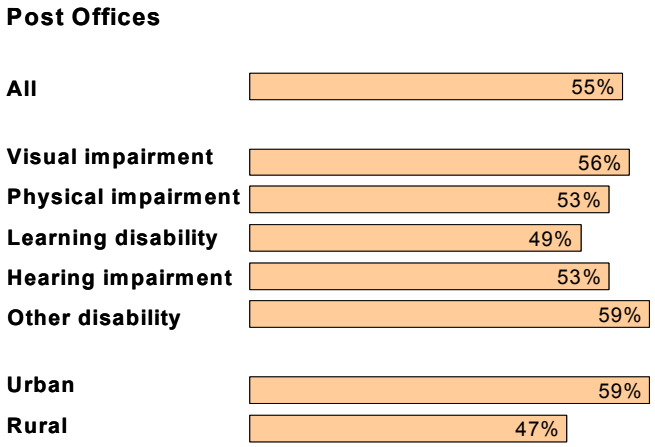
6.8.6 Further Analysis – Disabled Participants

The ***Disabled participant analysis*** below shows how participant attitudes to the top three location scorers within the Disabled participant group – **post offices, passport offices** and **banks/building societies** differs across gender, age, location and impairment type.

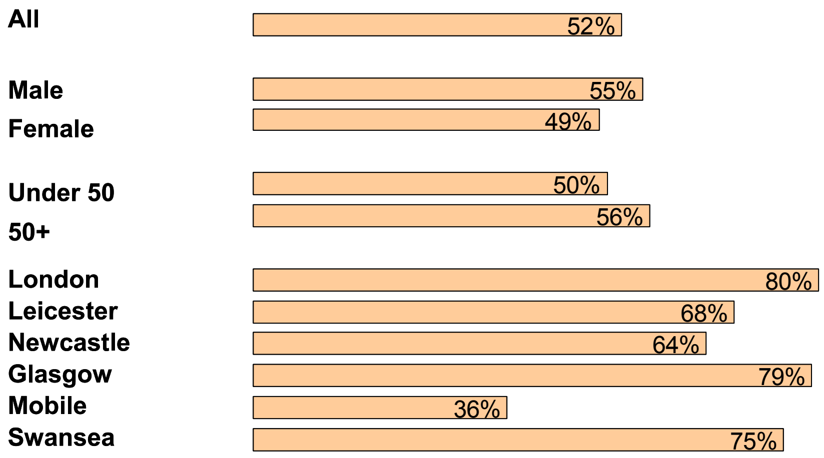
The results below show that post offices were most favoured by Leicester participants or participants with a visual impairment (excluding 'other disability') and least by Newcastle participants. Passport offices were most favoured by London and Glasgow participants and those with a hearing impairment; they were least favoured by Mobile participants and those with a learning disability.

Banks were mostly favoured by Glasgow (and Swansea) participants and those with a hearing impairment and least by Newcastle participants, those with a learning disability and those residing in Rural areas.

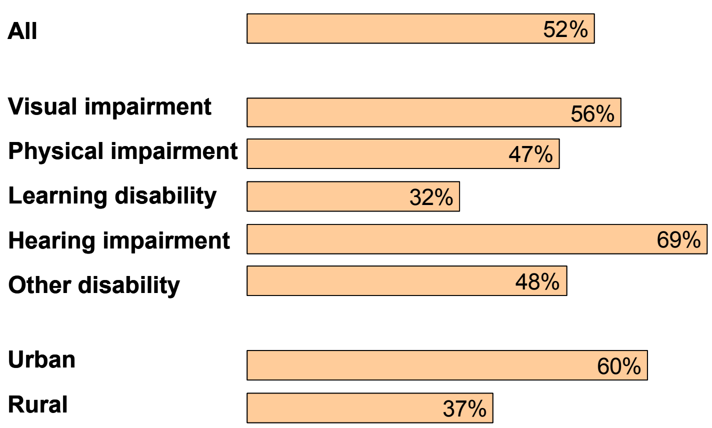


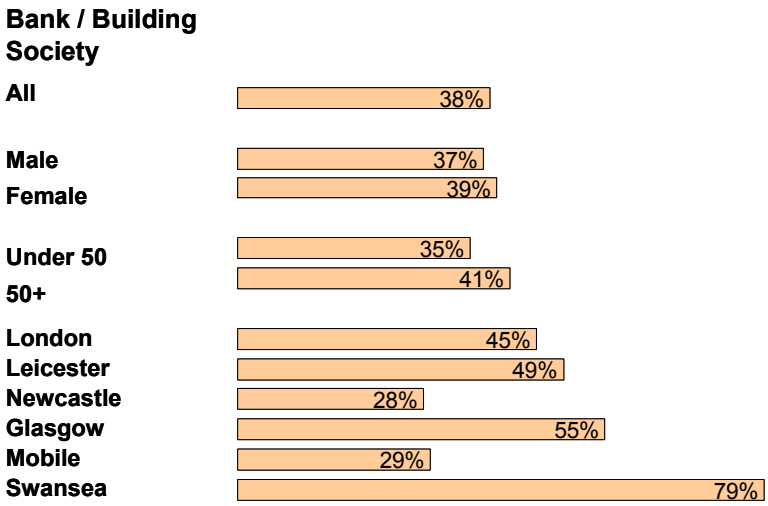


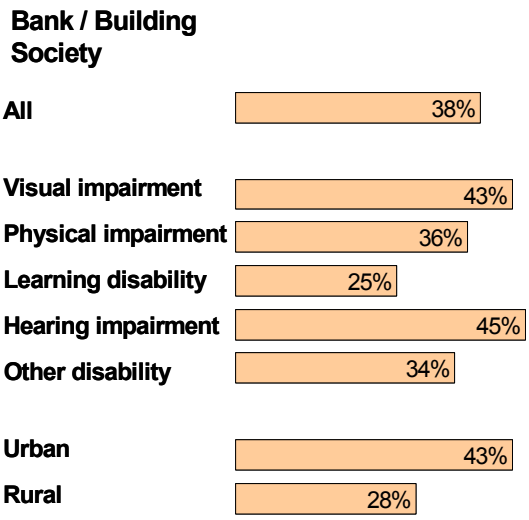
Passport Offices



Passport Offices







Key Observation

(Disabled) Those with a learning disability showed the least inclination for preferring any of the top three locations (post offices, passport offices, banks).

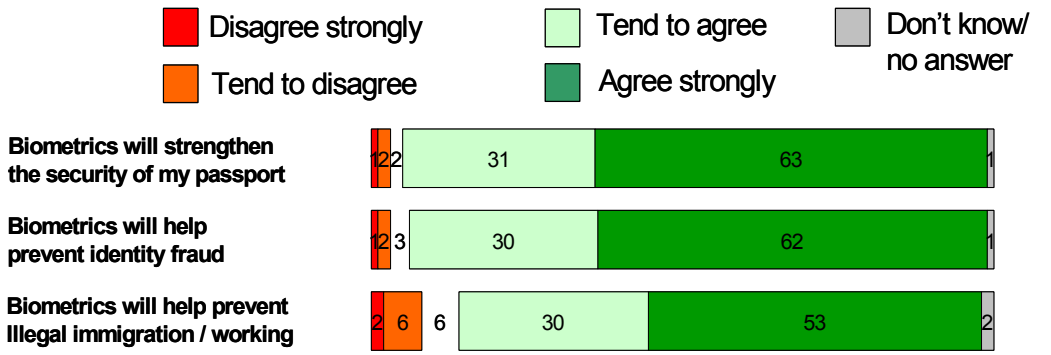
6.9 Participant Attitude – 'Views on biometrics' (Section 3: Q31)

For each of the following statements, please indicate the extent to which you agree or disagree

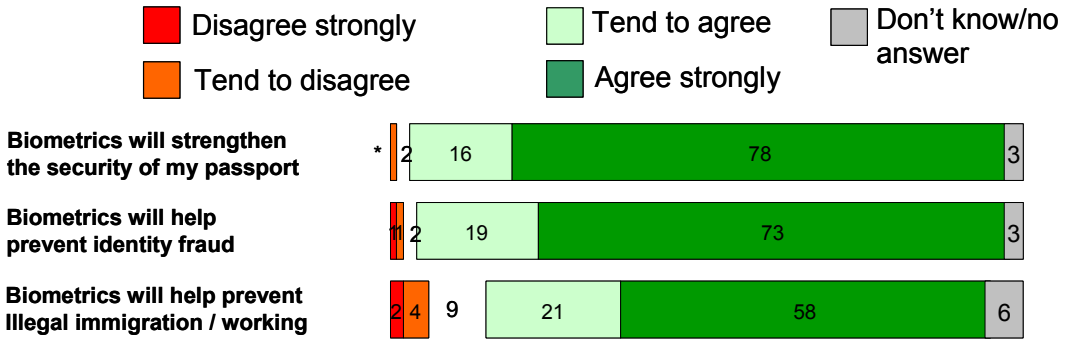
Middle block refers to those who 'neither favour nor oppose'. Figures given are percentages

This main question is made up of six 'sub-questions' or statements, and whilst all six sub questions were seen by participants as part of one overall question the results are presented below in two parts. Part I, the first three sub questions, show that those who 'agreed' with the statement have an assumed 'leaning' towards the concept of biometrics. Part II presents the second three sub-questions which suggest that those who 'disagreed' with the statement have an assumed leaning towards biometrics. Importantly, the assumptions in both part I and II should be noted, i.e. it is assumed that participants who "do not believe biometrics are a civil liberties infringement" or who "are not concerned about the secure storage of biometric information" do have a leaning towards biometrics – and this may not necessarily be true.

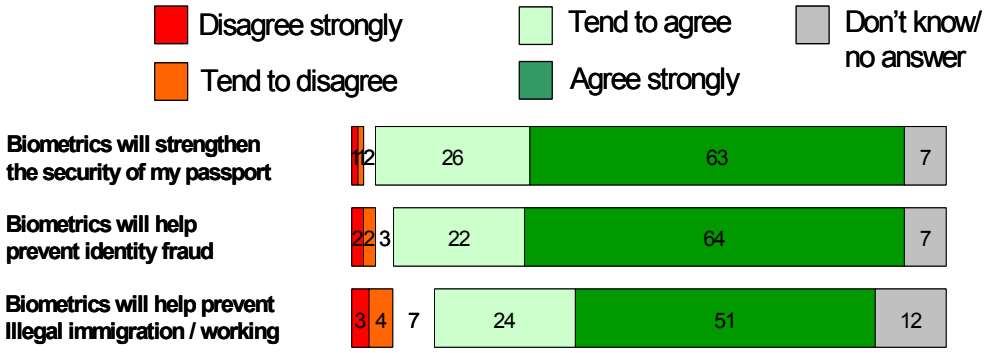
6.9.1 Quota Group Result (part I)



6.9.2 Opportunistic Group Result (part I)

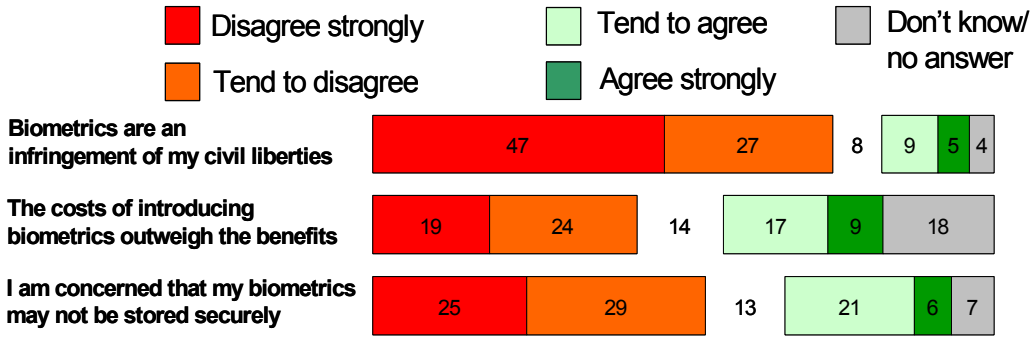


6.9.3 Disabled Participant Result (part I)

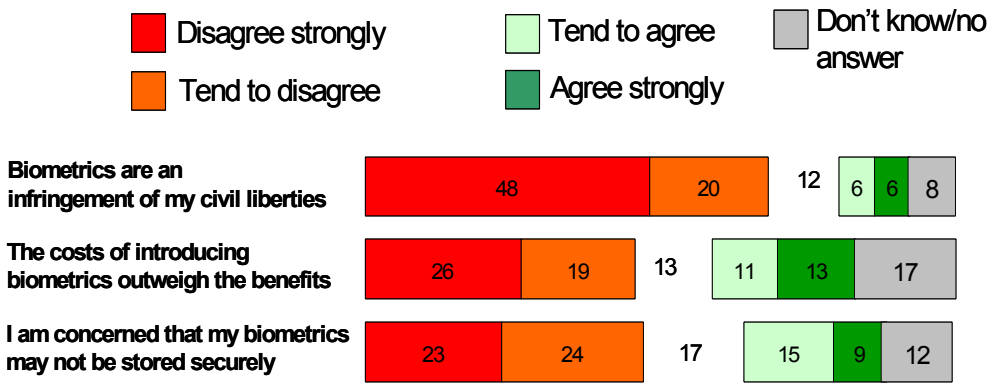


The results across the Quota, Opportunistic and Disabled participant groups follow a similar pattern and are encouraging, with all question scores tending toward a positive attitude regarding the concept of biometrics. In all three groups, a majority of participants strongly agree biometrics will strengthen passport security, help prevent identity fraud and help prevent illegal immigration. Very few participants in any of the three groups disagree with any of the above three statements, although a notable number (12%) of the Disabled participant group 'didn't know / no answer' as to whether biometrics would help prevent illegal immigration / working.

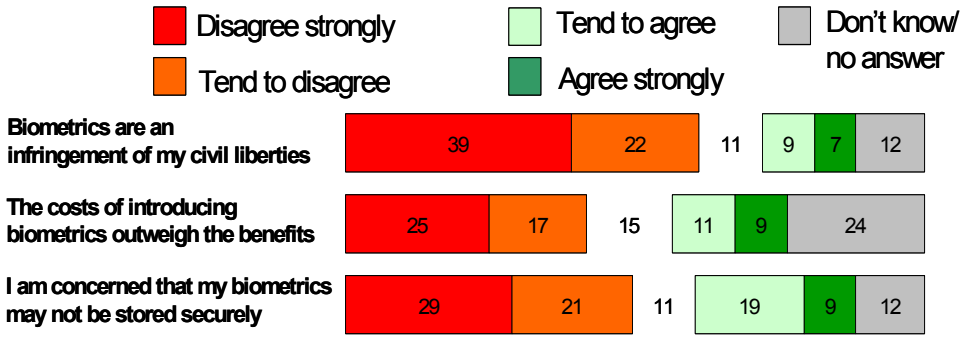
6.9.4 Quota Group Result (part II)



6.9.5 Opportunistic Group Result (part II)



6.9.6 Disabled Participant Result (part II)



The majority of participants in all three groups, i.e. 74% of the Quota group, 68% of the Opportunistic group and 61% of the Disabled participant group do not believe that biometrics are an infringement on their civil liberties. About a quarter of people in the Quota and Opportunistic groups and about one fifth of the Disabled participants believe the costs of introducing biometrics will outweigh the benefits. A little over a quarter, in the Quota and Disabled participant groups and approx a quarter in the Opportunistic group are concerned that their biometric information may not be stored securely – but about half of all participants seem comfortable with the storage security.

The two areas, costs versus benefits and storage of biometrics, do, however, also have a significant number of 'neither favour nor oppose' / 'don't know' / 'no answer' responses. They are the only two areas where less than half of the Opportunistic participants scored 'positively' (towards biometrics) and some 32%, 30% and 39% of the Quota, Opportunistic

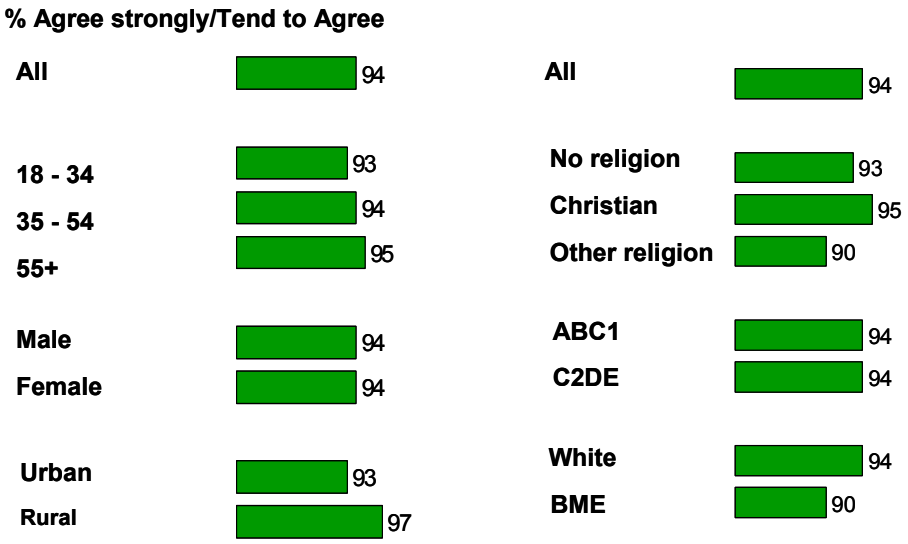
and Disabled participant groups respectively neither agreed or disagreed as to whether costs would outweigh benefits. This all suggests that targeted information on benefits and security would help future participants become more informed.

Key Observation
The majority of participants, in the Quota, Opportunistic and Disabled groups, strongly agree biometrics will help with passport security, preventing identity fraud, preventing illegal immigration and are not an infringement on their civil liberties.

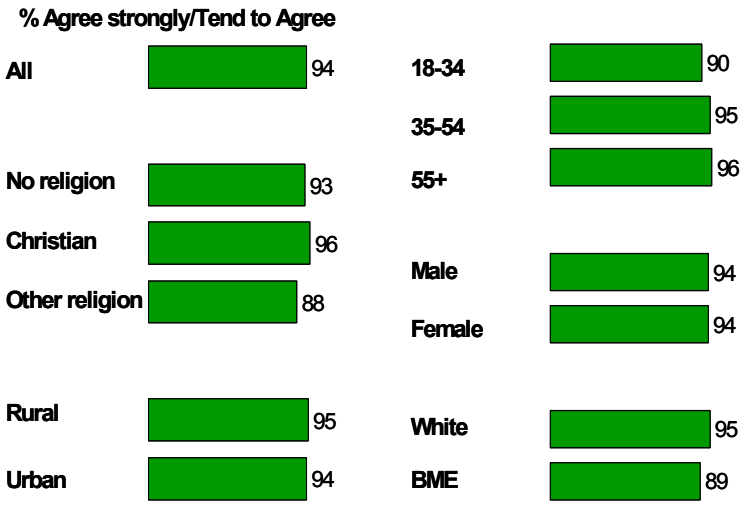
6.9.7 Further Analysis – Quota, Opportunistic & Disabled Participants

The ***further analysis*** below breaks down each of the individual questions which make up question 31. The **Quota** group breakdown is followed by the **Opportunistic** group breakdown, which is then followed by the **Disabled participant group** breakdown per question.

"Biometrics will strengthen the security of my passport" – Quota Sample

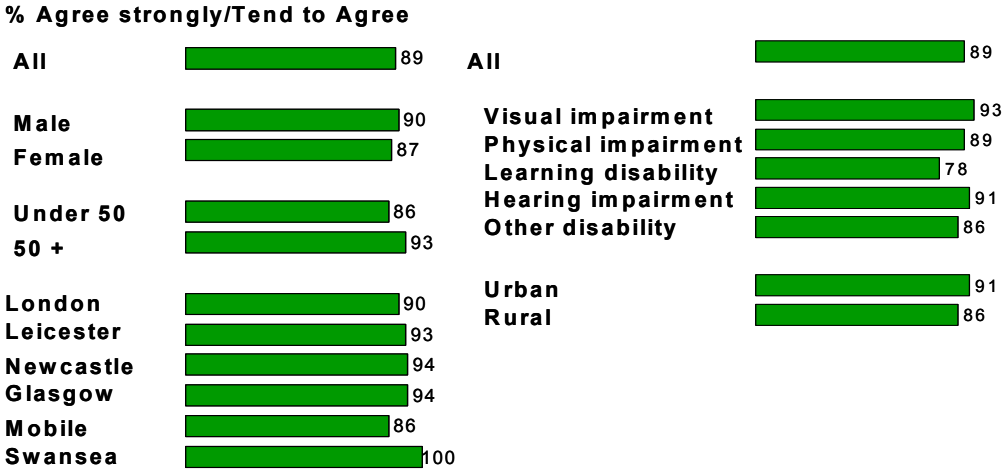


"Biometrics will strengthen the security of my passport" – Opportunistic Sample



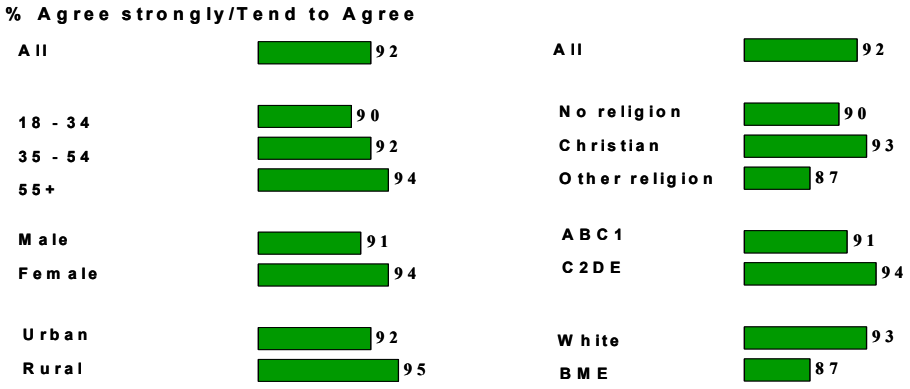
Key Observation
(Opportunistic) All sub-groups score highly for believing biometrics will strengthen passport security.

"Biometrics will strengthen the security of my passport" – Disabled Participants



Key Observation
(Disabled) All sub-groups score high in believing biometrics will strengthen passport security, the only slight dip being amongst those with a learning disability (78%).

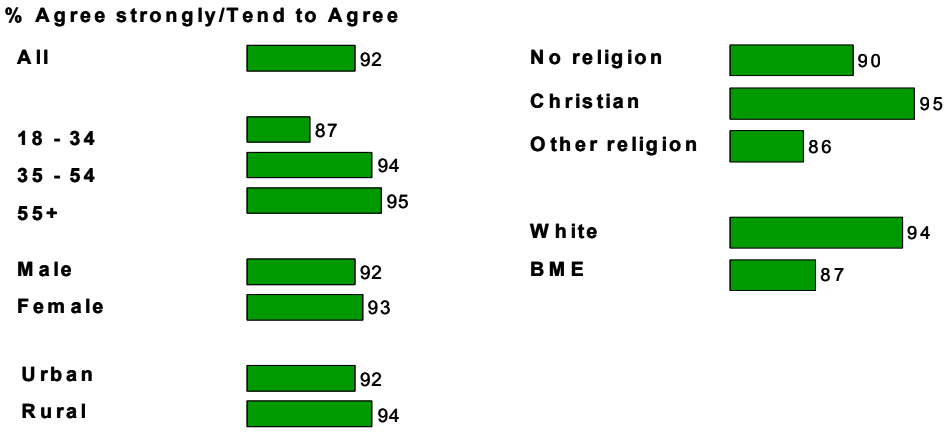
"Biometrics will help prevent identity fraud" – Quota Sample



Key Observation

(Quota) A greater number of participants from the White sub-group believe biometrics will help prevent identity fraud compared with participants from the BME sub-group.

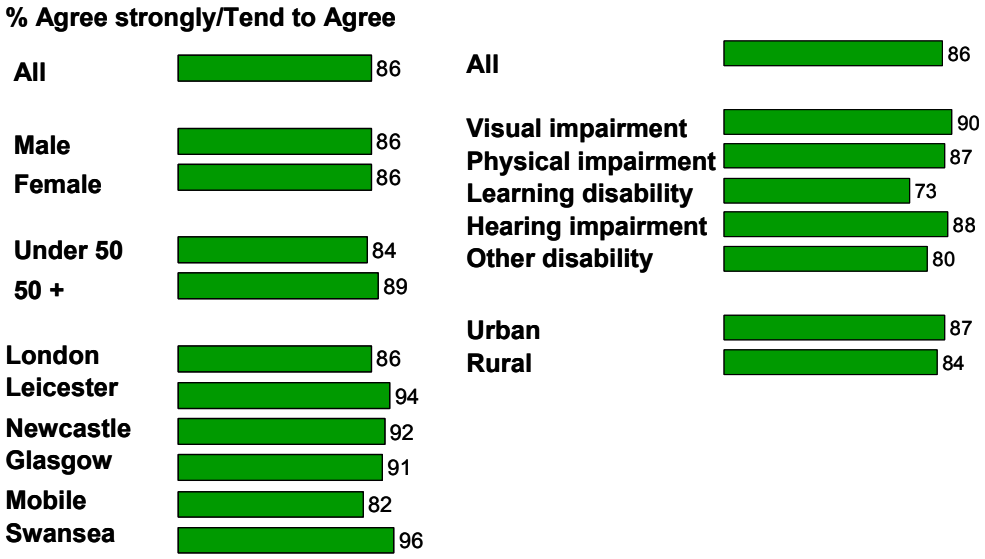
"Biometrics will help prevent identity fraud" – Opportunistic Sample



Key Observation

(Opportunistic) At least 85% of every sub-group believes biometrics will help prevent identity fraud. There are, however, 7%+ point differences between 18-34yr vs 55+yrs; Other Religion vs Christian; BME vs White with the latter sub-groups scoring the higher.

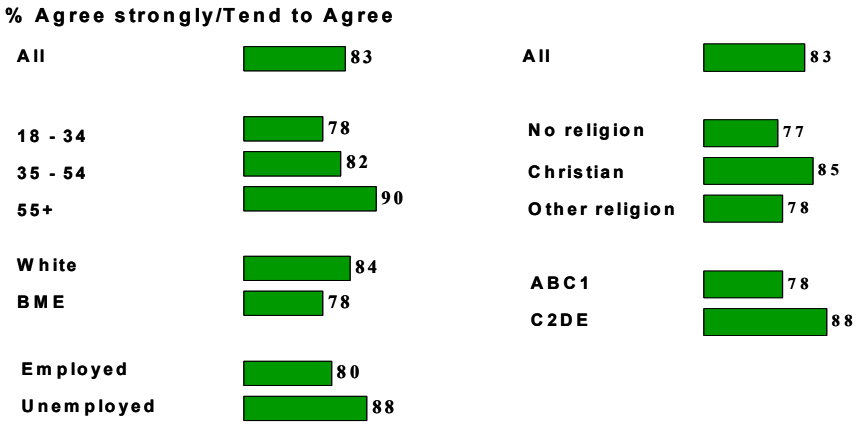
"Biometrics will help prevent identity fraud" – Disabled Participants



Key Observation

(Disabled) All sub-groups score highly in agreeing that biometrics will help prevent identity fraud, the only slight dip being amongst those with a learning disability (73%).

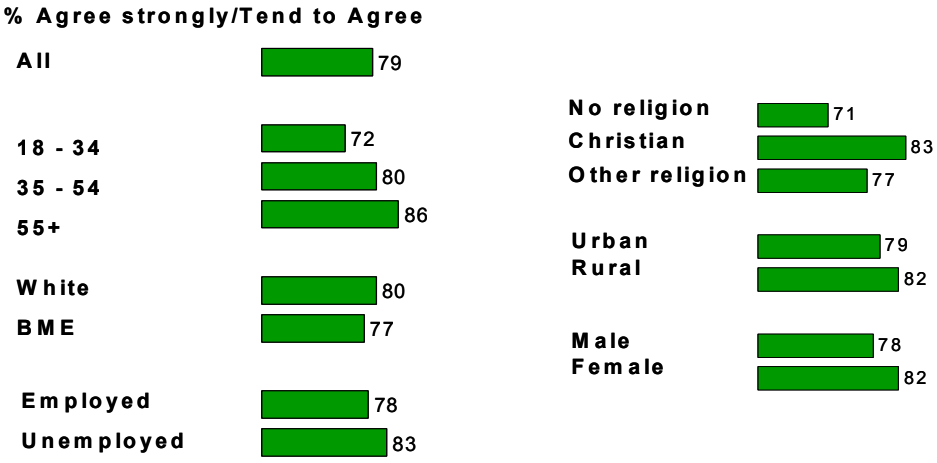
"Biometrics will help prevent illegal immigration / working" – Quota Sample



Key Observation

(Quota) The sub-groups who are most likely to believe that biometrics will help prevent illegal immigration working are 55+yrs, White, Unemployed, Christian and the C2DE sub-group.

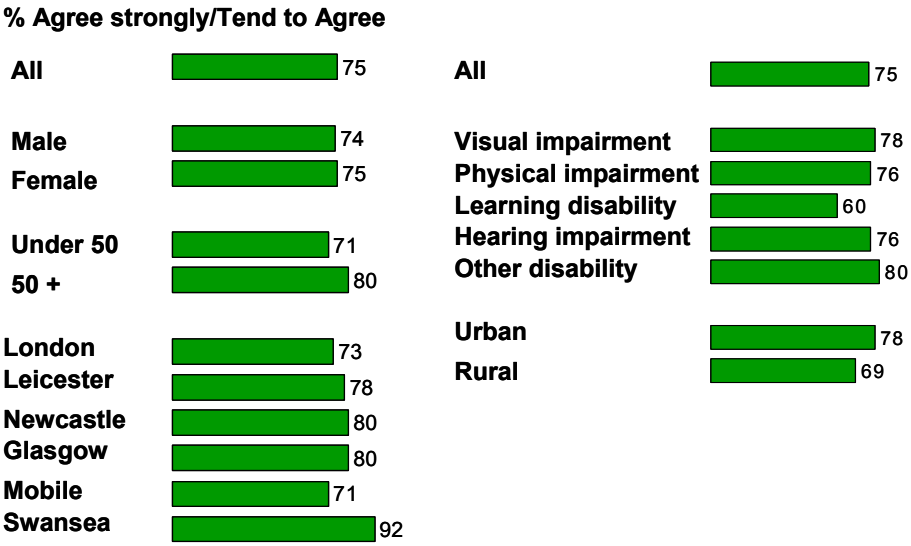
"Biometrics will help prevent illegal immigration / working" – Opportunistic Sample



Key Observation

(Opportunistic) At least 70% all sub-groups believe biometrics will help prevent illegal immigration / working. The most significant sub-group differences are the 18-34yr olds (72%) vs 55+yr olds (86%) and No Religion (71%) vs Christian (83%).

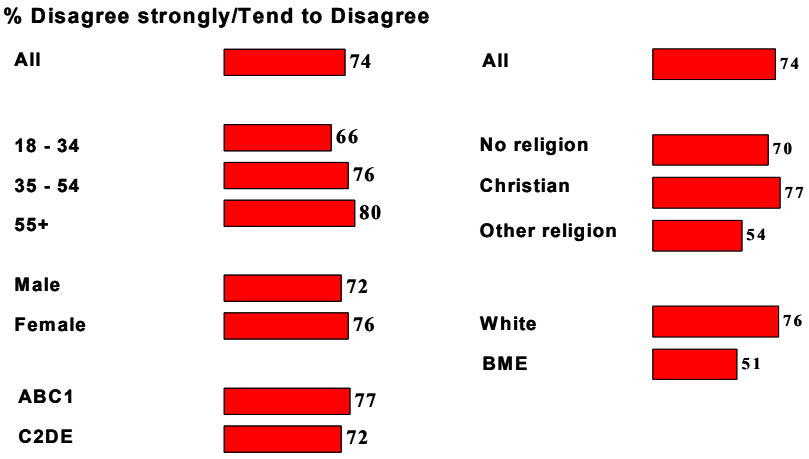
"Biometrics will help prevent illegal immigration / working" – Disabled Participants



Key Observation

(Disabled) Three quarters of participants with visual, physical or hearing disabilities agree that biometrics will help prevent illegal immigration working; this drops to 60% for those with a learning disability.

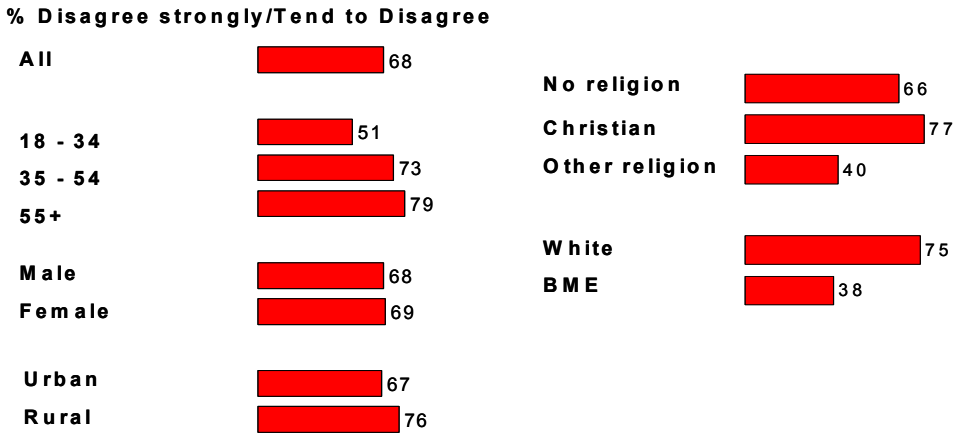
"Biometrics are an infringement of my civil liberties" – Quota Sample



Key Observation

(Quota) The sub-groups most likely to believe biometrics are an infringement on their civil liberties are 18-34yrs, the C2DE sub-group, Other Religion and the BME sub-groups.

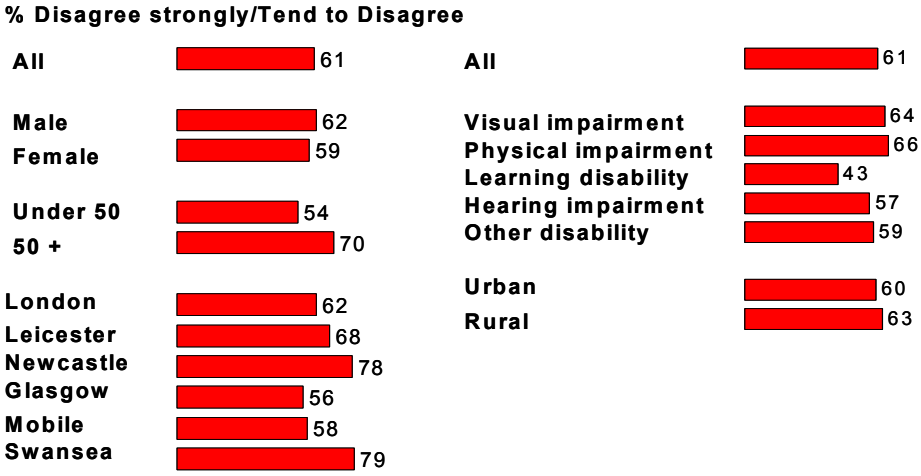
"Biometrics are an infringement of my civil liberties" – Opportunistic Sample



Key Observation

(Opportunistic) Although 68% of the overall group do not believe biometrics are an infringement on their civil liberties, this falls to 51% for 18-34 yr old, 40% for the Other Religion and 38% for the BME sub-groups.

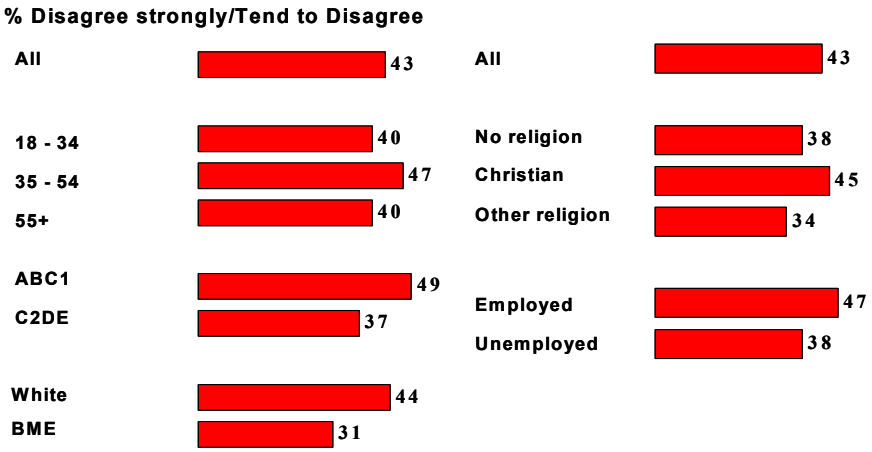
"Biometrics are an infringement of my civil liberties" – Disabled Participants



Key Observation

(Disabled) The sub-groups most likely to believe biometrics are an infringement on their civil liberties are the under 50 yrs old and those with a learning disability.

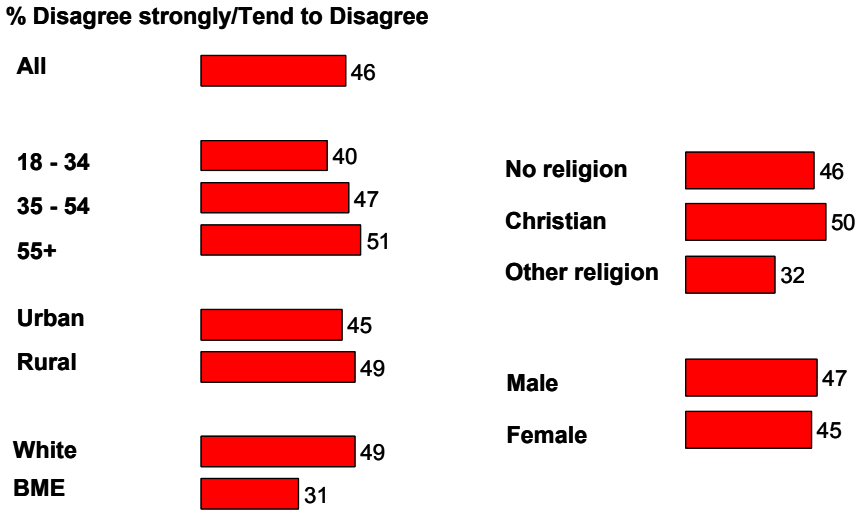
"The costs of introducing biometrics outweigh the benefits" – Quota Sample



Key Observation

(Quota) The sub-groups most likely to believe the benefits of introducing biometrics outweigh the costs are the 35-54yrs, social group ABC1, the White sub-group, the Christian sub-group and the Employed.

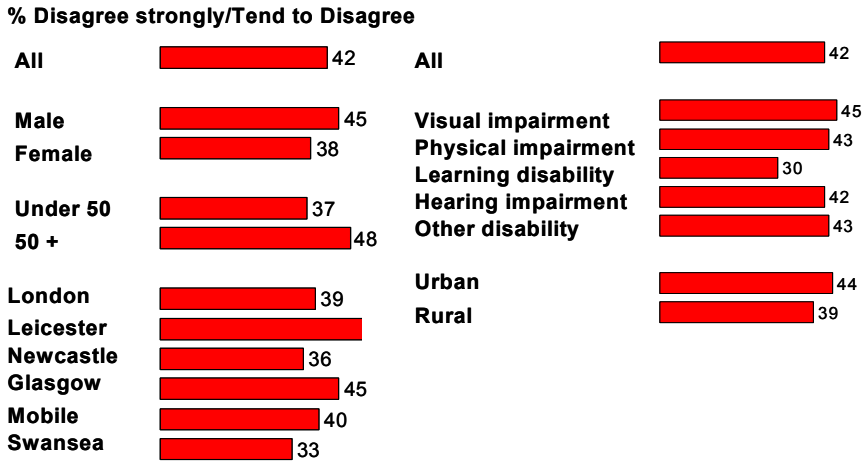
"The costs of introducing biometrics outweigh the benefits" – Opportunistic Sample



Key Observation

(Opportunistic) The sub-groups who are most likely to believe the costs of introducing biometrics outweigh the benefits are the 18-34yr old, the Other Religion and the BME sub-groups.

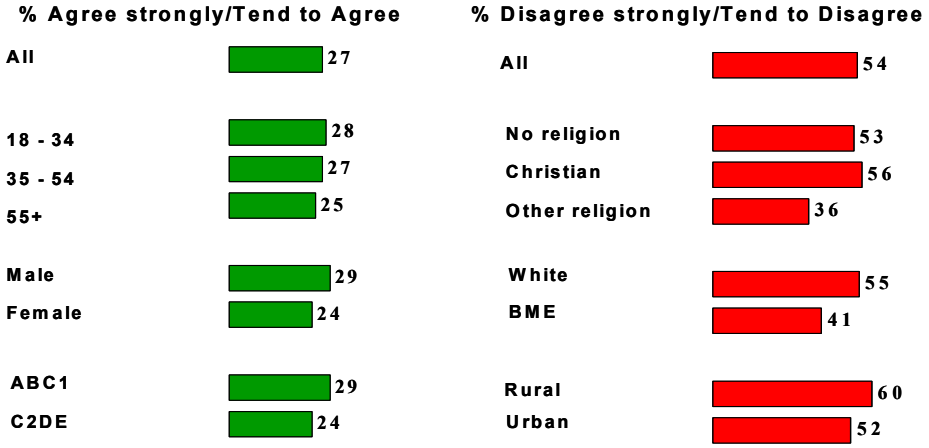
"The costs of introducing biometrics outweigh the benefits" – Disabled Participants



Key Observation

(Disabled) The sub-groups most likely to believe the benefits of introducing biometrics outweigh the costs are the 50+yrs, males, and Leicester participants. Those with a learning disability are the most likely to believe the costs outweigh the benefits.

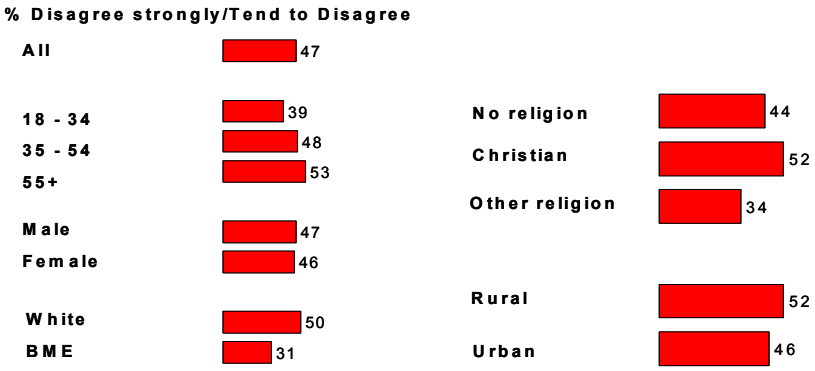
"I am concerned that my biometrics may not be stored securely" – Quota Sample



Key Observation

(Quota) The sub-groups most likely to believe their biometric data may not be stored securely are the Male, BME, Other Religion and the ABC1 sub-groups.

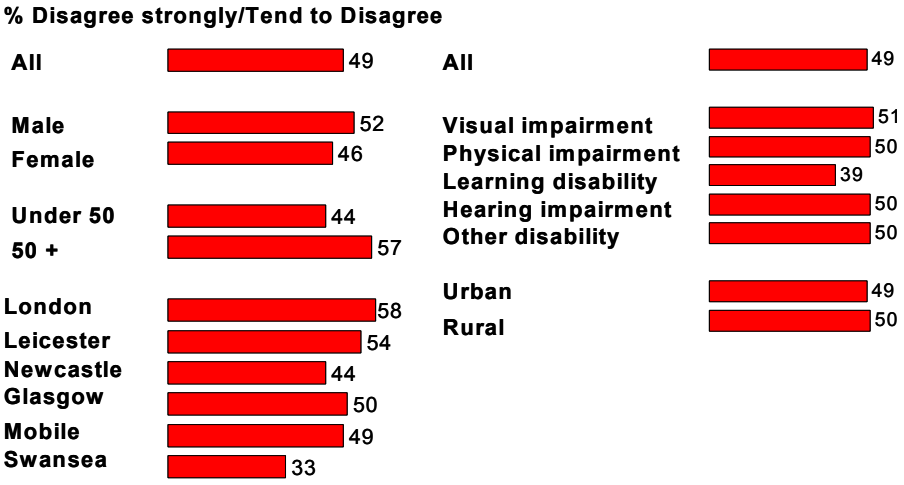
"I am concerned that my biometrics may not be stored securely" – Opportunistic Sample



Key Observation
(Opportunistic) The sub-groups most likely to be concerned over the secure storage of their biometrics are the 18-34 yr old, the Other Religion and the BME sub-groups.

Note: the above observation is made on the basis that the three mentioned sub-groups scored lowest for 'disagreeing' with the statement of "concern about biometrics being stored securely".

"I am concerned that my biometrics may not be stored securely" – Disabled Participants



Key Observation

(Disabled) The sub-groups most likely to believe their biometric data may not be stored securely are the under 50yrs, and those with a learning disability.

Appendix A - Detailed Enrolment Analysis

A1 Process Times

A1.1 Overall Enrolment Times

Overall enrolment times have been calculated from the point at which the operator retrieves the participant's details from the system in order to start enrolment, to the point at which the operator accepts the participant's signature. The card printing step has been ignored in calculating the overall enrolment times, although process times for this step are analysed in a later section. Minimum, maximum, average and median enrolment times are shown below for all Trial participants according to the category of enrolment. Enrolments have been categorised as:

- All Face/Iris/Fingerprint – where the participant attempted face, iris and fingerprint enrolment, regardless of the success of each enrolment;
- Successful Face/Iris/Fingerprint – where the participant successfully enrolled on face, iris and fingerprint biometrics;
- 1st Time Successful Face/Iris/Fingerprint – where the participant successfully enrolled on face, iris and fingerprint biometrics at the first attempt on each;
- All Face/Iris – where the participant attempted face and iris enrolment only, regardless of the success of each enrolment;
- Successful Face/Iris – where the participant successfully enrolled on face and iris biometrics but did not attempt fingerprints;
- 1st Time Successful Face/Iris – where the participant successfully enrolled on face and iris biometrics at the first attempt on each, but did not attempt fingerprints;
- All Face/Fingerprint – where the participant attempted face and fingerprint enrolment only, regardless of the success of each enrolment;
- Successful Face/Fingerprint – where the participant successfully enrolled on face and fingerprint biometrics but did not attempt iris;
- 1st Time Successful Face/Fingerprint – where the participant successfully enrolled on face and fingerprint biometrics at the first attempt on each, but did not attempt iris.

N.B. the results for face/iris and face/fingerprint relate to the Quota sample only. All Opportunistic and Disabled participants should have attempted enrolment on all three biometrics, although there are a small number where the operators decided to miss out one biometric.

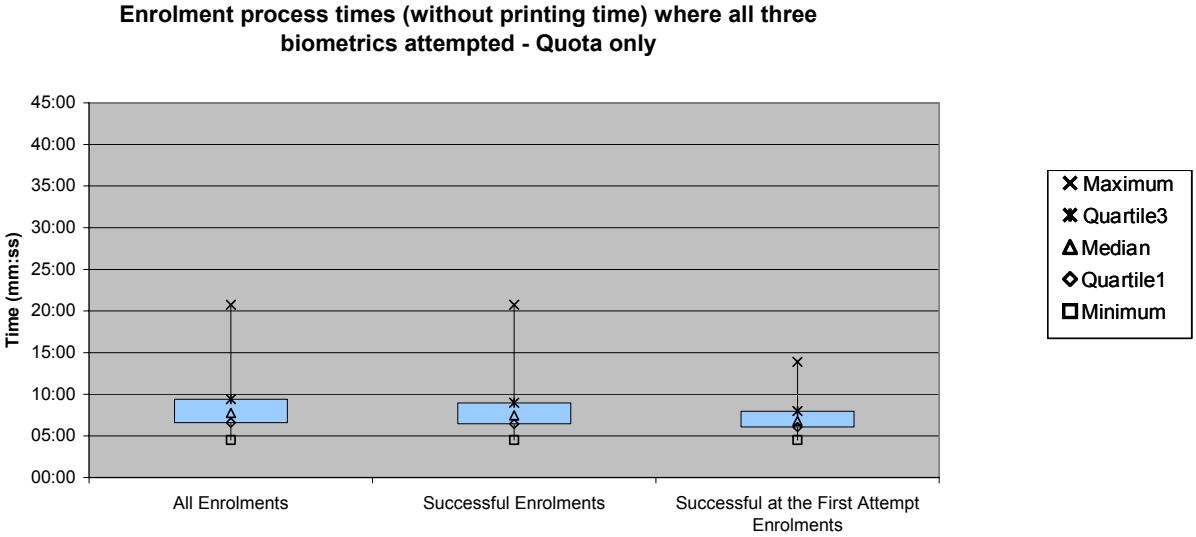
Any enrolment that has been affected by a technical issue, or an operator error, has been excluded from the calculation of average times. This is to prevent any distortion.

Enrolment Type	Average Time excluding print time (mm:ss)	Minimum time excluding print time (mm:ss)	Median Time excluding print time (mm:ss)	Maximum time excluding print time (mm:ss)
All Face/Iris/Fingerprint (Quota)	08:15	04:30	07:45	20:44
Successful Face/Iris/Fingerprint (Quota)	07:56	04:30	07:29	20:44
1st Time Successful Face/Iris/Fingerprint (Quota)	07:06	04:30	06:47	13:53
All Face/Iris/Fingerprint (Disabled)	10: 20	04:47	09:39	32:21
Successful Face/Iris/Fingerprint (Disabled)	09:43	05:05	09:09	26:28
1st Time Successful Face/Iris/Fingerprint (Disabled)	08:32	05:05	08:10	20:03
All Face/Iris/Fingerprint (Opportunistic)	08:17	04:23	07:48	40:51
Successful Face/Iris/Fingerprint (Opportunistic)	08:05	04:30	07:38	40:51
1st Time Successful Face/Iris/Fingerprint (Opportunistic)	07:22	04:30	07:05	33:31
All Face/Iris (Quota)	04:13	02:03	03:40	12:46
Successful Face/Iris (Quota)	03:51	02:03	03:29	12:46
1st Time Successful Face/Iris (Quota)	03:23	02:03	03:17	12:46

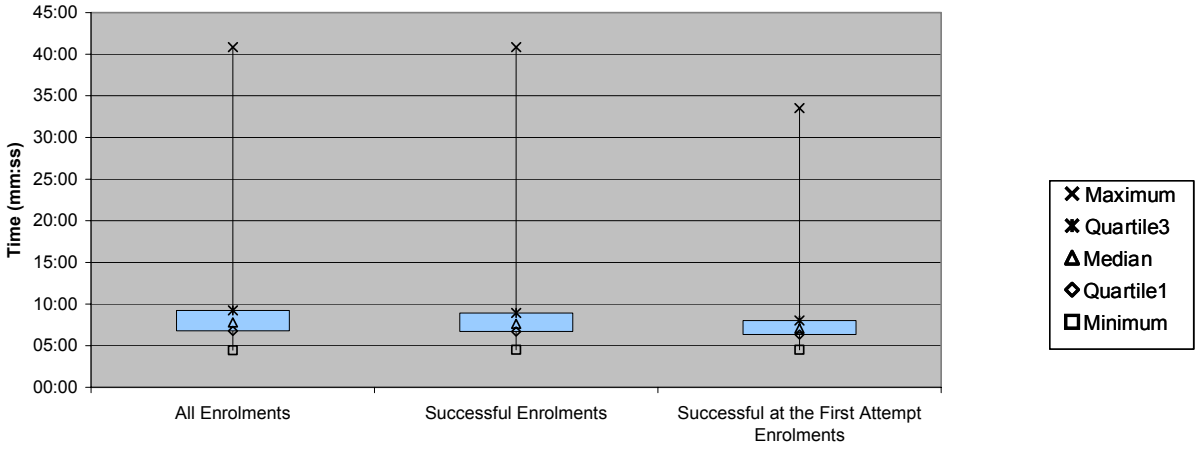
Enrolment Type	Average Time excluding print time (mm:ss)	Minimum time excluding print time (mm:ss)	Median Time excluding print time (mm:ss)	Maximum time excluding print time (mm:ss)
All Face/Fingerprint (Quota)	05:56	03:19	05:38	15:06
Successful Face/Fingerprint (Quota)	05:56	03:19	05:38	15:06
1st Time Successful Face/Fingerprint (Quota)	05:32	03:19	05:16	12:02

As can be seen, biometric enrolment of participants from the Disabled participant group took longer than biometric enrolment of participants from the Quota and Opportunistic sample groups. No significant difference occurred between the time taken for Quota and Opportunistic participants.

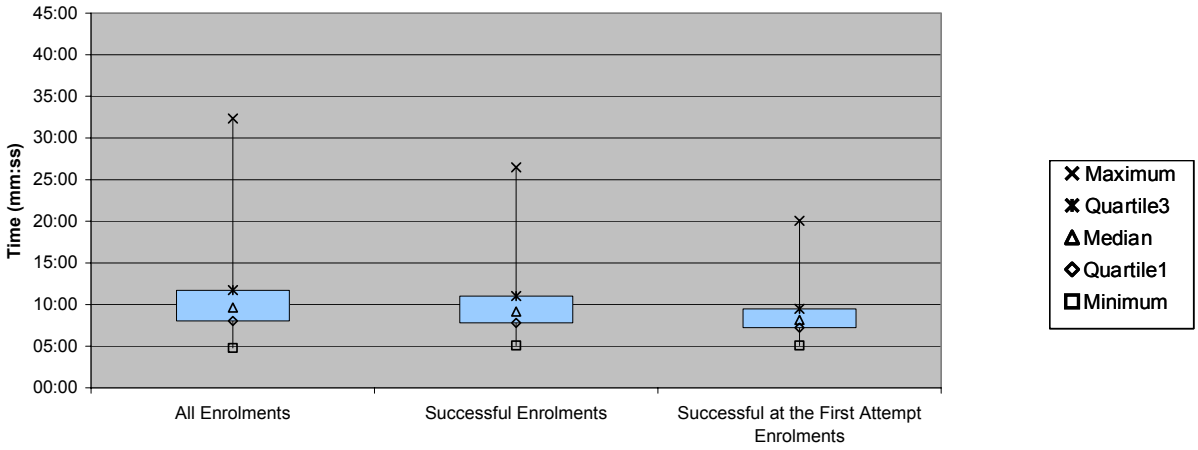
The dispersion of enrolment times is shown by the following boxplots. In all cases there is a high level of dispersion in the enrolment process times.



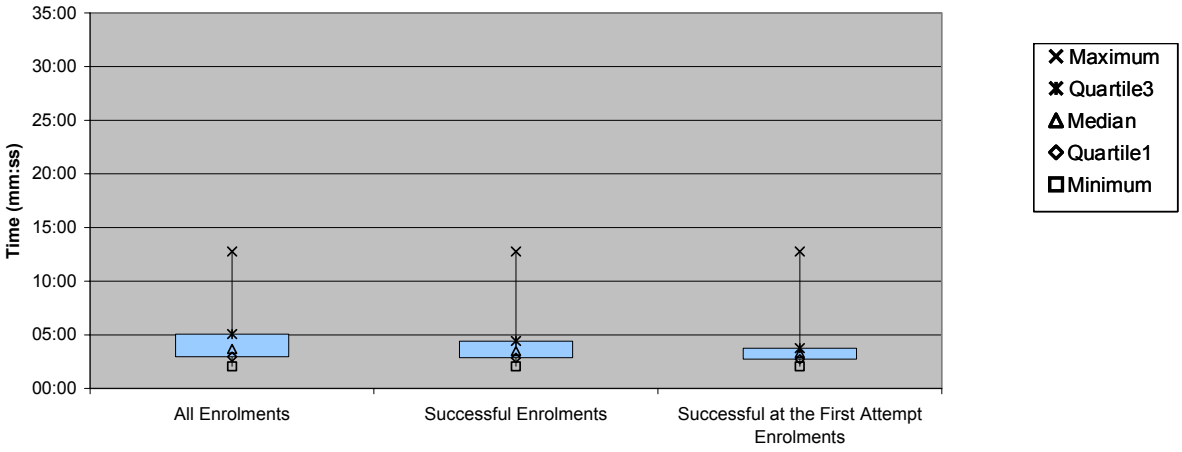
Enrolment process times (without printing time) where all three biometrics attempted - Opportunistic only



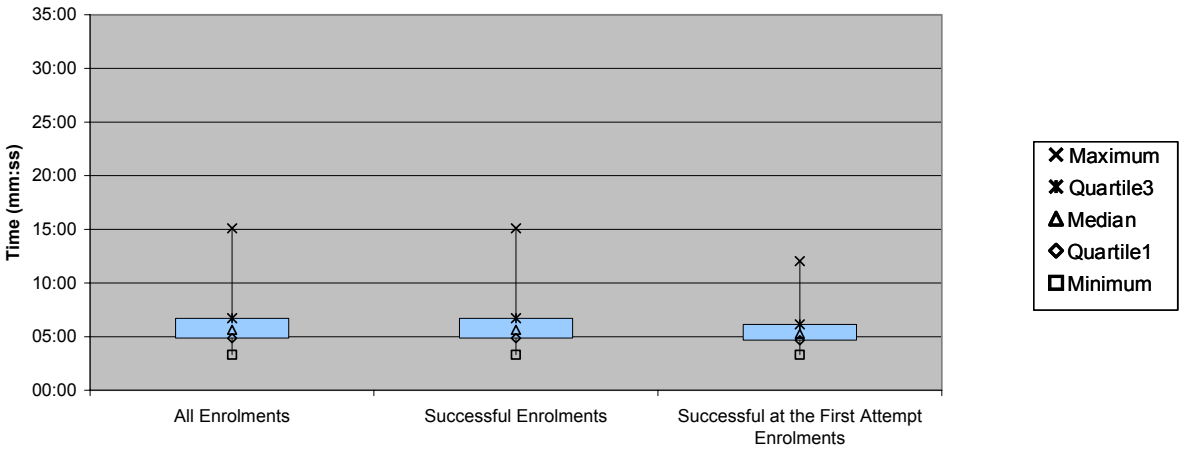
Enrolment process times (without printing time) where all three biometrics attempted - Disabled only



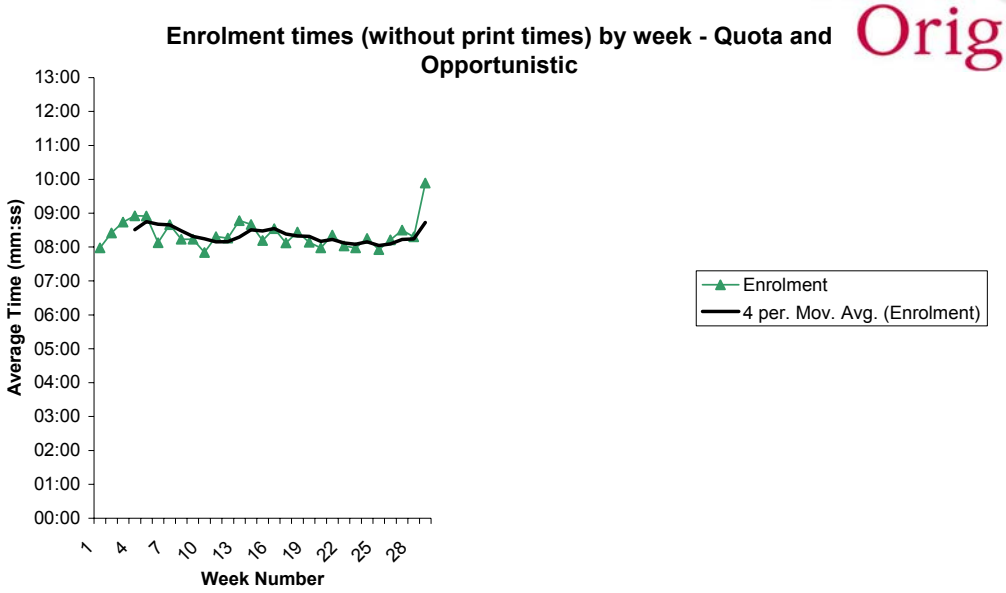
Enrolment process times (without printing time) where only face and iris biometrics attempted - Quota only



Enrolment process times (without printing time) where only face and fingerprints biometrics attempted - Quota only

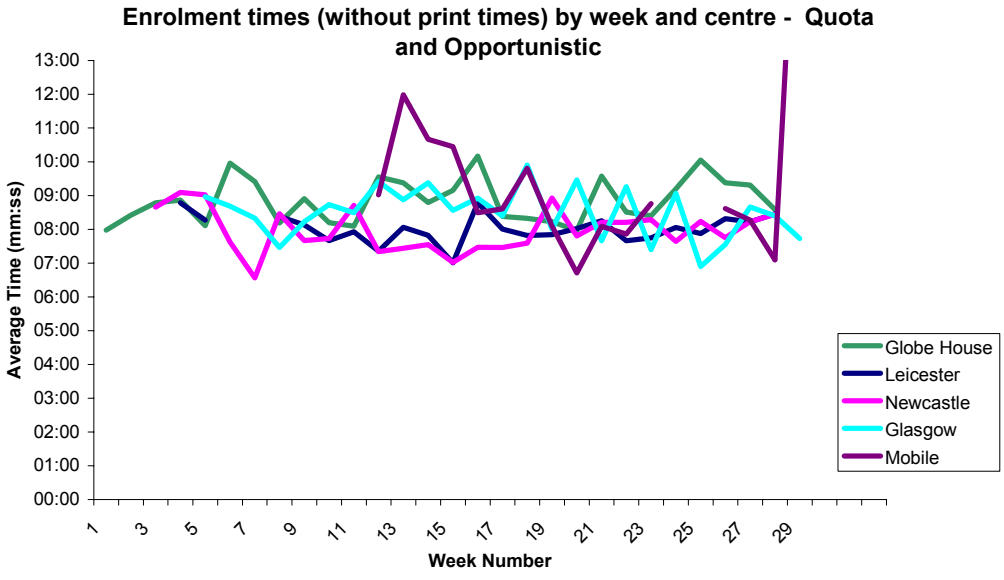


The average Quota enrolment time (all biometrics attempted) was 8 minutes and 15 seconds and the average Opportunistic enrolment time (all biometrics attempted) was 8 minutes and 17 seconds. As no significant difference has been found between Quota and Opportunistic enrolment times, the weekly average times for the combined Opportunistic and Quota dataset have been analysed to see if there was any trend over time. As can be seen the average weekly enrolment time on the whole remained close to the overall average. The exception to this occurred in week 29 where the average enrolment time rose to 9 minutes and 53 seconds, however no overall trend over time can be seen.



The above chart shows a moving average trendline which averages the results for four weeks.

As enrolment centres did not all become operational at the same time, it is possible that aggregating the data for all enrolment centres together is masking underlying trends at each centre, and so each enrolment centre's data has been analysed on an individual basis. Once again no underlying trend can be seen, but it is worth noting that the enrolment times at the mobile unit have been erratic, whereas the enrolment times at each fixed enrolment centre has shown little variation. This analysis also shows that the mobile unit is responsible for the sharp increase in enrolment times in week 29. The volume of Opportunistic enrolment was low during that week and so a small number of lengthy enrolments have distorted the figures for that week.



There are small differences between the average enrolment times of the fixed enrolment centres. Globe House had the longest enrolment times and Newcastle the shortest. As will be evident later these reflect the fact that at Globe House fingerprint enrolment tended to

take longer than at Newcastle.

Average Enrolment Times per Centre (Opportunistic)	
Enrolment Centre	**Average Enrolment Time without print time (mm:ss)**
Globe	08:40
Leicester	07:40
Newcastle	07:49
Glasgow	08:29
Mobile	10:36

Average Enrolment Times per Centre (Quota and Opportunistic)	
Enrolment Centre	**Average Enrolment Time without print time (mm:ss)**
Globe	08:46
Leicester	07:57
Newcastle	07:55
Glasgow	08:35
Mobile	08:46

A1.2 Individual Step Times[8]

Key statistical information is shown below for each enrolment step by sample group. The individual step process times are analysed in more detail in the following sections.

Step	Sample Type	Average Time (mm:ss)	Minimum time (mm:ss)	Median Time (mm:ss)	Maximum time (mm:ss)
a) Take Photo	Quota	00:39	00:06	00:33	06:49
	Opportunistic	00:40	00:05	00:34	03:44
	Disabled	00:51	00:09	00:44	04:50
b) Record facial biometric	Quota	00:33	00:19	00:28	06:07
	Opportunistic	00:32	00:19	00:27	08:08
	Disabled	00:43	00:21	00:34	08:29
c) Record iris biometric	Quota	02:25	01:02	01:54	10:10
	Opportunistic	02:25	00:08	01:56	28:29
	Disabled	03:02	00:10	02:30	21:37
d) Record fingerprint biometric	Quota	03:57	02:07	03:40	13:06
	Opportunistic	03:53	01:20	03:37	21:37
	Disabled	04:52	00:32	04:25	21:40
e) Record signature	Quota	00:22	00:02	00:18	04:26
	Opportunistic	00:21	00:02	00:17	04:56
	Disabled	00:24	00:02	00:18	03:19
f) Print card	Quota	03:45	03:04	03:23	22:33
	Opportunistic	03:42	03:05	03:24	24:38
	Disabled	04:26	03:10	03:37	28:31

[8] Individual step times do not add up to equal the overall enrolment times in the previous section although the difference is a small one. There are two reasons. First, the overall enrolment times include an additional process step whereby the operator retrieves the participant's record from the system and checks the details before proceeding. Second the base data are slightly different. A technical issue that affected **any** biometric would cause the entire enrolment to be removed from the calculation of the average enrolment times, whereas the timings for the biometrics that were unaffected would be used in the calculation of the average times for those individual steps.

A1.2.1 Take Photo Step Times

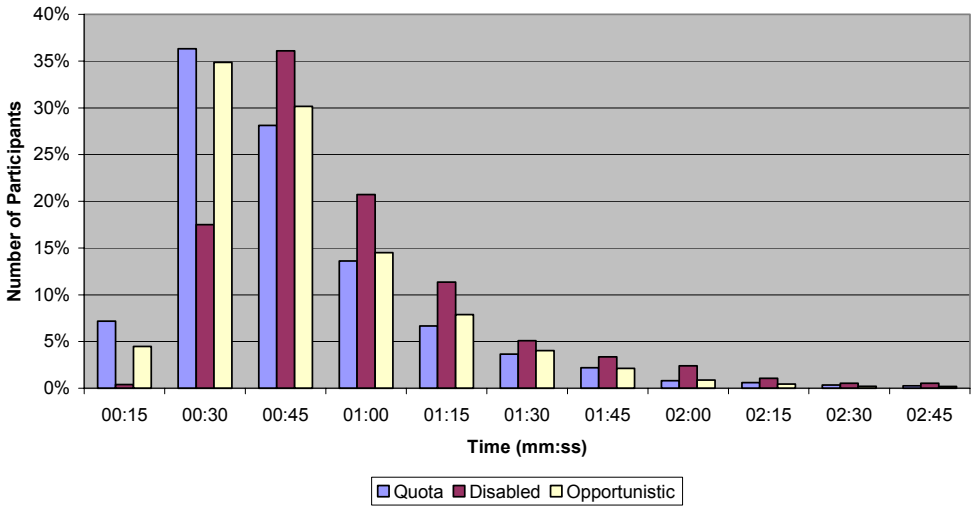
Although for the Quota sample the length of time taken to record the participant's image varied between 6 seconds and 6 minutes 49 seconds, the majority (72%) were taken in 45 seconds or less and 85% were taken in 1 minute or less. Similarly with the Opportunistic sample, the length of time taken varied between 5 seconds and 3 minutes and 45 seconds, but the majority (70%) were taken in 45 seconds or less and 84% were taken in 1 minute or less. For Disabled participants the time taken was on the whole slightly greater ranging from a minimum of 49 seconds to a maximum of 4 minutes and 50 seconds.

As this step is not actually recording biometric data, minimal information is automatically recorded and so the precise reasons why one person has taken six minutes forty-nine seconds cannot be established. However, the reasons why some participants take longer are as follows:

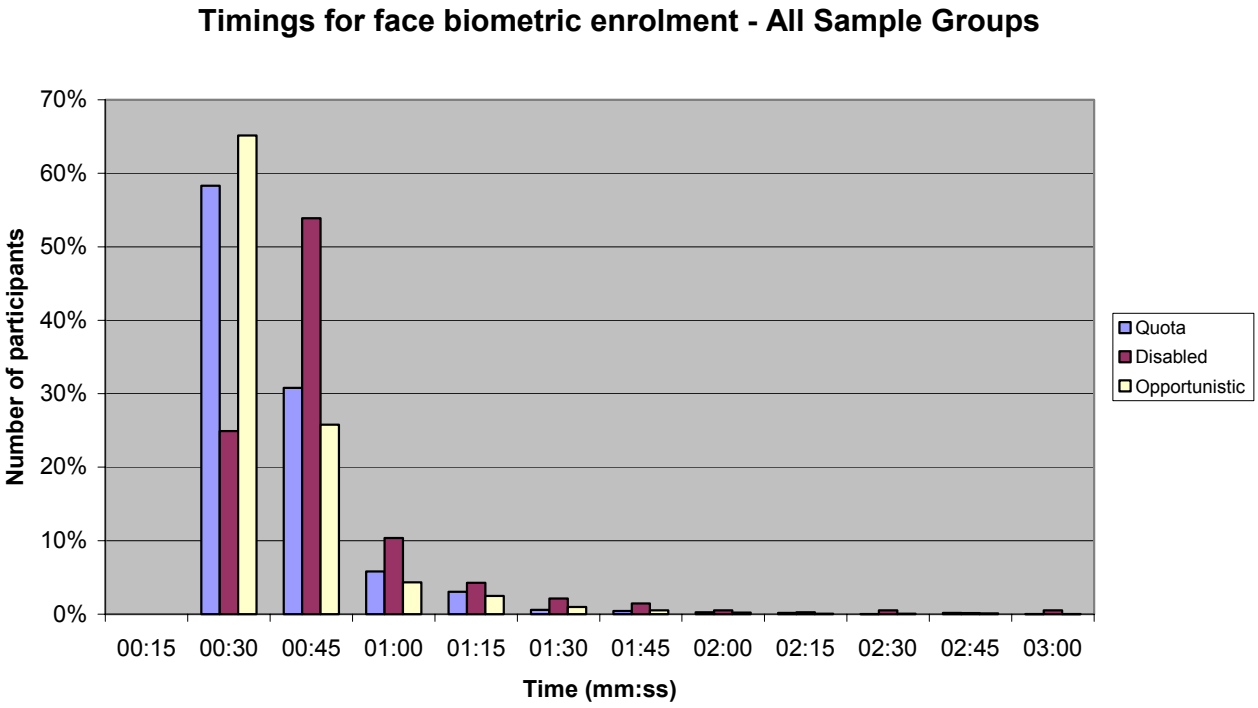
- some participants need to adjust the height of the chair;
- some participants do not position themselves the correct distance from the camera and have to be asked to move forwards or backwards;
- as the image is printed on the card, participants and the operator have the option of rejecting an image and recording a new one. Typically the operator does this if the participant's eyes are closed. The participant asks for a new image if they do not like the one they are shown. Although the majority of participants only required one image, a small number asked for a second image, and exceptionally a participant asked for further additional attempts.

N.B. in the interests of clarity only 99% of participants have been included in the histogram below. The remaining participants had photo acquisition times of between 2 minutes 45 seconds and 7 minutes.

Timings for acquisition of ID-card photo - All Sample Groups



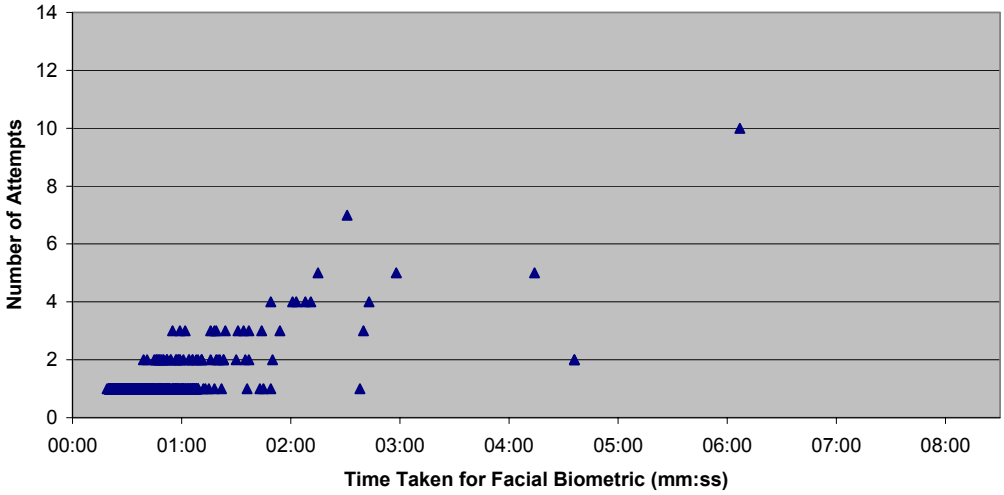
A1.2.2 Record Facial Biometric Step



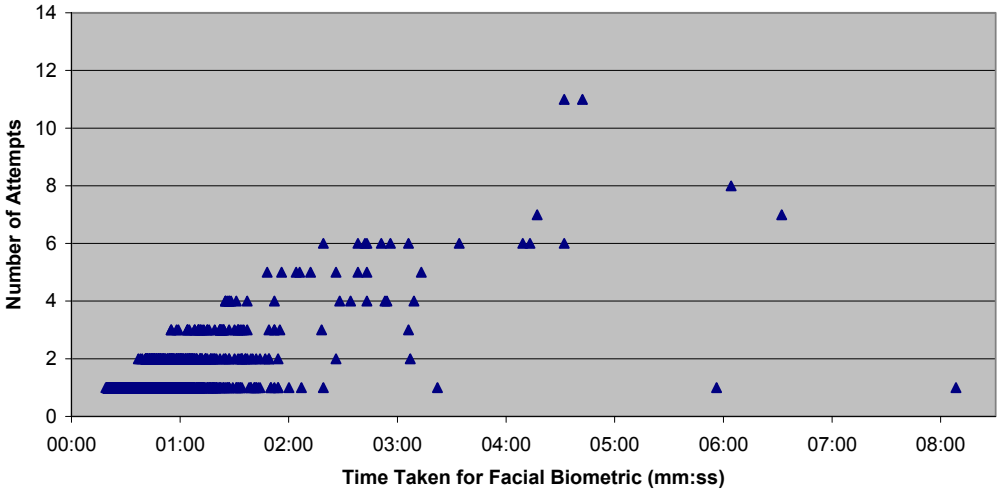
N.B. in the interests of clarity 99% of the participants have been included in the above histogram. The remaining participants had facial biometric enrolment times between 3 minutes and 9 minutes

Facial biometric enrolment for participants from the Quota and Opportunistic sample groups tended to be quicker than for the Disabled participant group. 98% of Quota facial biometrics and 98% of Opportunistic facial biometrics were recorded in one minute and fifteen seconds or less, whereas the corresponding figure for the Disabled participant group was 93%. As more than one attempt can be required to obtain a facial biometric the time taken can be expected to reflect the number of attempts required. As the diagrams below show there is a link but it is not the only factor influencing the time taken. Saving the biometric sets the end time on the facial biometric statistics and some operators may be explaining the next step before saving the face biometric.

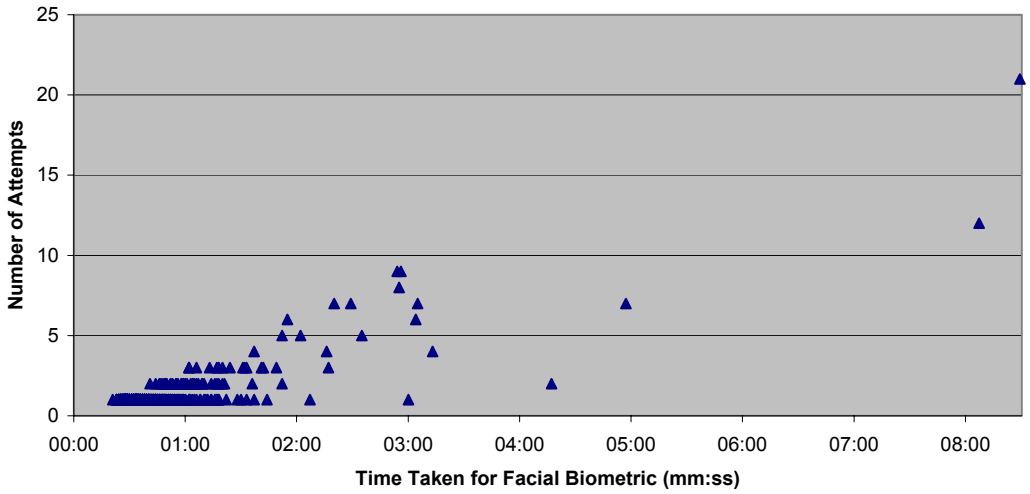
Face biometric enrolment: number of attempts vs time taken - Quota only



Face biometric enrolment: number of attempts vs time taken - Opportunistic only



Face biometric enrolment: number of attempts vs time taken - Disabled only



Average Face Enrolment Times per Centre (Quota)		
Centre	**Sample Size**	**Average enrolment time**
Globe House	289	00:29
Leicester	642	00:33
Newcastle	502	00:29
Glasgow	473	00:39
Mobile	94	00:32

Quota sample figures, have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results

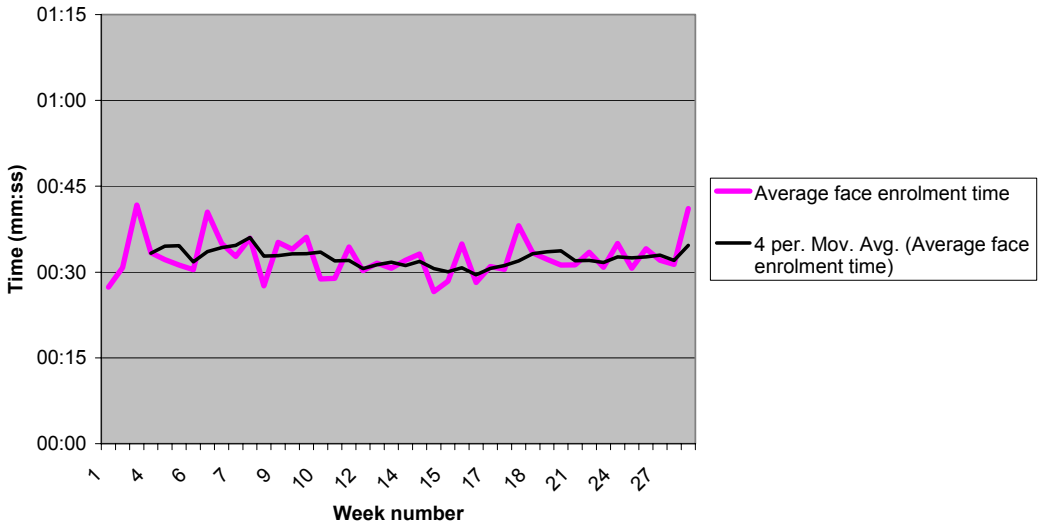
Average Face Enrolment Times per Centre (Quota and Opportunistic)		
Centre	**Sample Size**	**Average enrolment time**
Globe House	1886	00:31
Leicester	2923	00:30
Newcastle	1958	00:30
Glasgow	1535	00:41
Mobile	964	00:32

Average Face Enrolment Times per Centre (Disabled)		
Centre	**Sample Size**	**Average enrolment time**
Globe House	71	00:43
Leicester	69	00:30
Newcastle	32	00:45
Glasgow	111	00:47
Mobile	425	00:44
Swansea	24	00:36
Newcastle (LBTN)	18	00:36

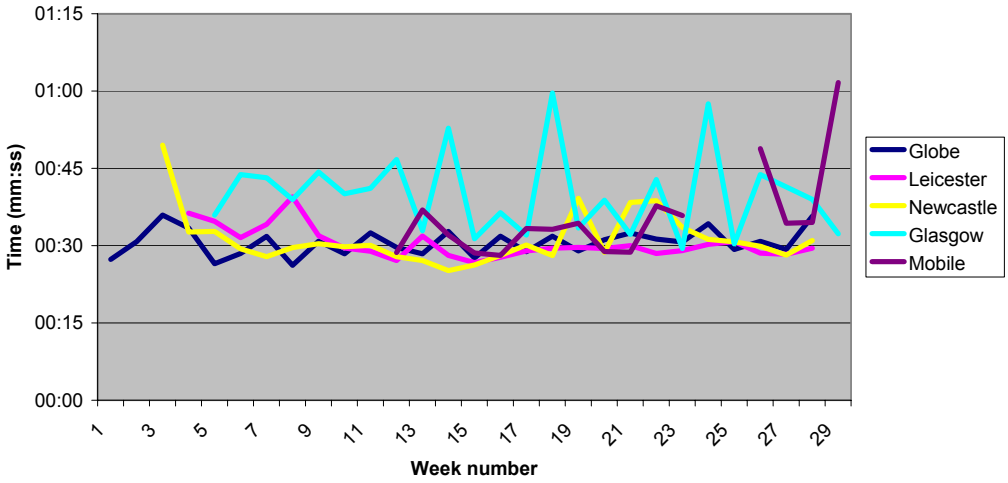
In keeping with the overall picture, the average facial biometric enrolment time at each enrolment centre for Disabled participants tended to be greater than that for the Quota sample participants. The exception to this is Leicester where the Quota and Disabled participant facial biometric enrolment times are similar. Facial biometric enrolment tended to take slightly longer at Glasgow than the other enrolment centres. The reason for this is unknown.

Analysis of the average Quota face enrolment time has shown some dips but no obvious trend over time is evident. Each enrolment centre's data has been analysed on an individual basis but again no trend over time is evident. However, this analysis reveals that not only did facial biometric enrolment tend to take longer in Glasgow than elsewhere, enrolment times appear to be more erratic than elsewhere.

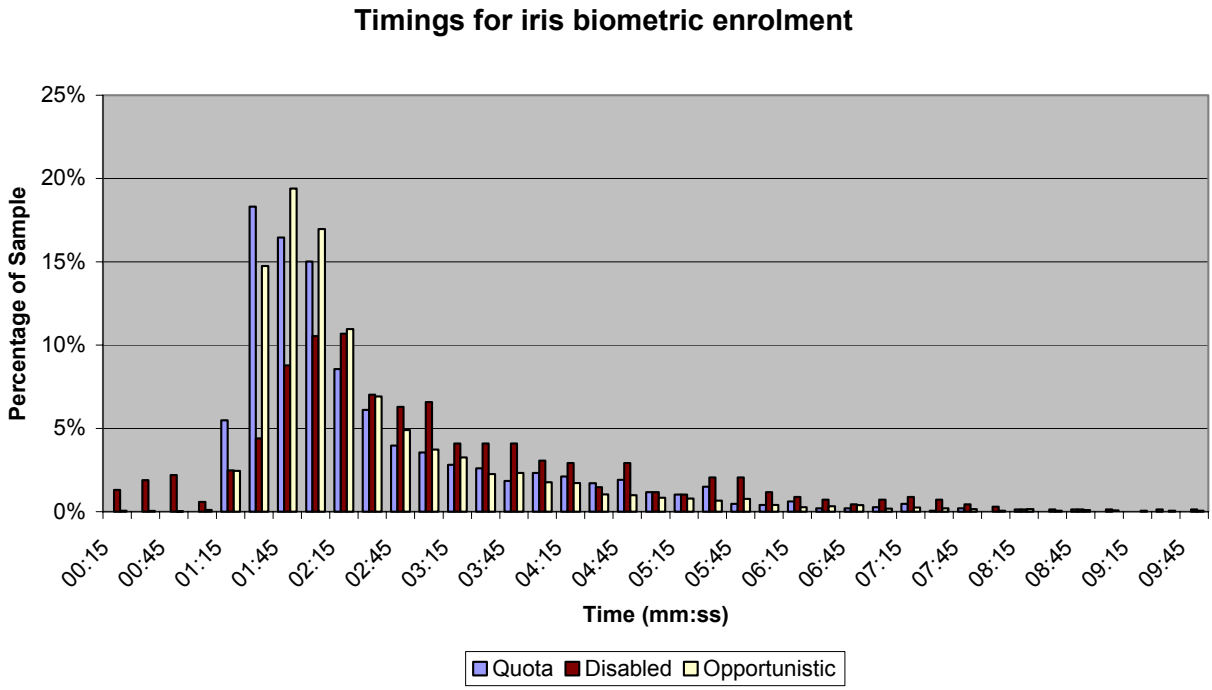
Average face enrolment time by week Quota and Opportunistic



Average face enrolment time by week and centre - Quota and Opportunistic



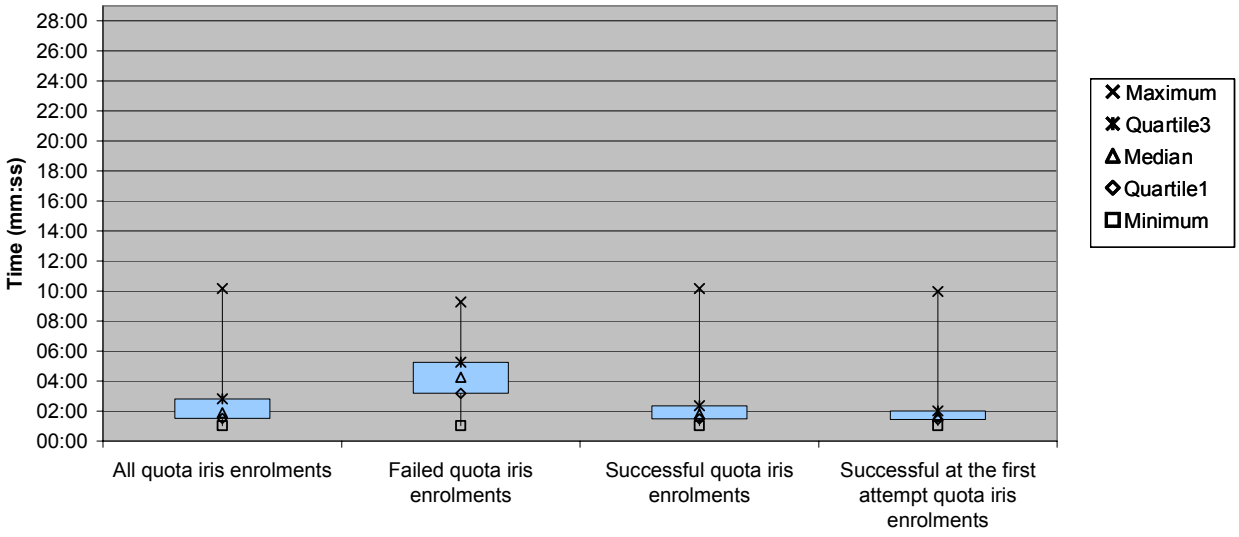
A1.2.3 Record Iris Biometric Step



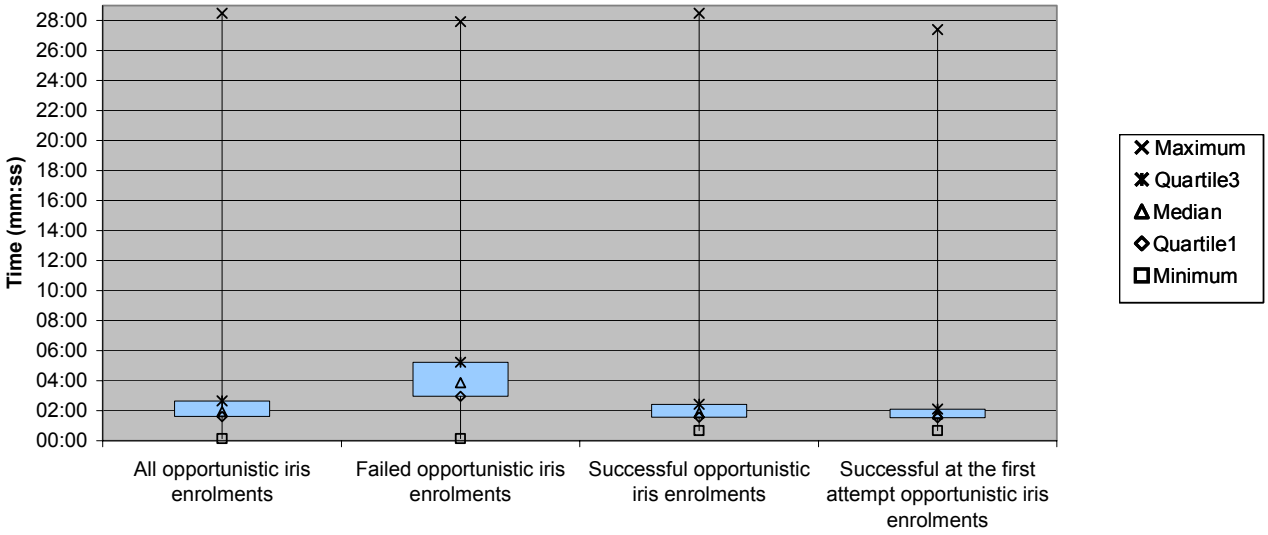
N.B. in the interests of clarity 99% of the participants have been included in the above histogram. The remaining 1% had iris biometric enrolment times between 10 minutes and 29 minutes.

The relative dispersions of iris enrolments can perhaps best be seen in the boxplots below.

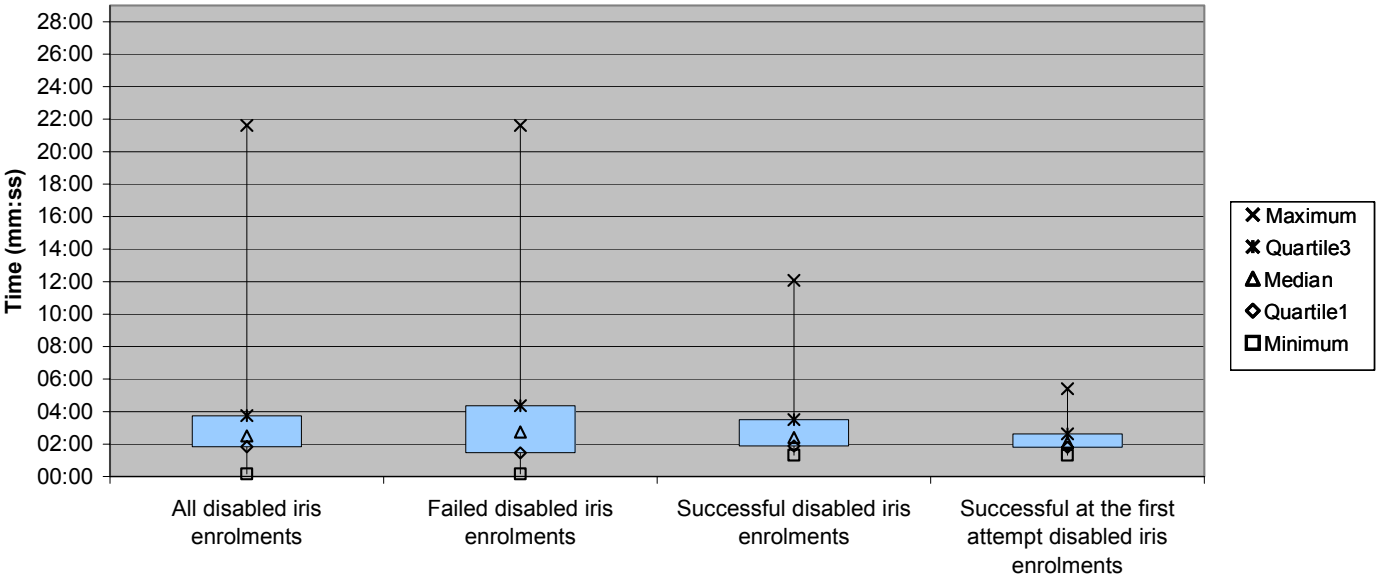
Iris biometric enrolment: process times - Quota only



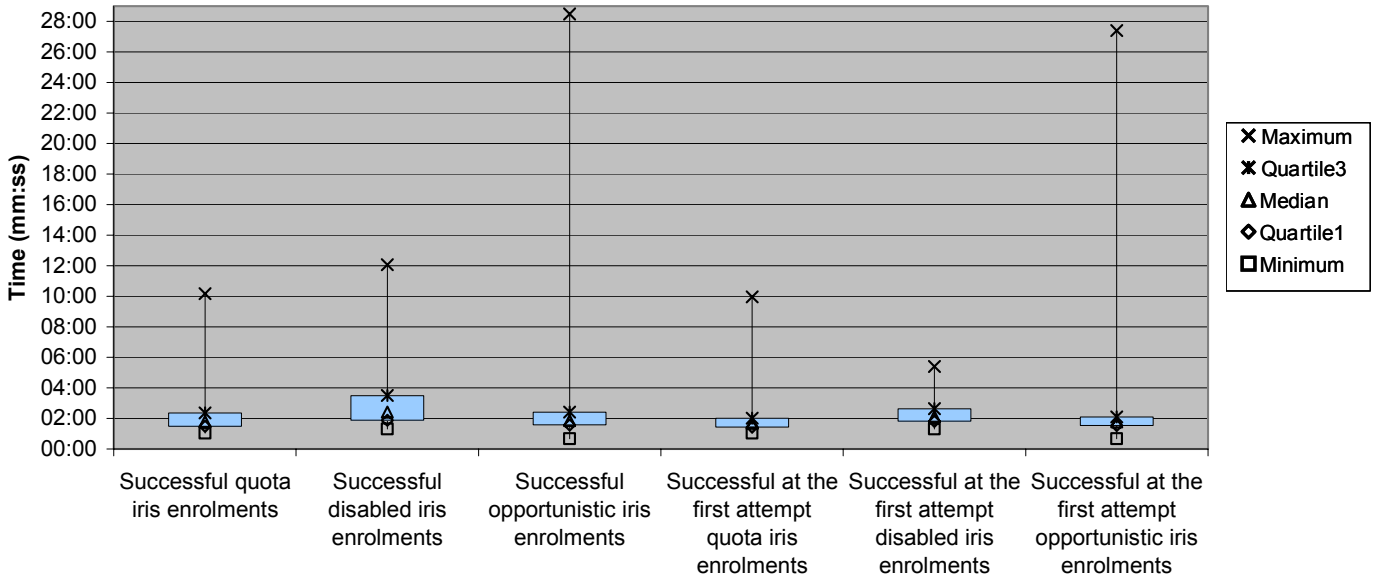
Iris biometric enrolment: process times - Opportunistic only



Iris biometric enrolment: process times - Disabled only



Iris biometric enrolment: process times - All Sample Groups



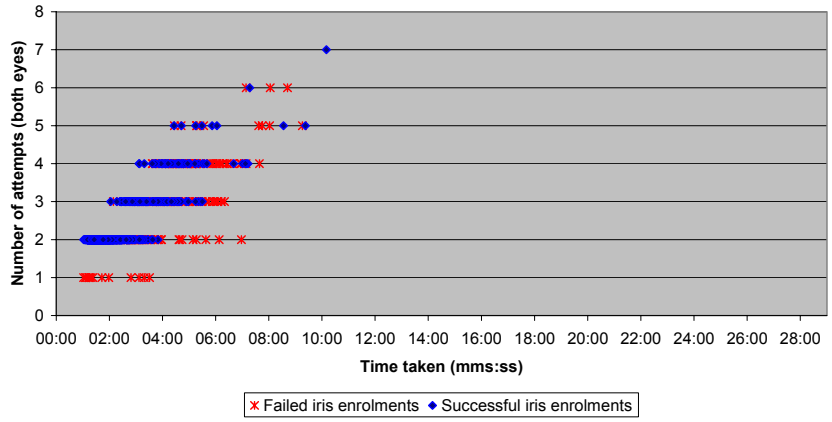
Iris biometric enrolment for the Disabled participant group tended to take longer than for the Quota sample group. As will be shown later in the report, Disabled participants were less likely to enrol on the iris biometric at the first attempt than participants from the Quota sample. This could explain the longer enrolment times.

On the whole, failed iris biometrics took longer than successful ones. This is because the

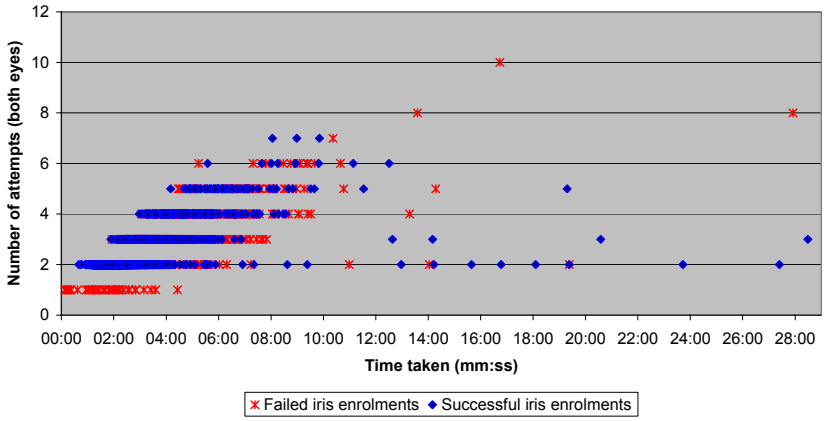
majority of people who successfully enrolled their irises required only one attempt whereas usually the people who failed to enrol made several attempts. Given this it would be expected that the minimum time for a failed iris biometric would be considerably longer than for a successful iris biometric. However, this is not the case. The reason is that where either the participant was unhappy about continuing or else the operator assessed very early on that the irises would fail to enrol, the operator cancelled iris enrolment without making the usual minimum of three attempts.

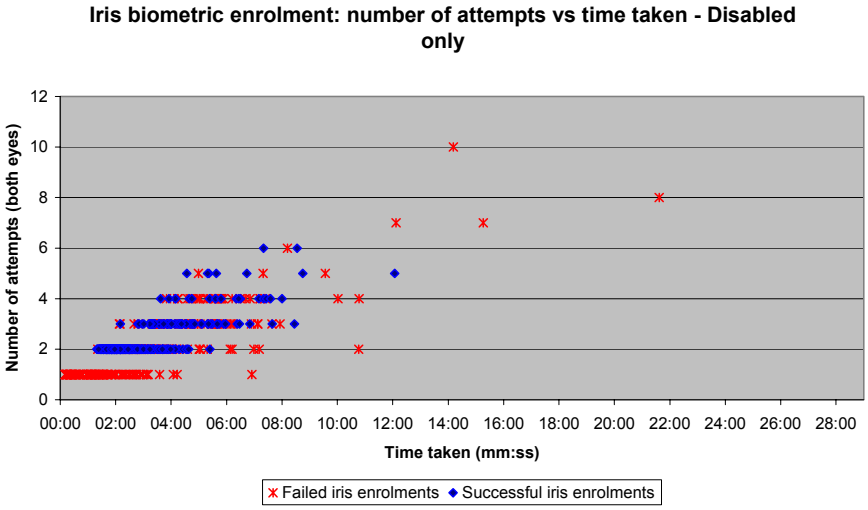
As already stated, there is a relationship between the time taken for iris enrolment and the number of attempts. This is shown by the scatterplots that follow.

Iris biometric enrolment: number of attemptsvs time taken - Quota only



Iris biometric enrolment: number of attempts vs time taken - Opportunistic only





NB the minimum number of attempts required for successful enrolment is 2 (1 per eye)

Two things can be noted from the preceding scatterplots:

- There are several enrolments where the number of attempts was 1. As the minimum number of attempts required for successful enrolment is 2, these are cases where the operator only made one attempt on one eye and did not attempt the other eye at all. This occurred where the operator determined very early on that iris enrolment would fail and so did not proceed. There are more of these for the Disabled participant group than for the Quota sample group. This will be considered further in the section analysis iris enrolment success rates.

- For any particular attempt number there was considerable variation in the time taken. For example, where the number of attempts was 2, the time taken for Quota participants varied between 01:02 (mm:ss) and 06:58 (mm:ss). There are two reasons for this sort of variation. First, between one attempt and another the operator has a chance to intervene in the process and make changes such as repositioning the mirror, repositioning the chair or in some cases trying a different chair altogether. The length of these interventions varies. Second, for any attempt the number of shots the camera takes can vary. It will take up to 12 shots but can stop after 4 shots if it has obtained an acceptable iris image by then.

Although there are small differences between the average iris biometric enrolment times of the enrolment centres, these do not appear to be connected to iris enrolment success. Globe House tended to have the highest average iris enrolment times and also had the highest iris enrolment rate (96% for Quota and Opportunistic participants) which would suggest that Globe House are more successful because they spend longer trying. However, the average 1st attempt iris enrolment time for Globe House was also higher than for the other enrolment centres.

Average Iris Enrolment Times per Centre (Quota)			
Centre	**Average enrolment time (all)**	**Average enrolment time (successful only)**	**Average enrolment time (1st time success only)**
Globe House	02:59	02:30	01:56
Leicester	02:24	02:06	01:46
Newcastle	02:17	02:01	01:40
Glasgow	02:39	02:21	02:01
Mobile	02:39	02:31	02:03

Quota sample figures, have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results

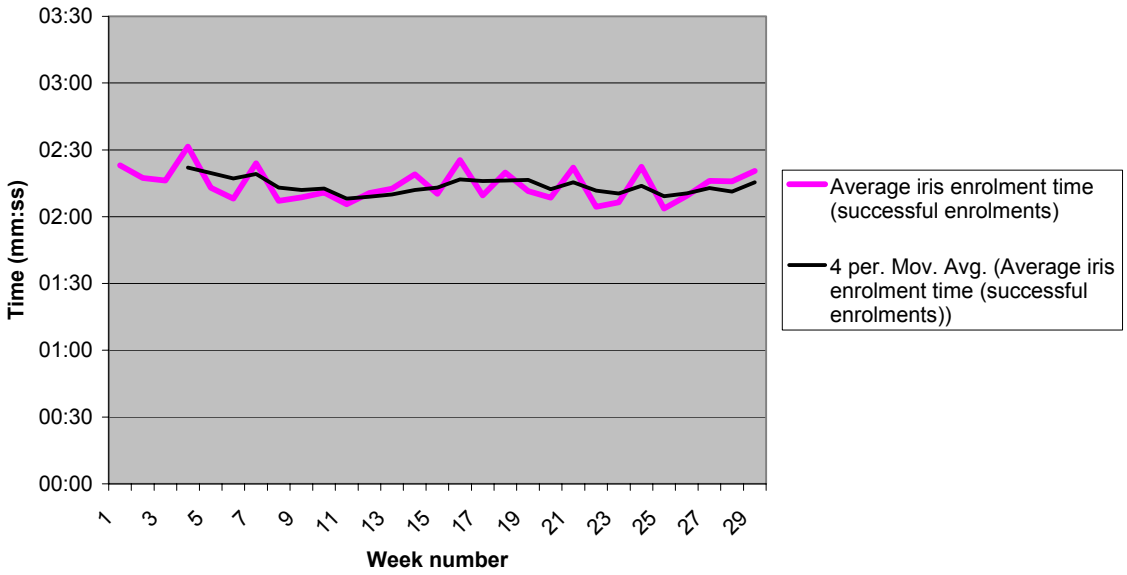
Average Iris Enrolment Times per Centre (Quota and Opportunistic)			
Centre	**Average enrolment time (all)**	**Average enrolment time (successful only)**	**Average enrolment time (1st time success only)**
Globe House	02:39	02:28	02:04
Leicester	02:17	02:05	01:47
Newcastle	02:13	01:59	01:43
Glasgow	02:34	02:22	02:00
Mobile	02:30	02:18	01:56

Average Iris Enrolment Times per Centre (Disabled)			
Centre	**Average enrolment time (all)**	**Average enrolment time (successful only)**	**Average enrolment time (1st time success only)**
Globe House	04:55	03:58	02:32
Leicester	02:41	02:26	01:58
Newcastle	02:24	02:10	02:10
Glasgow	03:42	03:41	03:11
Mobile	02:43	02:48	02:12
Swansea	02:56	02:33	02:22
Newcastle (LBTN)	03:12	02:34	02:34

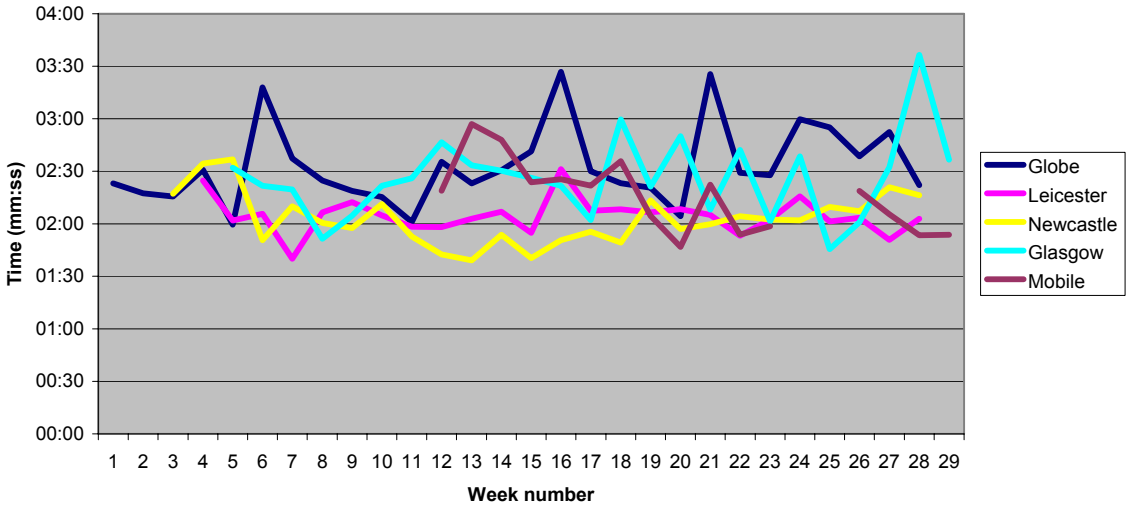
In keeping with the overall picture, the average iris biometric enrolment time at each enrolment centre for Disabled participants tended to be greater than that for the Quota and Opportunistic sample participants.

No trend over time is evident from the overall weekly enrolments or those at the individual centres.

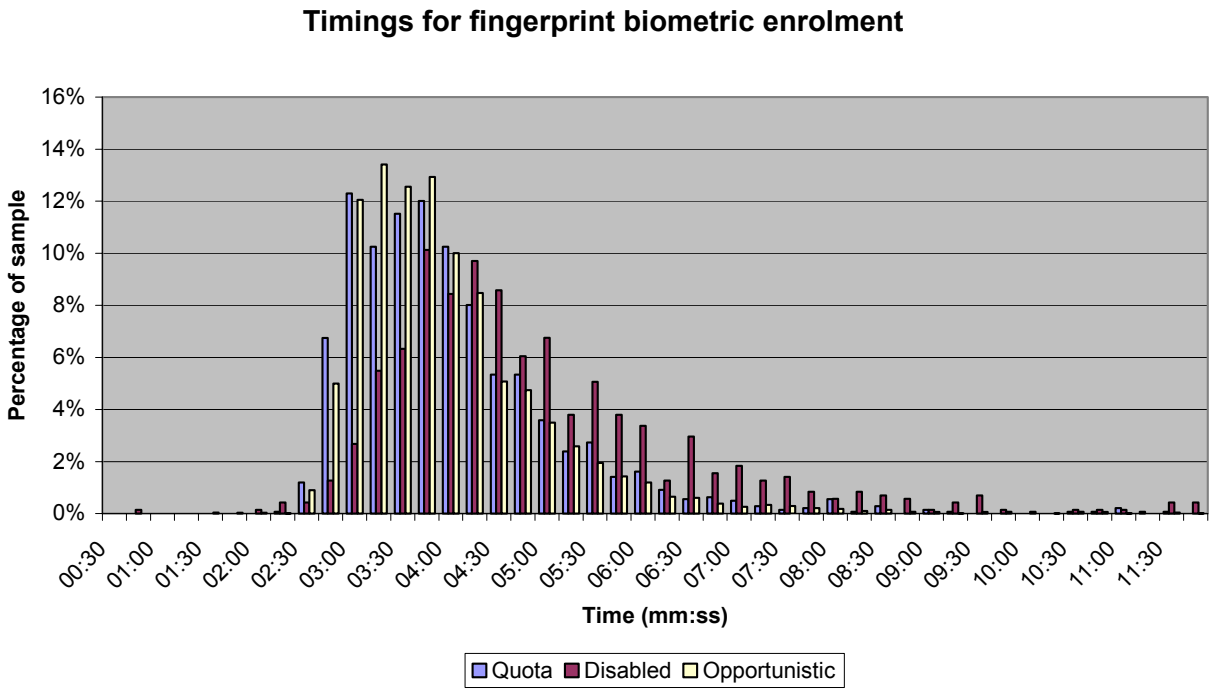
Average iris enrolment time by week - Quota and Opportunistic



Average iris enrolment time by week and centre - Quota and Opportunistic



A1.2.4 Record Fingerprint Biometric Step

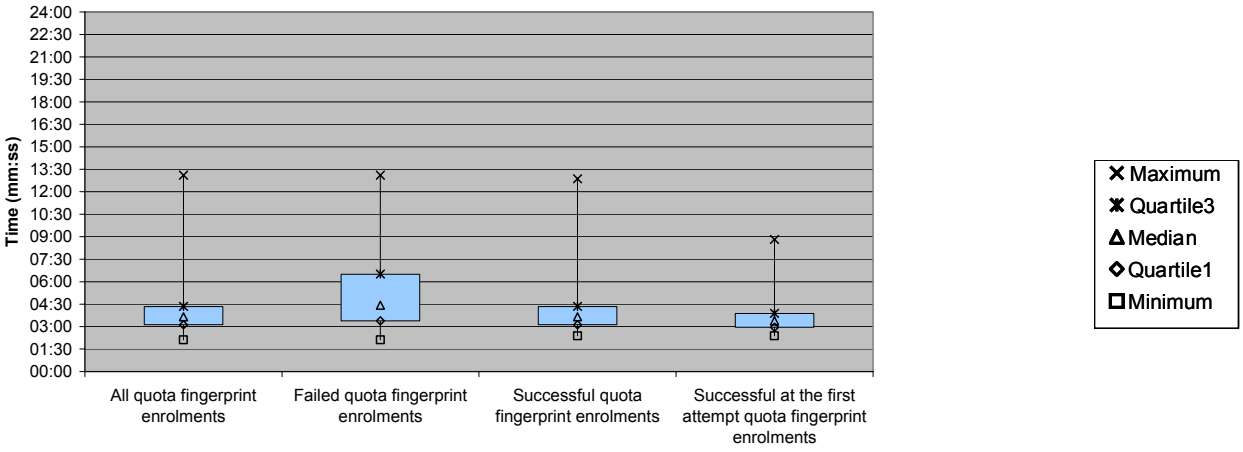


NB in the interests of clarity 99% of the participants have been included in the above histogram. The remaining participants had fingerprint biometric enrolment times between 11¾ minutes and 21¾ minutes.

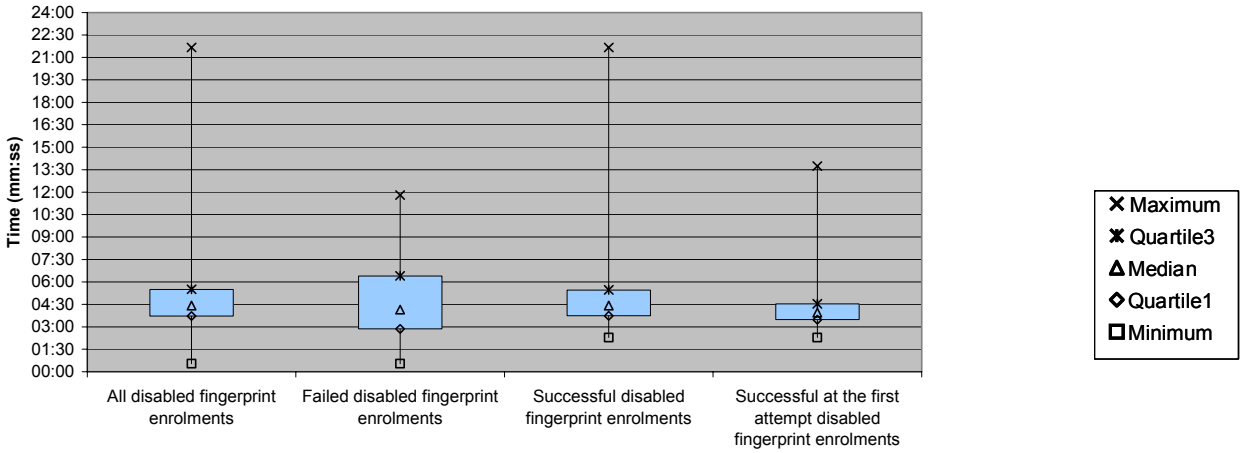
As with the facial and iris biometrics, fingerprint biometric enrolment for the Disabled participant group tended to take longer than for the Quota and Opportunistic sample. 85% of Quota fingerprints and 89% of Opportunistic participants took five minutes or less to be recorded and matched against the preloaded one million fingerprints. The corresponding figure for the Disabled participants is 66%.

Dispersion of the data can be seen from the following boxplots.

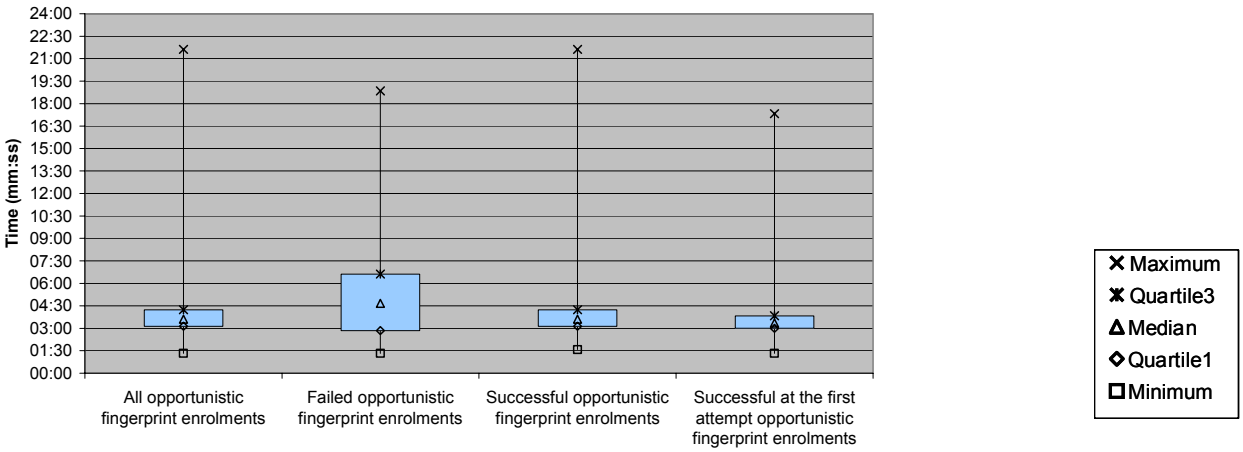
Fingerprint biometric enrolment: process times - Quota only



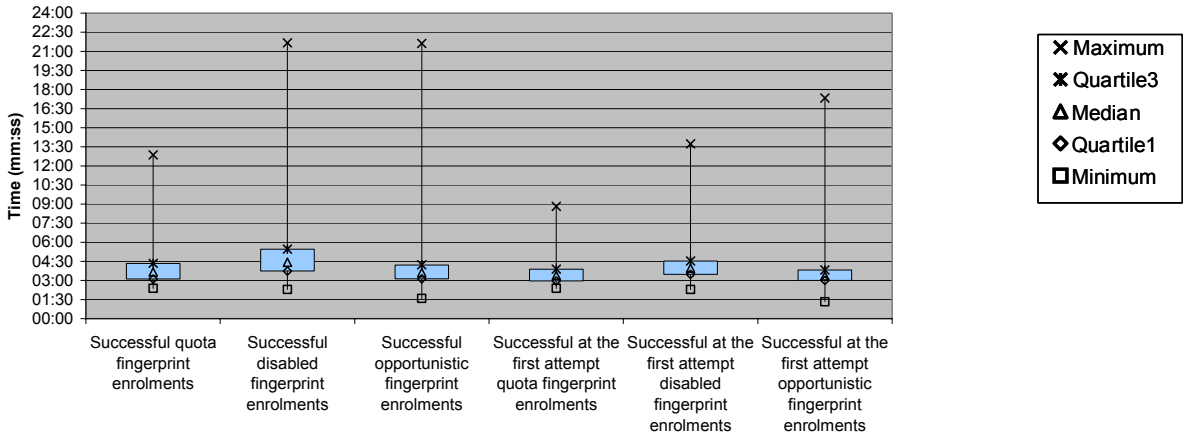
Fingerprint biometric enrolment: process times - Disabled only



Fingerprint biometric enrolment: process times - Opportunistic only



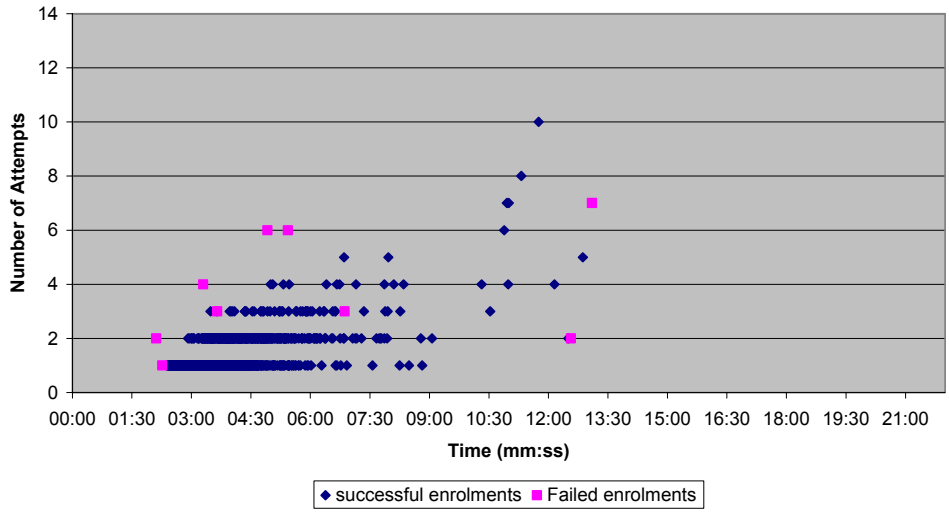
Fingerprint biometric enrolment: process times - All Sample Groups



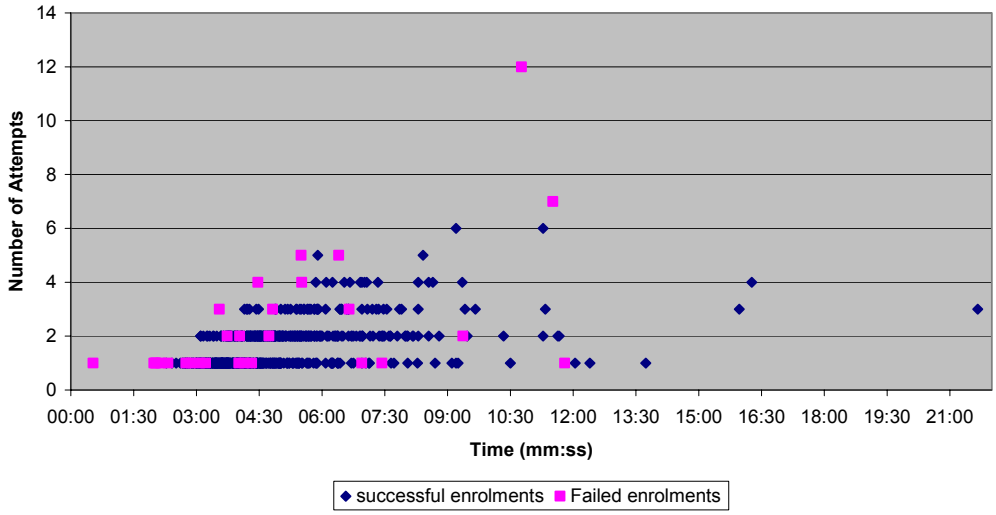
As can be seen from the preceding charts, fingerprint biometric enrolment for the Disabled participant group tended to take longer than for participants from the Quota and Opportunistic sample groups. As will be shown later in the report, Disabled participants were less likely to enrol on the fingerprint biometric at the first attempt than participants from the Quota sample. This could explain the longer enrolment times.

The dispersal of the fingerprint enrolment times is linked to the number of attempts that were required as is indicated in the following scatterplots. The reason why there is a degree of dispersion even for data where the attempt numbers are equal is due to the number of times that the operator has to ask the participant to position their fingers before any image can be recorded. For example, where a participant has large hands or unusually long fingers, it can take the operator some time before the hand is placed so that all fingers can be detected.

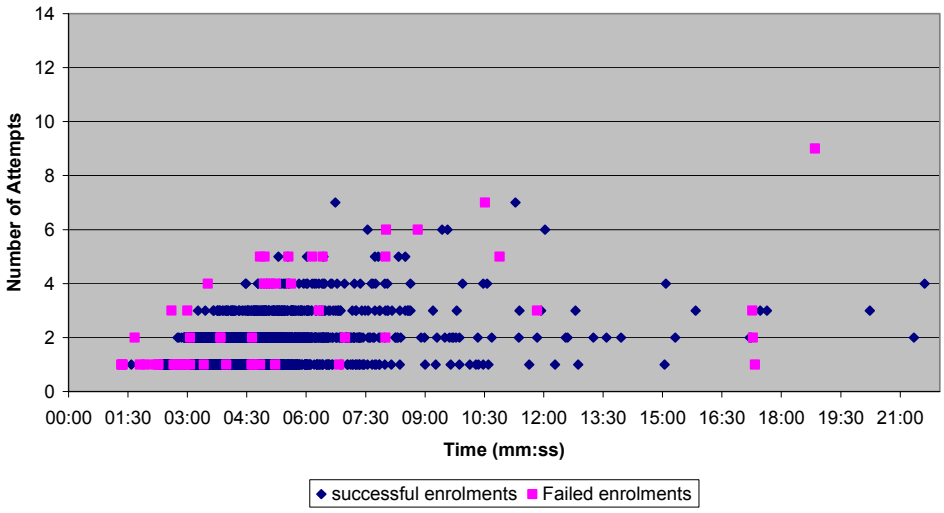
Fingerprint Attempts vs time Taken - Quota only



Fingerprint Attempts vs time Taken - Disabled only



Fingerprint Attempts vs time Taken - Opportunistic only



Of the fixed enrolment centres, fingerprint enrolment times tended to be greatest at Globe House but the reason for this is unknown. The mobile unit also tended to have comparatively high fingerprint enrolment times, possibly as a result of the method of communication used.

Average Fingerprint Enrolment Times per Centre (Quota)			
Centre	**Average enrolment time (all)**	**Average enrolment time (successful only)**	**Average enrolment time (1st time success only)**
Globe House	04:03	04:03	03:51
Leicester	03:47	03:47	03:18
Newcastle	03:41	03:41	03:13
Glasgow	04:02	04:00	03:39
Mobile	05:11	05:05	04:23

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

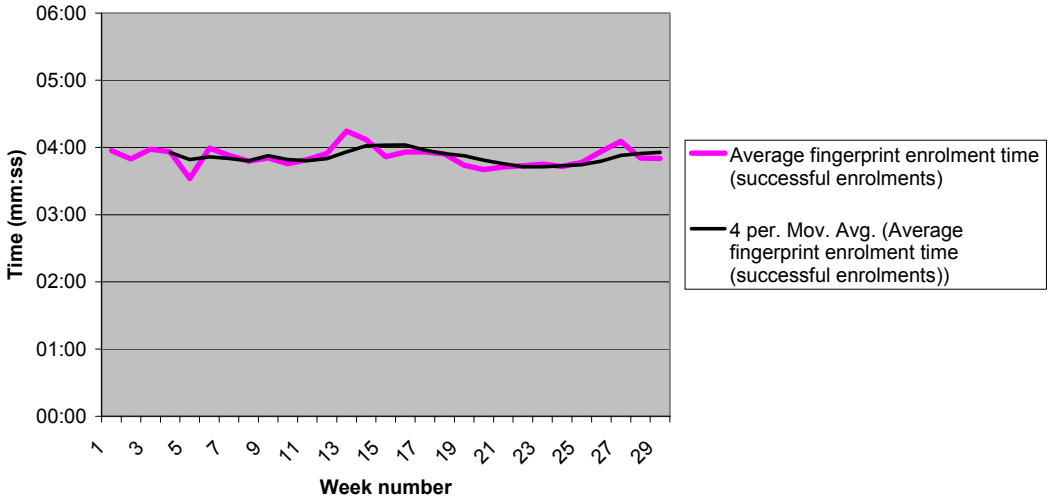
Average Fingerprint Enrolment Times per Centre (Quota and Opportunistic)			
Centre	**Average enrolment time (all)**	**Average enrolment time (successful only)**	**Average enrolment time (1st time success only)**
Globe House	04:03	04:02	03:41
Leicester	03:42	03:42	03:20
Newcastle	03:45	03:45	03:22
Glasgow	03:57	03:57	03:41
Mobile	04:18	04:15	03:50

Average Fingerprint Enrolment Times per Centre (Disabled)			
Centre	**Average enrolment time (all)**	**Average enrolment time (successful only)**	**Average enrolment time (1st time success only)**
Globe House	05:21	05:21	04:37
Leicester	03:59	04:05	03:45
Newcastle	04:25	04:19	03:46
Glasgow	04:29	04:30	04:11
Mobile	05:08	05:06	04:20
Swansea	04:31	04:31	04:00
Newcastle (LBTN)	04:06	04:10	04:00

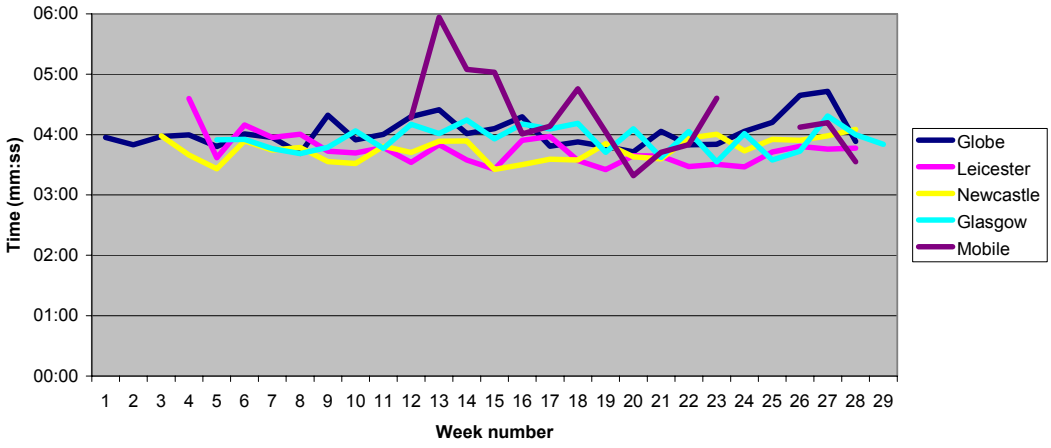
The average fingerprint biometric enrolment time at each enrolment centre for Disabled participants tended to be greater than that for the Quota and Opportunistic sample participants.

No trend over time is evident from the overall weekly enrolments or those at the individual centres.

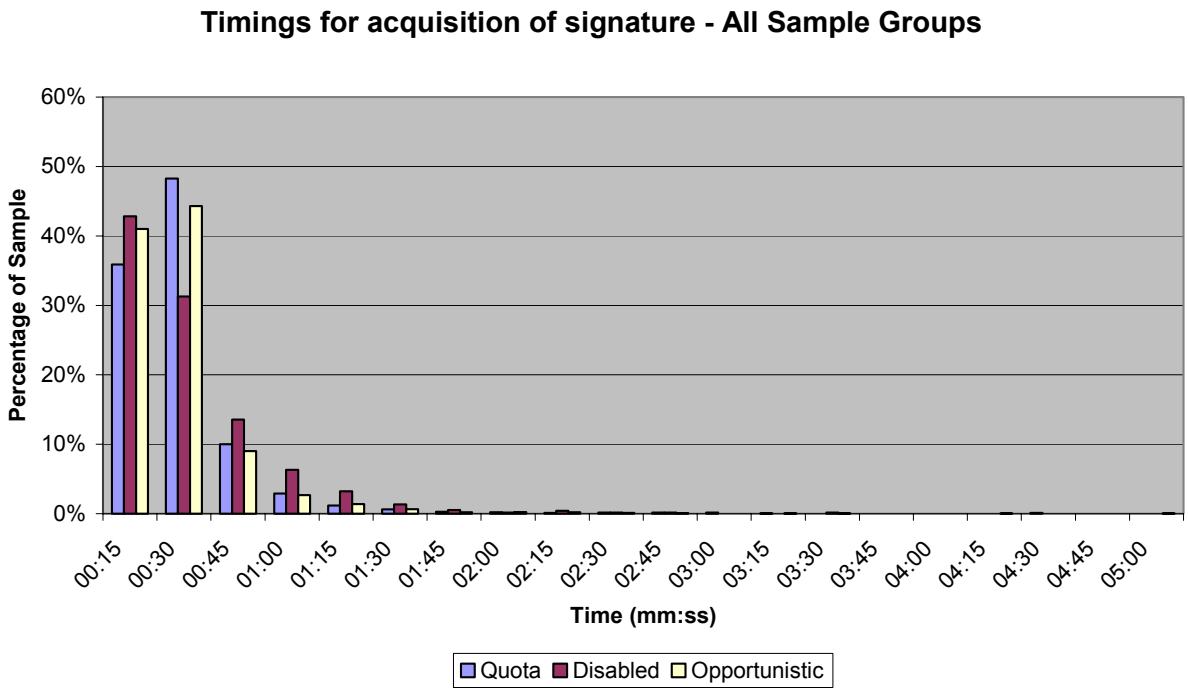
Average fingerprint enrolment time (successful enrolments) by week - Quota and Opportunistic



Average fingerprint enrolment time (successful enrolments) by week and centre - Quota and Opportunistic

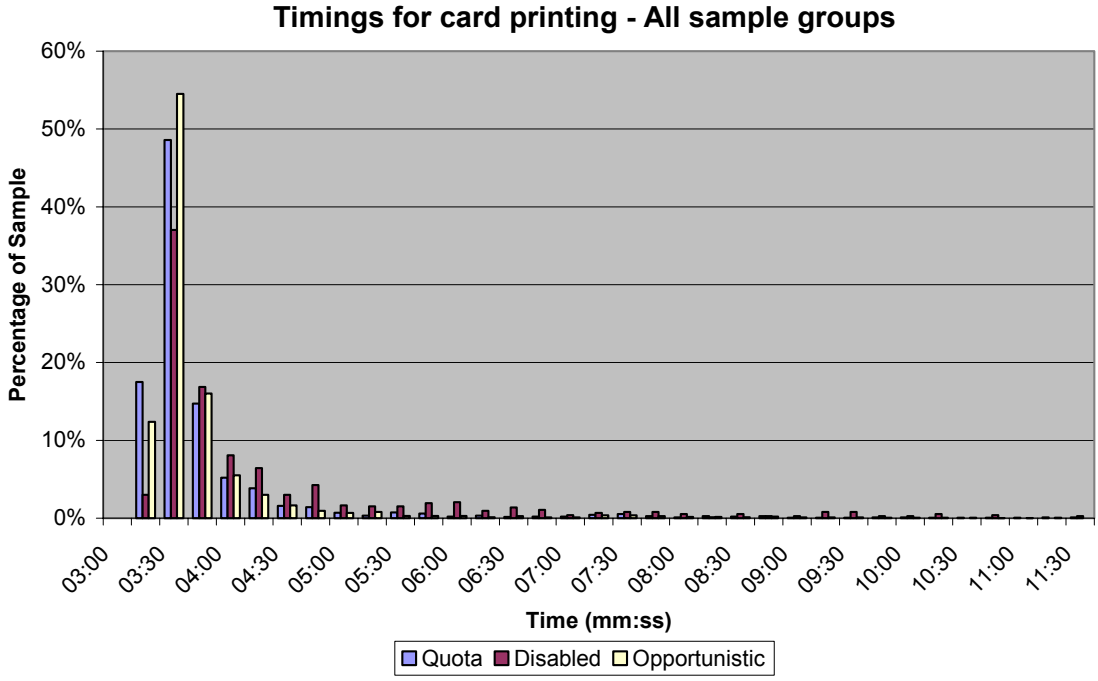


A1.2.5 Record Signature Step



The majority of signatures were recorded in 30 seconds or less. As the signature is not one of the three biometric steps, minimal information is recorded about this step and so it is difficult to determine why in some cases this step took considerably longer. A small sample has been looked at and no linked incidents have been found. In the case where the signature took four minutes and twenty-six seconds the operator noted an issue with the preceding fingerprint step. This is in fact the most likely reason why the signature step took so long. If there was a delay in saving the fingerprints, the operator would not usually keep the participant sat there waiting but would ask for the questionnaire or interview to be started. This would mean that when the system prompted for the participant's signature there would be a delay until the participant returned to the booth.

A1.2.6 Print Card times



N.B. in the interests of clarity 99% of the participants have been included in the above histogram. The remaining 1% had print card times between 11½ minutes and 29 minutes.

The majority of cards are printed in 4 minutes or less. Where it appears to have taken longer to print a card this is for one of two reasons:

- The card did not print successfully and had to be reprinted;
- The operator did not immediately acknowledge that the print had been successful. The system records the end of card printing as being when the operator records that the card has printed. If for some reason the operator does not do this for some time then it appears as if the card took a long time to print. This is almost certainly what happened in the case with the longest card print time (over twenty-one minutes).

A2 Facial Enrolment

A2.1 Facial Enrolment Failure Operator Observations

The 0.15% failure rate in the Quota group actually represents the failure of three people to enrol on the face biometric. In two cases the participants wore glasses and there was a reflection in one of the lenses. If the position of the participants had been adjusted slightly the reflection would have disappeared, there is no reason to believe that facial biometric enrolment would still have failed. In the case of the third failure, the participant had very dark skin and it appears that insufficient light fell on the face. The operator made seven attempts to obtain the biometric, altering the participant's position and the angle of the lights but to no avail.

The 0.08% failure rate in the Opportunistic group actually represents the failure of six people to enrol on the face biometric. In one case the participant wore a baseball hat and refused to remove it for the facial biometric enrolment. In one case the participant was partially sighted and appeared to have difficulty looking straight ahead. For the four remaining failures no operator observations were recorded.

For the facial biometric enrolment failures from the Disabled participant group, the following table gives the operator observation and the nature of the impairment if given on the questionnaire. As can be seen from this, where the operator has been able to determine a reason for failure it is either because the participant's wheelchair has prevented correct positioning or because the participant cannot hold their head up.

Wheelchairs can hamper positioning if the participant is relatively short as it means that the camera is then too high to obtain sufficient detail of the face. An inability to hold the head up is an issue because the camera needs to locate the participant's eyes. If the eyes are not looking at the camera then they cannot be located.

Although there were no operator observations for 8 of the failures, an examination of the photographs showed that in 3 cases the participants had white hair that was similar to the background colour of the booth. This could have been a factor.

Analysis of Operator Observations for Face Enrolment Failures from the Disabled Participant Group

Observation	Volume	Participant's Impairment
Participant unable to hold head up and look at the camera	6	1 with physical, visual, hearing and learning impairments; 4 with physical impairment
Participant's wheelchair prevented correct positioning	4	1 with physical and visual impairment; 1 with physical impairment;1 with learning and physical impairments;1 with visual, physical and learning impairments

Participant had heavy fringe	1	Learning disability
Undetermined	4	1 with visual impairment; 1 with physical impairment; 2 with visual, physical and hearing impairments.
No detail given but operator noted participant's physical impairment as the reason for failure	1	No details given for participant
Participant was hearing helmet and refused to remove it	1	Physical impairment

A2.2 Analysis of Factors Affecting Facial Enrolment at the First Attempt

A2.2.1 Quota and Opportunistic

Enrolment Centre

The first-time face enrolment success rate for Globe House was significantly lower, and that for Leicester significantly higher, than for the other enrolment centres. As the system used and process followed was the same in Leicester and Globe House, the differences could be due to environmental factors, operator factors or participant factors. Given the difference identified in the following age and ethnic group analysis the author suggests an environmental factor is responsible, possibly lighting.

1st Time Success Face Enrolment Rates per Centre (Quota)		
Centre	**Sample size**	**% Success at 1st Attempt**
Globe House	289	95.16%
Leicester	642	95.48%
Newcastle	502	98.01%
Glasgow	471	96.82%
Mobile	94	97.87%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Time Success Face Enrolment Rates per Centre (Quota and Opportunistic)		
Centre	**Sample size**	**% Success at 1st Attempt**
Globe House	1886	94.43%
Leicester	2922	97.02%
Newcastle	1957	96.93%
Glasgow	1533	95.69%
Mobile	964	95.75%

Participant Ethnic Group

1st Time Success Face Enrolment Rates by Ethnic Group (Quota)		
Ethnic Origin	**Sample size**	**% Success at 1st Attempt**
Asian	94	94.68%
Black	76	94.74%
Chinese/East Asian	5	80.00%
Other	29	93.10%
White	1794	96.77%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Time Success Face Enrolment Rates by Ethnic Group (Quota and Opportunistic)		
Ethnic Origin	**Sample size**	**% Success at 1st Attempt**
Asian	810	96.91%
Black	389	93.06%
Chinese/East Asian	45	95.56%
Other	273	95.24%
White	7734	96.22%

There is some evidence from the preceding tables for a link between ethnicity and the first attempt facial biometric enrolment rate, since Black participants were less likely to successfully enrol at the first attempt. As the majority of Black participants enrolled either at Leicester or Globe House, the data from these two centres has been analysed further. At Globe House the first attempt facial biometric enrolment rate is significantly lower for Black participants than for White participants. Although the success rate for Black participants at Leicester is lower than for White participants, the difference is not great enough to be confident that a link exists. For all ethnic groups the first attempt enrolment rate is lower in Globe than Leicester suggesting there is a factor that has affected facial biometric enrolment at Globe House. Whatever this factor is, its impact has been greatest on Black participants.

1st Time Success Face Enrolment Rates at Globe House by Ethnic Group (Quota and Opportunistic)		
Ethnic Origin	**Sample size**	**% Success at 1st Attempt**
Asian	168	95.24%
Black	113	87.61%
Chinese/East Asian	16	93.75%
Other	77	94.81%
White	1508	94.96%

1st Time Success Face Enrolment Rates at Leicester by Ethnic Group (Quota and Opportunistic)		
Ethnic Origin	**Sample size**	**% Success at 1st Attempt**
Asian	522	96.93%
Black	237	94.94%
Chinese/East Asian	14	92.86%
Other	135	96.30%
White	2013	97.27%

Participant Age

1st Time Success Face Enrolment Rates by Age Group (Quota)		
Age Range	**Sample size**	**% Success at 1st Attempt**
18-24	263	98.10%
25-34	382	97.38%
35-44	370	96.76%
45-54	339	96.46%
55-59	200	94.00%
60-64	143	96.50%
65+	301	95.35%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Time Success Face Enrolment Rates by Age Group (Quota and Opportunistic)		
Age Range	**Sample size**	**% Success at 1st Attempt**
18-24	1056	97.63%
25-34	1798	97.16%
35-44	1800	95.89%
45-54	1812	95.58%
55-59	931	95.06%
60-64	728	94.92%
65+	1137	95.95%

As with ethnic group analysis, the analysis seems to show a link between age-range and success at the first attempt. However, as there appears to be a factor influencing facial biometric enrolment at Globe House, the figures from Globe House and Leicester have been analysed. Whereas at Globe House the likelihood of success at the first attempt decreased with age, no such pattern is evident from the Leicester data.

1st Time Success Face Enrolment Rates at Globe House by Age Range (Quota and Opportunistic)		
Age Range	**Sample size**	**% Success at 1st Attempt**
18-24	140	97.86%
25-34	442	97.06%
35-44	494	94.33%
45-54	399	94.24%
55-59	163	91.41%
60-64	129	90.70%
65+	119	89.92%

1st Time Success Face Enrolment Rates at Leicester by Age Range (Quota and Opportunistic)		
Age Range	**Sample size**	**% Success at 1st Attempt**
18-24	395	97.97%
25-34	581	96.39%
35-44	459	96.73%
45-54	526	97.34%
55-59	278	96.40%
60-64	227	96.48%
65+	456	97.59%

Participant Gender

The first-time success rate seems unrelated to gender.

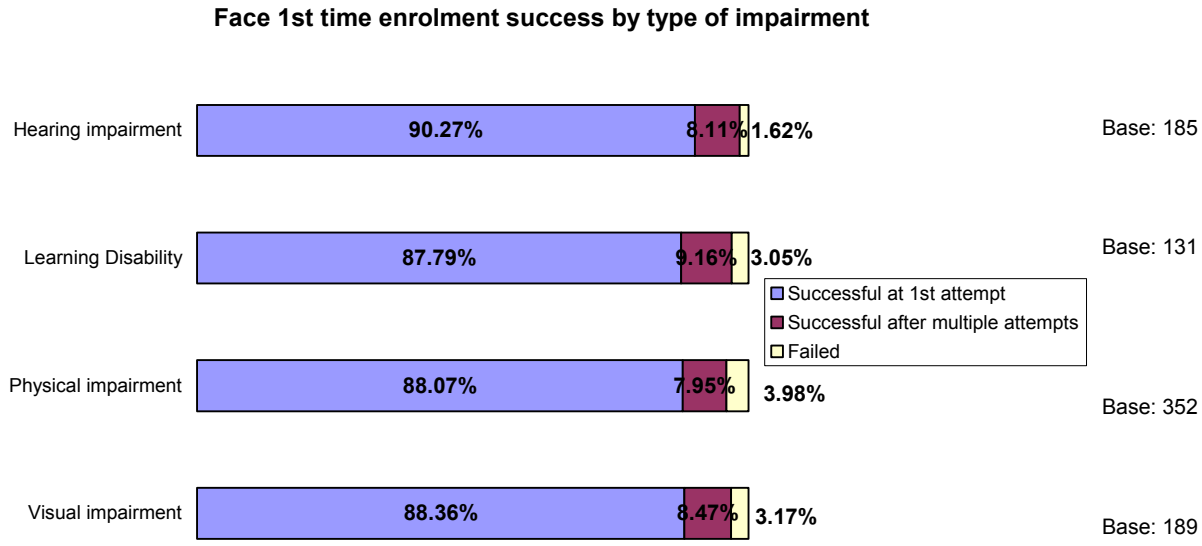
1st Time Success Face Enrolment Rates by Gender (Quota)		
Gender	**Sample size**	**% Success at 1st Attempt**
Female	870	96.55%
Male	1128	96.45%

Quota sample figures, have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results

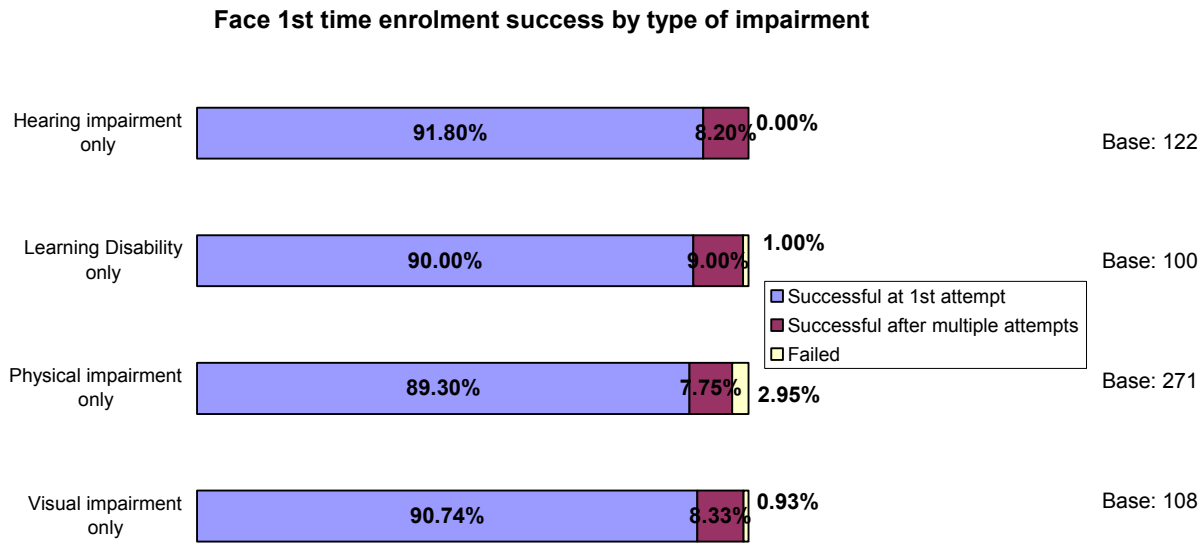
1st Time Success Face Enrolment Rates by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**% Success at 1st Attempt**
Female	3391	96.23%
Male	5871	96.07%

A2.3 Analysis of Facial Enrolment by Impairment Type

The following chart shows the facial biometric first attempt success rate by type of impairment.



Some participants had more than one type of impairment. The same analysis has been carried out again using only those participants with one type of impairment.



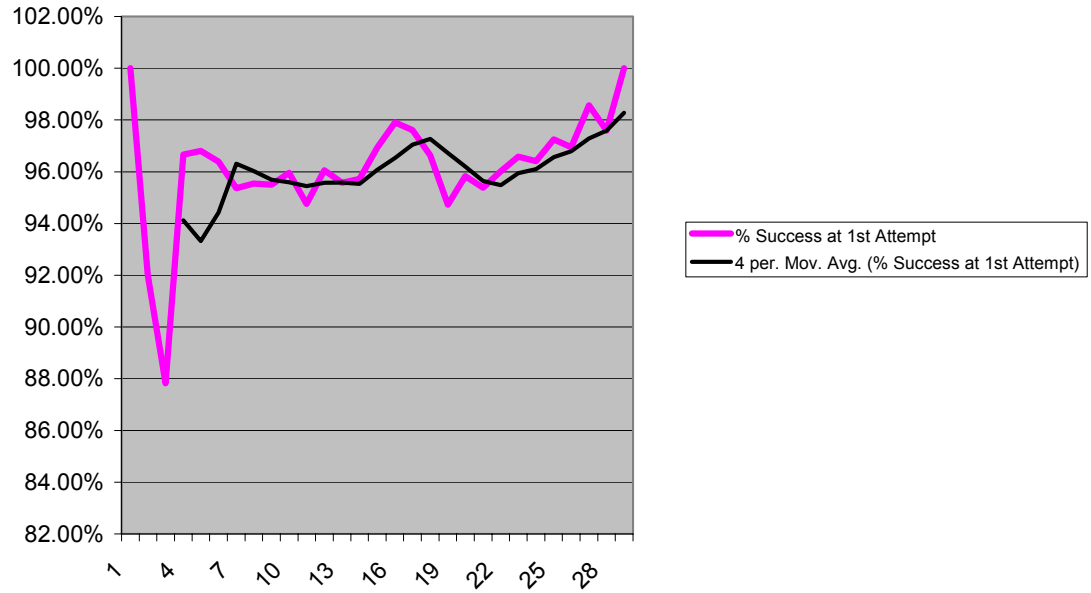
All impairment types tended to decrease the likelihood of the participant enrolling successfully on face at the first attempt. The operators have not always noted the reasons for retries being necessary and so the following suggested causes are to a degree speculative:

- For participants with learning disabilities, a likely cause of retries is difficulty in keeping still and looking ahead at the camera.
- For participants with a physical impairment, likely causes of retries are difficulty in holding the head in the required position and wheelchairs making it harder for the operator to position the participant correctly.
- For participants with a hearing impairment it is likely that retries are a result of the operator finding it hard to communicate with the participant and correct positional problems during the first attempt.

A2.4 Trend Over Time

The first time success rate shows a slight upwards trend over time. This could indicate that the operators get better at positioning the participants correctly at the outset, but given the possibility of environmental factors mentioned previously, it could also be that these environmental factors are varying over time.

Face biometric enrolment:% Success at first attempt by week - Quota and Opportunistic



A3 Iris Enrolment

A3.1 Iris Enrolment Failure Operator Observations

The following tables summarise the operator observations for the iris enrolment failures for each sample group. Where further information is available about individual cases this follows each table.

A3.1.1 Iris Enrolment Failures (Quota)

Operator observations for iris enrolment failures (Quota group)	
Observation	**Volume**
Positioning	3
Behavioural	13
Medical Condition	24
Participant didn't want to continue	12
Eyelashes	1
Hard contact lenses	1
Small/narrow eyes	11
Droopy eyelids	5
Heavy eye make-up	3
Eyes not level	2
Van rocking	2
Turn in eye	2
English not 1st language	1
Wandering eye	1
Undetermined	99

Positioning: participants who were very short tended to be looking up at the mirror even with the chair at the maximum height. This led the eyelids to obscure part of the iris. One participant was in a wheelchair and was unable to raise herself to the correct height.

Behavioural: some participants had difficulty in following the camera and operator prompts or in remaining still. For 11 of the failures in this category the operators have given some additional detail:

- 2 wouldn't keep still;
- 1 was blinking a lot
- 1 kept jerking his head, seemingly because he was worried about the camera
- 1 didn't seem to want to look into the mirror
- 1 was awkward about getting into position
- 1 was moving about a lot
- 1 wouldn't move into correct position
- 3 were unable to follow instructions.

Medical condition: some participants volunteered information about conditions that

affected their eyes. Potentially these conditions could affect the ability to obtain images of their irises. These were as follows:

- 9 had cataracts;
- 4 previously had cataracts but they had been removed
- 4 had eye operations at some time in the past;
- 2 currently had eye infections;
- 1 had a split cornea;
- 1 had a twitch in the eyes and had also had botox injections;
- 1 had an eye injury
- 1 was partially sighted;
- 1 had bloodshot eye requiring frequent use of eyedrops.

Participant didn't want to continue: normally the operators made several attempts to obtain iris images. However, if the participant felt uncomfortable or simply didn't want to retry then no further attempts to record the iris were made. For the failures in this category the operators have given some additional detail:

- participant was elderly and didn't want to make further attempts;
- three participants found the process uncomfortable and didn't want to make further attempts. In one case the participant had hay fever.
- participant in a hurry and didn't want to make further attempts;
- participant's eyes were watering;
- participant's eyes became sore;
- two participants became distressed and so the operator decided not to make further attempts;
- three participants just didn't want to make any further attempts (no reason given).

Undetermined: there are three groups within this category: cases where no observation was recorded by the operators, cases where the camera did not take any shots even after the participant was repositioned by the operator and cases where the camera took shots but was unable to obtain an acceptable iris image.

A3.1.2 Iris Enrolment Failures (Opportunistic)

Operator observations for iris enrolment failures (Opportunistic group)	
Observation	**Volume**
Positioning	26
Behavioural	42
Medical Condition	54
Participant didn't want to continue	17
Eyelashes	3
Small/narrow eyes	25
Droopy eyelids	20
Couldn't hear instructions	2
Heavy eye make-up	8
Lazy eye	6
Deep-set eyes	1
Eyes not level	2

Van rocking	1
Turn in eye	1
English not 1st language	12
Wandering eye	5
Lighting	1
Large pupils	1
Coloured contact lenses	1
Contact lenses of unknown type	3
Squint	1
Close set eyes	1
Undetermined	403

Positioning: these failures can be further categorised as follows:

- 9 were participants who were very short and the chair in the booth could not raise them to the height required. As with the Quota sample group, where this happens the participant tended to look up at the camera and the iris would be partially obscured by eyelids.
- 2 were wheelchair users whose wheelchairs could not get close enough to the camera. This was either because the fingerprint device which was sunk into the desk caught on a wheelchair control, or because there was insufficient space under the desk for long wheelchairs;
- 3 were wheelchair users who could not be raised to the correct height for the camera, leading the participants to be looking up rather than straight ahead;
- 1 participant had trouble positioning himself/herself because of a broken collar bone;
- 1 participant could not get close enough but the reason for this has not been noted;
- 1 participant was unable to position himself/herself because of disability but the nature of the problem has not been noted;
- 1 participant's build prevented him/her getting close enough to the camera;
- 3 participants were unable to position themselves because of visual impairment;
- no details were given for the remaining 4

Behavioural: For 37 of the failures in this category the operators have given some additional detail:

- 3 wouldn't keep still;
- 4 were blinking a lot
- 1 was very nervous because of a recent eye operation;
- 6 became irritated or impatient with the camera;
- 2 were distracted by accompanying children or friends;
- 12 had difficulty following the instructions;
- 2 kept turning their heads to the side instead of moving to the side when prompted by the camera or operator;
- 1 didn't look in the mirror as requested;
- 3 made no attempt to open their eyes wider when requested by the operator;

- 1 made large movements when prompted to move by the operator in spite of being asked to make small movements;
- 1 kept tilting his/her head.
- 1 didn't listen to the instructions properly

Medical condition: some participants volunteered information about conditions that affected their eyes. Potentially these conditions could affect the ability to obtain images of their irises. These were as follows:

- 7 had cataracts;
- 8 previously had cataracts but they had been removed
- 6 had eye operations at some time in the past;
- 2 were awaiting eye operations for unspecified conditions;
- 2 currently had eye infections. In one case the operator noted that the infection affected the participant's ability to open the eyes wide;
- 4 had damaged eyes as a result of an accident or infection;
- 5 had glaucoma;
- 5 were diabetic;
- 2 had glass eyes;
- 1 had an aniridia (no irises);
- 1 had no pupils;
- 1 had microphthamia;
- 1 had a squint;
- 1 had an eye condition causing frequent blinking;
- 1 had scar tissue on one eye
- 1 was being treated for an eye disease (no details given);
- 1 had watery eyes as a result of Graves disease;
- 1 had macular degeneration;
- 1 had a detached retina;
- 3 had unspecified problems with their eyes.

Participant didn't want to continue: for the failures in this category the operators have given some additional detail:

- 1 participant was elderly (aged 85) and didn't want to make further attempts;
- 1 participant found the process a strain on their eyes and didn't want to make further attempts;
- 2 participant were in a hurry and didn't want to make further attempts;
- 3 participants' eyes were watering;
- 1 participant's eyes became sore;
- 1 participant was tired;
- 8 participants just didn't want to make any further attempts (no reason given).

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A3.1.3 Iris Enrolment Failures (Disabled)

Operator observations for iris enrolment failures (Disabled)	
Observation	**Volume**
Positioning	81
Behavioural	27
Medical Condition	17
Participant didn't want to continue	7
Operator didn't want to continue	2
Small/narrow eyes	5
Droopy eyelids	5
Couldn't hear instructions	7
Lazy eye	1
Deep-set eyes	1
Watery eyes	1
Turn in eye	2
Undetermined	110

Positioning: these failures can be further categorised as follows:

- 21 were wheelchair users whose wheelchairs could not get close enough to the camera. This was either because the fingerprint device which was sunk into the desk caught on a wheelchair control, or because there was insufficient space under the desk for long wheelchairs;
- 11 were wheelchair users who could not be positioned to the correct height for the camera. As with the Quota sample group, where this happens the participant tended to look up at the camera and the iris would be partially obscured by eyelids.
- 3 were wheelchair users where the operators believed that correct position could not be attained because of the wheelchair but gave no further details;
- 1 participant had trouble positioning himself because of a bad back;
- 1 was a participant who was very short who could not be positioned to the height required;
- 2 were participants whose height prevented correct positioning, but whether this is because they were too tall or too short has not been noted;
- 2 were unable to position themselves because of disability but the nature of the problem has not been noted;
- 21 participants were unable to position themselves because of visual impairment.
- 5 were hearing impaired participants who found it difficult to position themselves even though a sign language interpreter was present and giving instructions;
- no details were given for the remaining 14.

Behavioural: some participants had difficulty in following the camera and operator prompts or in remaining still. For all of the failures in this category the operators have given some additional detail:

- 12 had learning difficulties and were unable to follow instructions. In three of these cases the operator has noted they were unable to make **small** movements when prompted and in three cases they were unable to follow instructions to open their eyes wide;
- 4 couldn't keep still;
- 4 had learning difficulties and couldn't look into the mirror;
- 3 couldn't or wouldn't look into the mirror for long enough;
- 2 couldn't follow instructions;
- 1 wouldn't remove his helmet;
- 1 appeared to make no attempt to open their eyes wide when asked.

Medical condition: either some participants volunteered information or the operators observed information about conditions that affected their eyes. Potentially these conditions could affect the ability to obtain images of their irises. These were as follows:

- 2 had a prosthetic eye;
- 1 was a wheelchair user who had cerebral palsy. There were difficulties in positioning because of the wheelchair, but in addition the participant made involuntary movements;
- 1 was diabetic and had blurred vision;
- 1 had glaucoma;
- 1 had an eye operation at some time in the past;
- 1 had nerve damage (nature unspecified);
- 2 had nystagmus;
- 1 was photophobic;
- 1 was unable to hold their head up;
- 1 had an eye that would not open fully;
- 1 had a missing eye
- 1 had cataracts;
- 1 had dilated pupils as a result of eyedrops;
- in the remaining case the operator noted that the participant failed because of their disability but gave no further details.

Participant didn't want to continue: normally the operators made several attempts to obtain iris images. However, if the participant felt uncomfortable or simply didn't want to retry then no further attempts to record the iris were made:

- 1 participant didn't like the lights and wanted to stop;
- 1 participant had just had enough after the first attempt;
- 5 didn't want to continue (no reason given).

Operator didn't want to continue: as stated previously, the operators would normally make several attempts to obtain iris images. In both cases the operator was unhappy about continuing because of the age of the participant (75 and 94).

Couldn't hear instructions: these participants went through the Trial without a sign language interpreter being present. They couldn't hear the instructions and so were dependent on the flashing arrows on the front of the camera unit to position themselves. They were unable to follow these.

Undetermined: there are three groups within this category: cases where no observation

was recorded by the operators, cases where the camera did not take any shots even after the participant was repositioned by the operator and cases where the camera took shots but was unable to obtain an acceptable iris image.

A3.2 Analysis of Factors Affecting Iris Enrolment (Quota and Opportunistic)

A3.2.1 Iris Enrolment Success

Enrolment Centre

The iris enrolment success rate for Leicester was significantly lower than for the other enrolment centres. As the system used and process followed was the same in Leicester as elsewhere, the differences could be due to environmental factors, operator factors or participant factors.

Iris Enrolment Success Rates by Centre (Quota)		
Centre	**Sample size**	**Iris Success Rate**
Globe House	208	96.63%
Leicester	454	84.80%
Newcastle	372	88.44%
Glasgow	358	85.75%
Mobile	71	85.92%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

Iris Enrolment Success Rates by Centre (Quota and Opportunistic)		
Centre	**Sample size**	**Iris Success Rate**
Globe House	1782	95.68%
Leicester	2710	88.15%
Newcastle	1807	88.99%
Glasgow	1387	88.10%
Mobile	934	94.22%

Participant Ethnic Group

Iris Enrolment Success Rates by Ethnic Origin (Quota)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	75	84.00%
Black	54	74.07%
Chinese/East Asian	4	75.00%
Other	20	90.00%
White	1310	88.47%

Quota sample figures have been shown separately. However, further commentary and analysis relates to the combined Opportunistic and Quota results.

Iris Enrolment Success Rates by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	781	88.09%
Black	358	81.01%
Chinese/East Asian	43	86.05%
Other	263	90.11%
White	7164	91.33%

The preceding tables indicate a link between ethnicity and the iris biometric enrolment success, since Black participants in particular were less likely to successfully enrol than other ethnic groups. As the iris enrolment success rates have been found to vary between enrolment centres, the data from Globe House and Leicester has been analysed on an individual basis to see if there is still evidence of a link. Both Globe House and Leicester had significantly different iris enrolment success rates for the different ethnic groups.

Iris Success Rates by Ethnic Origin at Globe House (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	164	94.51%
Black	112	82.14%
Chinese/East Asian	15	100.00%
Other	75	97.33%
White	1414	96.75%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

Iris Success Rates by Ethnic Origin at Leicester (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	505	87.92%
Black	212	80.19%
Chinese/East Asian	14	85.71%
Other	128	90.63%
White	1848	88.96%

Participant Age

Iris Enrolment Success Rate by Age Range (Quota)		
Age Range	**Sample Size**	**Iris Success Rate**
18-24	186	90.32%
25-34	283	92.58%
35-44	273	91.21%
45-54	245	91.43%
55-59	156	90.38%
60-64	96	83.33%
65+	224	70.98%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

Iris Enrolment Success Rate by Age Range (Quota and Opportunistic)		
Age Range	**Sample Size**	**Iris Success Rate**
18-24	966	90.89%
25-34	1673	93.48%
35-44	1683	94.41%
45-54	1699	92.23%
55-59	875	91.31%
60-64	675	86.81%
65+	1049	78.27%

The preceding analysis contains evidence of link between age-range and iris enrolment success. As before, the figures from Globe House and Leicester have been analysed further. Both Globe House and Leicester had significantly different iris enrolment success rates for the different age-range groups. The likelihood of iris enrolment success seems to decrease with age.

Iris Enrolment Success Rate by Age Range at Globe House (Quota and Opportunistic)		
Age Range	**Sample Size**	**Iris Success Rate**
18-24	135	98.52%
25-34	415	96.14%
35-44	461	96.75%
45-54	385	95.58%
55-59	153	96.73%
60-64	123	89.43%
65+	110	91.82%

Iris Enrolment Success Rate by Age Range at Leicester (Quota and Opportunistic)		
Age Range	**Sample Size**	**Iris Success Rate**
18-24	360	92.22%
25-34	543	91.71%
35-44	432	93.98%
45-54	485	90.52%
55-59	261	88.12%
60-64	212	83.49%
65+	417	73.62%

Participant Gender

Iris Enrolment Success Rate by Gender (Quota)		
Gender	**Sample size**	**Iris Success Rate**
Female	632	86.87%
Male	831	88.33%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

Iris Enrolment Success Rate by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**Iris Success Rate**
Female	3119	88.87%
Male	5501	91.47%

The preceding analysis contains evidence of link between gender and iris enrolment success. As before, the figures from Globe House and Leicester have been analysed further. However, although Leicester had significantly different iris enrolment success rates for males and females, the same is not true of Globe House. This suggests that gender is not a factor.

A3.2.2 Iris Enrolment Success at the First Attempt

Enrolment Centre

The first time success rate has varied between enrolment centres, as shown below.

1st Attempt Iris Enrolment Success Rates by Centre (Quota)		
Centre	**Sample size**	**1st time success as % of overall enrolments**
Globe House	208	82.21%
Leicester	454	71.59%
Newcastle	372	72.31%
Glasgow	358	71.79%
Mobile	71	66.20%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Attempt Iris Enrolment Success Rates by Centre (Quota and Opportunistic)		
Centre	**Sample size**	**1st time success as % of overall enrolments**
Globe House	1782	79.97%
Leicester	2710	75.35%
Newcastle	1807	77.09%
Glasgow	1387	72.60%
Mobile	934	80.09%

Participant Ethnic Group

As with iris enrolment success, there is evidence for a link between ethnicity and the first attempt success rate.

1st Attempt Iris Enrolment Success Rates by Ethnic Origin (Quota)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	75	68.00%
Black	54	50.00%
Chinese/East Asian	4	50.00%
Other	20	75.00%
White	1310	74.35%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Attempt Iris Enrolment Success Rates by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Iris Success Rate**
Asian	781	70.93%
Black	358	59.22%
Chinese/East Asian	43	67.44%
Other	263	73.76%
White	7164	78.43%

Participant Age

There is evidence for a link between participant age and the first attempt success rate.

1st Attempt Iris Enrolment Success Rate by Age Range (Quota)		
Age Range	**Sample Size**	**1st time success as % of overall enrolments**
18-24	186	75.81%
25-34	283	79.15%
35-44	273	79.12%
45-54	245	78.78%
55-59	156	69.23%
60-64	96	63.54%
65+	224	56.25%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Attempt Iris Enrolment Success Rate by Age Range (Quota and Opportunistic)		
Age Range	**Sample Size**	**1st time success as % of overall enrolments**
18-24	966	78.57%
25-34	1673	81.59%
35-44	1683	83.07%
45-54	1699	79.40%
55-59	875	74.29%
60-64	675	69.63%
65+	1049	59.49%

Participant Gender

There does not appear to be a link between participant gender and the first attempt success rate.

1st Attempt Iris Enrolment Success Rate by Gender (Quota)		
Gender	**Sample size**	**1st time success as % of overall enrolments**
Female	632	71.84%
Male	831	74.01%

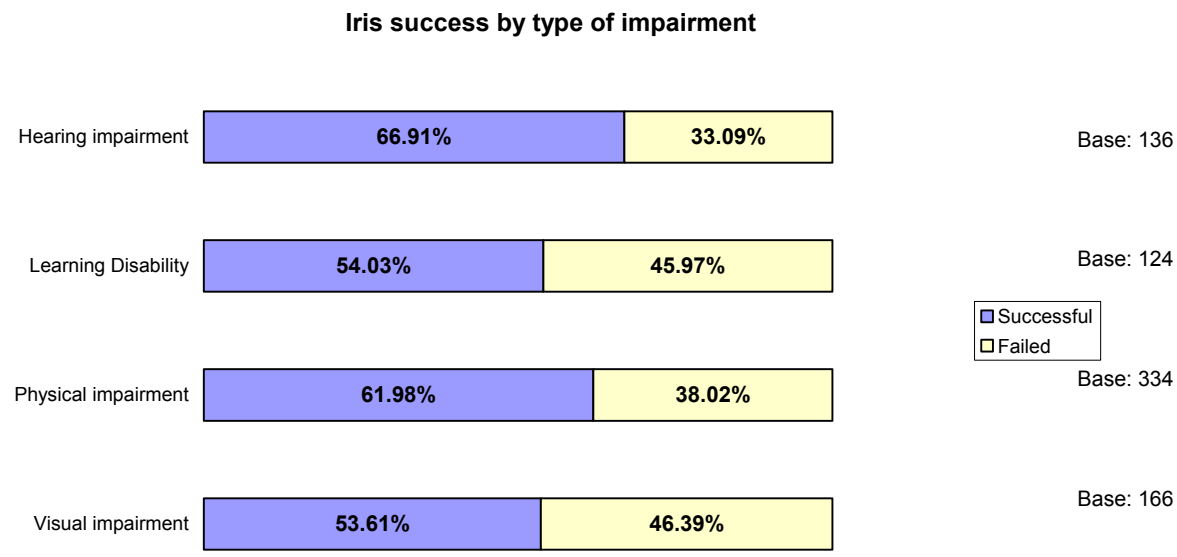
Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Attempt Iris Enrolment Success Rate by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**1st time success as % of overall enrolments**
Female	3119	75.54%
Male	5501	77.42%

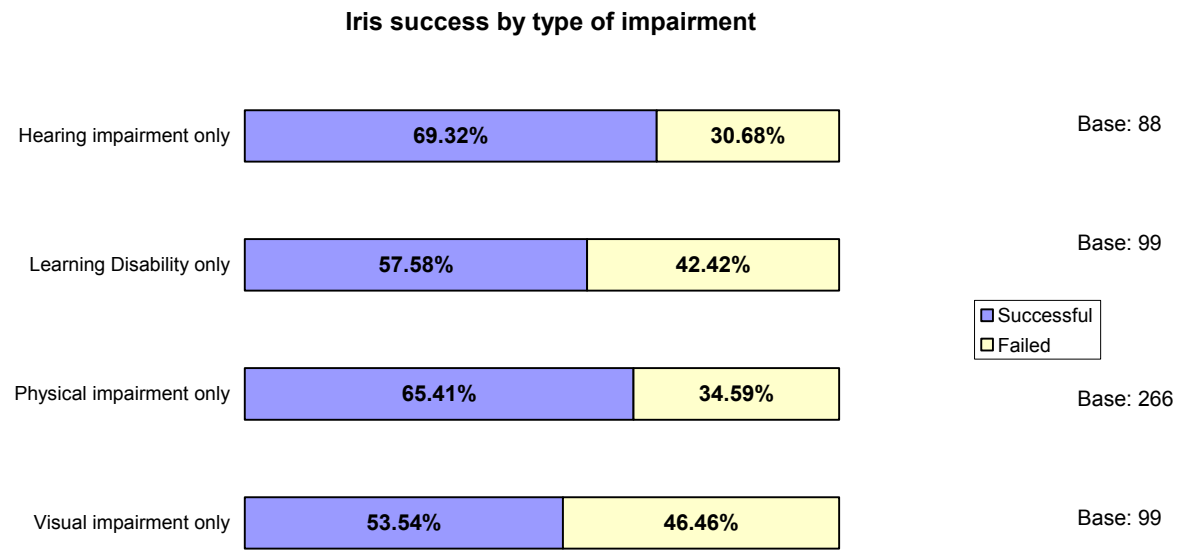
A3.3 Analysis of Iris Enrolment by Impairment Type

A3.3.1 Iris Enrolment Success

The following chart shows the iris biometric success rate by type of impairment.



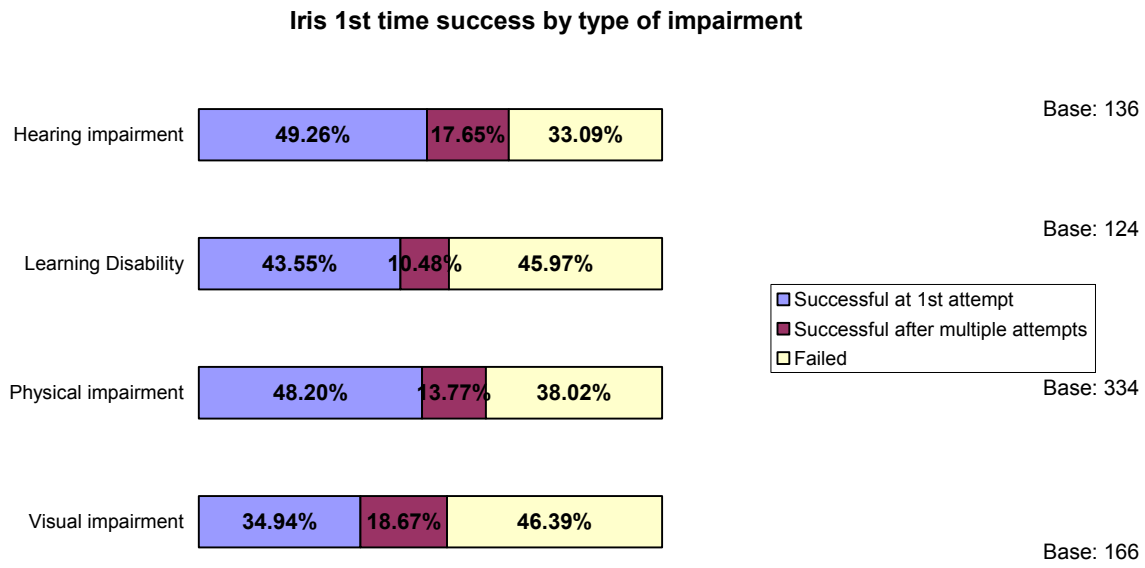
Some participants had more than one type of impairment. The same analysis has been carried out again using only those participants with one type of impairment.



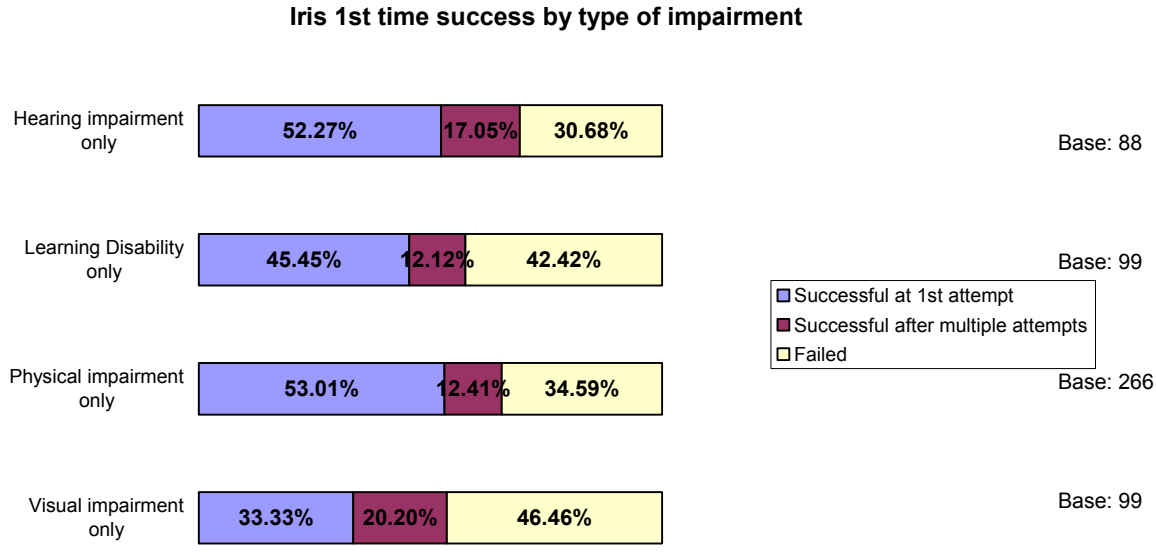
All impairment types tend to decrease the likelihood of the participant enrolling successfully on iris.

A3.3.2 Iris Enrolment Success at the First Attempt

The following chart shows the iris biometric success rate by type of impairment.

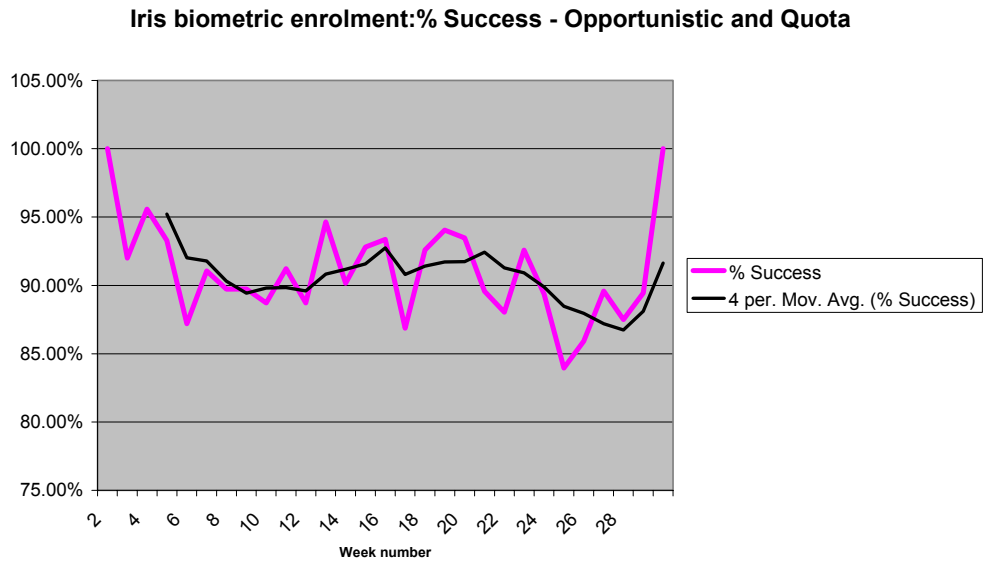


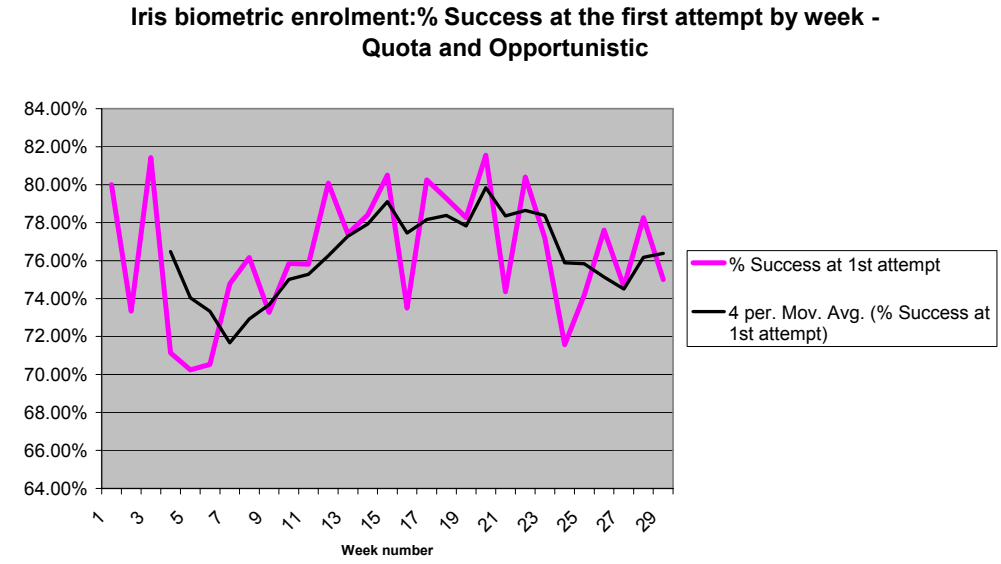
Some participants had more than one type of impairment. The same analysis has been carried out again using only those participants with one type of impairment.



Participants with a visual impairment were less likely to successfully enrol on iris at the first attempt than other Disabled participants.

A3.4 Trend Over Time





Although there are peaks and troughs in the rate each week, there is no underlying trend.

A4 Fingerprint Enrolment

A4.1 Reasons for Recording Fingers as Missing

The detailed reasons why the fingers had to be recorded as missing are as follows:

Quota Sample:

- 1 participant had a broken hand;
- 1 participant had a plaster over one finger;
- 2 participants had physical impairment affecting one hand. All of the fingers of that hand were treated as being missing.

Opportunistic Sample:

- 3 participant had a plaster over one finger;
- 4 participants had missing fingers. 1 participant had 3 fingers missing from one hand, 1 participant had no fingers on one hand, 1 participant had two fingers missing from one hand, 1 participant had 1 missing finger and 1 participant's left hand was missing;
- 2 participants had arthritis in one hand and one finger of the affected hand could not be placed on the device.
- 1 participant's right hand had been affected by a stroke and the hand could not be straightened.
- The fingerprints of one participant's left hand could not be detected by the fingerprint device and had to be treated as missing;
- The fingerprints of one participant's left hand were scarred as a result of surgery had to be treated as missing;
- 3 participants had a broken finger
- 2 participants had a finger with a missing tip.
- 4 participants had a bent finger that couldn't be placed straight on the device;
- 1 participant had two bent fingers that couldn't be placed straight on the device;
- 1 participant had a wart on one finger;
- in two cases one little finger's image was too faint.

Disabled participants:

- 1 participant had a plaster over one finger;
- 1 participant had muscle weakness in right forearm which affected the participant's ability to place the fingers. The right thumb and right little finger had to be treated as being missing;
- 1 participant had no right arm and just had two fingers on the left hand;
- 1 participant with Multiple Sclerosis could not place their thumbs on the fingerprint device and so the thumbs were treated as being missing;
- 1 participant had Cerebral Palsy that affected their hands and some fingers had to be treated as being missing
- 1 participant only had one hand.

A4.2 Fingerprint Enrolment Failure Reasons

A4.2.1 Fingerprint Enrolment Failures (Quota)

The 0.69% failure rate represents the failure of ten people to enrol on the fingerprint biometric. These failures have been investigated:

- in 2 cases the fingerprints falsely matched with fingerprints obtained earlier in the Trial
- in 1 case the participant did not want to retry fingerprint enrolment and so the operator did not continue;
- in the other 7 cases, each participant had one finger where insufficient detail could be obtained.

A4.2.2 Fingerprint Enrolment Failures (Opportunistic)

The 0.73% failure rate represents the failure of fifty-two people to enrol on the fingerprint biometric. These failures have been investigated:

- in 12 cases the fingerprints falsely matched with fingerprints obtained earlier in the Trial;
- in 7 cases the fingerprint images were so poor that they did not pass the front-end quality-checks;
- in 1 case the fingers had been badly burned but there is no information about the number of fingers affected;
- in 21 cases, each participant had one finger where insufficient detail could be obtained;
- in 4 cases, each participant had two fingers where insufficient detail could be obtained;
- in 4 cases, each participant had three fingers where insufficient detail could be obtained;
- in the other 3 cases, each participant had five or more fingers where insufficient detail could be obtained.

A4.2.3 Fingerprint Enrolment Failures (Disabled)

The 4.07% failure rate represents the failure of twenty-nine people to enrol on the fingerprint biometric. Further detail on each of these is given below.

Description of Problem	Participant Impairment type
One finger where insufficient detail could be obtained (scarred).	Hearing impairment
Couldn't get sufficient detail from right hand fingers	Visual and hearing impairment
Participant had severe arthritis and couldn't position fingers	Physical impairment
Couldn't get sufficient detail from three fingers	Visual impairment

Description of Problem	Participant Impairment type
Disability prevented participant positioning fingers on device (no details given).	Physical and hearing impairment
Couldn't get sufficient detail from two fingers	Visual and physical impairment
Participant had Multiple Sclerosis and couldn't straighten fingers	Physical impairment
Couldn't get sufficient detail from one finger.	Physical impairment
Couldn't get sufficient detail from one finger. Participant found it difficult to position fingers because of disability and ended up placing fingers horizontally.	Physical impairment and learning disability
Couldn't get sufficient detail from one finger. Partial movement in participant's hands made it hard to position fingers	Visual, physical, hearing impairment and learning disability
Needed to retry on four fingers. Disability made it impossible for participant to place fingers on device one at a time and so it was not possible to retry all four fingers	Physical impairment
Retries were needed but the participant became distressed and so the operator didn't continue	Learning disability
Couldn't get sufficient detail from one finger.	Learning disability
Fingers were too dry and the participant wouldn't allow operator to moisten fingers	Learning disability
Participant didn't have the patience to sit and do retries	Learning disability
Participant couldn't unbend fingers	Physical impairment and learning disability
Participant couldn't unbend fingers	Visual, physical impairment and learning disability
Couldn't get sufficient detail from one finger.	Physical impairment and learning disability
Couldn't get sufficient detail from one finger.	Physical impairment and learning disability
Fingerprints falsely matched with fingerprints obtained earlier in the Trial	Physical impairment
Couldn't get sufficient detail from two fingers. However, the quality of the fingerprints was generally very low - possibly as a result of the operator having to help the participant with finger positioning.	Physical impairment
Fingers very dirty	Physical impairment
Couldn't get sufficient detail from two fingers	Learning disability
Couldn't get sufficient detail from two fingers	Physical impairment
Couldn't get sufficient detail from two fingers	Physical impairment
Couldn't get sufficient detail from one finger	Physical impairment
Couldn't get sufficient detail from one finger	Physical impairment
Fingerprints falsely matched with fingerprints obtained earlier in the Trial	Physical impairment
Couldn't get sufficient detail from one finger	Physical impairment

A4.3 Analysis of Factors Affecting Fingerprint Enrolment (Quota and Opportunistic)

A4.3.1 Fingerprint Enrolment Success

Enrolment Centre

The enrolment rates have varied slightly across the enrolment centres but the difference is not significant.

Fingerprint Enrolment Success Rates by Centre (Quota)		
Centre	**Sample size**	**Fingerprint Success Rate**
Globe House	203	100.00%
Leicester	450	99.56%
Newcastle	374	98.93%
Glasgow	319	99.06%
Mobile	93	98.92%

Quota sample figures have been shown separately. However, further commentary and analysis relates to the combined Opportunistic and Quota results.

Fingerprint Enrolment Success Rates by Centre (Quota and Opportunistic)		
Centre	**Sample size**	**Fingerprint Success Rate**
Globe House	1794	99.61%
Leicester	2681	99.18%
Newcastle	1794	99.22%
Glasgow	1335	99.18%
Mobile	942	99.15%

Participant Ethnic Group

There is evidence in the following analysis of a link between ethnicity and fingerprint enrolment success.

Fingerprint Enrolment Success Rate by Ethnic Origin (Quota)		
Ethnic Origin	**Sample Size**	**Fingerprint Success Rate**
Asian	56	100.00%
Black	53	100.00%
Chinese/East Asian	4	100.00%
Other	25	96.00%
White	1301	99.31%

Fingerprint Enrolment Success Rate by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Fingerprint Success Rate**
Asian	756	99.07%
Black	351	97.72%
Chinese/East Asian	44	100.00%
Other	267	99.25%
White	7117	99.37%

Participant Age

The age groups had varying enrolment success rates but the differences are not significant.

Fingerprint Enrolment Success Rate by Age Range (Quota)		
Age Range	**Sample Size**	**Fingerprint Success Rate**
18-24	189	99.47%
25-34	279	98.92%
35-44	266	99.62%
45-54	237	99.16%
55-59	147	98.64%
60-64	105	100.00%
65+	216	99.54%

Quota sample figures have been shown separately. However, further commentary and analysis relates to the combined Opportunistic and Quota results.

Fingerprint Enrolment Success Rate by Age Range (Quota and Opportunistic)		
Age Range	**Sample Size**	**Fingerprint Success Rate**
18-24	964	98.96%
25-34	1659	99.10%
35-44	1673	99.46%
45-54	1678	99.46%
55-59	859	99.07%
60-64	677	99.41%
65+	1036	99.32%

Participant Gender

No significant differences have been found between the enrolment success rates for males and females.

Fingerprint Enrolment Success Rate by Gender (Quota)		
Gender	**Sample size**	**Fingerprint Success Rate**
Female	627	99.20%
Male	812	99.38%

Quota sample figures have been shown separately. However, further commentary and analysis relates to the combined Opportunistic and Quota results.

Fingerprint Enrolment Success Rate by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**Fingerprint Success Rate**
Female	3091	99.09%
Male	5455	99.38%

Participant Social Class (Quota only)

Fingerprint Enrolment Success Rate by social class		
Social Class	**Sample Size**	**Fingerprint Success Rate**
A	35	100.00%
B	304	98.70%
C1	494	98.39%
C2	191	99.48%
D	198	98.00%
E	217	97.30%

Quota sample figures have been shown separately. However, further commentary and analysis relates to the combined Opportunistic and Quota results

A4.3.2 Fingerprint Enrolment Success at the First Attempt

Enrolment Centre

1st Time Fingerprint Enrolment Success Rates by Centre (Quota)		
Centre	**Sample size**	**1st time success as % of overall enrolments**
Globe House	203	77.83%
Leicester	450	63.78%
Newcastle	374	63.10%
Glasgow	319	75.55%
Mobile	93	70.97%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Time Fingerprint Enrolment Success Rates by Centre (Quota and Opportunistic)		
Centre	**Sample size**	**1st time success as % of overall enrolments**
Globe House	1794	75.36%
Leicester	2681	65.57%
Newcastle	1794	66.00%
Glasgow	1335	79.10%
Mobile	942	69.85%

Participant Ethnic Group

Analysis of the first attempt fingerprint enrolment success rates reveals a possible link with ethnic origin. As rates have also been found to vary by enrolment centre, the link with ethnic origin has been confirmed from an analysis of the data from Leicester and Globe House.

1st Time Fingerprint Enrolment Success Rate by Ethnic Origin (Quota)		
Ethnic Origin	**Sample Size**	**1st time success as % of overall enrolments**
Asian	56	66.07%
Black	53	58.49%
Chinese/East Asian	4	75.00%
Other	25	56.00%
White	1301	69.41%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Time Fingerprint Enrolment Success Rate by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**1st time success as % of overall enrolments**
Asian	756	70.90%
Black	351	54.70%
Chinese/East Asian	44	65.91%
Other	267	74.91%
White	7117	70.86%

1st Time Fingerprint Enrolment Success Rate at Globe House by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**1st time success as % of overall enrolments**
Asian	159	75.47%
Black	111	60.36%
Chinese/East Asian	16	50.00%
Other	76	77.63%
White	1430	76.71%

1st Time Fingerprint Enrolment Success Rate at Leicester by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**1st time success as % of overall enrolments**
Asian	485	69.48%
Black	206	52.91%
Chinese/East Asian	13	61.54%
Other	133	72.93%
White	1841	65.40%

Participant Age

Analysis of the first attempt fingerprint enrolment success rate appears to show a link with the participant's age. However, an analysis of Leicester's data shows little variation in the rate by age and Globe House's data shows no significant variation by age.

1st Time Fingerprint Enrolment Success Rate (Quota)		
Age Range	**Sample Size**	**1st time success as % of overall enrolments**
18-24	189	65.61%
25-34	279	70.61%
35-44	266	71.80%
45-54	237	70.04%
55-59	147	67.35%
60-64	105	66.67%
65+	216	65.28%

Quota sample figures, have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results

1st Time Fingerprint Enrolment Success Rate (Quota and Opportunistic)		
Age Range	**Sample Size**	**1st time success as % of overall enrolments**
18-24	964	72.51%
25-34	1659	70.46%
35-44	1673	72.86%
45-54	1678	70.14%
55-59	859	69.85%
60-64	677	68.09%
65+	1036	65.93%

1st Time Fingerprint Enrolment Success Rate at Globe House (Quota and Opportunistic)		
Age Range	**Sample Size**	**1st time success as % of overall enrolments**
18-24	131	84.73%
25-34	422	73.22%
35-44	473	77.38%
45-54	375	70.67%
55-59	158	77.22%
60-64	122	76.23%
65+	113	76.11%

1st Time Fingerprint Enrolment Success Rate at Leicester (Quota and Opportunistic)		
Age Range	**Sample Size**	**1st time success as % of overall enrolments**
18-24	361	66.48%
25-34	544	63.97%
35-44	416	64.90%
45-54	475	66.74%
55-59	252	70.24%
60-64	210	62.38%
65+	423	65.01%

Participant Gender

Analysis of the first attempt fingerprint enrolment success rate appears to show a link with the participant's gender in that male participants were more likely to enrol at the first attempt than female participant. An analysis of Globe House's and Leicester's data confirms this trend.

1st Time Fingerprint Enrolment Success Rate by Gender (Quota)		
Gender	**Sample size**	**1st time success as % of overall enrolments**
Female	627	65.07%
Male	812	71.43%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

1st Time Fingerprint Enrolment Success Rate by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**1st time success as % of overall enrolments**
Female	3091	64.90%
Male	5455	73.36%

1st Time Fingerprint Enrolment Success Rate at Globe House by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**1st time success as % of overall enrolments**
Female	523	72.47%
Male	1271	76.55%

1st Time Fingerprint Enrolment Success Rate at Leicester by Gender (Quota and Opportunistic)		
Gender	**Sample size**	**1st time success as % of overall enrolments**
Female	1018	59.82%
Male	1663	69.09%

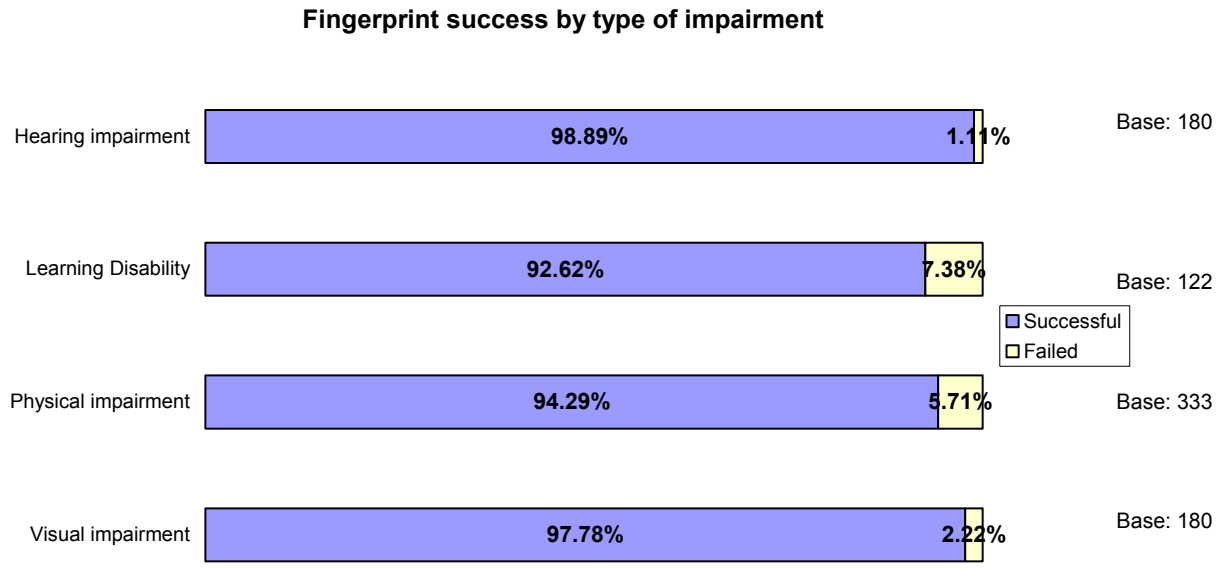
Participant Social Class (Quota only)

1st Attempt Fingerprint Enrolment Success Rate by social class (Quota)		
Social Class	**Sample Size**	**Fingerprint Success Rate**
A	35	71.43%
B	304	71.38%
C1	494	67.61%
C2	191	71.73%
D	198	63.13%
E	217	69.12%

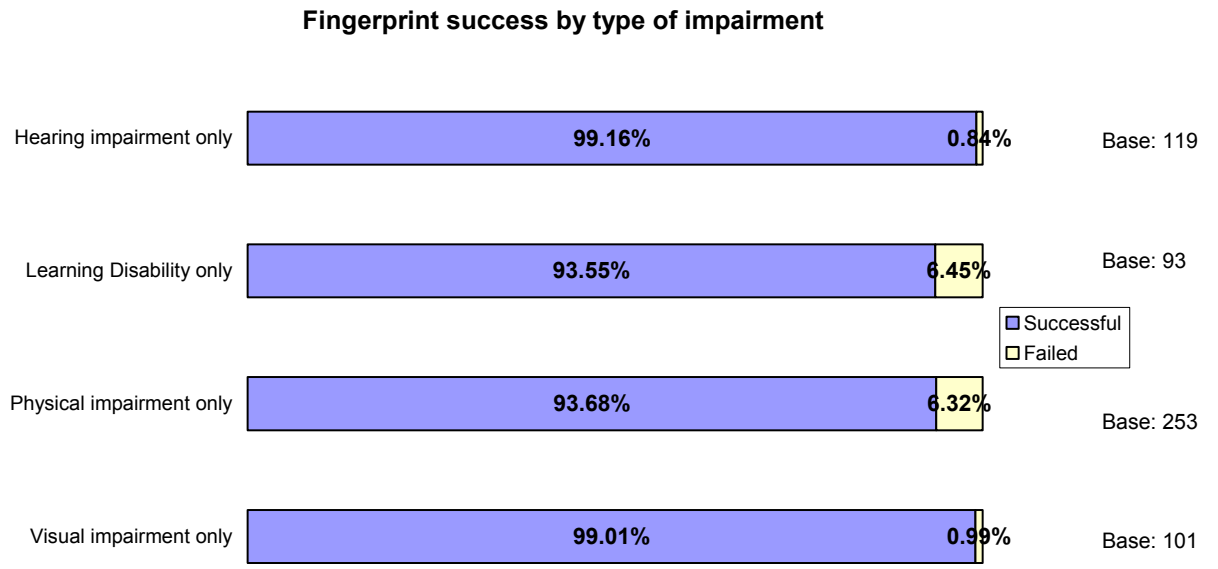
A4.4 Analysis of Fingerprint Enrolment by Impairment Type

A4.4.1 Fingerprint Enrolment Success

The following chart shows the fingerprint biometric success rate by type of impairment.

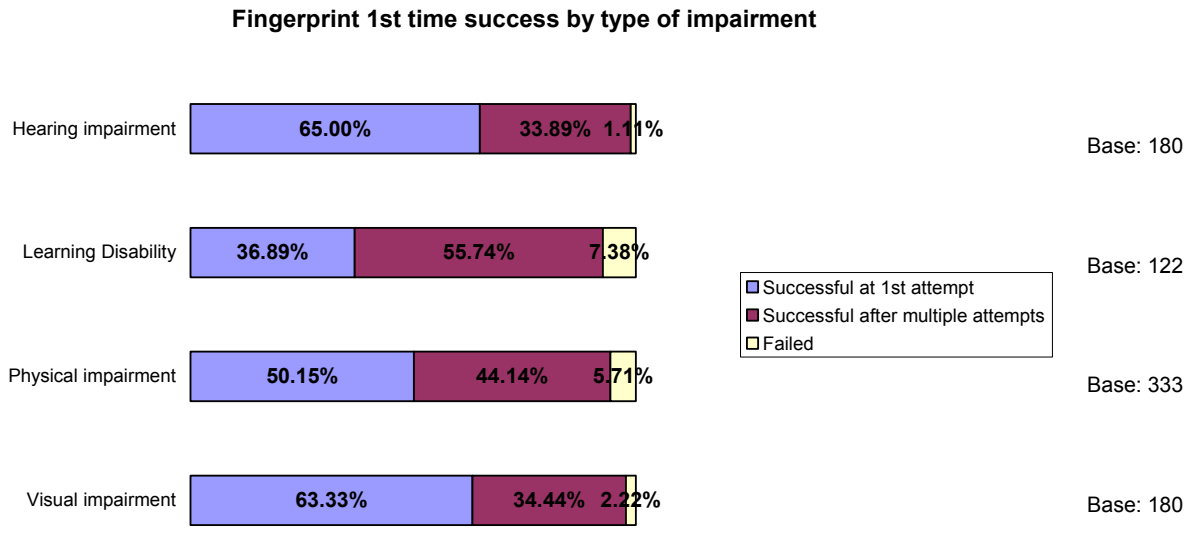


Some participants had more than one type of impairment. The same analysis has been carried out again using only those participants with one type of impairment.

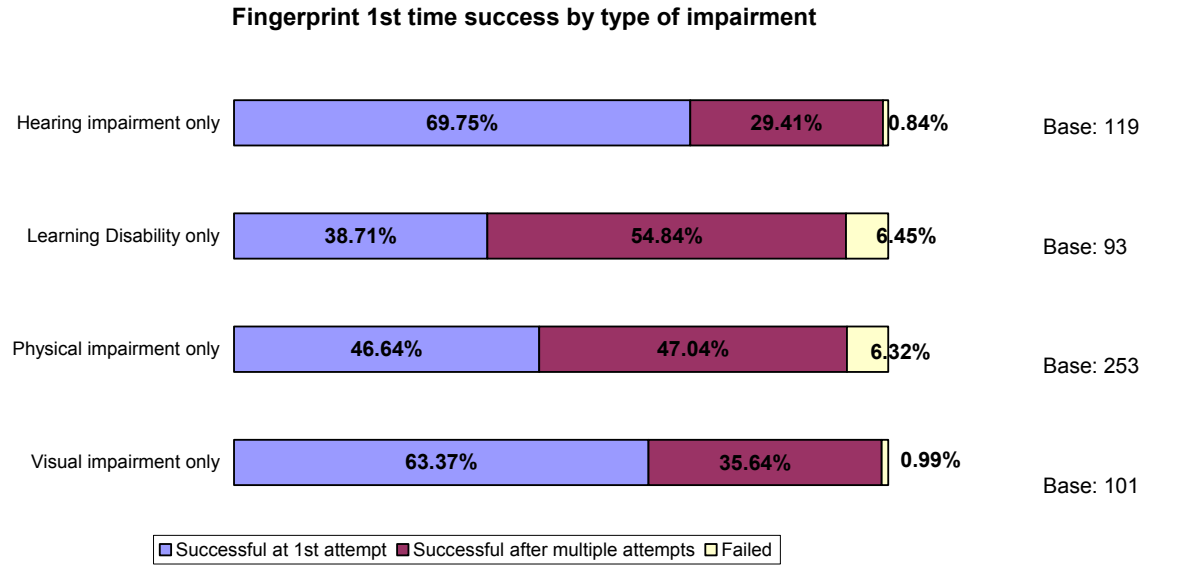


A4.4.2 Fingerprint Enrolment Success at the First Attempt

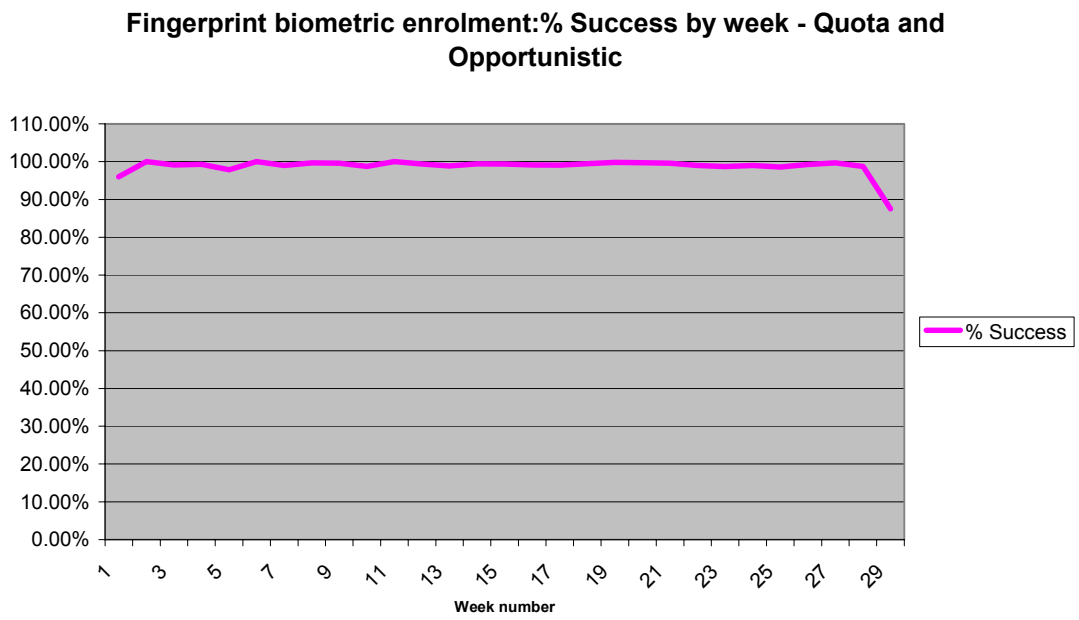
The following chart shows the fingerprint biometric 1st time success rate by type of impairment.

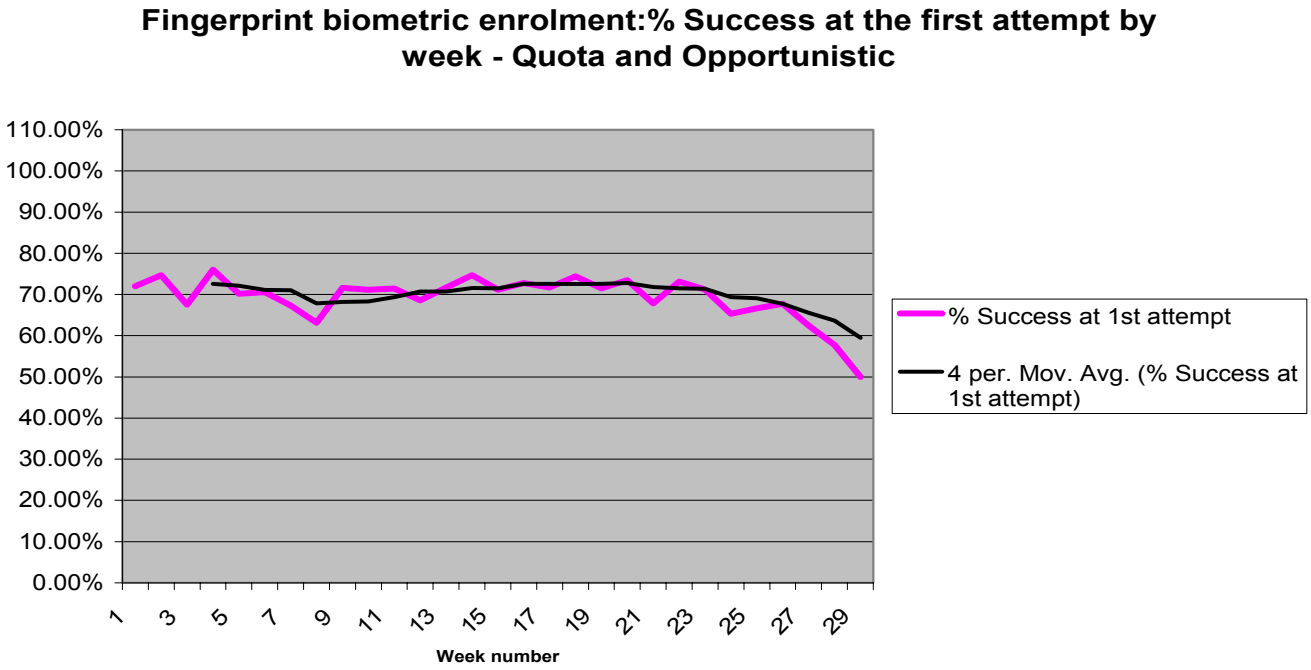


Some participants had more than one type of impairment. The same analysis has been carried out again using only those participants with one type of impairment.



A4.5 Trend Over Time





Although there are peaks and troughs in the rate each week, there is no underlying trend.

Appendix B - Detailed Verification Analysis

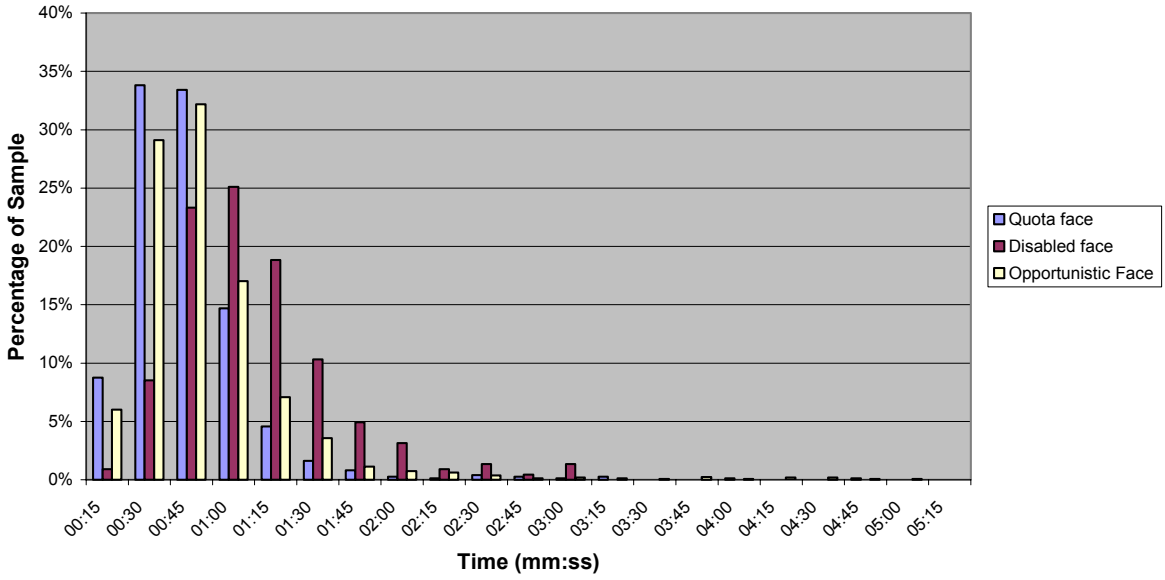
B1 Process Times

Key statistical information is shown below for each type of verification by sample group.

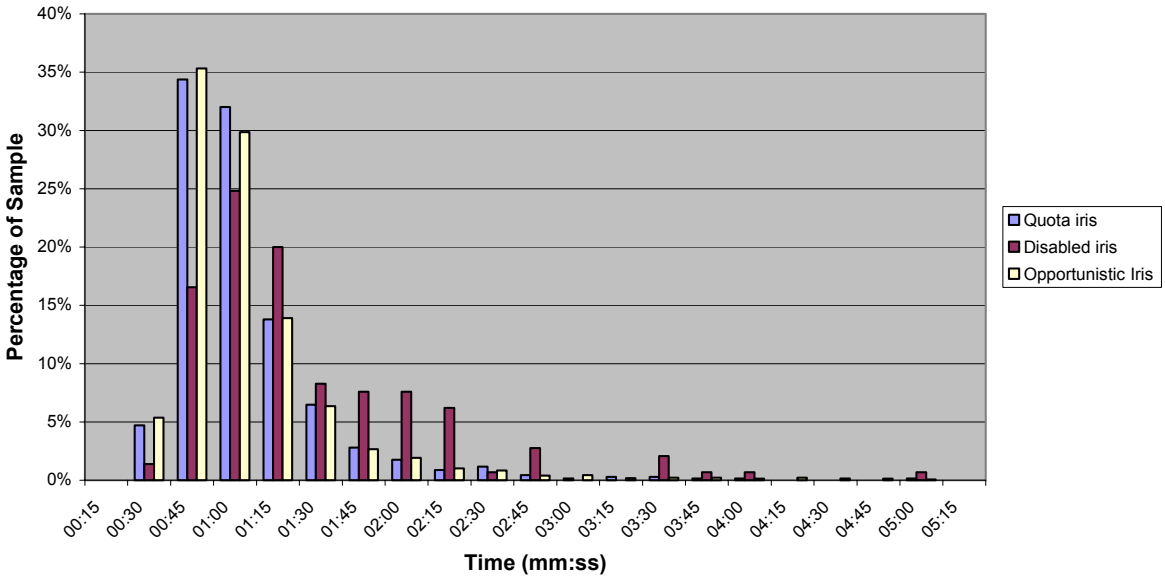
Step	Sample Type	Average Time (mm:ss)	Minimum time (mm:ss)	Median Time (mm:ss)	Maximum time (mm:ss)
Face verification	Quota	00:39	00:05	00:33	10:01
	Opportunistic	00:45	00:05	00:36	11:18
	Disabled	01:03	00:08	00:56	07:24
Iris verification	Quota	00:58	00:17	00:49	08:27
	Opportunistic	00:59	00:18	00:49	17:13
	Disabled	01:18	00:25	01:06	04:58
Fingerprint verification	Quota	01:13	00:24	00:56	08:41
	Opportunistic	01:11	00:22	00:54	10:13
	Disabled	01:20	00:27	01:05	06:08

The histograms and boxplots that follow illustrate the dispersion of the verification data. N.B. in the interests of clarity 99% of the participants have been included in the following histograms. The 1% excluded face verifications are between 5 minutes and 11 minutes 30 seconds.

Timings for Face Verification

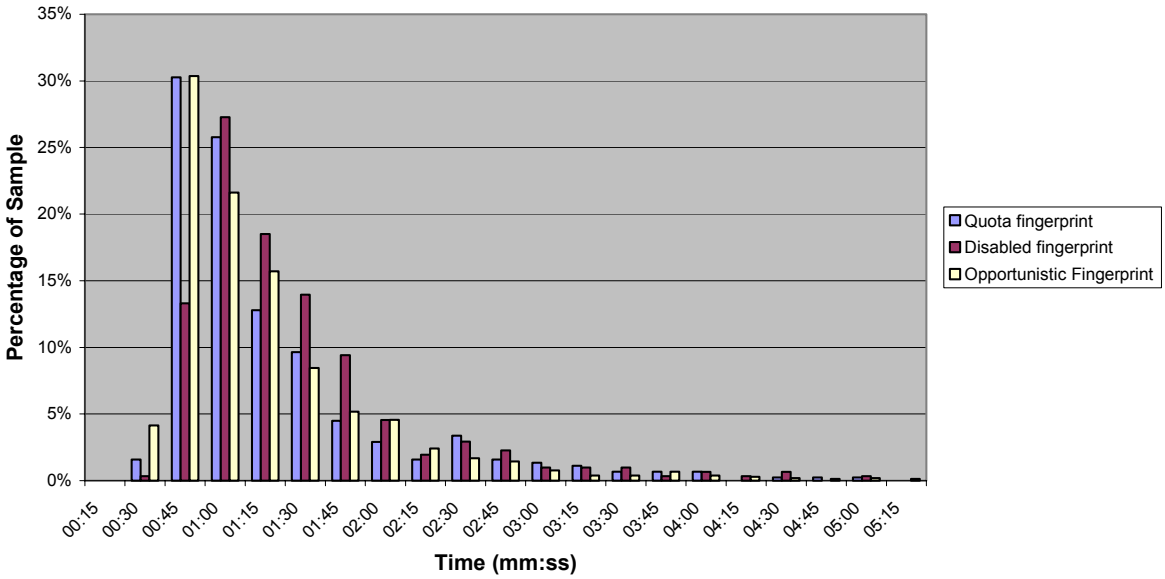


Timings for Iris Verification



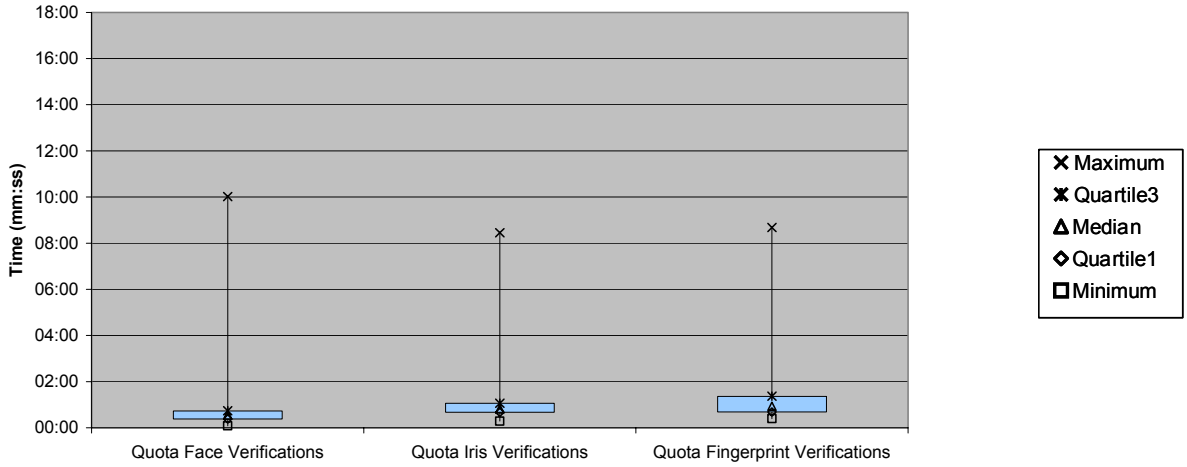
The 1% excluded iris verifications took between 5 minutes and 17 minutes 30 seconds.

Timings for Fingerprint Verification

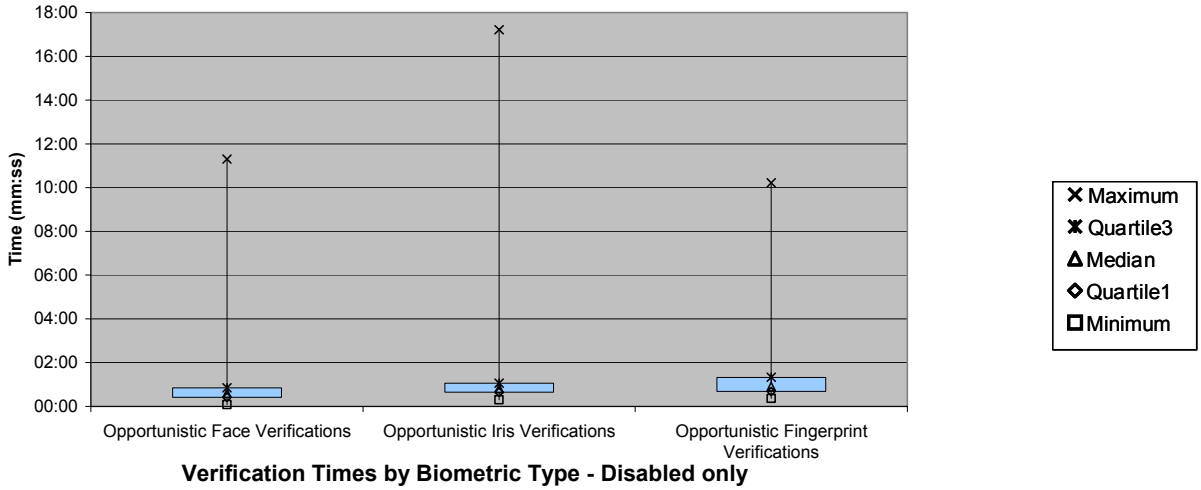


The 1% excluded fingerprint verifications took between 5 minutes 15 seconds and 10 minutes 15 seconds.

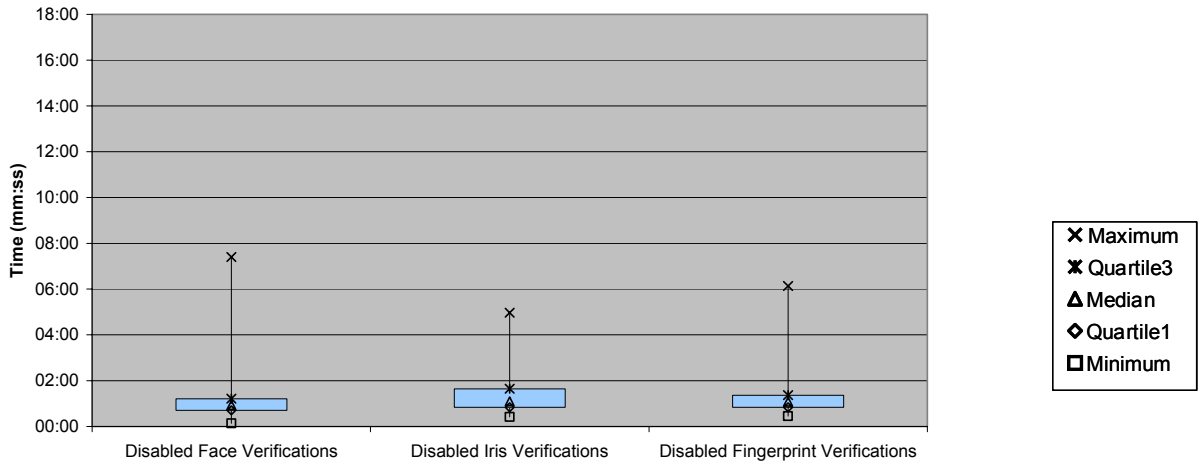
Verification Times by Biometric Type - Quota only

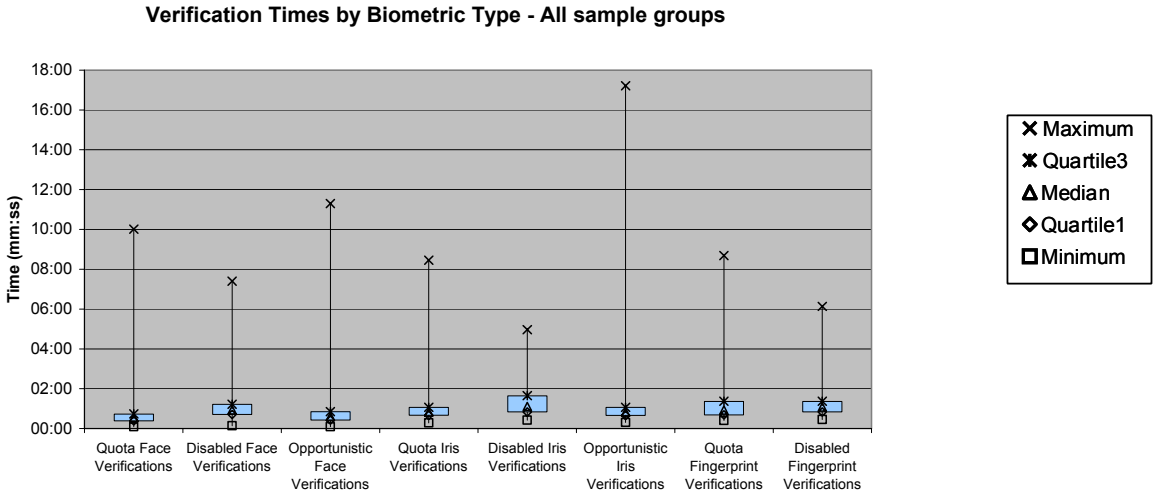


Verification Times by Biometric Type - Opportunistic only



Verification Times by Biometric Type - Disabled only





This shows that on the whole face verification is slightly quicker than iris verification which in turn is slightly quicker than fingerprint verification. The greater height of the fingerprint box indicates that there is a higher degree of dispersion for fingerprint times. The reason for this is that some participants are able to provide acceptable fingerprint images from the first two fingers that are attempted, but other participants need to try several different fingers before ones are found that are acceptable.

Verification tended to be quicker for the Quota and Opportunistic sample participants than for the Disabled participants.

B2 Facial Verification

B2.1 Facial Verification Failure Operator Observations

Every time verification failed, the operators were asked to determine the reason for the failure. These categories have been described further on the following page. As no significant difference has been found between the verification rates for the Quota and Disabled participant groups, then no distinction has been made between sample groups in the table below.

Operator observations for failed face verifications (all sample groups)	
Observation	**Number**
Undetermined	593
Lighting issues	98
Participant Position	59
Behavioural	29
Appearance change	23
Skin Tone	10
Background disturbance	4
Suspect Face Template	4
Couldn't hold position	9
Struggled to follow instructions	1

As can be seen, most face verification failures have been categorised as undetermined. As face verification takes a short time, and as the operator cannot retry face verification there is little opportunity for the operator to assess the problem and take corrective action.

Lighting issues: reflection from glasses or from the skin, in particular the forehead has caused face verification to fail.

Participant Position: Where the participant was sat too low or too high then the angle of the face relative to the camera was different from that at enrolment and caused verification to fail.

Behavioural: excessive movement of the participant's head during verification has caused failure.

Appearance change: where participants changed their appearance slightly between enrolment and verification, verification failed. These are participants who wore their glasses during enrolment but not verification, or vice versa. Another example is a lady who tucked her hair back behind her ears between enrolment and verification.

Skin Tone: it is the perception of the operators, particularly at Globe House, that dark-skinned people have had problems with face verification. If this is true then there should be a link between ethnic group and face verification success (see tables below).

Background disturbance: movement in the background affected the camera.

Suspect Face Template: whereas normally the score given to a face biometric during enrolment continuously varies between 0 and 10, in some cases a face has scored '10', without scoring any other intermediate values. Possibly the templates generated from these are not of sufficient quality and could be the reason for face verification failure. This issue has been raised with Identix.

Couldn't hold position: some participants found it difficult to hold the correct position while face verification was completed. Although, as these participants managed to hold position long enough to complete facial biometric enrolment, this observation may be unrelated to the cause of failure.

Struggled to follow instructions: one participant found it difficult to follow the operator instructions. As with the previous observation, since this participant managed to hold position long enough to complete facial biometric enrolment, this observation may be unrelated to the cause of failure.

B2.2 Analysis of Factors Affecting Facial Verification

As previously stated, environmental issues at the enrolment centres have caused the face verification success rate to vary significantly from one enrolment centre to another, and as the enrolment centres did not have the same cross-section of the population, any further analysis would be impacted by the location differences. To prevent this, further analysis has been confined to looking at two enrolment centres separately: Globe House and Leicester. These have been chosen because sufficient numbers of the major ethnic groups and age groups have attempted face verification at these centres to make the analysis statistically valid. For the sake of consistency, analysis by gender has also been carried out on just these two centres.

By Ethnic Group

Face Verification Success at Globe House by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Verification Success Rate**
Asian	34	58.82%
Black	22	22.73%
Chinese/East Asian	3	66.67%
Other	13	53.85%
White	312	59.94%

Face Verification Success at Leicester by Ethnic Origin (Quota and Opportunistic)		
Ethnic Origin	**Sample Size**	**Verification Success Rate**
Asian	209	89.47%
Black	96	83.33%
Chinese/East Asian	5	100.00%
Other	52	98.08%
White	535	83.18%

The above results are inconclusive as the pattern in the centres is different. Possibly the environmental factors that affect face verification success affect some ethnic groups more than others.

By Participant Age

Leicester and Globe House both have significantly different rates for different age groups, although the centres show slightly different patterns. However, both centres show that

face verification is less likely to succeed where participants are aged 60 and over.

Face Verification Success by Age Range at Globe (Quota and Opportunistic)		
Age Group	**Sample Size**	**Verification Success Rate**
18-24	20	65.00%
25-34	89	64.04%
35-44	106	60.38%
45-54	93	54.84%
55-59	26	53.85%
60-64	30	46.67%
65+	20	40.00%

Face Verification Success by Age Range at Leicester (Quota and Opportunistic)		
Age Group	**Sample Size**	**Verification Success Rate**
18-24	139	92.09%
25-34	174	90.23%
35-44	122	84.43%
45-54	152	88.16%
55-59	77	84.42%
60-64	67	77.61%
65+	167	77.84%

By Gender

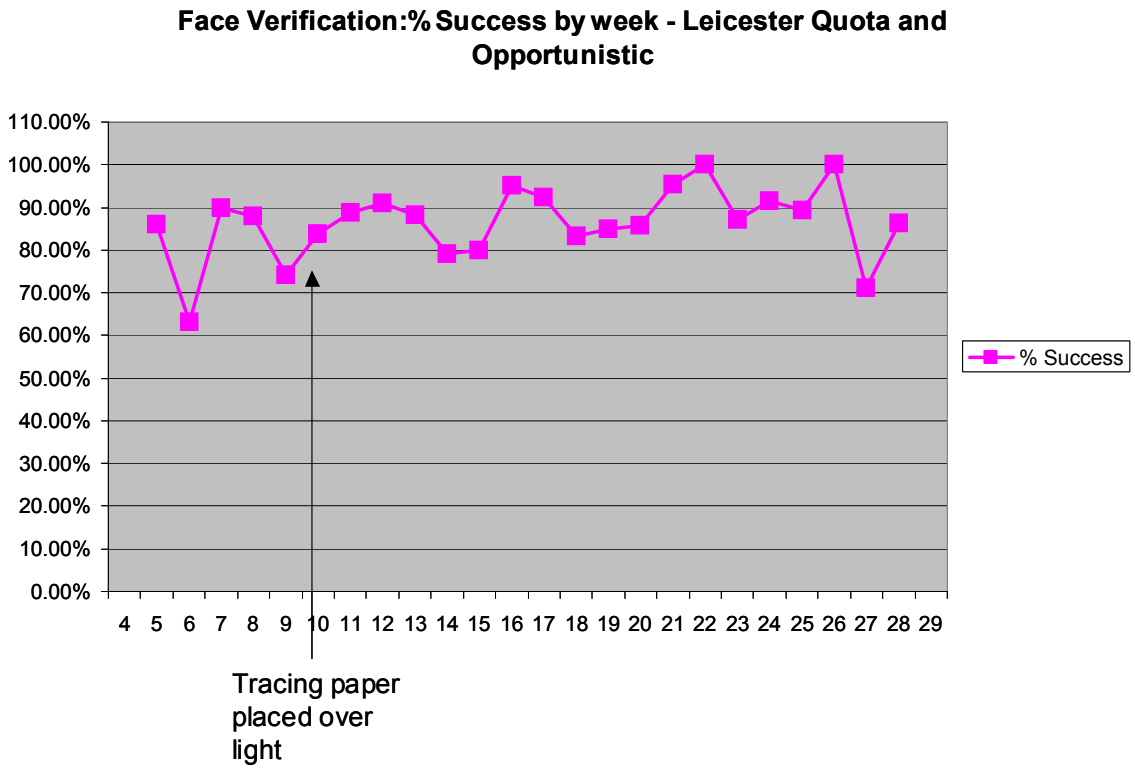
Gender is not a factor in face verification success

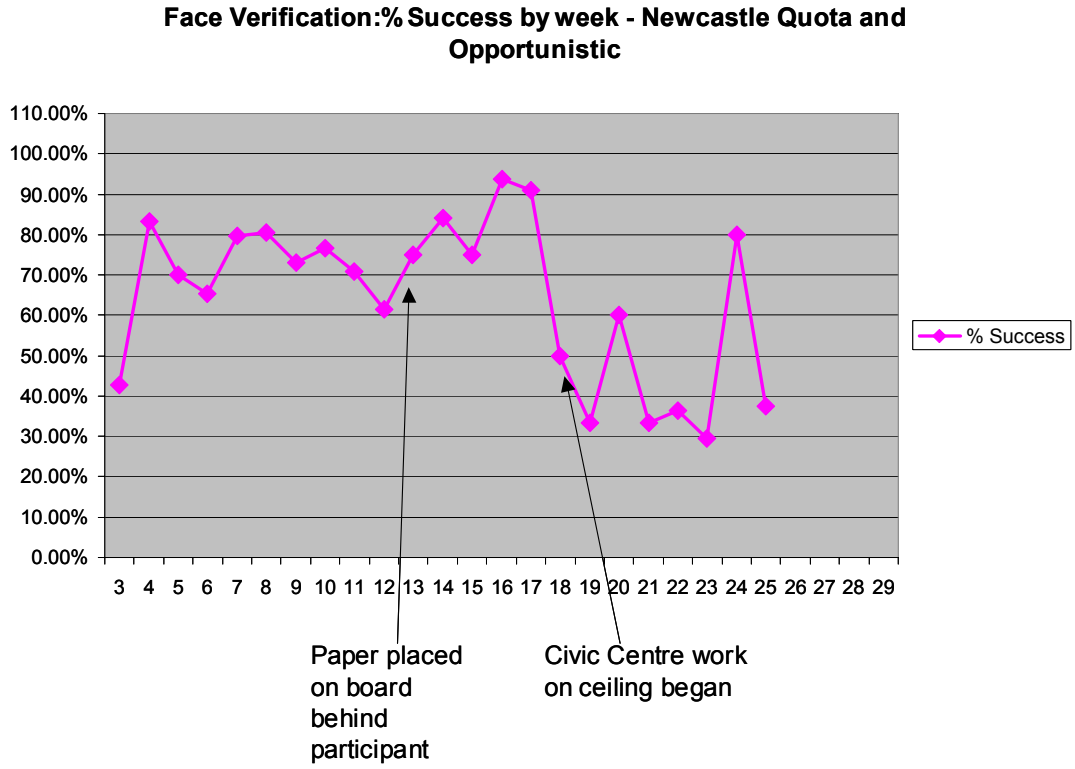
Face Verification Success by Gender at Globe House (Quota and Opportunistic)		
Gender	**Sample Size**	**Verification Success Rate**
Female	98	50.00%
Male	286	60.14%

Face Verification Success by Gender at Leicester (Quota and Opportunistic)		
Gender	**Sample Size**	**Verification Success Rate**
Female	327	83.79%
Male	571	86.69%

B2.3 Trend over time

Given the environmental factors affecting face verification at each site, it would not be informative to look at the weekly trend. However, the charts below show the weekly rate at Leicester and Newcastle.





B3 Iris Verification

B3.1 Iris Verification Failure Operator Observations

For the Quota sample: 3 iris verifications were cancelled and 12 failed. For 2 of the failures, the operators were able to force retries and determine the reason for the original failure. In both these cases the participants were wearing glasses during the original verification. During the forced retries the participants removed their glasses and the verification was successful. In one of these cases the participant's glasses contained vari-focal lenses. It is not known whether the other participant's glasses contained vari-focal lenses or not. No additional information is available about the other 10 iris verification failures.

For the Opportunistic sample there were 96 actual failures but the operators were only able to identify possible reasons for failure in 27 cases.

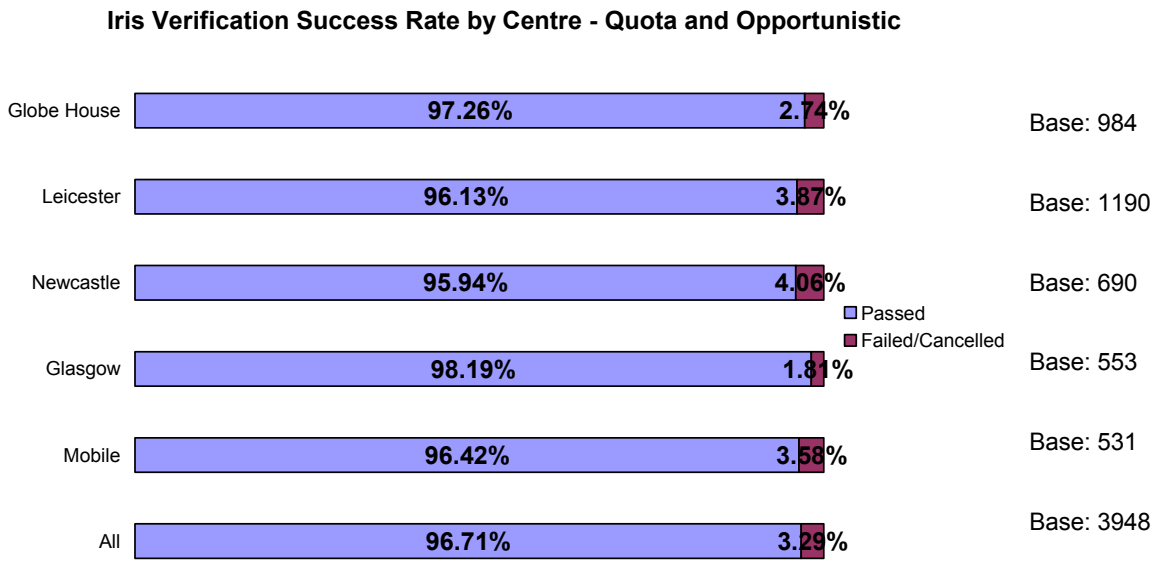
- In 10 cases the operators were able to force retries and determine the reason for the original failure. In all 10 cases the participants were wearing glasses during the original verification. During the forced retries the participants removed their glasses and the verification was successful. In 5 of these cases the participant's glasses contained vari-focal lenses, in 1 the glasses contained bi-focal lenses. It is not known what type of lenses were in the other 4 participants' glasses;

- in 3 cases the operator noted the strength of the participant's lenses as a possible problem but did not force a retry;

- in 3 cases there were reflections from the participant's glasses;
- there were problems positioning 4 participants;
- 2 participants moved too much;
- 1 participant had a prosthetic eye. However, it should be noted that two other participants with a prosthetic eye successfully enrolled and verified on the iris biometric.
- 1 participant was wearing coloured contact lenses;
- 2 participants were wearing tinted glasses;
- 1 participant was not responding to the camera prompts.

For the Disabled participants: 12 iris verifications failed but the operators were only able to identify possible reasons for failure in two cases. In one case the likely reason for failure was that the participant was wearing tinted glasses. In the other case the participant was wearing glasses during verification, and the verification was subsequently successful when the participant removed their glasses and the operator forced a retry. Four of the participants who failed iris verification were visually impaired, however at this stage no link can be established between visual impairment and iris verification failure. The overall number of iris verification failures is too low for any analysis by type of impairment.

B3.2 Analysis of Factors Affecting Iris Verification (Quota and Opportunistic)



There are slight differences between the success rates at the enrolment centres, but not enough to be significant.

By Ethnic Group

The verification success rate was lower for the Chinese/East Asian group than for any other. However, if the success rate is calculated as a percentage of successful and failed verifications rather than all attempted verifications, the success rate for the Chinese/East Asian group moves closer to that for other ethnic groups. It does not appear that ethnicity is a factor in iris verification success.

Iris Verification Success by Ethnic Origin (Quota only)		
Ethnic Origin	**Sample Size**	**Verification Success Rate**
Asian	31	100.00%
Black	25	96.00%
Chinese/East Asian	1	0.00%
Other	11	100.00%
White	619	97.90%

Iris Verification Success by Ethnic Origin (Quota and Opportunistic)			
Ethnic Origin	**Sample Size**	**Verification Success Rate**	**Verification Success Rate (ignoring cancellations)**
Asian	280	96.07%	97.46%
Black	143	95.80%	95.80%
Chinese/East Asian	19	89.47%	94.44%
Other	101	96.04%	97.00%
White	3400	96.85%	97.05%

By Participant Age

From the following analysis it is evident that there is a link between iris verification success and age. Participants aged 55 or over were less likely to verify successfully than participants aged less than 55.

Iris Verification Success by Age Range (Quota only)		
Age Group	**Sample Size**	**Verification Success Rate**
18-24	84	100.00%
25-34	138	99.28%
35-44	144	97.92%
45-54	128	96.09%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

55-59	77	94.81%
60-64	43	100.00%
65+	73	97.26%

Iris Verification Success by Age Range (Quota and Opportunistic)			
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Success Rate (ignoring cancellations)**
18-24	369	98.10%	98.91%
25-34	747	97.99%	98.39%
35-44	850	97.29%	97.87%
45-54	819	97.31%	97.79%
55-59	439	94.53%	94.75%
60-64	330	95.45%	96.33%
65+	394	93.91%	94.63%

By Gender

There is no significant difference between the iris verification success rates for males and females.

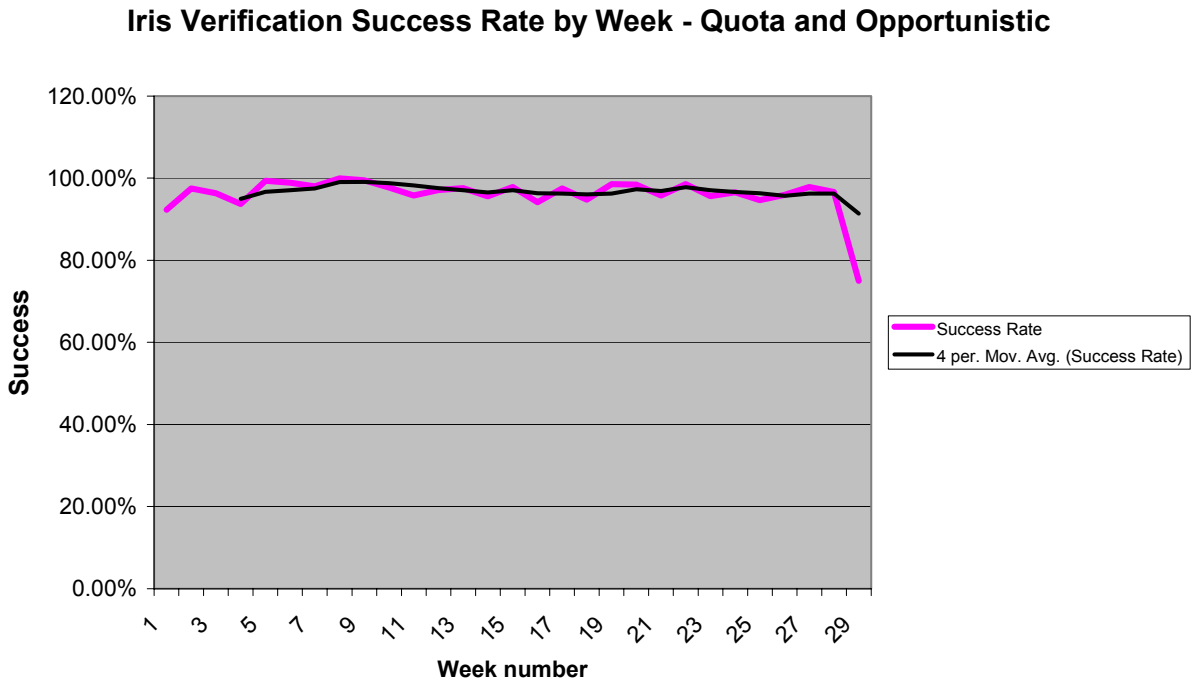
Iris Verification Success by Gender (Quota only)		
Gender	**Sample Size**	**Verification Success Rate**
Female	286	98.60%
Male	401	97.26%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

Iris Verification Success by Gender (Quota and Opportunistic)		
Gender	**Sample Size**	**Verification Success Rate**
Female	1370	96.79%
Male	2578	96.66%

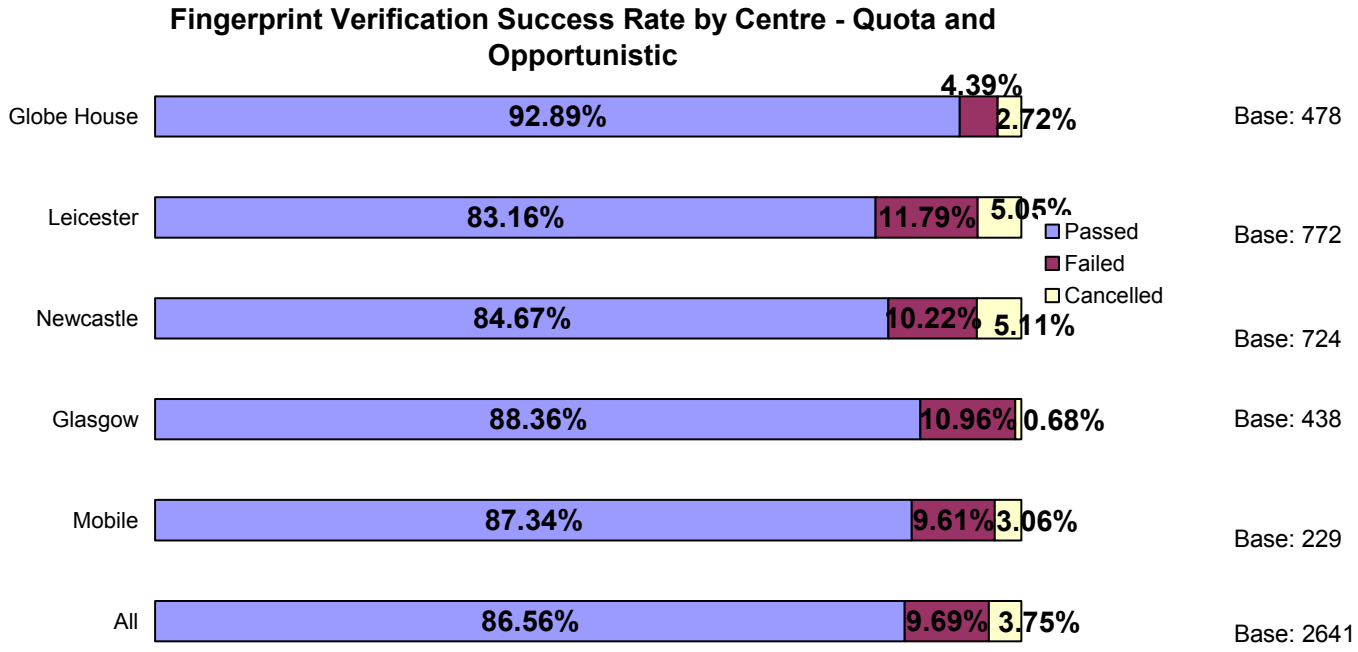
B3.3 Trend over Time

No underlying trend with the iris verification success rate is evident.



B4 Fingerprint Verification

B4.1 Analysis of Factors Affecting Fingerprint Verification (Quota and Opportunistic)



Fingerprint verification success was significantly lower in Newcastle and Leicester than at the other enrolment centres.

By Ethnic Group

Although the following tables indicate a link between verification success and ethnic origin, the different rates at the enrolment centres mean that it is not possible to have confidence that such a link exists. The fingerprint verification failures at Globe House and Leicester have been analysed separately but the volume of cancellations/failures is not high enough in all ethnic groups to allow conclusions to be drawn.

Fingerprint Verification Success by Ethnic Origin (Quota)				
Ethnic Origin	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
Asian	18	77.78%	11.11%	11.11%
Black	16	87.50%	0.00%	12.50%
Chinese/East Asian	3	100.00%	0.00%	0.00%
Other	11	63.64%	18.18%	18.18%
White	439	81.55%	12.07%	6.38%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

Fingerprint Verification Success by Ethnic Origin (Quota and Opportunistic)				
Ethnic Origin	Sample Size	Verification Success Rate	Verification Failure Rate	Verification Cancellation Rate
Asian	231	92.21%	5.19%	2.60%
Black	106	92.45%	1.89%	5.66%
Chinese/East Asian	13	100.00%	0.00%	0.00%
Other	88	87.50%	4.55%	7.95%
White	2199	85.54%	10.82%	3.64%

Fingerprint Verification Success by Ethnic Origin at Globe House (Quota and Opportunistic)				
Ethnic Origin	Sample Size	Verification Success Rate	Verification Failure Rate	Verification Cancellation Rate
Asian	38	94.74%	5.26%	0.00%
Black	39	97.44%	0.00%	2.56%
Chinese/East Asian	4	100.00%	0.00%	0.00%
Other	18	83.33%	0.00%	16.67%
White	379	92.61%	5.01%	2.37%

Fingerprint Verification Success by Ethnic Origin at Leicester (Quota and Opportunistic)				
Ethnic Origin	Sample Size	Verification Success Rate	Verification Failure Rate	Verification Cancellation Rate
Asian	152	91.45%	5.26%	3.29%
Black	55	87.27%	3.64%	9.09%
Chinese/East Asian	2	100.00%	0.00%	0.00%
Other	48	85.42%	8.33%	6.25%
White	514	79.96%	5.06%	5.06%

By Participant Age

There are significant differences in the verification success rates for different age groups. Although Globe House and Leicester have significantly different verification success rates overall, analysis of the rates at Globe House and Leicester on an individual basis also shows significant differences for different age groups.

Fingerprint Verification Success by Age Range (Quota only)				
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
18-24	75	86.67%	8.00%	5.33%
25-34	99	87.88%	7.07%	5.05%
35-44	84	83.33%	7.14%	9.52%
45-54	74	81.08%	9.46%	9.46%
55-59	49	73.47%	22.45%	4.08%
60-64	33	75.76%	15.15%	9.09%
65+	73	72.60%	20.55%	6.85%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

Fingerprint Verification Success by Age Range (Quota and Opportunistic)				
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
18-24	369	91.33%	6.23%	2.44%
25-34	556	91.73%	4.50%	3.78%
35-44	477	92.24%	3.77%	3.98%
45-54	466	87.34%	8.37%	4.29%
55-59	256	81.64%	15.23%	3.13%
60-64	178	77.53%	16.85%	5.62%
65+	339	72.27%	24.19%	3.54%

Fingerprint Verification Success by Age Range at Globe House (Quota and Opportunistic)				
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
18-24	37	100.00%	0.00%	0.00%
25-34	128	94.53%	2.34%	3.13%
35-44	134	95.52%	0.75%	3.73%
45-54	79	96.20%	2.53%	1.27%
55-59	38	94.74%	0.00%	5.26%
60-64	29	82.76%	17.24%	0.00%
65+	33	66.67%	30.30%	3.03%

Fingerprint Verification Success by Age Range at Leicester (Quota and Opportunistic)				
Age Group	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
18-24	119	89.08%	5.88%	5.04%
25-34	178	88.76%	6.18%	5.06%
35-44	95	89.47%	5.26%	5.26%
45-54	126	84.92%	8.73%	6.35%
55-59	75	77.33%	18.67%	4.00%
60-64	57	71.93%	22.81%	5.26%
65+	122	71.31%	24.59%	4.10%

By Gender

Analysis of the overall verification success rates shows a significant difference between the rates for males and females. Overall females were less likely to verify successfully than males. Analysis of the Globe House and Leicester data also shows a lower success rate for females than for males but the differences at Globe House are not significant enough to have confidence that gender is a factor.

Fingerprint Verification Success by Gender (Quota only)				
Gender	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
Female	248	80.65%	12.90%	6.45%
Male	239	82.01%	10.46%	7.53%

Quota sample figures have been shown separately, however, further comment and analysis relates to the combined Opportunistic and Quota results.

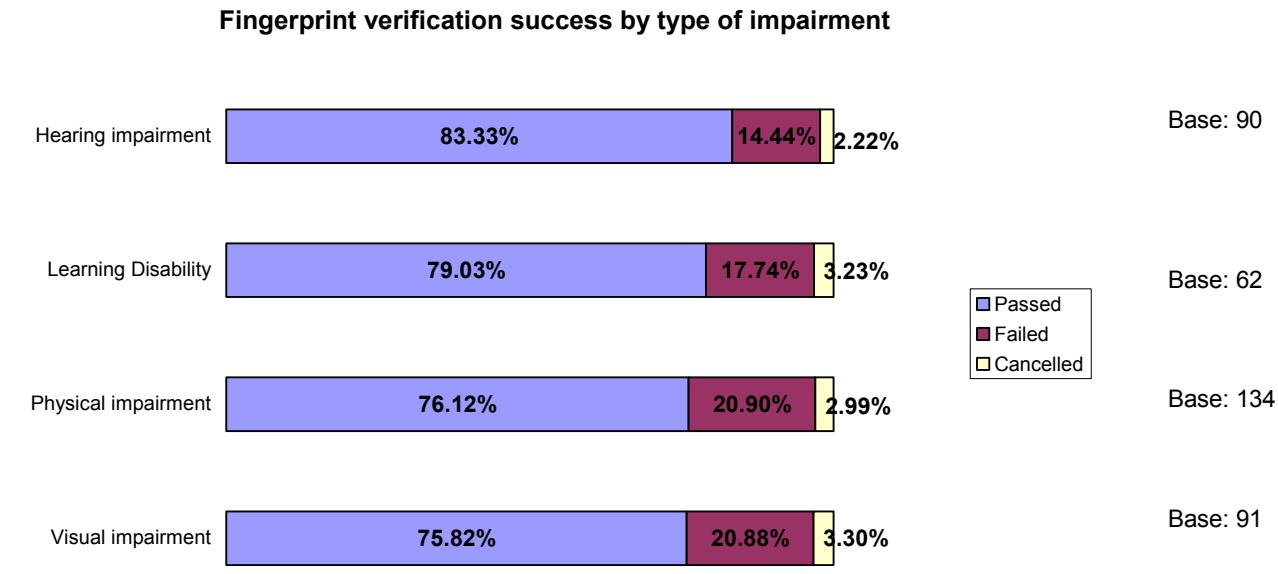
Fingerprint Verification Success by Gender (Quota and Opportunistic)				
Gender	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
Female	1078	84.88%	11.69%	3.43%
Male	1563	87.72%	8.32%	3.97%

Fingerprint Verification Success by Gender at Globe House (Quota and Opportunistic)				
Gender	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
Female	164	91.46%	4.27%	4.27%
Male	314	93.63%	4.46%	1.91%

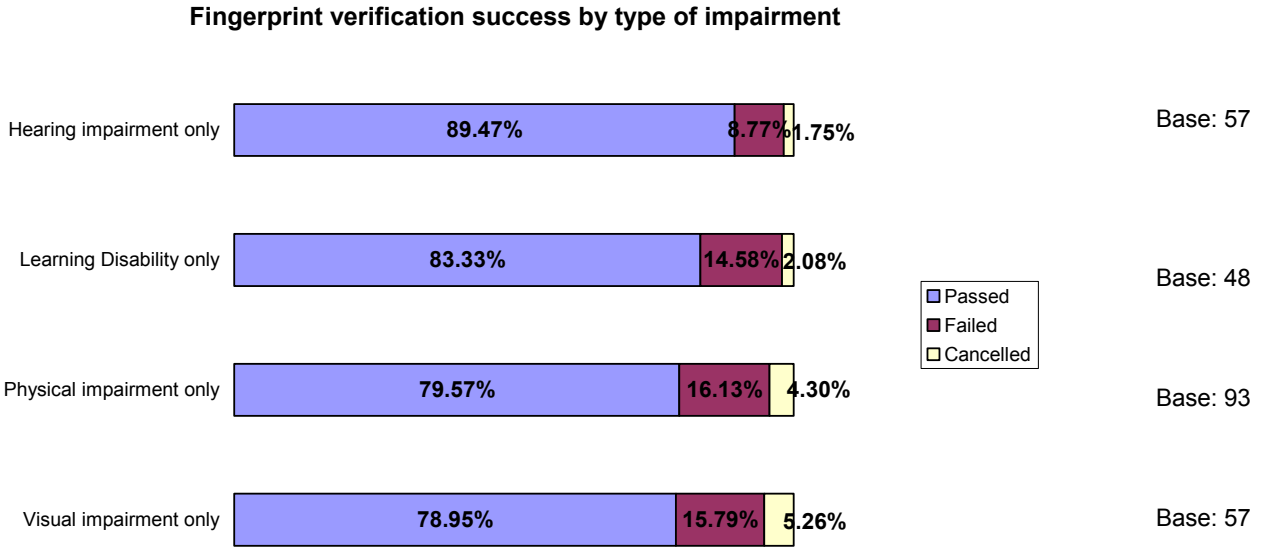
Fingerprint Verification Success by Gender (Quota and Opportunistic)				
Gender	**Sample Size**	**Verification Success Rate**	**Verification Failure Rate**	**Verification Cancellation Rate**
Female	309	79.61%	14.89%	5.50%
Male	463	85.53%	9.72%	4.75%

B4.2 Analysis of Fingerprint Verification by Impairment Type

The following chart shows the fingerprint verification success rate by type of impairment.

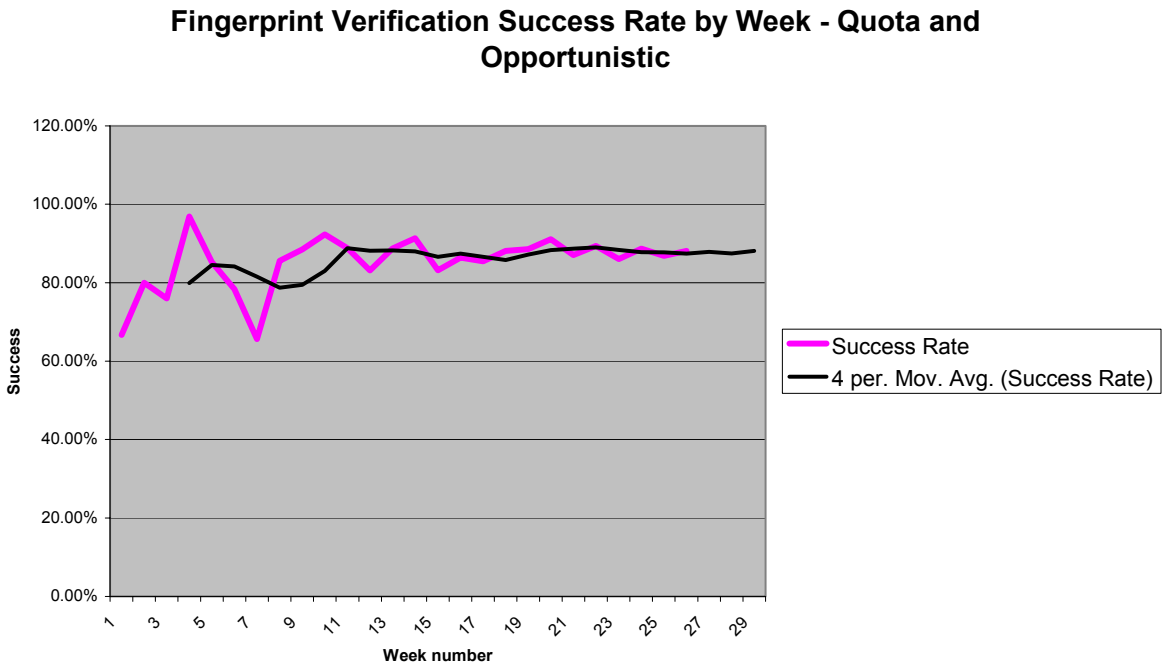


The same analysis has been carried out again using only those participants with one type of impairment.



B4.3 Trend over Time

Although a sharp dip occurred in week 7, this has been investigated and is due to Newcastle having a low success rate (42%) in that week. No underlying trend with the fingerprint verification success rate is evident.



Appendix C - Technology

C1 Technical solution for UK Passport Service Biometrics Trial

C1.1 Overview

Although this was not a Technology Trial, for reasons of completeness, the technology used has been described in this section. All the rates quoted are specific to the software and hardware configurations used in the Trial. The technical solution for the biometrics system is split into two parts, the front-end client enrolment and verification sites, and the back-end servers where all the biometrics data and authentication applications are hosted. These are both shown in Figure 26.

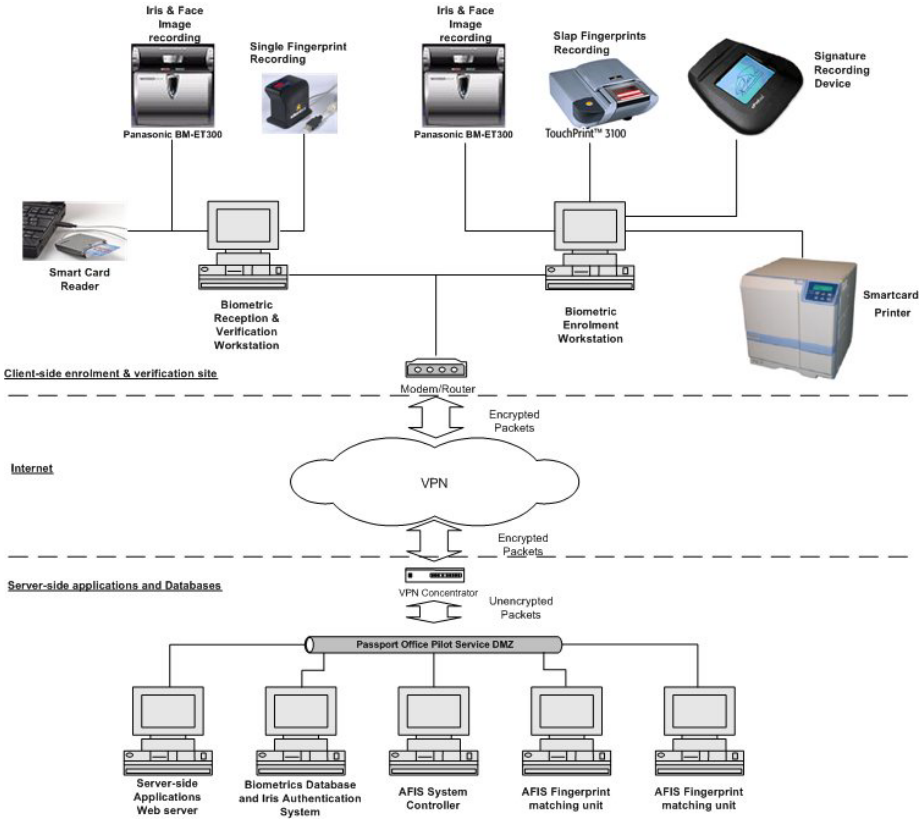


Figure 26 – Overview of Technical Architecture for UKPS Biometrics Test

For the Trial there were four static sites (London, Newcastle, Leicester and Glasgow) and a mobile unit. Each had exactly the same enrolment and verification equipment as shown in Figure 26, the only difference being the means of data communication to/from the central biometric servers. This is explained later on in this section.

Each client site consisted of two PCs, one was used for reception and verification duties, and the other was used for enrolling participants.

The biometric recording equipment was connected to each PC as shown above. These were controlled using vendor supplied API/SDKs, the versions of which, were the latest available at the start of the Trial and subsequently used throughout the lifetime of the Trial. Even though updates to software and firmware were available during the Trial, keeping the original versions allowed a consistent baseline for the Trial.

C1.2 Reception PC

The reception PC was used for participant registration and subsequent verification (after enrolment). The registration and verification application was a web-based application running under Microsoft IIS. For the initial entry of participant's details, the client-side application used HTML forms to record the data, which was then sent onto the central servers to be registered in the databases.

For verification, the application interfaced with the smartcard reader using specially written software (using the Schlumberger Cyberflex Access SDK v4) for the Trial, to read the participant's reference number off the smartcard, and then depending upon which biometric was chosen to verify against, the application interfaced directly with the various items of biometric recording equipment using vendor supplied APIs (these are outlined in the Enrolment PC sub-section).

The Panasonic BM-ET300 camera was used for acquiring face or iris biometrics and the Identix DFR-2080 single fingerprint reader was used to acquire the fingerprint biometric for verification. The recorded biometric data was then sent onto the central server for matching against the biometric data stored for the reference number read from the smartcard. The verification result of the match was then passed back to the client site.

C1.3 Enrolment PC

This PC recorded a participant's biometric data for enrolment. It was housed within a booth that contained the combined photo, face and iris image camera (Panasonic BM-ET300), the fingerprint scanner (Touchprint 3100) and signature capture pad. These were all connected to the PC, as was the EdiGuard IDX380 smartcard printer.

The enrolment application was again web-based running on a Microsoft IIS web server installed on this PC. A series of ASP pages were written using ActiveX components to interface with the biometric equipment using the vendors APIs. All data recorded was sent onto the back-end central server for processing.

The video camera part of the Panasonic BM-ET300 camera unit was used to capture a photo of the participant and also the Facial biometric. This was recorded using the Identix FaceIt software (v5.0) taking a series of images from the video camera.

For recording the iris biometric, the participant was prompted to look into the mirror portion of the BM-ET300 camera, which contained two cameras in a fixed position. The Iridian PrivateID software (v2.3 build 11) was used to control the recording of each iris in turn, prompting the participant using an automated voice (from the BM-ET300 camera) to move forwards, backwards, left or right to ensure that each camera could focus on each iris in turn.

For Fingerprint enrolment, the application interfaced with the Touchprint 3100 fingerprint scanner using the Identix LiveScan TP-3000/3100 SDK (v1.02.0002) showing a real-time picture of the fingerprints being recorded. The participant's fingerprints were recorded as a series of slap images in this order: left hand fingers, left hand thumb, right hand fingers

and finally right hand thumb. The Aware NISTPack Toolkit (V3.0) and Sequence Checker (v1.5) software were used to separate the four finger "slap" fingerprints into individual prints and also perform an initial quick quality check on each fingerprint image. There was further quality checking on the central servers by the NEC PID software (see below). This highlighted to the client site, if specific fingerprints needed to be retaken if the quality of the prints was below a specific threshold.

After the recording of the participant's biometrics, the enrolment application then asked for a sample signature using the ePadInk SDK (v1.02). Here the signature pad was used to scan in the signature, which was saved as a Microsoft Windows bitmap within the central server's biometrics database.

The final stage of enrolment was the production of the smartcard. The participant's photograph and biometrics were written to the chip on the card, using a program specifically written for this Trial, which in turn used the smartcard chip writer built into the printer. Once completed, then the smartcard had its surfaces printed, with the chip facing side having the participant's photo, name and reference number.

C1.4 Client-Server Communications

Data communication between the client sites (static and mobile unit) and the central servers was via HTTP requests from the web server on each of the client PCs, to the central server-side web server. In this way the central web server acted as a central point of communication, passing on any data request/submission to the relevant system as required and handling the returning data automatically.

Any binary data sent between the client PCs and the central web server was converted into base-64 XML for transmission and then re-encoded at the central web server.

The security of the data transmission was handled by establishing a Virtual Private Network (VPN) between the static sites, the mobile unit and the central servers over the Internet connection.

In the case of the static sites the PCs were connected into a local network using an ADSL router as a hub. This in turn set up the VPN between itself and the VPN concentrator, which acted as a gateway to accessing the Biometric Trial's central servers. A BT Business Broadband account was used for the required Internet access.

For the mobile unit, a VPN connection over the Internet was also used but this time depending upon the location of the mobile unit, there was a choice between using ADSL and WiFi or Satellite Internet access.

For sites using ADSL, the mobile unit was parked relatively close to the building where the ADSL had been installed. From here a wireless network was created and the mobile unit then securely logged into the wireless network using WEP keys and MAC address filtering to gain Internet access.

For sites where ADSL was not an option, a Satellite Internet service from Aramiska was used. Accompanying the mobile unit was a vehicle with the satellite dish on a motorised mount.

The VPN connection was setup using Cisco Client VPN software (v4.0.1) on each PC, each connecting separately to the VPN concentrator.

C1.5 Server-side platforms

The back-end servers were hosted at the Atos Origin data centre at Andover and were comprised of the following platforms:

C1.6 Central Server

All data requests to the central server took the form of calls to specific Active Server Pages (hosted by the central web server), which handled:

- Entry/update of registration details into database
- Storage of photo, facial biometric template, iris template, fingerprint images and templates, signature and enrolment statistics
- Match iris request
- Match fingerprint request
- Verification of Iris and Fingerprints

The server configuration was a quad-processor PC server box with a RAID disk array, hosting the Microsoft IIS web server.

The IIS web server was the controlling Biometrics server application, handling all the data requests by hosting a series of ASPs that dealt with accepting the data request (be it storage or retrieval).

Access to the NEC AFIS Fingerprint system was accomplished in two parts. Firstly fingerprint quality checking and template generation was done via the NEC PID API. The templates generated were those that were passed back to the client site and written onto the participant's smartcard. The more detailed template generation and 1-to-many checking performed by AFIS was accessed via the IntroNavi^{tm} Interface Adapter (IIA) API.

Data was passed back to the calling ASP in XML format. Binary data such as the iris template was encoded in base64.

C1.7 Biometrics Database server

Biometric details were held on a separate server running SQL Server 2000 (v8.00.194). The SQL Server 2000 database acted as the main repository for participant registration details, iris templates, photos, facial biometric templates and signatures. Fingerprint data was held within the AFIS system.

Access to the database was from the ASPs hosted on the central web server. These use explicit SQL statements, within Visual Basic ADODB calls to insert/update and retrieve data as necessary.

C1.8 Iridian KnoWho Authentication Server

The Iridian KnoWho Authentication Server (KWASv1.3.2) was used for the matching of iris templates, against those held within the Biometrics Database server's iris database. The KWAS was in two parts, a Windows service and an API. The service controlled the KWAS server process, which communicated with the Iris database held on the Biometrics database server and performed the one-to-many Iris matching process. The API was called via Visual Basic wrappers from the iris-matching ASP. This API accepted the iris-

matching request from the client site, passing it onto the service, which then co-ordinated the reading of iris templates from the SQL 2000 server database to match against the given participant's iris template.

C1.9 NEC AFIS System- Fingerprint Matching and Database

The Fingerprint matching and database system that was used in the Trial system was the NEC Automated Fingerprint Identification System (AFIS). This consisted of 3 PC servers that housed the various components of the system (system controller and 2 Fingerprint Matching Processors) and RAID storage devices to hold the database(s).

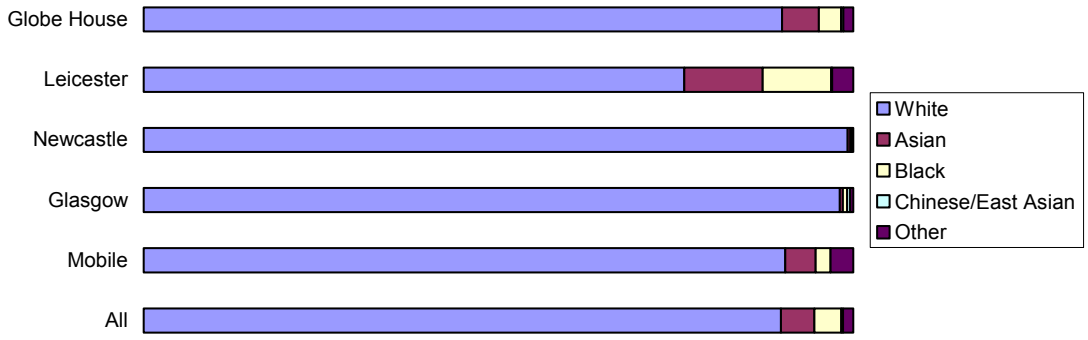
Access to the AFIS system was through an NEC derived API layer IntroNavi^{tm} Interface Adapter (IIA). This provided the 1-to-many matching required when a client first enrolled on the system and was checked against the whole fingerprint database.

Appendix D - Demographics of Sample Groups

D1 Quota

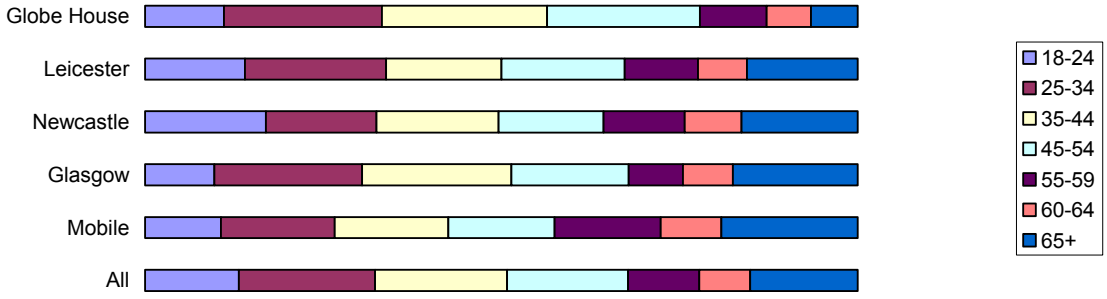
The following charts show the breakdown of the Quota participants by ethnic origin, age range, gender, religion, social class, working status and into urban or rural dwellers. The breakdown is shown for each enrolment centre and overall.

Breakdown of Quota Participants by Ethnic Origin



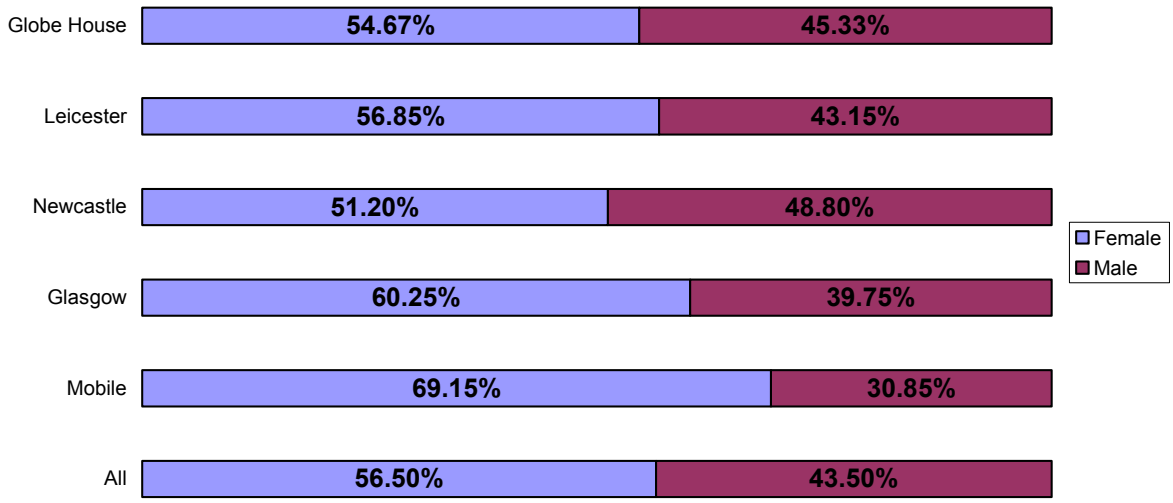
	All	Mobile	Glasgow	Newcastle	Leicester	Globe House
Other	1.45%	3.19%	0.42%	0.20%	2.96%	1.38%
Chinese/East Asian	0.25%	0.00%	0.42%	0.20%	0.16%	0.35%
Black	3.80%	2.13%	0.63%	0.00%	9.66%	3.11%
Asian	4.70%	4.26%	0.42%	0.40%	11.06%	5.19%
White	89.80%	90.43%	98.10%	99.20%	76.17%	89.97%

Breakdown of Quota Participants by Age Range

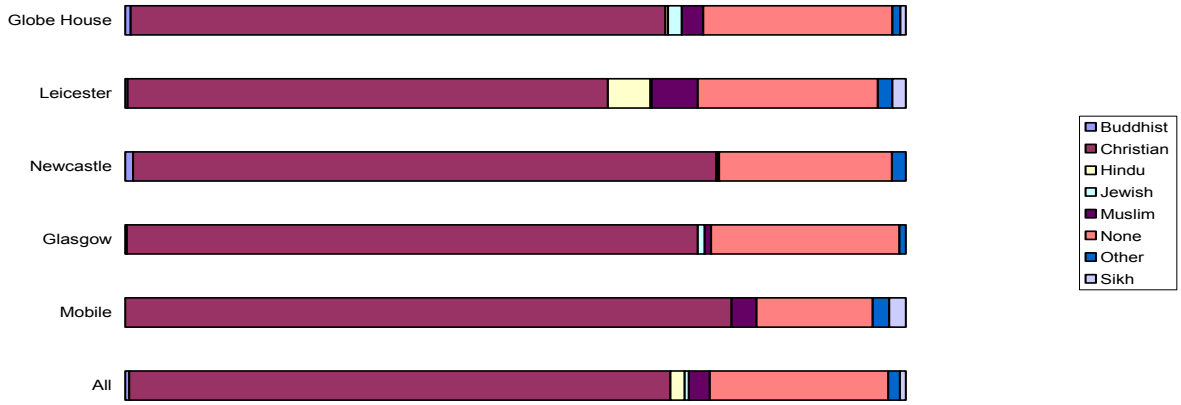


	All	Mobile	Glasgow	Newcastle	Leicester	Globe House
65+	15.10%	19.15%	17.55%	16.33%	15.58%	6.57%
60-64	7.15%	8.51%	6.98%	7.97%	6.85%	6.23%
55-59	10.00%	14.89%	7.61%	11.35%	10.28%	9.34%
45-54	16.95%	14.89%	16.49%	14.74%	17.29%	21.45%
35-44	18.55%	15.96%	20.93%	17.13%	16.20%	23.18%
25-34	19.10%	15.96%	20.72%	15.54%	19.78%	22.15%
18-24	13.15%	10.64%	9.73%	16.93%	14.02%	11.07%

Breakdown of Quota Participants by Gender

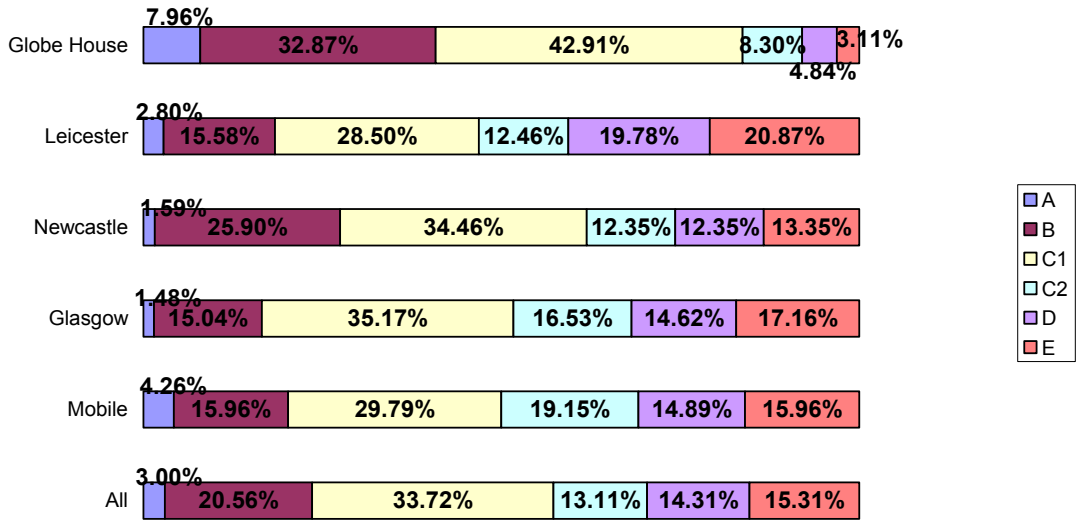


Breakdown of Quota Participants by Religion



	Globe House	Leicester	Newcastle	Glasgow	Mobile	All
Buddhist	0.69%	0.31%	1.00%	0.21%	0.00%	0.50%
Christian	68.51%	61.53%	74.70%	73.15%	77.66%	69.35%
Hindu	0.35%	5.45%	0.00%	0.00%	0.00%	1.80%
Jewish	1.73%	0.16%	0.20%	0.85%	0.00%	0.55%
Muslim	2.77%	5.92%	0.20%	0.85%	3.19%	2.70%
None	24.22%	23.05%	22.11%	24.10%	14.89%	22.85%
Other	1.04%	1.87%	1.79%	0.85%	2.13%	1.50%
Sikh	0.69%	1.71%	0.00%	0.00%	2.13%	0.75%

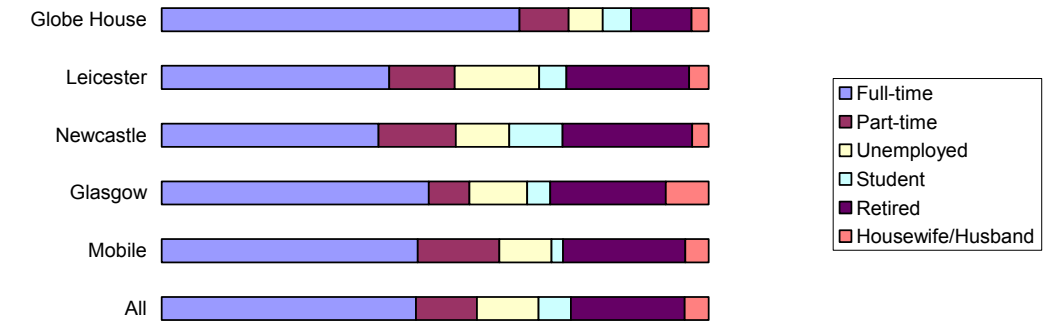
Breakdown of Quota Participants by Social Class



The social class definitions are those used by the Institute of Practitioners in Advertising, and are standard on all surveys carried out by MORI (Market and Opinion Research International Limited).

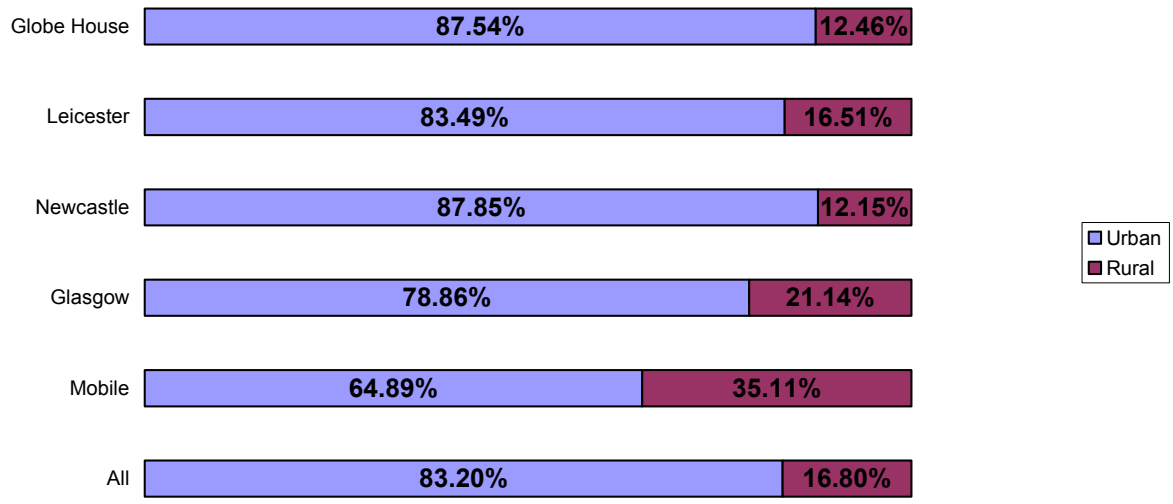
	Social Class	Occupation of Chief Income Earner
A	Upper Middle Class	Higher managerial, administrative or professional
B	Middle Class	Intermediate managerial, administrative or professional
C1	Lower Middle Class	Supervisor or clerical and junior managerial, administrative or professional
C2	Skilled Working Class	Skilled manual workers
D	Working Class	Semi and unskilled manual workers
E	Those at the lowest levels of subsistence	State pensioners, etc, with no other earnings

Breakdown of Quota Participants by Working Status



	All	Mobile	Glasgow	Newcastle	Leicester	Globe House
Housewife/Husband	4.40%	4.26%	7.82%	2.99%	3.58%	3.11%
Retired	20.80%	22.34%	21.14%	23.71%	22.43%	11.07%
Student	5.90%	2.13%	4.23%	9.76%	4.98%	5.19%
Unemployed	11.25%	9.57%	10.57%	9.76%	15.42%	6.23%
Part-time	11.15%	14.89%	7.40%	14.14%	11.99%	9.00%
Full-time	46.50%	46.81%	48.84%	39.64%	41.59%	65.40%

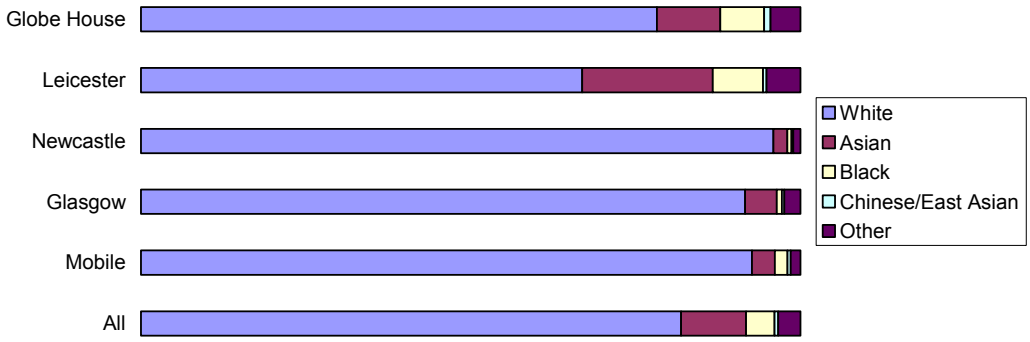
Breakdown of Quota Participants into Urban and Rural Dwellers



D2 Opportunistic

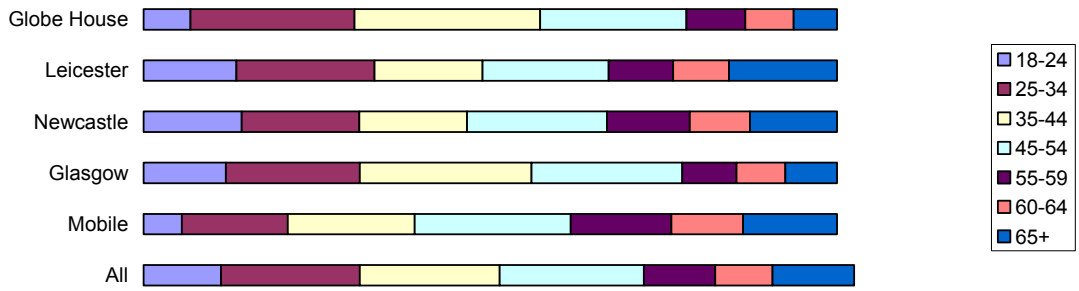
The following charts show the breakdown of the Opportunistic participants by ethnic origin, age range, gender, religion and into urban or rural dwellers.

Breakdown of Opportunistic Participants by Ethnic Origin



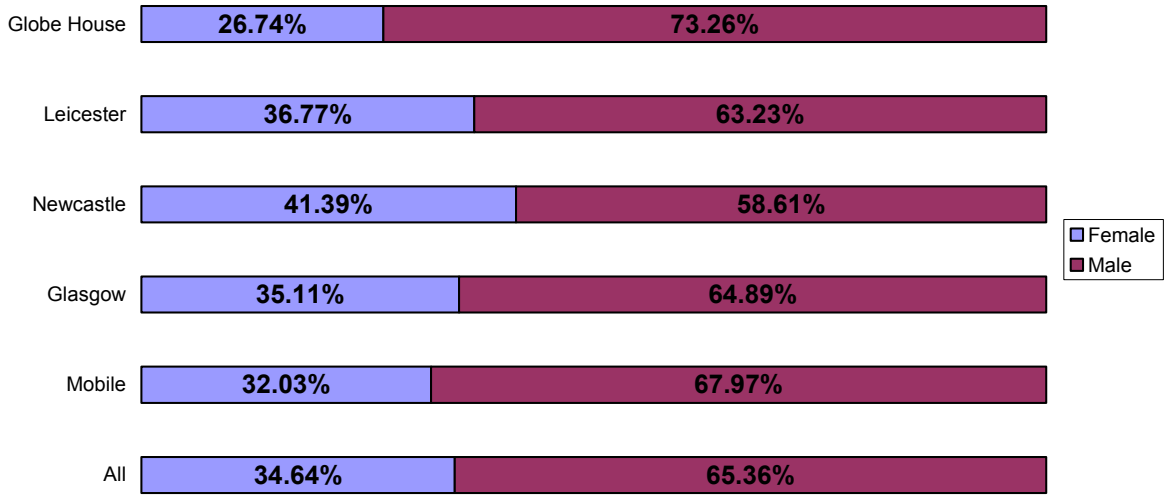
	All	Mobile	Glasgow	Newcastle	Leicester	Globe House
Other	3.38%	1.50%	2.45%	1.10%	5.14%	4.58%
Chinese/East Asian	0.55%	0.46%	0.38%	0.28%	0.57%	0.94%
Black	4.31%	1.96%	0.75%	0.62%	7.59%	6.65%
Asian	9.87%	3.46%	4.81%	2.13%	19.80%	9.59%
White	81.89%	92.63%	91.60%	95.87%	66.90%	78.24%

Breakdown of Opportunistic Participants by Age Range

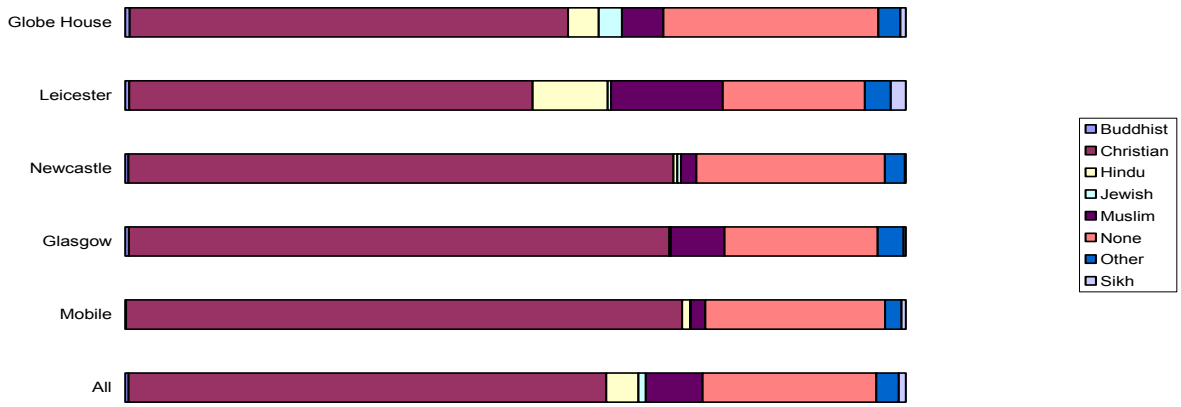


	All	Mobile	Glasgow	Newcastle	Leicester	Globe House
65+	11.79%	13.56%	7.44%	12.57%	15.61%	6.26%
60-64	8.25%	10.34%	7.06%	8.65%	8.02%	6.95%
55-59	10.31%	14.48%	7.82%	11.95%	9.29%	8.52%
45-54	20.78%	22.53%	21.75%	20.19%	18.19%	21.10%
35-44	20.18%	18.28%	24.76%	15.52%	15.61%	26.74%
25-34	19.99%	15.29%	19.30%	16.96%	19.90%	23.67%
18-24	11.18%	5.52%	11.86%	14.15%	13.37%	6.76%

Breakdown of Opportunistic Participants by Gender

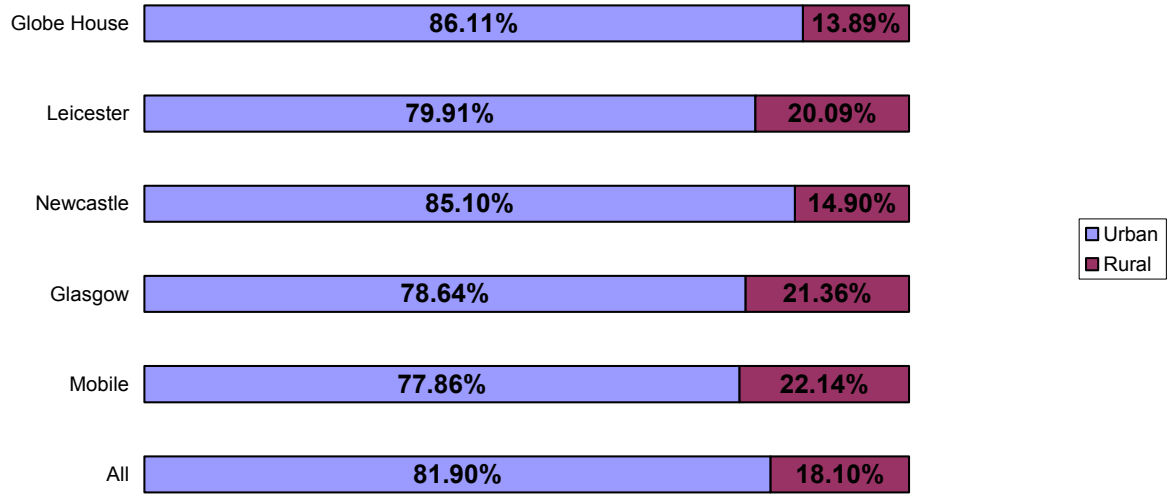


Breakdown of Opportunistic Participants by Religion



	Globe House	Leicester	Newcastle	Glasgow	Mobile	All
Buddhist	0.56%	0.48%	0.41%	0.48%	0.12%	0.44%
Christian	56.15%	51.72%	69.83%	69.22%	71.20%	61.20%
Hindu	3.95%	9.59%	0.48%	0.10%	1.04%	4.12%
Jewish	2.95%	0.44%	0.48%	0.10%	0.12%	0.91%
Muslim	5.33%	14.34%	1.93%	6.88%	1.84%	7.29%
None	27.54%	18.21%	24.17%	19.60%	23.04%	22.24%
Other	2.82%	3.30%	2.55%	3.35%	2.07%	2.90%
Sikh	0.69%	1.93%	0.14%	0.29%	0.58%	0.90%

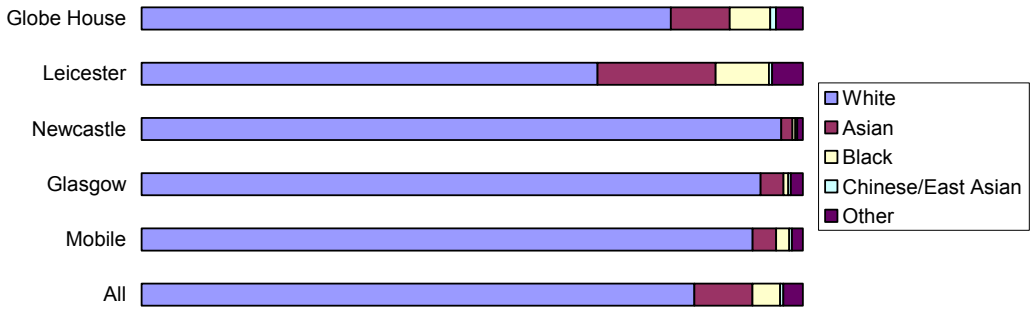
Breakdown of Opportunistic Participants into Urban and Rural Dwellers



D3 Quota and Opportunistic Combined

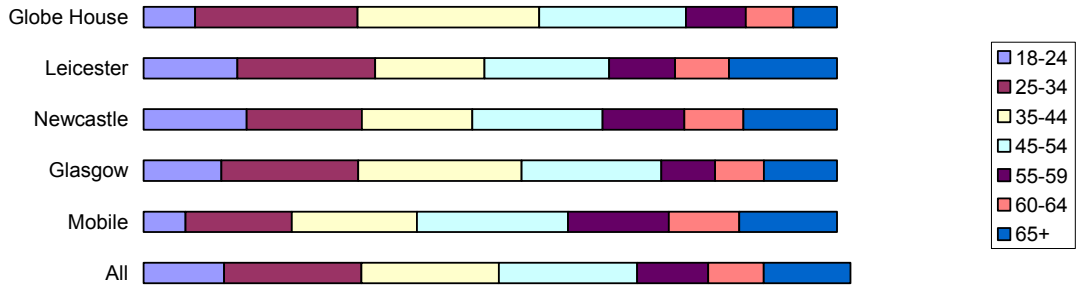
The following charts show the breakdown of the combined Opportunistic and Quota participants by ethnic origin, age range, gender, religion and into urban or rural dwellers.

Breakdown of Quota and Opportunistic Participants by Ethnic Origin



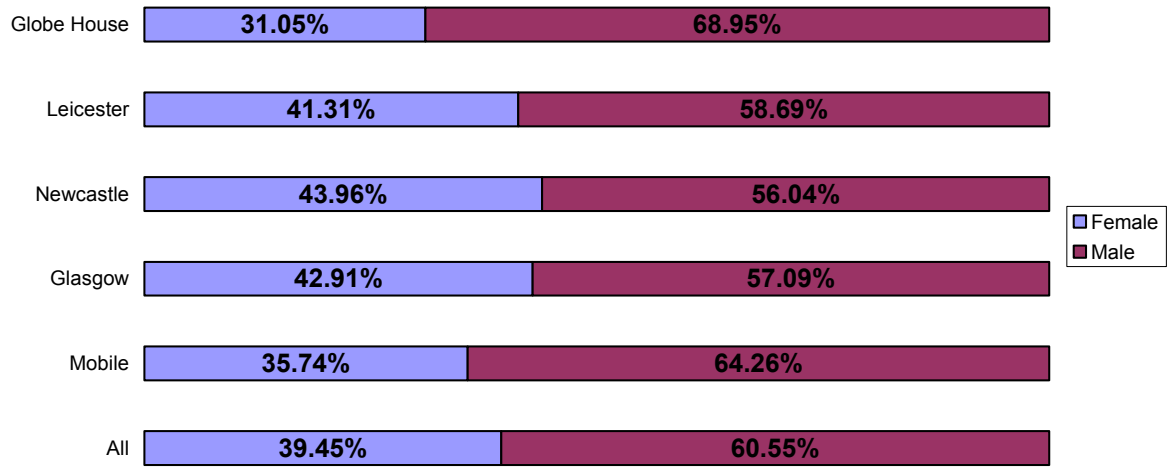
	All	Mobile	Glasgow	Newcastle	Leicester	Globe House
Other	2.96%	1.66%	1.83%	0.87%	4.66%	4.09%
Chinese/East Asian	0.49%	0.42%	0.39%	0.26%	0.48%	0.85%
Black	4.20%	1.98%	0.72%	0.46%	8.05%	6.10%
Asian	8.75%	3.53%	3.46%	1.69%	17.88%	8.92%
White	83.60%	92.41%	93.61%	96.73%	68.94%	80.04%

Breakdown of Quota and Opportunistic Participants by Age Range

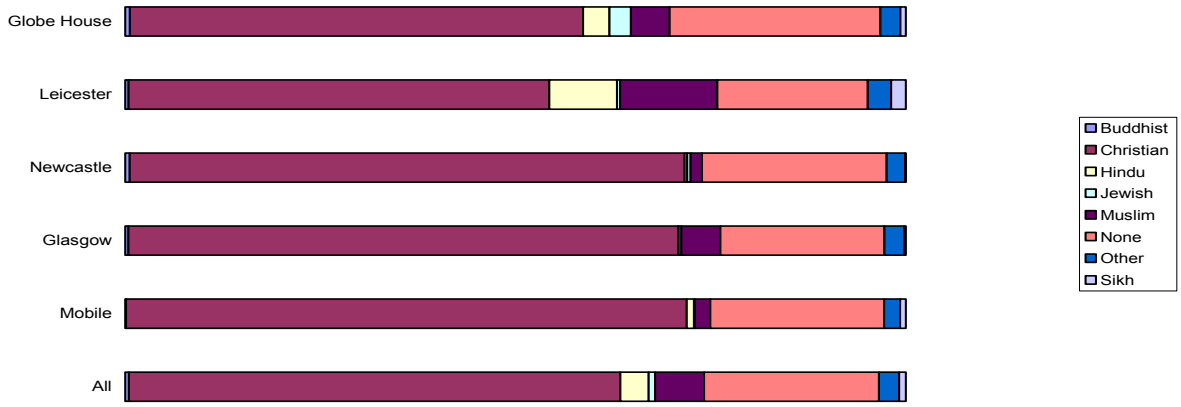


	All	Mobile	Glasgow	Newcastle	Leicester	Globe House
65+	12.52%	14.11%	10.55%	13.53%	15.60%	6.31%
60-64	8.01%	10.17%	7.04%	8.48%	7.77%	6.84%
55-59	10.24%	14.52%	7.75%	11.80%	9.51%	8.64%
45-54	19.93%	21.78%	20.13%	18.79%	18.00%	21.16%
35-44	19.82%	18.05%	23.58%	15.93%	15.74%	26.19%
25-34	19.79%	15.35%	19.74%	16.60%	19.88%	23.44%
18-24	11.62%	6.02%	11.21%	14.86%	13.51%	7.42%

Breakdown of Quota and Opportunistic Participants by Gender

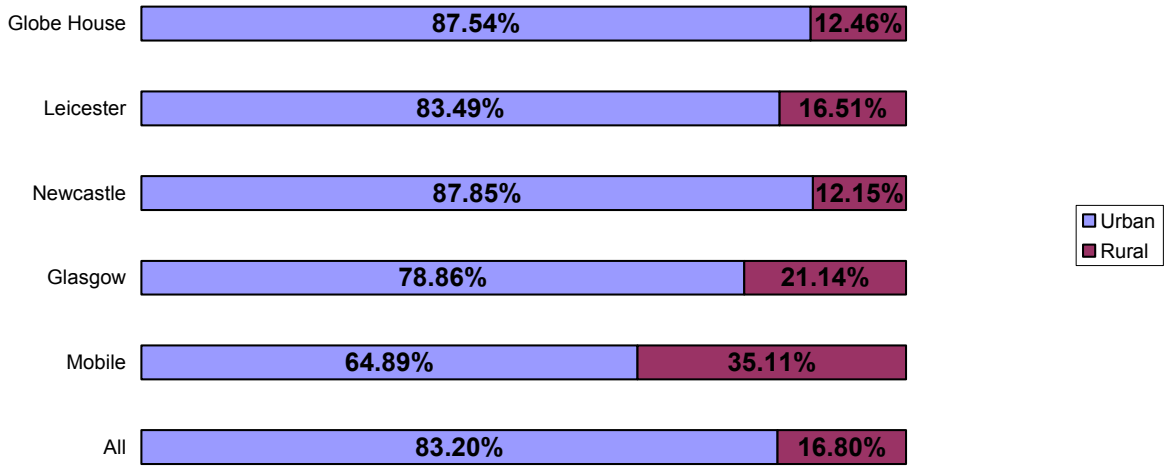


Breakdown of Quota and Opportunistic Participants by Religion



	Globe House	Leicester	Newcastle	Glasgow	Mobile	All
Buddhist	0.58%	0.45%	0.56%	0.39%	0.10%	0.45%
Christian	58.05%	53.88%	71.08%	70.44%	71.83%	62.96%
Hindu	3.40%	8.68%	0.36%	0.07%	0.94%	3.62%
Jewish	2.76%	0.38%	0.41%	0.33%	0.10%	0.83%
Muslim	4.94%	12.48%	1.48%	5.00%	1.98%	6.29%
None	27.03%	19.27%	23.64%	21.00%	22.25%	22.37%
Other	2.55%	2.98%	2.35%	2.57%	2.08%	2.60%
Sikh	0.69%	1.89%	0.10%	0.20%	0.73%	0.87%

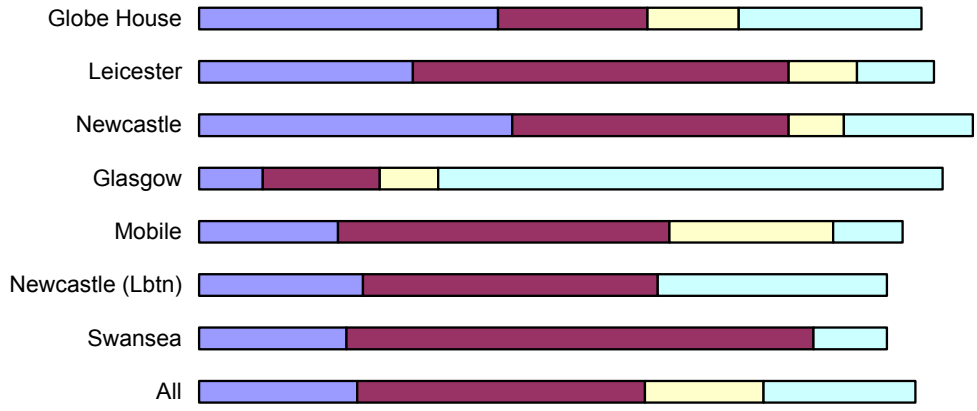
Breakdown of Quota and Opportunistic Participants into Urban and Rural Dwellers



D4 Disabled Participants

The following charts show the breakdown of the Disabled participants by type of impairment, age range, gender, and into urban or rural dwellers. The breakdown is shown for each enrolment centre and overall.

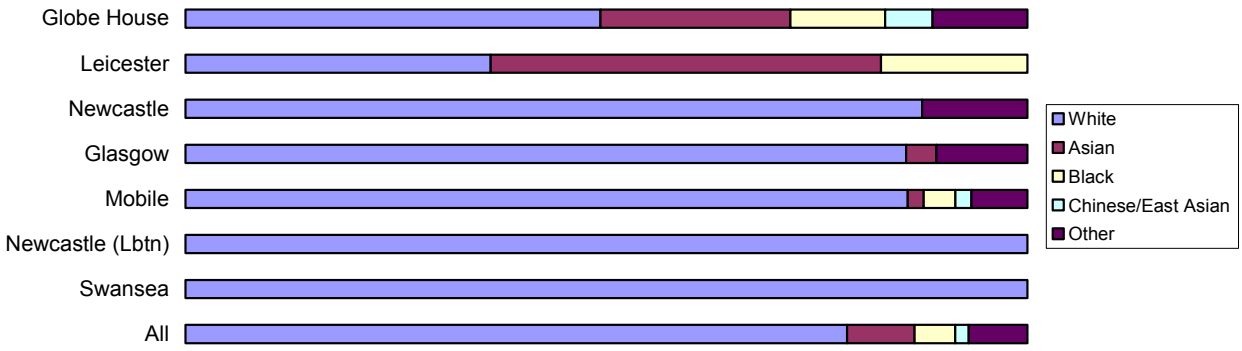
Breakdown of Disabled Sample by Impairment Type



	All	Swansea	Newcastle (Lbtn)	Mobile	Glasgow	Newcastle	Leicester	Globe House
Hearing impairment	25.73%	12.50%	38.89%	11.76%	85.59%	21.88%	13.04%	30.99%
Learning Difficulties	20.13%	0.00%	0.00%	27.76%	9.91%	9.38%	11.59%	15.49%
Physical impairment	48.80%	79.17%	50.00%	56.24%	19.82%	46.88%	63.77%	25.35%
Visual impairment	26.80%	25.00%	27.78%	23.53%	10.81%	53.13%	36.23%	50.70%

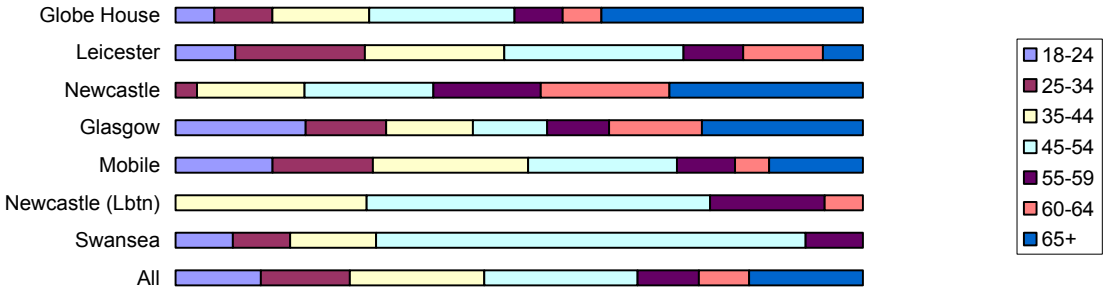
NB The above percentages add up to more than 100% because some participants have more than one impairment.

Breakdown of Disabled Sample Participants by Ethnic Origin



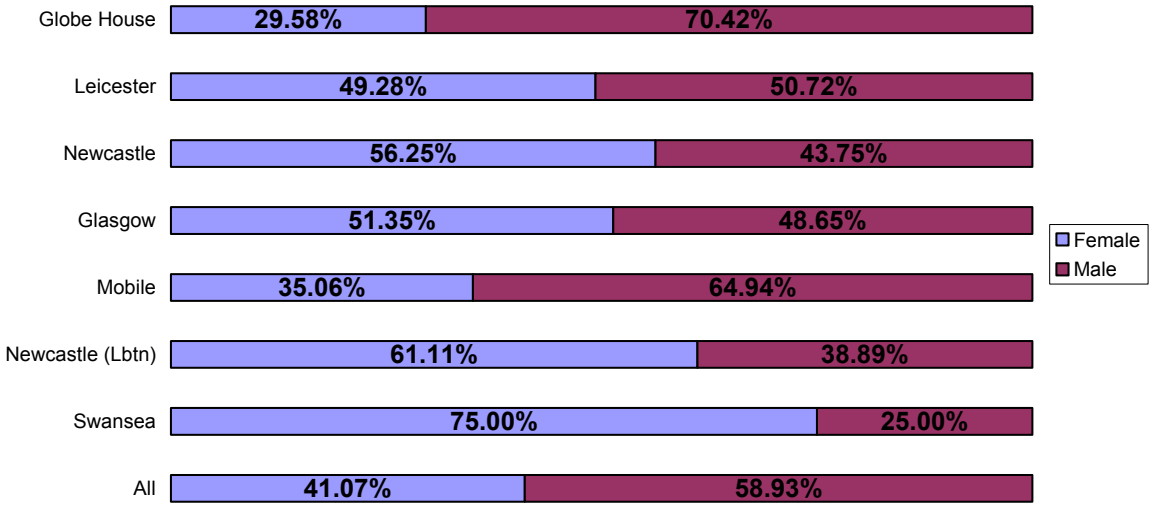
	All	Swansea	Newcastle (Lbtn)	Mobile	Glasgow	Newcastle	Leicester	Globe House
Other	1.74%	0.00%	0.00%	1.66%	2.70%	3.13%	0.00%	2.82%
Chinese/East Asian	0.40%	0.00%	0.00%	0.47%	0.00%	0.00%	0.00%	1.41%
Black	1.20%	0.00%	0.00%	0.95%	0.00%	0.00%	4.35%	2.82%
Asian	2.01%	0.00%	0.00%	0.47%	0.90%	0.00%	11.59%	5.63%
White	94.65%	100.00%	100.00%	96.45%	96.40%	96.88%	84.06%	87.32%

Breakdown of Disabled Sample by Age Range

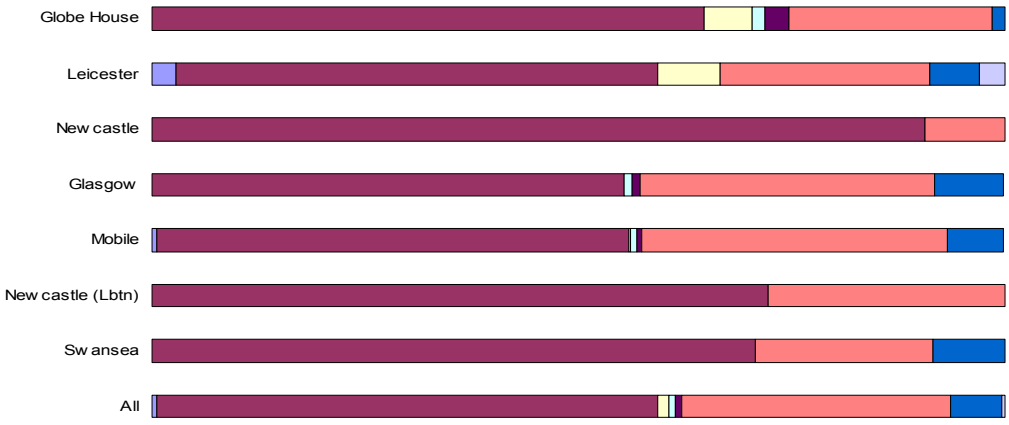


	All	Swansea	Newcastle (Lbtn)	Mobile	Glasgow	Newcastle	Leicester	Globe House
65+	16.53%	0.00%	0.00%	13.65%	23.42%	28.13%	5.80%	38.03%
60-64	7.33%	0.00%	5.56%	4.94%	13.51%	18.75%	11.59%	5.63%
55-59	8.93%	8.33%	16.67%	8.47%	9.01%	15.63%	8.70%	7.04%
45-54	22.27%	62.50%	50.00%	21.65%	10.81%	18.75%	26.09%	21.13%
35-44	19.60%	12.50%	27.78%	22.59%	12.61%	15.63%	20.29%	14.08%
25-34	12.93%	8.33%	0.00%	14.59%	11.71%	3.13%	18.84%	8.45%
18-24	12.40%	8.33%	0.00%	14.12%	18.92%	0.00%	8.70%	5.63%

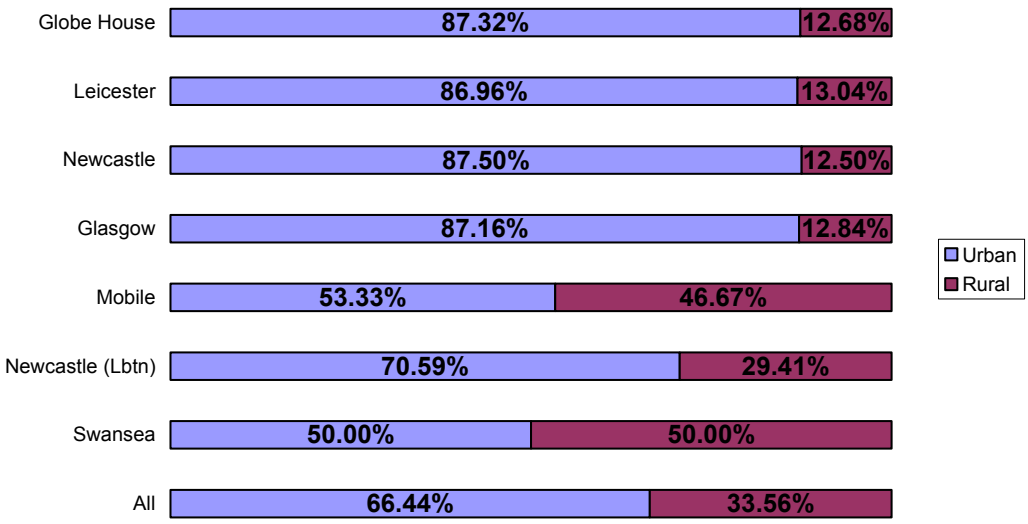
Breakdown of Disabled Sample by Gender



Breakdown of Disabled Sample Participants by Religion



	Globe House	Leicester	Newcastle	Glasgow	Mobile	Newcastle (Lb	Swansea	All
Buddhist	0.00%	2.90%	0.00%	0.00%	0.00%	0.00%	0.00%	0.27%
Christian	1.41%	5.80%	0.00%	8.18%	6.71%	0.00%	8.33%	5.94%
Hindu	23.94%	24.64%	9.38%	34.55%	35.73%	27.78%	20.83%	31.58%
Jewish	2.82%	0.00%	0.00%	0.91%	0.72%	0.00%	0.00%	0.81%
Muslim	1.41%	0.00%	0.00%	0.91%	0.72%	0.00%	0.00%	0.67%
None	5.63%	7.25%	0.00%	0.00%	0.24%	0.00%	0.00%	1.35%
Other	64.79%	56.52%	90.63%	55.45%	55.40%	72.22%	70.83%	58.84%
Sikh	0.00%	2.90%	0.00%	0.00%	0.48%	0.00%	0.00%	0.54%


Breakdown of Disabled Sample into Urban and Rural Dwellers
Globe House
87.32%
12.68%
Leicester
86.96%
13.04%
Newcastle
87.50%
12.50%
Glasgow
87.16%
12.84%
Mobile
53.33%
46.67%
Newcastle (Lbtn)
70.59%
29.41%
Swansea
50.00%
50.00%
All
66.44%
33.56%
Urban
Rural

Appendix E - Trial Results – Process and Experience Correlation

This section compares the responses to certain questions in the questionnaire with the participant's actual experience when going through the process. The purpose of this is comparison is to answer the following questions:

- For each biometric, is there a relationship between the time actually taken and the participant's perception of that time as being too long?
- For each biometric, is there a relationship between how the participant rated the overall experience and the length of time to attempt enrolment on that biometric?
- For each biometric, is there a relationship between how the participant rated the overall experience and the success of the attempted enrolment on that biometric?
- Is there a relationship between the participant's preferred biometric and the success of the attempted enrolment on that biometric?

E1 Time Taken

E1.1 Facial Biometric Enrolment

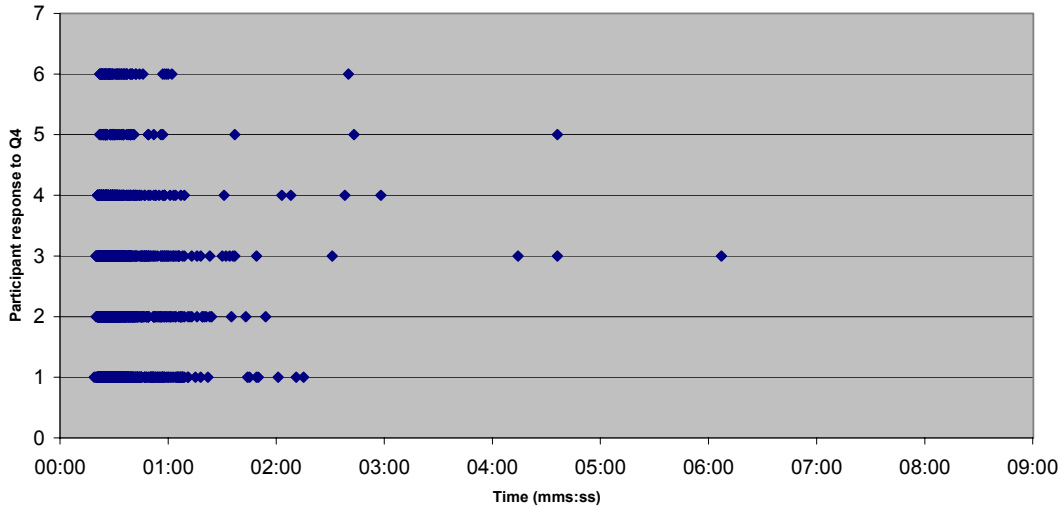
For all sample groups, there does not seem to be a strong relationship between the time taken for facial biometric enrolment and a participant's response to Question 4 (*How did the time it took to take your recognition biometric compare with what you expected?)*

Three of the Quota participants who said it took a lot longer than expected had an actual facial biometric enrolment time of less than 30 seconds which was below the average time for the facial biometric. Three of the Quota participants who said it was a lot quicker than expected had actual facial biometric enrolment times of over 2 minutes, times which were well above average. Once the facial biometric reached a time in excess of 1 minute 30 seconds then Quota participants tended to feel this was longer than expected.

Once facial biometric enrolment times for the Opportunistic sample participants reached 2 minutes then participants tended to think this was longer than expected. However, there were participants who had facial biometric enrolment times of over 3 minutes who found this quicker than expected.

Similarly, although three of the four participants from the Disabled participant group who said facial biometric enrolment took a lot longer than expected had above average facial biometric enrolment times (45 seconds, 1 minute 8 seconds and 1 minute 18 seconds), the majority of participants with comparable enrolment times did not feel this was excessive. Yet someone from the Disabled participant group who had a facial biometric enrolment of nearly 5 minutes felt this was a lot quicker than expected.

Face biometric enrolment: participant response to question about time taken vs actual time taken - Quota only



Response values:

1: A lot quicker than expected

2: A little quicker than expected

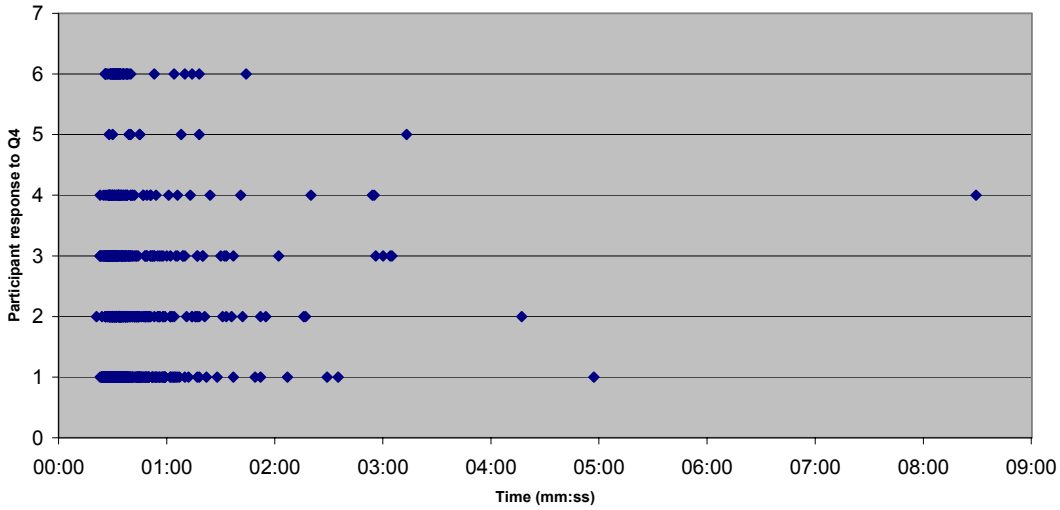
3: About the same as expected

4: A little slower than expected

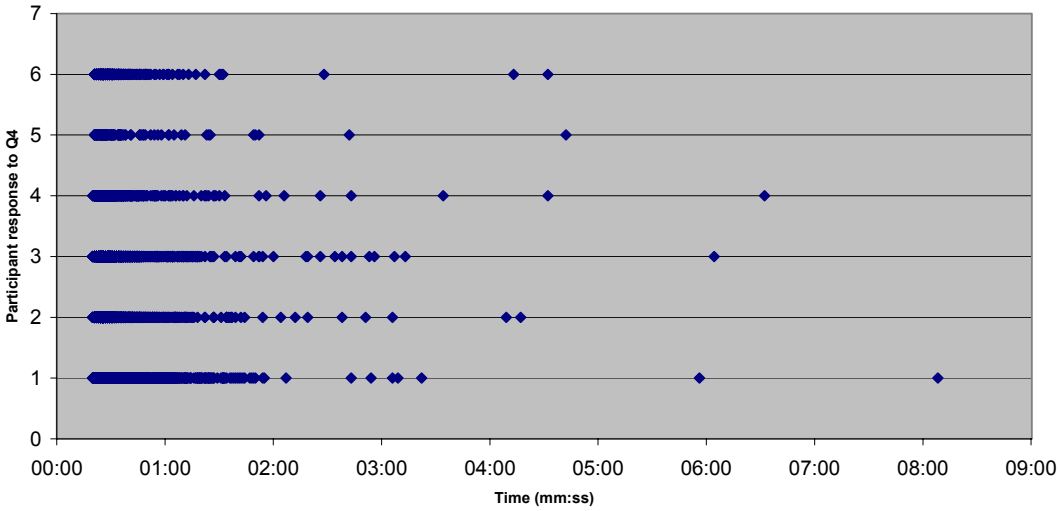
5: A lot slower than expected

6: Don't know

Face biometric enrolment: participant response to question about time taken vs actual time taken - Disabled only



Face biometric enrolment: participant response to question about time taken vs actual time taken - Opportunistic only



Response values:

1: A lot quicker than expected

2: A little quicker than expected

3: About the same as expected

4: A little slower than expected

5: A lot slower than expected

6: Don't know

E1.2 Iris Biometric Enrolment

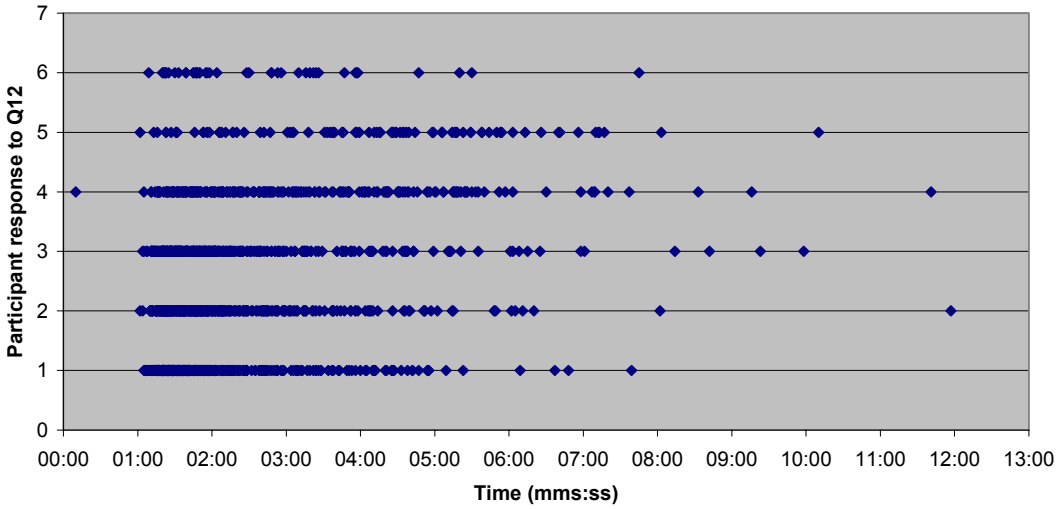
For all sample groups, no strong relationship appears to exist between the time taken for iris biometric enrolment and a participant's response to Question 12 (*How did the time it took to take your recognition biometric compare with what you expected?)*

The Quota participant who actually had the longest iris enrolment experience (just less than 12 minutes) said it was a little quicker than expected. Quota participants with relatively short iris enrolment times (less than 2 minutes) tended to consider this quicker than expected, but there were still many Quota participants who considered it slower. Only when iris biometric enrolment times reached 3 minutes and 15 seconds did the number who found it slower than expected begin to outweigh the number who found it quicker than expected.

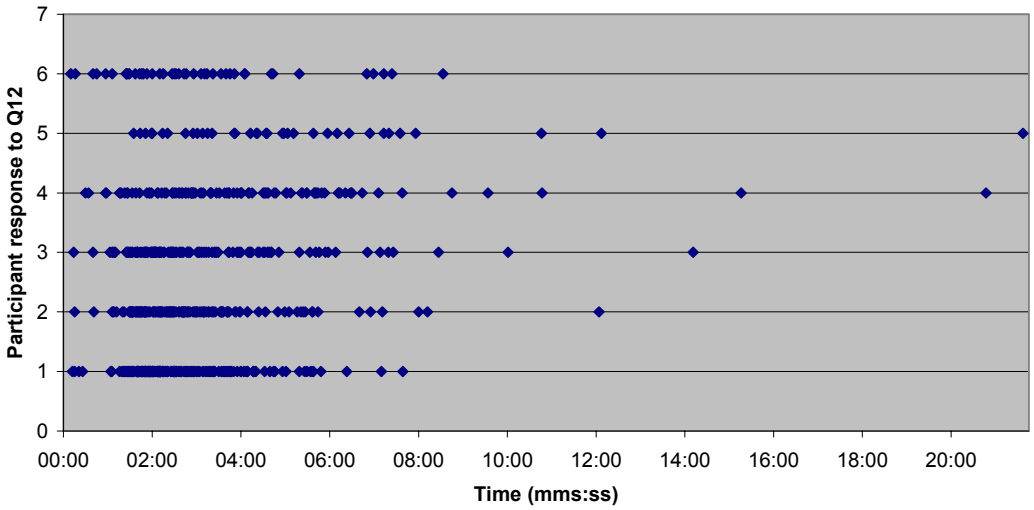
For Opportunistic participants, only when iris biometric enrolment times reached 5 minutes and 15 seconds did the number who found it slower than expected begin to outweigh the number who found it quicker than expected.

On the whole, once iris biometric times reached 5 minutes or thereabouts, the Disabled participant group tended to think the time was longer than expected, but this is not clear-cut. There are participants with iris enrolment times in excess of 6 minutes who found the time quicker than expected.

Iris biometric enrolment: participant response to question about time taken vs actual time taken - Quota only



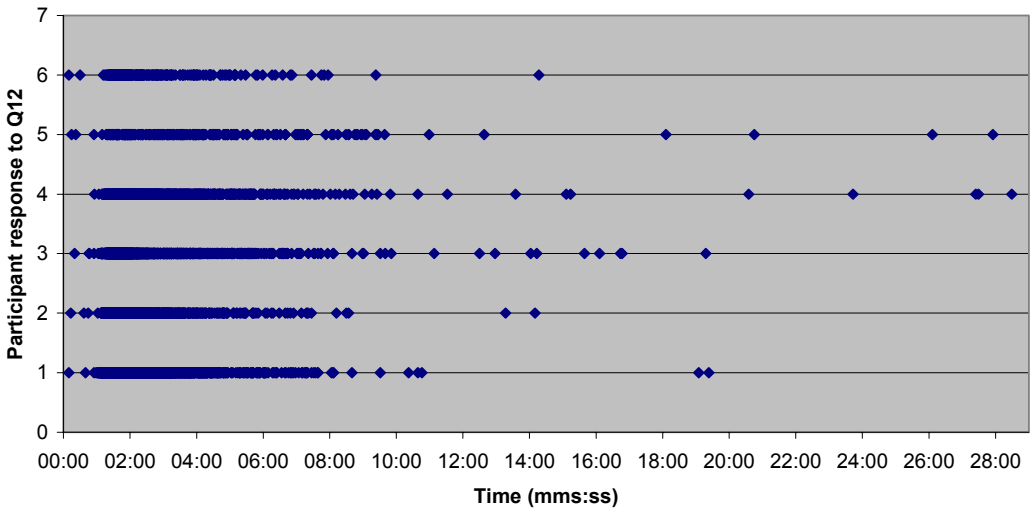
Iris biometric enrolment: participant response to question about time taken vs actual time taken - Disabled only



Response values:

1: A lot quicker than expected	4: A little slower than expected
2: A little quicker than expected	5: A lot slower than expected
3: About the same as expected	6: Don't know

Iris biometric enrolment: participant response to question about time taken vs actual time taken - Opportunistic only



E1.3 Fingerprint Biometric Enrolment

As with the face and iris biometrics, no strong relationship appears to exist between the time taken for fingerprint biometric enrolment and participant's response to Question 20 (*How did the time it took to take your recognition biometric compare with what you expected?)*

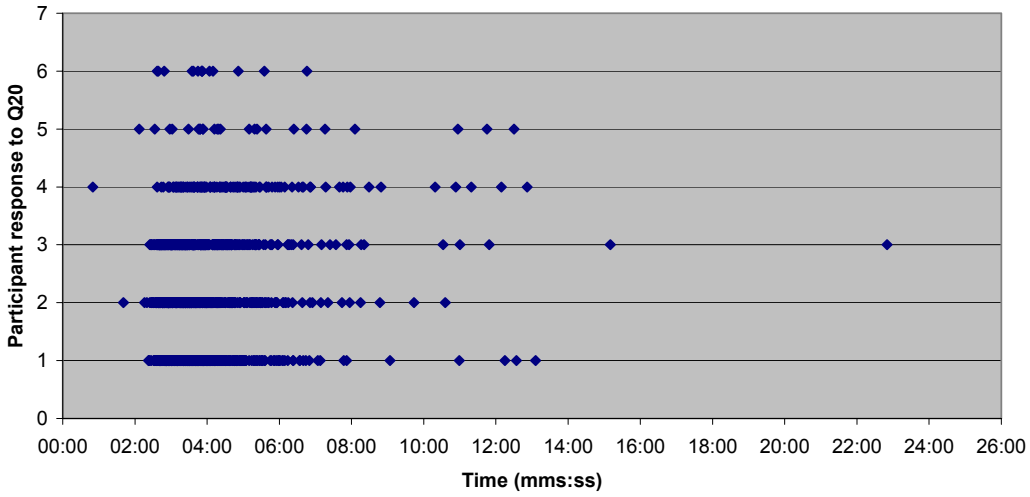
The participant who actually had the shortest fingerprint enrolment experience (50 seconds) found the experience slower than expected. The participant with the longest fingerprint enrolment (nearly 27 minutes) found the experience quicker than expected.

Quota participants with fingerprint enrolment times between 2½ minutes and 5¼ minutes tended to consider this quicker than expected, but there were still many participants who considered it slower. Only when fingerprint biometric enrolment times exceeded 5¼ minutes did the number of Quota participants who found it slower than expected begin to outweigh the number who found it quicker than expected.

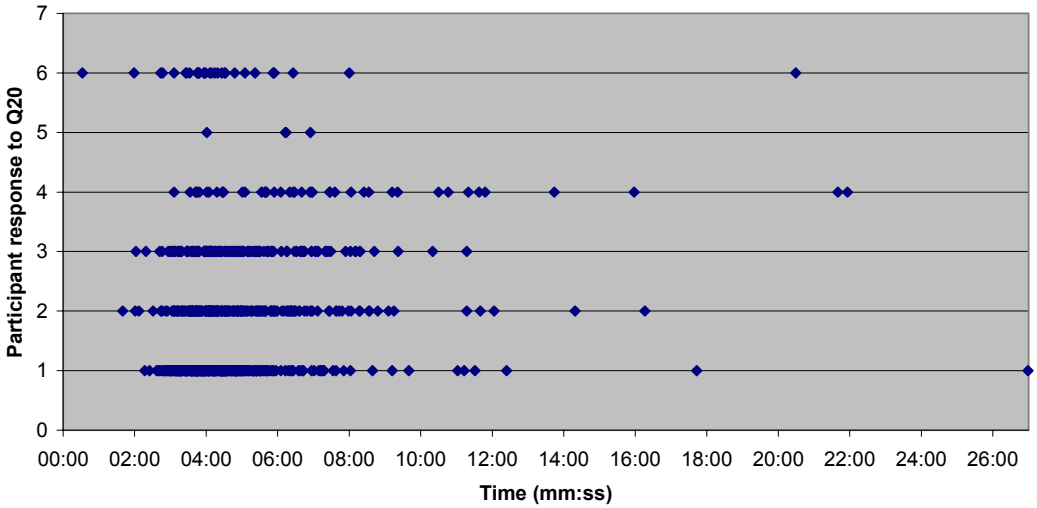
Opportunistic sample participants with fingerprint biometric enrolment times in excess of 7¾ minutes tended to think this was longer than expected, but even excessively long enrolment times were found to quicker than expected to some participants.

Disabled participants with fingerprint enrolment times between 2½ minutes and 7 minutes tended to consider this quicker than expected, but there were still many participants who considered it slower. Only when fingerprint biometric enrolment times exceeded 8¼ minutes did the number of Disabled participants who found it slower than expected begin to outweigh the number who found it quicker than expected

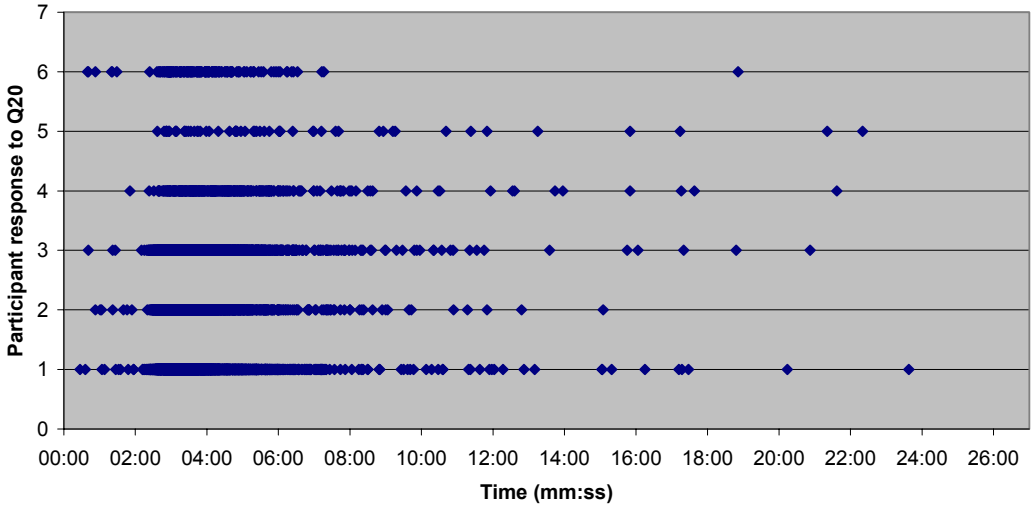
Fingerprint biometric enrolment: participant response to question about time taken vs actual time taken - Quota only



Fingerprint biometric enrolment: participant response to question about time taken vs actual time taken - Disabled only



Fingerprint biometric enrolment: participant response to question about time taken vs actual time taken - Opportunistic only



Response values:

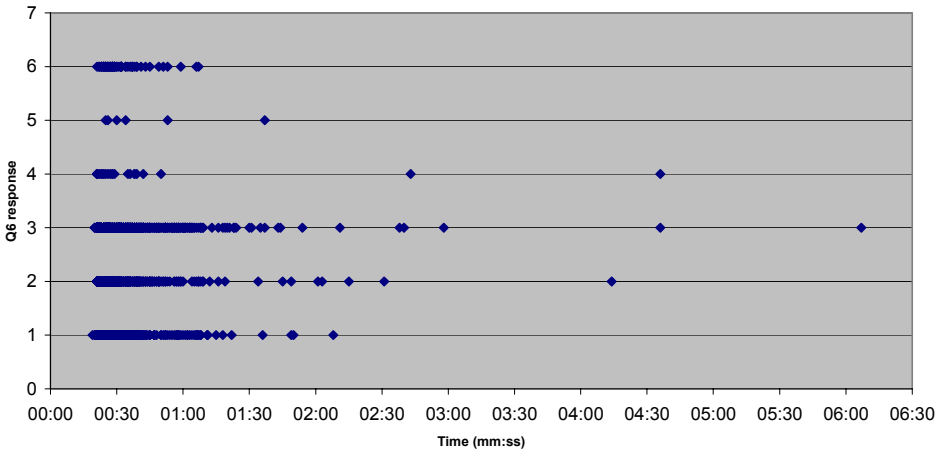
1: A lot quicker than expected	4: A little slower than expected
2: A little quicker than expected	5: A lot slower than expected
3: About the same as expected	6: Don't know

E2 Overall Experience

E2.1 Face Biometric Enrolment

The length of time taken by facial biometric enrolment does not seem to have been a factor in the participant's response to question 6 (*Overall how did you feel about the experience of giving your biometrics?)*

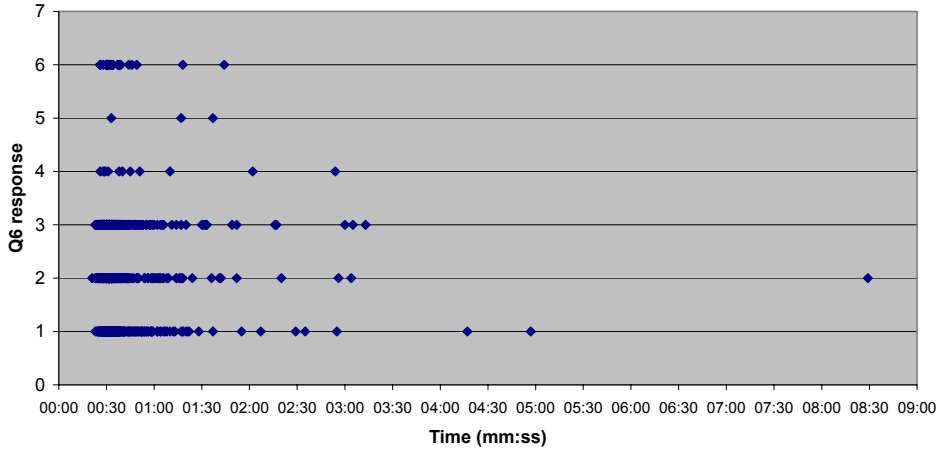
Face enrolment overall experience: Q6 response vs time taken - Quota only



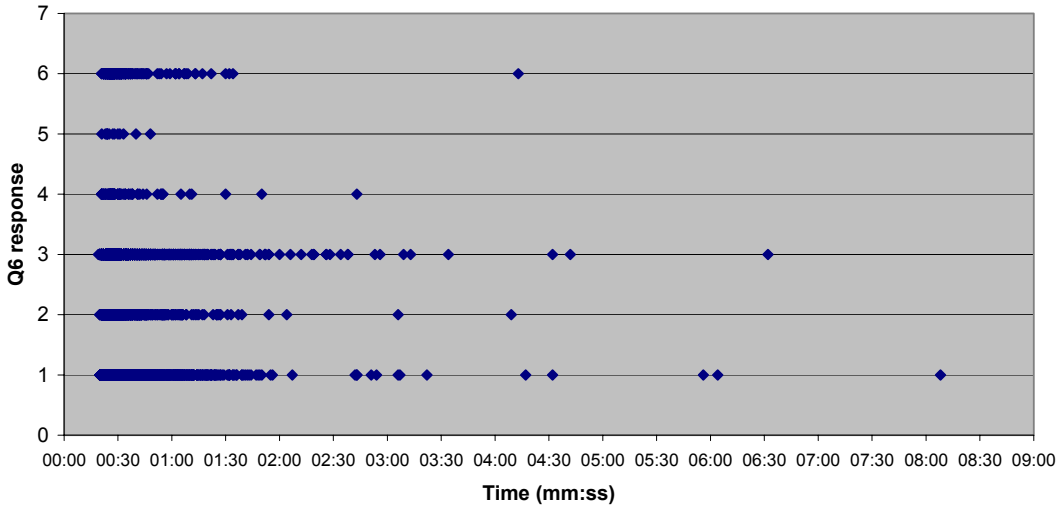
Response values:

1: Much better than expected
2: A little better than expected
3: About the same as expected
4: A little worse than expected
5: A lot worse than expected
6: Don't know

Face enrolment overall experience: Q6 response vs time taken - Disabled only



Face enrolment overall experience: Q6 response vs time taken - Opportunistic only



Of the three Quota participants, ten Disabled participants and six Opportunistic sample participants who failed facial biometric enrolment, only 3 found the experience worse than expected – one in each group.

Enrolment failure does not seem to have been a factor in how the participant found the facial biometric enrolment experience.

Facial biometric enrolment success by response to Q6 (Quota)		
Q6 response	No. of facial biometric enrolment failures	No. of facial biometric enrolment successes
1		514
2	1	467
3	1	918
4	1	23
5		6
6		67

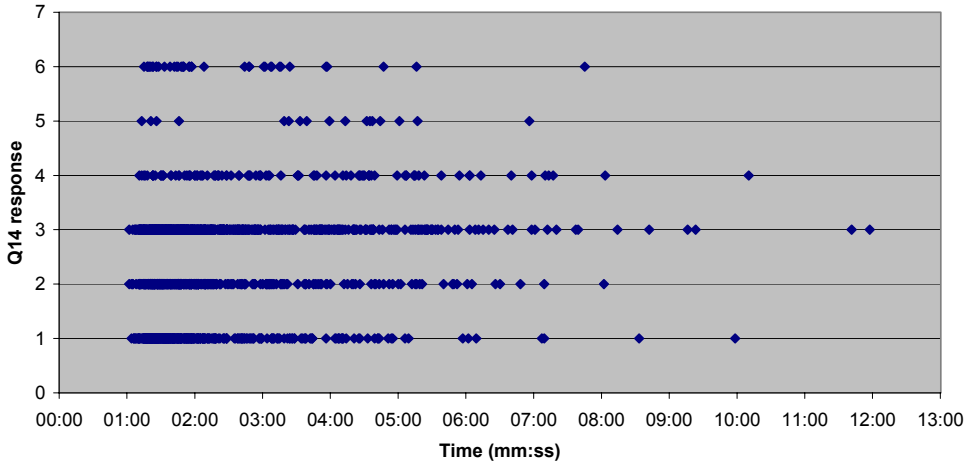
Facial biometric enrolment success by response to Q6 (Disabled)		
Q6 response	No. of facial biometric enrolment failures	No. of facial biometric enrolment successes
1	2	289
2	6	170
3	6	215
4	1	11
5		3
6		28

Facial biometric enrolment success by response to Q6 (Opportunistic)		
Q6 response	No. of facial biometric enrolment failures	No. of facial biometric enrolment successes
1	1	3172
2	1	1031
3	3	2678
4	1	79
5		13
6		236

E2.2 Iris Biometric Enrolment

The length of time taken by iris biometric enrolment does not seem to have been a factor in the participant's response to question 14 (*Overall how did you feel about the experience of giving your biometrics?)*

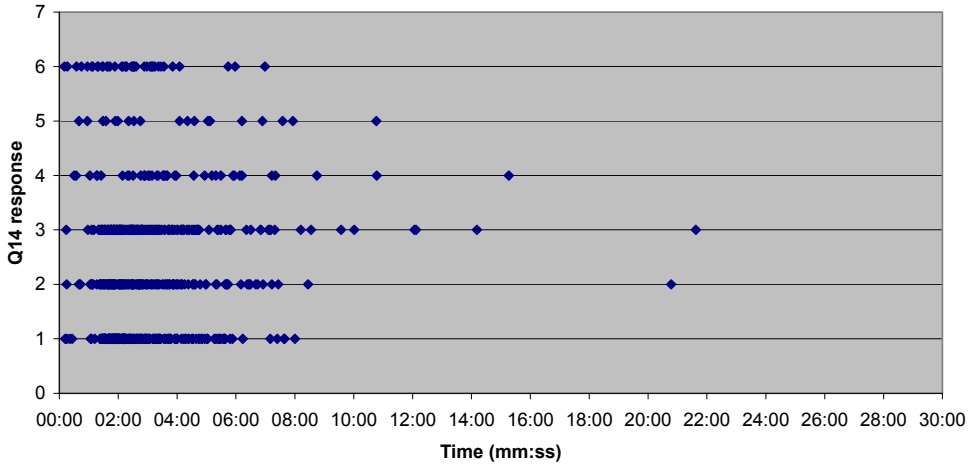
Iris enrolment overall experience:Q14 response vs time taken - Quota only



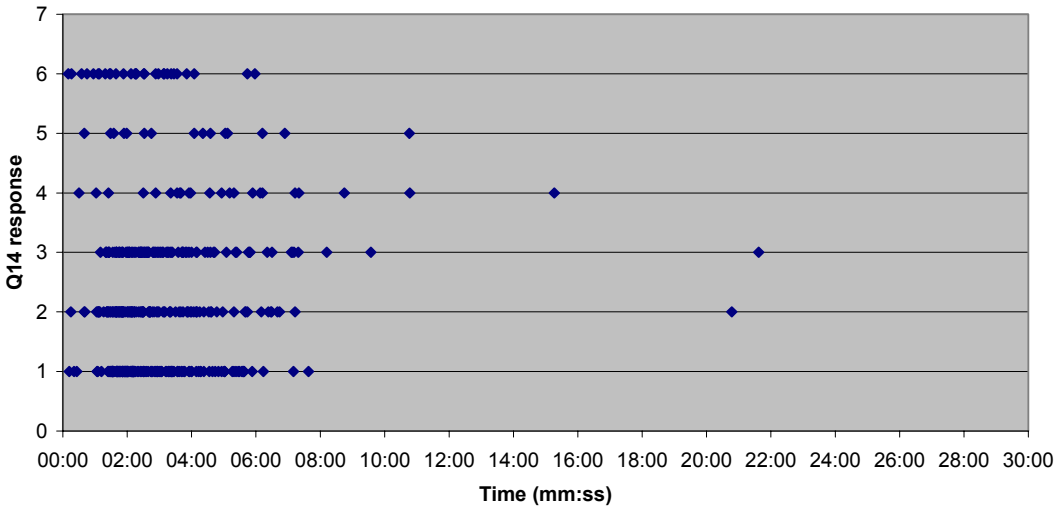
Response values:

1: Much better than expected	4: A little worse than expected
2: A little better than expected	5: A lot worse than expected
3: About the same as expected	6: Don't know

Iris enrolment overall experience:Q14 response vs time taken - Disabled only



Iris enrolment overall experience:Q14 response vs time taken - Disabled only



Of the participants who failed iris biometric enrolment, more people found the experience better than expected than found it worse than expected. Enrolment failure does not seem to have been a factor in how the participant found the iris biometric enrolment experience. However, it cannot be guaranteed that in all cases participants were aware they had failed iris enrolment.

Iris biometric enrolment success by response to Q14 (Quota)		
Q14 response	No. of iris biometric enrolment failures	No. of iris biometric enrolment successes
1	29	355
2	31	289
3	92	526
4	37	64
5	9	8
6	8	33

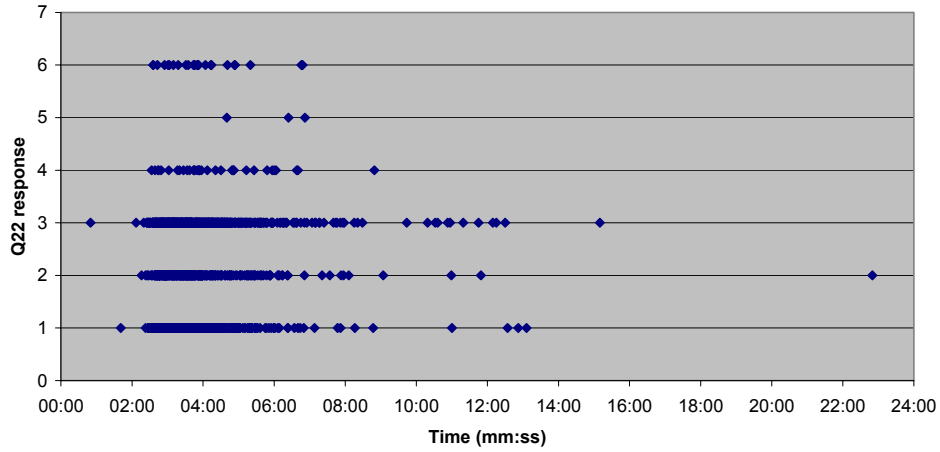
Iris biometric enrolment success by response to Q14 (Disabled)		
Q14 response	No. of iris biometric enrolment failures	No. of iris biometric enrolment successes
1	56	164
2	59	97
3	57	103
4	22	18
5	15	4
6	19	22

Iris biometric enrolment success by response to Q14 (Opportunistic)		
Q14 response	No. of iris biometric enrolment failures	No. of iris biometric enrolment successes
1	197	2740
2	92	921
3	256	2346
4	62	228
5	21	32
6	41	186

E2.3 Fingerprint Biometric Enrolment

The length of time taken by fingerprint biometric enrolment does not seem to have been a factor in the participant's response to question 22 (*Overall how did you feel about the experience of giving your biometrics?)*

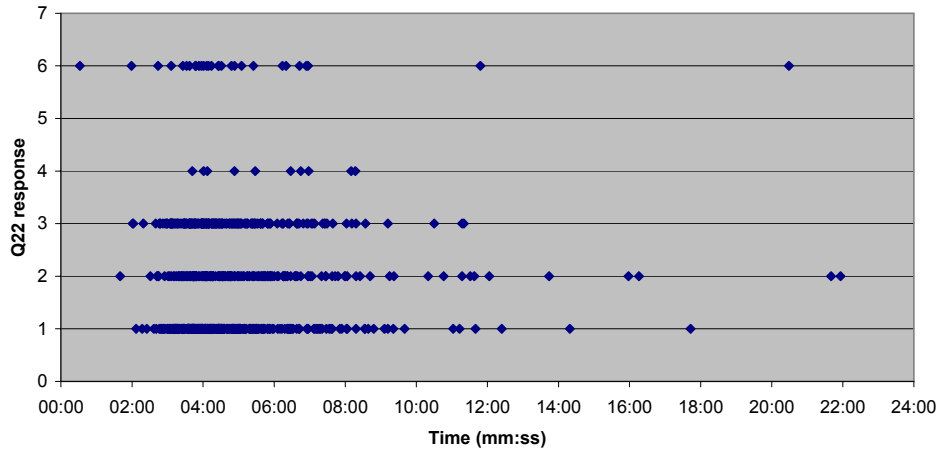
Fingerprint enrolment overall experience:Q22 response vs time taken - Quota only



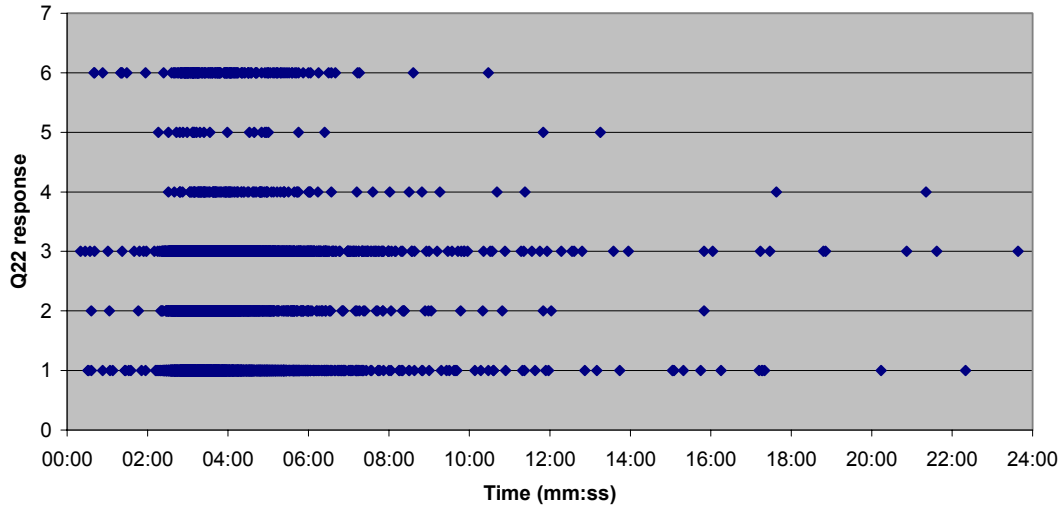
Response values:

1: Much better than expected	4: A little worse than expected
2: A little better than expected	5: A lot worse than expected
3: About the same as expected	6: Don't know

Fingerprint enrolment overall experience:Q22 response vs time taken - Disabled only



Fingerprint enrolment overall experience:Q22 response vs time taken - Opportunistic only



Of the participants who failed fingerprint biometric enrolment, more people found the experience better than expected than found it worse than expected. Enrolment failure does not seem to have been a factor in how the participant found the fingerprint biometric enrolment experience.

Fingerprint biometric enrolment success by response to Q22 (Quota)		
Q22 response	**No. of fingerprint biometric enrolment failures**	**No. of fingerprint biometric enrolment successes**
1	7	438
2	9	326
3	15	596
4	2	34
5	1	3
6	4	23

Fingerprint biometric enrolment success by response to Q22 (Disabled)		
Q22 response	**No. of fingerprint biometric enrolment failures**	**No. of fingerprint biometric enrolment successes**
1	20	299
2	15	160
3	12	178
4		10
6	4	25

Fingerprint biometric enrolment success by response to Q22 (Opportunistic)		
Q22 response	**No. of fingerprint biometric enrolment failures**	**No. of fingerprint biometric enrolment successes**
1	71	3068
2	13	976
3	45	2658
4	4	112
5	3	21
6	11	153

E3 Preferred Biometric

E3.1 Quota Sample

Of the 9 people in the Quota sample who failed [9]iris and fingerprint enrolment and who expressed a biometric preference in response to question 26:

- 2 people chose iris as their preferred biometric;
- 5 people chose face as their preferred biometric;
- 2 people chose fingerprint as their preferred biometric.

Of the 103 people who failed iris enrolment, were successful at fingerprint enrolment and who expressed a biometric preference in response to question 26:

- 24 people chose iris as their preferred biometric;

[9] This and other failed totals in this section include technical failures.

- 32 people chose face as their preferred biometric;
- 47 people chose fingerprint as their preferred biometric.

Of the 13 people who failed fingerprint enrolment, were successful at iris enrolment and who expressed a biometric preference in response to question 26:

- 7 people chose iris as their preferred biometric;
- 3 people chose face as their preferred biometric;
- 3 people chose fingerprint as their preferred biometric.

E3.2 Opportunistic Sample

Of the 16 people in the Quota sample who failed iris and fingerprint enrolment and who expressed a biometric preference in response to question 26:

- 10 people chose iris as their preferred biometric;
- 3 people chose face as their preferred biometric;
- 3 people chose fingerprint as their preferred biometric.

Of the 498 people who failed iris enrolment, were successful at fingerprint enrolment and who expressed a biometric preference in response to question 26:

- 179 people chose iris as their preferred biometric;
- 123 people chose face as their preferred biometric;
- 196 people chose fingerprint as their preferred biometric.

Of the 86 people who failed fingerprint enrolment, were successful at iris enrolment and who expressed a biometric preference in response to question 26:

- 52 people chose iris as their preferred biometric;
- 17 people chose face as their preferred biometric;
- 17 people chose fingerprint as their preferred biometric.

For Quota and Opportunistic participants the participants' preference for a biometric was on the whole iris regardless of whether iris enrolment had been successful or had failed. The exception was when participants failed iris biometric enrolment but fingerprint enrolment was successful, where they tended to choose the fingerprint biometric as their preferred one.

E3.3 Disabled Participants

Of the 18 Disabled participants who failed iris and fingerprint enrolment and who selected a 1st choice biometric:

- 6 people chose iris as their preferred biometric;

- 2 people chose face as their preferred biometric;
- 10 people chose fingerprint as their preferred biometric.

Of the 145 people who failed iris enrolment, were successful at fingerprint enrolment and who selected a 1st choice biometric in response to question 26:

- 34 people chose iris as their preferred biometric;
- 50 people chose face as their preferred biometric;
- 61 people chose fingerprint as their preferred biometric.

Of the 8 people who failed fingerprint enrolment, were successful at iris enrolment and who selected a 1st choice biometric in response to question 26:

- 2 person chose iris as their preferred biometric;
- 3 people chose face as their preferred biometric;
- 2 people chose fingerprint as their preferred biometric.

Although the overall preference of the Disabled participants was for the iris biometric, this preference is not true for participants who failed iris enrolment. For those participants the fingerprint biometric was preferred.

Appendix F – Copy of Opportunistic Questionnaire

❑❑/❑❑/❑❑

DD MM YY

UK Passport Office Biometrics Trial

The trial

Thank you for agreeing to participate in this important trial. The trial will involve you taking part in a dummy enrolment process during which a member of the UK Passport Service Team (or DVLA in Glasgow) will take a photograph of your facial characteristics, take an image recording of your iris and of your fingerprints, using specialist equipment.

The process is completely safe and your assistance will help the UK Passport Service evaluate the practicalities of using biometric identification in the future. You are able to withdraw from the research if you wish to.

We would then like to ask you to complete a questionnaire about your experience so that we can evaluate how people feel about each of these techniques.

All of the information that you provide will be treated in the strictest confidence. The process will not mean that you have enrolled for an identity card, this is just a trial.

The questionnaire:

There are three parts to this questionnaire.

When we report we would like to be able to look at the findings by different groups such as men and women, therefore there are some questions about yourself. All information collected will be anonymised. The first section of the questionnaire covers these questions. Please try to fill it in before you are enrolled.

The other two sections relate to the stages you go through for the trial. The receptionist will tell you which section to fill in and when. Please do not fill in more than you are asked to, as each section asks about your experiences at certain points in the trial.

The UK Passport Service values your opinions and would like to reassure you that the answers you give are entirely confidential. No-one from the UK Passport Service will ever see your results and when the results are reported they will not be linked back to you individually.

How to complete the questionnaire:

There are no right or wrong answers.

Most of the questions have a list of responses with numbers. Please choose the response which is closest to your opinion and put the appropriate number in the box.

For example: [ ]

Other questions have small boxes where you are asked to tick the answer closest to your opinion or where you can tick as many answers as apply.

For example: ☑

In some cases you are asked to write in your answer in your own words.

SECTION 1	Demographic Questions

QA. **Are you?** PLEASE TICK THE BOX THAT APPLIES

Male ❑

Female ❑

QB **How old are you?**

.

PLEASE WRITE YOUR EXACT AGE IN THE BOXES PROVIDED ❑❑

QC. **And are you currently**

PLEASE WRITE THE NUMBER IN THE BOX PROVIDED ❑

1 = Working full-time

2 = Working part-time

3 = Unemployed

4 = Student

5 = Retired

QD. **What is your ethnic origin?**

PLEASE WRITE THE NUMBER IN THE BOX PROVIDED ❑

1 = White

2 = Asian

3 = Black

4 = Chinese / East Asian

5 = Other

QE. **What is your religion?**

PLEASE WRITE THE NUMBER IN THE BOX PROVIDED ❑

1 = None

2 = Christian

3 = Buddhist

4 = Hindu

5 = Jewish

6 = Muslim

7 = Sikh

8 = Other

QF. **Which of the following best describes the area in which you live?** PLEASE TICK THE BOX THAT APPLIES

Urban (city/town) ❑

Rural (village/isolated house) ❑

SECTION 2 | Post Enrolment

Please answer this section when you have been through the process of enrolment.

Firstly, thinking about the booth you sat in for the enrolment process.

Q1. **How concerned were you about privacy in the booth during the enrolment process?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Very concerned
2 = Fairly concerned
3 = Neither concerned nor unconcerned
4 = Fairly unconcerned
5 = Very unconcerned
6 = Don't know

Now thinking abut the facial image recording process

Q2. **Before you took part in the trial how concerned were you about having your facial biometric recorded?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Very concerned
2 = Fairly concerned
3 = Not very concerned
4 = Not at all concerned
5 = Don't know

Q3. **Was the level of intrusion better or worse than you expected?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Much better than expected
2 = A little better than expected
3 = About the same as expected
4 = A little worse than expected
5 = A lot worse than expected
6 = Did not have any expectations
7 = Don't know

Q4. **How did the time it took to take your facial recognition biometric compare with what you expected?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Much quicker than expected
2 = A little quicker than expected
3 = About the same as expected
4 = A little slower than expected
5 = A lot slower than expected
6 = Don't know

Q5. **How easy or difficult did you find it to position yourself in the booth so that your facial recognition biometric could be taken?**

PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Very easy
2 = Fairly easy
3 = Fairly difficult
4 = Very difficult
5 = Don't know

Please answer Q7 if you found the experience worse than you expected

Q7. **What made the experience of having your facial recognition biometric taken worse than you had expected?**
Please write in your answer in the space below

.....
.....
.....
.....

Everyone please answer this question

Q8. **Would you be in favour or opposed to facial recognition being adopted as a means of establishing identity for passport purposes?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Strongly in favour
2 = In favour
3 = Neither in favour nor opposed
4 = Opposed
5 = Strongly opposed

Q6. **And <u>overall</u> how did you feel about the experience of giving your facial biometric?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Much better than expected	(GO TO Q8)
2 = A little better than expected	(GO TO Q8)
3 = About the same as expected	(GO TO Q8)
4 = A little worse than expected	(GO TO Q7)
5 = A lot worse than expected	(GO TO Q7)
6 = Don't know	(GO TO Q7)

Now thinking <u>about the iris image recording</u> process

Q9. **Before you took part in the trial how concerned were you about having your iris biometric recorded?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Very concerned
2 = Fairly concerned
3 = Not very concerned
4 = Not at all concerned
5 = Don't know

Q10. **Was the level of intrusion you experienced during the iris image recording better or worse than you expected?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Much better than expected

2 = A little better than expected

3 = About the same as expected

4 = A little worse than expected

5 = A lot worse than expected

6 = Don't know

Q11. **How did the time it took to have your iris image recorded compare with what you expected?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Much quicker than expected

2 = A little quicker than expected

3 = About the same as expected

4 = A little slower than expected

5 = A lot slower than expected

6 = Don't know

Q12. **How easy or difficult did you find it to position yourself in the booth so that your iris image could be recorded?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Very easy

2 = Fairly easy

3 = Fairly difficult

4 = Very difficult

5 = Don't know

Q13. **And <u>overall</u> how did you feel about the experience of having your Iris image recorded?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Much better than expected (GO TO Q15)

2 = A little better than expected (GO TO Q15)

3 = About the same as expected (GO TO Q15)

4 = A little worse than expected (GO TO Q14)

5 = A lot worse than expected (GO TO Q14)

6 = Don't know (GO TO Q14)

Please answer this question if you found the experience worse that you expected at Q13

Q14. **What was it that made the experience of having your iris image recorded worse than you had expected?**
PLEASE WRITE IN YOUR ANSWER

.....

.....

.....

.....

Q15. **If iris image recording was adopted as a means of establishing identity for passport purposes would you be in favour or opposed to providing an iris image?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

1 = Strongly in favour

2 = In favour

3 = Neither in favour nor opposed

4 = Opposed

5 = Strongly opposed

6 = Don't know

I would now like you to think about the process of recording the image of your **fingerprints**

Q16. **Before you took part in the trial how concerned were you about having your fingerprints recorded?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Very concerned
2 = Fairly concerned
3 = Not very concerned
4 = Not at all concerned
5 = Don't know

Q17. **Was the level of intrusion (i.e. definition) you experienced during the fingerprint image recording better or worse than you expected?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Much better than expected
2 = A little better than expected
3 = About the same as expected
4 = A little worse than expected
5 = A lot worse than expected
6 = Don't know

Q18. **How did the time it took to have your fingerprint image recorded compare with what you expected?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Much quicker than expected
2 = A little quicker than expected
3 = About the same as expected
4 = A little slower than expected
5 = A lot slower than expected
6 = Don't know

Q19. **How easy or difficult did you find it to position yourself in the booth so that your fingerprint image could be recorded?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Very easy
2 = Fairly easy
3 = Fairly difficult
4 = Very difficult
5 = Don't know

Q20. **And overall how did you feel about the experience of having your fingerprints taken?**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Much better than expected	(GO TO Q22)
2 = A little better than expected	(GO TO Q22)
3 = About the same as expected	(GO TO Q22)
4 = A little worse than expected	(GO TO Q21)
5 = A lot worse than expected	(GO TO Q21)
6 = Don't know	(GO TO Q21)

Please answer this question if you found the experience worse than you expected at Q20

Q21. **What was it that made the experience of having your fingerprint image recorded worse than you had expected?**

.....
.....
.....
.....

Q22. **If fingerprint images were adopted as a means of establishing identity for passport purposes would you be in favour or opposed to providing an image of your fingerprints?** PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = Strongly in favour

2 = In favour

3 = Neither in favour nor opposed

4 = Opposed

5 = Strongly opposed

6 = Don't know

Q23. **In order of preference, please could you rank the methods of identification that you experienced?**

What would be your first choice? Your second choice?

Your third choice?
PLEASE TICK ONE BOX IN THE FIRST COLUMN, ONE BOX IN THE SECOND AND ONE BOX IN THE THIRD COLUMN.

	First choice	Second choice	Third choice
1 = Iris image recording	❑	❑	❑
2 = Facial image recording	❑	❑	❑
3 = Fingerprint image recording	❑	❑	❑
4 = No preference	❑		

End of section one

Please hand this questionnaire back to the receptionist. You will then be taken through a process which verifies the biometrics that you have provided.

Section 3	Post Verification

You have now been through the verification process. Please answer the questions in this section which relate to your experiences of it.

Q24. **Thinking now about the verification process which you have just undertaken, how quick would you say the verification process was?** PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = It was very quick
2 = It was fairly quick
3 = It was fairly slow
4 = It was very slow

Q25. **And how easy or difficult would you say the verification process was?** PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

❑

1 = It was very easy
2 = It was fairly easy
3 = It was fairly difficult
4 = It was very difficult

Q26. **Have you visited this centre, one of the other centres the mobile centre or the portable unit and taken part in this trial enrolment process on a previous occasion?** PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.

Yes ❑

No ❑

Don't know ❑

Q27. **Which of these types of locations if any do you feel would be suitable for biometric passport enrolment in the way that you have just done?** PLEASE TICK ALL THAT YOU FEEL ARE SUITABLE

Passport offices ❑

Post offices ❑

Town Halls ❑

Police stations ❑

Community centres ❑

Bank / building society ❑

Supermarket ❑

Travel agents ❑

Other – Please write in ❑

.....

None of these ❑

Q28. **Please read the statements listed below. For each statement please write in the number according to the extend you agree or disagree with it.**
PLEASE WRITE ONE SCORE IN THE BOX PROVIDED.
1 = Agree strongly
2 = Tend to agree
3 = Neither agree nor disagree
4 = Tend to disagree
5 = Disagree strongly
6 = Don't know

Biometrics will strengthen the security of my passport	❑
Biometrics will help prevent identity fraud	❑
Biometrics will help prevent illegal immigration/working	❑
Biometrics are an infringement of my civil liberties	❑
The costs of introducing biometrics will outweigh the benefits	❑
I am concerned my biometrics may not be stored securely	❑

Thank you for completing this questionnaire, please hand it back to the receptionist. Please be reassured that the information you've given us will remain completely confidential and that the biometric data gathered will be destroyed after these trials have been completed. If you have any questions about the trials please contact XXXXX on XXXXX. Thank you again for participating in this important trial.

About Atos Origin

Atos Origin is an international information technology services company. Its business is turning client vision into results through the application of consulting, systems integration and managed operations. The company's annual revenues are more than EUR 5 billion and it employs over 46,000 people in 40 countries. Atos Origin is the Worldwide Information Technology Partner for the Olympic Games and has a client base of international blue-chip companies across all sectors. Atos Origin is quoted on the Paris Eurolist Market and trades as Atos Origin, AtosEuronext, Atos Worldline and Atos Consulting. For more information, please visit the company's web site at www.atosorigin.com