
Assisted Human Reproduction National Data Registries - Do they accomplish a balance between the monitoring and publishing of performance and quality?

Proposals for an Irish registry.

Philip Milne

A dissertation submitted to the University of Dublin, in partial fulfilment of the requirements of Master of Science in Health Informatics, 2006.

Declaration

I declare the work described in this dissertation is, except where otherwise stated, my own work, and has not been submitted as an exercise for a degree at this or any other university.

Signed:

Date:

Copyright Permission

I agree that Trinity College Library may lend or copy this dissertation on request.

The copyright however will remain with the author, Philip Milne.

Signed:

Date:

Acknowledgments

I would like to thank my supervisor, Lucy Hederman who continually pulled me back on track when I kept getting diverted and sidetracked.

Merrion Fertility Clinic who agreed to pay for the course and allow time off in a busy time in our unit's development. Dr Mary Wingfield, Dr Evelyn Cottell, and Dr Ciara O'Meara for their constructive criticism.

To my parents, Alastair and Moraig for the continual encouragement and support.

and

To all the countless couples who are battling against infertility, whose only wish is to have a child. I hope this document may be of some use.

Summary

This dissertation considers if assisted human reproduction national data registries accomplish a balance between the monitoring and reporting of performance and quality. Proposals for an Irish registry are then suggested.

Background for the dissertation is presented which covers infertility and treatments, assisted reproduction regulation and the monitoring, funding and provision of assisted reproduction registries.

This dissertation suggests that assisted reproduction registries, specifically if presented in a league table format, are focused towards monitoring and reporting performance and do not reflect the quality of the process. Data published by the registries can often influence clinical, economic and regulatory practice's. Patients undergoing assisted reproduction ultimately wish to know their chance of conceiving and may select a clinic based upon a units performance. However, patients may not fully understand the potentially serious risks of undergoing treatment and the registries need to better reflect this.

Methodology included a comprehensive review of clinical performance league tables and assisted reproduction national registries as well as corresponding with representatives of the various European, US and Australian registries.

To be able to answer the dissertation question, we must present a review of clinical performance indicators and their publication in a format which allows comparison. The advantages and disadvantages of such a system are looked at. Performance indicators in assisted reproduction registries and the registries themselves are summarised. The possibility of developing a single parameter of quality is argued and possible quality indicators in assisted reproduction registries that could better reflect quality are suggested.

We find that performance based comparative league tables of assisted reproduction indicators do not provide this balance. Where data is presented on a prospective, national and non-unit specific basis, the registries provide a better balance between performance and quality but possible improvement is required.

Drawing from the first objective of the dissertation, a series of interim and long-term proposals for an Irish registry are suggested. There is currently no registry monitoring assisted reproduction in Ireland and its development is critically required. An interim registry would allow the retrospective annual review of treatments and to give a more accurate reflection of assisted conception in Ireland at the present time. Long term proposals suggest a prospective system, managed by an independent authority, driven by an electronic data interchange registration system that can monitor and publish data that gives a balanced approach to quality and performance of assisted human reproduction.

Contents

1. Chapter 1 - Introduction.....	6
2. Chapter 2 – Objectives, Outline & Contributions	7
2.1. Objectives.....	8
2.2. Literature and Research Methodology	12
2.3. Dissertation Outline	13
2.3.1. Background to the Dissertation (Chapter 3)	13
2.3.2. Monitoring and Publishing Clinical Performance Data (Chapter 4).....	13
2.3.3. Performance in AHR (Chapter 5)	14
2.3.4. Quality in AHR (Chapter 6).....	14
2.3.5. Proposals for an Irish Registry (Chapter 7)	14
2.3.6. Conclusion (Chapter 8)	14
2.4. Contributions of this Research	15
3. Chapter 3 – Background to the Dissertation.....	16
3.1. Infertility.....	17
3.2. AHR Treatments	18
3.2.1. Intrauterine Insemination (IUI)	18
3.2.2. In-vitro Fertilisation (IVF) & Intra-cytoplasmic Sperm Injection (ICSI).....	18
3.3. AHR Regulation	21
3.3.1. United Kingdom.....	22
3.3.2. Australia	22
3.3.3. United States	22
3.3.4. Ireland	23
3.4. AHR Monitoring.....	25
3.5. AHR Funding and Provision	26
3.6. Summary of Chapter 3.....	29
4. Chapter 4 – Monitoring and Publishing Clinical Performance Data	30
4.1. How do we define Performance?.....	31
4.2. Performance Indicators & League Tables.....	32
4.3. Public Release of Performance Data	35
4.4. Key Questions in Relation to Public Release of Performance Data	36
4.5. Key Problems in Relation to Public Release of Performance Data	37
4.6. Potential Advantages & Disadvantages of Publishing Performance Data	38
4.7. Avoiding the Harmful Effects of Publishing Performance Data	40
4.8. What are the effects of releasing the information to the user groups?	42
4.8.1. Use of Performance Data by Patients	42
4.8.2. Use of Clinical Performance Data by Providers.....	43
4.8.3. Use of Clinical Performance Data by Regulators.....	45
4.9. The School League Table Analogy	46

4.10.	Summary of Chapter 4.....	47
5.	Chapter 5 – Performance in AHR	48
5.1.	Definitions of Performance In Assisted Reproduction	49
5.1.1.	Live birth rate per cycle started.....	50
5.1.2.	Live birth rate per oocyte collection.....	50
5.1.3.	Live birth rate per embryo transfer.....	51
5.2.	Assisted Reproduction Data Registries	52
5.2.1.	What are the goals of an AHR registry?	52
5.2.2.	AHR Registry Methodology	53
5.2.3.	AHR Registry Funding	54
5.2.4.	AHR Registries – USA (SART)	55
5.2.5.	AHR Registries – UK (HFEA)	57
5.2.6.	AHR Registries – Australia (ANZARD)	59
5.2.7.	AHR Registries – Nordic Countries	60
5.2.8.	AHR Registries – Belgium (BELRAP).....	61
5.2.9.	AHR Registries – Germany (DIR)	61
5.2.10.	AHR Registries – France (FIVNAT) & Switzerland (CH-FIVNAT)	62
5.3.	What is being monitored by the registries?	64
5.3.1.	Demographic information	65
5.3.2.	Treatment details including outcome	65
5.3.3.	Side-effects for the women.....	66
5.3.4.	Child malformations and developmental problems.....	67
5.4.	Issues in AHR Performance League Tables	68
5.5.	Summary of Chapter 5.....	71
6.	Chapter 6 - Quality in AHR.....	72
6.1.	How do we define ‘Quality’	73
6.2.	Is there a single parameter of quality in AHR?	74
6.2.1.	Stimulation (pre in-vitro).....	75
6.2.2.	Laboratory (in-vitro).....	76
6.2.3.	Embryo Transfer and Outcome (post in-vitro).....	76
6.3.	What Could be Monitored by the Registries to Better Reflect Quality?.....	77
6.3.1.	Patient selection criteria	78
6.3.2.	Cycle Cancellation	79
6.3.3.	Incidence of Complications.....	79
6.3.4.	Multiple Birth Rate	80
6.3.5.	Adverse Incidents & Reporting	81
6.3.6.	Laboratory aspects	82
6.3.7.	Staff to Cycle Ratio.....	82
6.3.8.	Miscellaneous & Ancillary Services	83
6.4.	Summary of Chapter 6.....	84

7. Chapter 7 - Proposals for an Irish AHR Data Registry	85
7.1. AHR Databases In Ireland	86
7.2. Proposals for an Irish AHR Registry	88
7.3. Interim Proposals	89
7.4. Long-term Proposals	94
7.4.1. Proposal 1 – Regulation.	94
7.4.2. Proposal 2 – Standardisation.....	94
7.4.3. Proposal 3 – Funding.....	95
7.4.4. Proposal 4 – Monitoring & Reporting.....	96
7.5. Summary of Chapter 7.....	98
8. Chapter 8- Conclusion	99
9. Appendix 1 EIM Data Sheets.....	102
10. Appendix 2 ANZARD (Australia) Data Collection Examples	106
11. Appendix 3 SART (US) Data Collection Details.....	107
12. Appendix 4 HFEA (UK) Data Forms	111
13. Appendix 5 Examples of AHR Unit Reports	114
14. References	116

Tables & Figures

Table 3-1. IVF Centres and Cycles in Europe.	26
Table 3-2. Number of fresh cycles per million inhabitants.	27
Table 5-1. Activities and time line in the SART reporting process ¹⁶⁰ .	57
Table 5-2. National registries in selected countries.	65
Table 5-3. Examples of data stored by AHR registries.	66
Table 6-1. Recommendations for standard monitoring parameters ¹⁴⁴ .	75
Table 6-2. Embryologists workload in comparison with actual and required ²⁴⁶ .	82
Table 7-1. Irish fertility units and type of database.	86
Table 7-2. Irish fertility units and success rates.	87
Table 7-3. Recommended Dataset for an Interim National Irish AHR Registry, adapted from Australia's ANZARD ²⁴⁷ .	93
Figure 3.1 IVF Units by European country (modified from EHSRE data ⁷⁷).	28
Figure 5-1. HFEA registry database structure	58
Figure 9.1. Number and size of units.	102
Figure 9.2. Country Details.	102
Figure 9.3. Number of treatments and pregnancies 1.	103
Figure 9.4. Number of treatments and pregnancies 2.	103
Figure 9.5. Female Age.	104
Figure 9.6. Preimplantation genetic diagnosis.	104
Figure 9.7. AHR deliveries resulting from treatment.	105
Figure 9.8. Complications & foetal reductions.	105
Figure 10.1. ANZARD data collection example.	106
Figure 10.2. ANZARD data collection example.	106
Figure 11.1. Patient information.	107
Figure 11.2. Patient history.	107
Figure 11.3. Patient diagnosis.	108
Figure 11.4. AHR treatment.	108
Figure 11.5. Donor and retrieval data.	109
Figure 11.6. Transfer and outcome data.	109
Figure 11.7. Delivery information.	110
Figure 12.1. Female Patient Registration.	111
Figure 12.2. Partner Registration.	111
Figure 12.3. IVF Treatment & Embryo Creation/Use (page 1) .	112
Figure 12.4. IVF Treatment & Embryo Creation/Use (page 2) .	112
Figure 12.5. IVF Treatment & Embryo Creation/Use (page 3) .	113
Figure 12.6. Pregnancy Outcome.	113
Figure 13.1. Example of unit information from the UK registry.	114
Figure 13.2. Examples of unit information from the US registry.	115

Abbreviations

AHR	assisted human reproduction
ART	assisted reproduction (ive) technology (ies)/ technique (s)
ASRM	American Society for Reproductive Medicine
CARTR	Canadian Assisted Reproduction Technologies Registry
CDC	Centre for Disease Control
DIR	Deutsches IVF Register
EIM	European IVF Monitoring
ESHRE	European Society for Human Reproduction and Embryology
EU	European Union
FIVNAT	Fécondation In Vitro National
HFEA	Human Fertilisation and Embryology Authority
ICSI	Intra-cytoplasmic injection
IMB	Irish Medicines Board
IUI	Intra-uterine insemination
IVF	In- <i>vitro</i> fertilisation
LBR	Live birth rate
MRC	Medical Research Council
NHS	National Health Service
NICE	National Institute of Clinical Excellence
NPSU	National Perinatal Statistics Unit
OHSS	Ovarian Hyperstimulation Syndrome
RCOG	Royal College of Obstetricians and Gynaecologists
SART	Society for Assisted Reproductive Technologies
UK	United Kingdom
VLA	Voluntary Licensing Authority

Assisted reproduction units are referred by many different terms such as assisted conception units or clinics. These terms shall be referred to by 'assisted human reproduction' and 'units' in this document as this was the phraseology used in the Commission on Assisted Human Reproduction in Ireland, 2005 ¹.

1. Chapter 1 - Introduction

Assisted human reproduction (AHR) in Ireland is a rapidly expanding, specialised healthcare service that has ethical, moral, legal, social and economic implications for society. This service is not controlled by any regulatory authority. Although recommendations for controls to govern AHR in Ireland are well beyond the scope of this document, regulatory authorities in other countries routinely use data registries to monitor and publish data on AHR. Public and professionals use the data to 'rank' the unit's 'quality' in the form of league tables. Data published by the registries can often influence clinical, economic and regulatory practice.

The lack of even a voluntary data registry in Ireland leads to significant variation in practices and the possibility of manipulating published success rates, for example live birth rate. Such variations in practice hamper AHR surveillance which is necessary to build and preserve confidence in AHR among patients, professionals and the society at large.

The routine monitor of quality for both patients and professionals is to report success rates – “the take home baby rate”. However, publishing league tables in other countries has come under fire as perpetuating a more commercially driven system – where higher success rates equate to higher financial returns. To secure these high success rates, units may be manipulating clients, techniques and statistics ²⁻⁷. In the US, the AHR industry is worth over \$3 billion ⁸, in the UK, £500 million ⁷. Some prospective patients drive the market, wanting the product by any means and any cost possible. However having a high success rate (performance) does not always equate to a higher standard of quality. To the prospective AHR patient, obtaining the product at any cost is more important than providing a high-quality, balanced healthcare service. The ‘need-demand’ situation of AHR is pushing up costs and lowering quality⁸.

Does this mean the more you pay , the better the treatment ?

The goal of an AHR registry should be to publish data that can improve quality of service rather than concentrating solely on success rates. With only seven units in Ireland, most of which are geographically distinct from one another, a commercial industry is unlikely to develop here. It would be feasible to introduce a national registry in Ireland that would allow the benchmarking of units through monitoring of quality, efficacy and safety rather than focusing on performance league tables. The introduction and development of such a registry could be facilitated by reference to and incorporation of existing unit databases via electronic data interchange. Making full use of the internet is also recommended to better inform the public.

2. Chapter 2 – Objectives, Outline & Contributions

2.1. Objectives

The incentives for considering this subject were based upon two main issues: (1) there is a worldwide need for effective data collection and standardisation and (2) Ireland is lagging behind many similar sized countries in Europe for the provision, regulation, monitoring and reporting of assisted human reproduction (AHR).

From my observations in my role as an embryologist within units in the UK and in Ireland, I have seen that there is often a bias towards obtaining good success rates. This may seem an obvious statement. Surely the role of any unit is to enable the couple who are having difficulties, to conceive. However, nearly 50% of couples attending a unit will never conceive. These couples may then decide on a different path, such as more treatment elsewhere, counselling, adoption, surrogacy, gamete donation or accepting their childlessness. The role of an AHR unit is to manage the couple's infertility by performing the correct investigations and directing them towards the most suitable treatment⁹. Having a good success rate is important, but patients are not aware that, although this is an indicator of a unit's performance, it is not an indicator of quality. *The two must go hand-in-hand.* Effective management and a respectable success rate are critical if a unit is to provide a first-class service and survive in a commercial industry. This commercial industry exists in Ireland because of a lack of provision of state funding.

A national data registry for AHR in Ireland does not currently exist. The treatments and services associated with AHR are unregulated and their quality and performance unmonitored. Other countries have developed regulatory authorities one of whose roles is to monitor, collate, interpret and publish data on these services for the public and the professionals. The publication in a form that provides individual unit's data so comparison's can be drawn, has been controversial in other areas of public services such as education and healthcare. The public, professionals and regulators will utilise the data for different tasks such as selecting a unit to attend for treatment, improving clinical practice and to improve accountability. Several countries allow for the provision of AHR within their national health system but in others where this provision does not exist, private units fill the void and charge for services. Due to the commercial nature of the provision of these services, do the registries monitor, collate and publish the appropriate data?

This dissertation will consider two aspects of what AHR registries are monitoring and publishing, i.e. quality and performance, and will endeavour to establish if they are accomplishing a balance between the two. I shall give a brief explanation of what quality and performance are:

(1) Quality.

Quality in healthcare is a phrase that is widely used but is difficult to define. The Institute of Medicine attempted to describe it as being “*The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.*”¹⁰. To improve quality in healthcare they suggested six key components that would need to be involved: (1) *safety*, avoid injury to patients from the care that is intended to help them, (2) *timeliness*, reduce waits and harmful delays, (3) *effectiveness*, provide services based on scientific knowledge to all who could benefit and refrain from providing services to those not likely to benefit, (4) *efficiency*, avoid waste, (5) *equitability*, provide care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographical location, and socioeconomic status and (6) *patient centeredness*, provide care that is respectful of, and responsive to, individual patient preferences, needs, and values. Quality in AHR shall be reviewed in Chapter 6.

(2) Performance.

In monitoring quality in healthcare, we need to be able to measure attributes that are consistently (but not invariably) associated with its quality. In doing so, the ‘measured quality’ becomes a quantity and no longer a quality¹¹. Monitoring outcomes of treatment would be considered an approach to defining quality in health care. In AHR, the outcome of treatment is the key indicator that is used by many to define intended quality. But, outcome measurement assumes that consistently good outcomes can only come from quality health care. Therefore, good outcomes are insufficient to define quality health care. So in AHR, outcome can be termed as a performance indicator rather than a quality indicator as the efficiency of the unit in obtaining a successful outcome is what is actually being monitored. Performance in AHR shall be reviewed in Chapter 4

On contemplating a national registry for Ireland, several questions came to mind:

- (1) Is performance data the only information that registries should request from the units?
- (2) Are national data registries unintentionally promoting a commercial market place environment by predominantly monitoring performance indicators such as success rates?
- (3) Is concentrating on units’ performance by the registries diverting the focus from the main purpose of the unit – managing the subfertile patient, irrespective of a successful outcome or not?
- (4) Does publishing performance data in the league tables have an impact on clinical practice of the AHR units (whether positive or negative)?
- (5) Should there be some balance in reporting between performance and quality? If this is the case, what would the indicators be and how could the balance be achieved?

-
- (6) What should Ireland do (if anything) about developing a national monitoring and reporting system. Should this registry balance reporting performance (what the couples are interested in) and quality (what the regulators are interested in)?

The question of whether AHR registries are accomplishing the balance between monitoring and reporting of performance and quality will need to be addressed by considering the fundamentals of the dissertation question:

- (1) *How do we define quality and performance?*

Quality and its importance is mentioned throughout the dissertation. I shall define what quality is in its truest sense. I shall also look at the definition of healthcare performance.

- (2) *Definitions of performance in assisted reproduction?*

Performance and quality are frequently thought to be interchangeable terms and an original proposed role of clinical indicator performance tables was to improve 'quality' and effectiveness of treatment ¹². What are the definitions used in AHR registries to indicate quality.

- (3) *What are the goals of an AHR registry?*

AHR registries have developed radically since they were initially setup in most circumstances by national fertility societies. AHR has developed from a specialised healthcare service treating a select group of patients to an industry with billions of dollars. Have the goals of the registries kept pace? I shall look at what the goals are of a modern AHR registry.

- (4) *What is being monitored by the AHR registries?*

If we can understand the objectives of monitoring, we can then begin to assess what the registries monitor or could be monitoring to be able to satisfy the discussed objectives. To be able to successfully appraise the registries *output* we must first understand the *input*. This section shall look at what the registries request from the units, what they record and what information they publish.

- (5) *Is there a single parameter of excellence?*

Many of the national data registries only monitor and report the *performance* of AHR and very few actually monitor and report *quality*. Of the many indicators that can be monitored, is there a single parameter of 'excellence' that can be used to evaluate and grade a unit?

(6) *What could be monitored by the registries to reflect quality?*

I will have considered how AHR registries focus on an outcome centred approach to monitoring and publishing data. Registries are now needing to develop a more process orientated approach to this task due to a requirement by the public, professionals and regulators to standardise and attempt to improve quality within AHR. The introduction of the European Tissue Directive is aiming to enforce this by requiring that quality management systems are in place in AHR units. Should AHR registries be shifting their emphasis of what they monitor to match this and if so what indicators could they possibly monitor?

By reviewing the relevant literature and several national data registers, the dissertation hopes to be able to answer the question “*Do assisted reproduction national data registries accomplish a balance between the monitoring and reporting of performance and quality?*”. Proposals to develop a national registry for AHR in Ireland will then be suggested. It is hoped that such a registry will provide an even, balanced approach to both monitoring and reporting of performance *and* quality. It should be able to satisfy the intentions of monitoring the indicators of performance (how efficient a unit is in achieving an good outcome) and quality (quality improvement, accountability and patient choice).

2.2. Literature and Research Methodology

To attempt to answer the question of “*Do assisted reproduction national data registries accomplish a balance between the monitoring and reporting of performance and quality?*”, it will be necessary to complete an extensive literature review of AHR registries, performance and quality aspects of monitoring, collating and publishing AHR data. It will also be necessary to provide the reader with a background to the topic by covering aspects of infertility, AHR treatments and regulations that are imposed on AHR. Europe provides the key information due to the varied practices that occur in the large number of countries contained within the European Union. The US and Australasia will also be considered as, along with the UK, these countries have practiced AHR and have had registries in place for the longest period of time.

As part of the research process, I corresponded with representatives of these countries in order to ascertain the precise situation which exists in regards to these registries. Information on what data these registries collate and publish will be looked at.

I also able to attend a conference in December 2005 in Athens on “*International variation in Assisted Reproduction Technology practice and data collection*”¹³. This conference was attended by a large number of delegates, some renowned in the field, to discuss current issues in the variation of AHR practice and data collection. I would like to thank Merrion Fertility Clinic, Irish Clinical Embryologist Association and Serono Ireland (particular Richard Lennon) for providing the funding to attend this conference. I would also like to thank the delegates for providing much of the foundation work for this dissertation.

2.3. Dissertation Outline

The dissertation will be set out as follows:

2.3.1. Background to the Dissertation (Chapter 3)

Chapter three will provide the necessary background material so the reader can familiarise with the setting of the dissertation. Before the objectives can be answered, it will be necessary to understand the scale of infertility and the affect it has on many couples. Treatment can be an emotive, ethical and financially difficult which impacts heavily on couples who deal with it. Infertility has great and long term implications for all levels of society, such as falling population numbers. Although a discussion of infertility is outside the scope of this dissertation, an extended background section will be provided so the reader can identify with the setting, procedures and regulations associated with infertility.

It will be necessary to discuss how regulation (where it exists) has been developed. Regulation can impact significantly on the funding and uptake of infertility services, on how (whether voluntary or mandatory) and what information is recorded as well as its influence on how quality and performance in AHR is portrayed.

2.3.2. Monitoring and Publishing Clinical Performance Data (Chapter 4)

Chapter four will review clinical performance indicators, healthcare performance league tables and the public release of performance data. The impact they have on users of the data will be presented to provide the reader with a balanced foundation to show that the release of performance data, by itself, is self-defeating. There is a volume of research on the public release and use of performance league tables in other healthcare areas (such as surgical mortality rates) and in education. There exists a dichotomy between performance league table use within the different services for which they are published (*for example* education, police and healthcare); specifically, which user group (patients, providers or regulators) uses the information and to what purpose (choice, funding and legal). This may seem obvious to the casual observer. However, healthcare tables are rarely used by the people for whom they are intended, the public. They are routinely used by managers and directors. When it comes to AHR, performance league tables are widely used by the public ^{14;15}.

There are many issues to be dealt with about these aspects: how this information is gathered and studied and for what end it is eventually used. These issues are at the core of the dissertation. An extensive review is needed to consider the compounding issues that arise out of the publication of performance data.

2.3.3. Performance in AHR (Chapter 5)

Chapter five will deal with how performance in AHR is defined. A review of AHR registries will be covered. This dissertation is not meant to be a review on the various AHR data registries that are in existence or how they are managed. However the method, data and reporting methods they employ can be used to show how they impact on that country's position, provisions and use of AHR. It therefore plays an important role in laying the foundations of answering the dissertation question. A brief history and development of registries will be considered with examples of registries that exist in various countries and the what databases are used in Irish units due to a lack of a registry.

The information being monitored and published by registries will be summarised followed by a discussion of how these indicators are used to generate AHR performance data.

2.3.4. Quality in AHR (Chapter 6)

To provide the balance to performance, we shall need to consider quality in AHR. How do we define quality and can it be monitored in AHR. Can quality be defined by a single parameter and if not, what would can be monitored by the registries to better reflect quality.

2.3.5. Proposals for an Irish Registry (Chapter 7)

AHR is at a critical point in Ireland at the present moment. There is an urgent requirement for an AHR data registry. Although it is doubtful that more units will come into existence, it is extremely likely that the number of treatments that occur within the existing units will increase dramatically. By developing a data registry that would allow the monitoring and reporting of both quality and performance, it would help to build and preserve confidence in AHR among patients, professionals and society.

Based on the previously reviewed material and on the basis of the end result of the dissertation analysis and conclusion, a series of proposals for an Irish registry of AHR will be presented. These will be broken down into interim recommendations so that reliable figures can be produced in a standardised form for use by the units. Long-term proposals will be presented so that Ireland has the potential to develop a registry which will allow a benchmarking system for quality, clinical practice and developing trust with that service.

2.3.6. Conclusion (Chapter 8)

This chapter will bring together and consider the previously discussed dissertation objectives into a structured conclusion which will be able to resolve the dissertation question, "*Do the registries accomplish a balance between the monitoring and reporting of performance and quality?*".

2.4. Contributions of this Research

A large amount of research has been published on healthcare performance indicators, specifically American studies on report cards and mortality rates for cardiac surgical units ¹⁶⁻²⁵. There are also many studies on the publication of education league tables ²⁶⁻³⁰. But to date, little has been published on the actual monitoring of AHR or the potential positive and negative aspects of releasing this information. Several European publications on the epidemiological aspects of the outcomes of AHR have utilised cross-linked national data registries ³¹⁻³⁸. However, these publications have not looked at the data registries themselves from a quality or performance view point, but rather an epidemiological one. There have been four publications that have looked at AHR league tables (all UK), with two of these actively criticising performance league tables ^{2;3;6;39}.

After an exhaustive literature search, with the exception of those previously mentioned publications, no publications were found that considered the direct effects of national data registries on performance *and* quality aspects of AHR.

The contributions of this dissertation can be considered as follows:

- 1) The dissertation will provide a snapshot of the current worldwide practices of AHR national data registries.
- 2) This dissertation will provide evidence that data registries focus predominantly on performance and I believe that this may be at the expense of quality within AHR.
- 3) Based upon the research and review, the dissertation will provide a series of proposals (interim and long-term) for an Irish AHR national data registry. It is hoped that the proposals will be incorporated into a much needed registry, providing Ireland with a best of breed registry incorporating quality and performance.

3. Chapter 3 – Background to the Dissertation

3.1. Infertility

Infertility, whether male or female, can be defined as “*the inability to conceive after a year or more of regular, unprotected sexual intercourse*” ⁴⁰. Infertility affects men and women equally without discrimination. An estimated forty percent of infertility cases may be attributed to women, forty percent to the man and in twenty percent of cases, both partners contribute to the problem ⁴¹. Infertility can be divided into primary infertility, where the couple have never achieved a pregnancy and secondary infertility, where they have achieved a pregnancy in the past, even if there was no live birth.

The scale of infertility in humans is a reflection of our species’ inefficiency to reproduce. The Royal College of Obstetricians and Gynaecologists (RCOG) reported in their document of the management of infertility that 1 in 7 couples have an infertility problem in the UK ⁴². Although the prevalence of being infertile is not increasing, more couples are seeking help. This is possibly due to the stigma of infertility being eroded in today’s modern society. Even the highest rates of natural conception do not exceed thirty percent conceptions per cycle. The chance of conceiving after discontinuing contraception is approximately thirty percent in the first two cycles then quickly tapers over the remainder of a year ⁴³.

However, the majority of couples achieve a pregnancy within a few months of trying. Increasing female age is considered to be the major factor associated with diminishing fertility. Women in their twenties, with all other factors being equal, stand a 5 out of 6 chance of conceiving in their first year ⁴⁴.

Pregnancy and live birth rates decline from the mid-to late thirties ⁴⁵⁻⁴⁸ and delaying pregnancy is a common choice for women today for social and economic reasons. Because of this, age related infertility has increased over the last decade. It is estimated that at least 20% of women will wait until after the age of 35 to have their first child ⁴⁹. The recent explosion of information about fertility treatment in the media and on the Internet may give women a false sense of security in their choice to delay childbirth.

Infertility may also impact on social and economic factors in the future, such as dwindling populations and increasing numbers of older generations as fewer couples have families.

3.2. AHR Treatments

Couples are generally referred to an AHR unit by their general practitioner or clinician. Hormone tests and semen analyses are undergone in conjunction with a medical consultation. Further tests may be required such as genetic analysis and laparoscopic examination. Based on the results, the unit may recommend one of the following procedures (if any), possibly using donor gametes:

3.2.1. Intrauterine Insemination (IUI)

Intrauterine insemination (IUI) involves obtaining a semen sample at the time of ovulation, preparing it in the laboratory and then placing it in the woman's uterus.

IUI must be performed at the time of ovulation and so requires accurate timing. The cycle is monitored via vaginal ultrasound scanning. IUI may be performed during a "natural" cycle or more typically, in combination with fertility drugs.

IUI is recommended for certain problems such as mild sperm abnormalities, cervical problems or psycho-sexual problems. It may also be used for unexplained infertility. It is not suitable if the woman is over forty or the sperm quality is poor. It is recommended by the UK's National Institute of Clinical Excellence (NICE) that couples (were appropriate) should attempt four cycles of IUI before proceeding to IVF if unsuccessful⁹.

3.2.2. In-vitro Fertilisation (IVF) & Intra-cytoplasmic Sperm Injection (ICSI)

In-vitro fertilisation (IVF) literally means, "fertilised in glass". Eggs (oocytes) are removed from the ovary just before ovulation. The oocytes and sperm are then placed together outside the body in a dish. If fertilisation occurs, the embryo is returned to the uterus several days later. The original indication for IVF was damaged fallopian tubes, but it is now also used for a wide range of disorders such as unexplained infertility, endometriosis and male factor infertility.

While the above definition may sound simple, in reality IVF is a difficult, emotionally time-consuming and expensive treatment.

The chances of pregnancy with IVF are increased if more than one oocyte is recovered. To achieve this, we must first temporarily suppress the women's own reproductive hormone system in a process called down-regulation. The ovaries are then stimulated with fertility drugs (super-ovulation) in order to grow at least three mature oocytes.

Ovarian stimulation must be monitored to ensure that an appropriate number of oocytes develop and also to accurately time their retrieval. The oocytes are microscopic but develop in follicles which are

monitored by ultrasound scanning. Blood samples are also taken to measure the levels of estrogen. Estrogen production increases exponentially as the follicles develop. When ready, an oocyte release drug is given and oocyte retrieval is performed 36 hours later via vaginal ultrasound guided collection under sedation. It is a minor and relatively safe surgical procedure.

All women respond differently to fertility drugs. Units can correlate various parameters such as female age, follicle stimulation hormone level, female weight (body mass index) and reproductive pathology in an attempt to determine the appropriate stimulation dose. Ultrasound scans and serum estradiol tests five to seven days after beginning the drug monitor follicular development. It may be necessary to increase or decrease the dose of the drug to control this in conjunction with further scans until the follicular trigger is given and the oocyte collection can take place.

If fewer than three mature follicles develop, the outcome of the treatment is likely to be poor. The dose can be increased to the maximum allowed per day for several more days. If the follicles still do not respond, the patient can be cancelled, converted to IUI if appropriate or proceed to recovery with a chance of low or no oocytes being recovered. The problem of a poor response is common in older women and in women with elevated FSH.

Alternatively, the patient can over respond to the stimulation drugs. The ovaries produce more follicles than is considered safe. The unit can reduce the dose and continue monitoring and if brought under control, the patient can proceed to oocyte recovery. If the number of follicles and estradiol level continues to rise, the patient is at risk of developing OHSS. The unit can: (1) cease treatment, but the patient may still develop OHSS, (2) continue with treatment but fertilise the recovered oocytes and cryopreserve any resultant embryos, the patient is then cancelled and stops all treatment or (3) proceed to recovery and transfer any resultant embryos. The response is often dictated by the severity of the OHSS. If the patient becomes pregnant, this will aggravate OHSS.

For routine IVF, 50,000-100,000 sperm are mixed with each oocyte. Under other circumstances intracytoplasmic sperm injection (ICSI) may be used. This involves injecting a single sperm directly into an oocyte using a fine glass needle (as opposed to IVF where the sperm has to penetrate the oocyte independently). ICSI is recommended when sperm parameters are abnormal, for example, low count, poor motility or poor morphological appearance or where couples have had previously very poor fertilisation or failure to fertilise following standard IVF.

After eighteen hours, the first signs of fertilisation appear. Two pro-nuclei, one from the sperm and one from the oocyte begin to appear. About 60-70% of the oocytes collected will be fertilised. Some five percent of couples may not achieve fertilisation of any oocytes. The following day, the fertilised oocyte starts to divide into two cells and subsequently into four, eight and so on. After about 48-72 hours following oocyte collection, the embryos will usually consist of four to eight cells each and are

ready for transfer. Occasionally, the embryo fails to develop even though it has fertilised normally, in this case, a transfer cannot be made.

Embryos with the best morphological criteria are selected for transfer. The number transferred is dependent upon the regulations within a country. In the US, there are no limits but in the UK it is recommended that two are replaced (with three being allowed in certain cases). In Germany, Italy and Switzerland, only three embryos are cultured beyond the pro-nuclear stage and all three must be transferred.

The patient may be advised against having a fresh embryo transfer and instead be recommended to freeze the embryos for a later transfer. This may occur if there is a high risk of developing ovarian hyperstimulation syndrome or endometrium is not well developed.

In 30-50% of cycles, there may be supernumerary, high-quality embryos that were not transferred. These may be cryopreserved and subsequently used if the fresh cycle is unsuccessful or if the couple wishes to try for another pregnancy.

3.3. AHR Regulation

Where AHR is practiced, there is some degree of regulation imposed on the units by their government or medical council. Units are expected to abide by the regulations and prove they are abiding by the regulations and that they are providing their patients with a minimum standard. By publishing performance indicators, patients may be able to see that units are abiding by these regulations. Often, performance indicator results can be used to alter clinical practice and to possibly improve overall quality, performance, care and standards. Examples include: reducing the number of embryos transferred from three to two in the UK and changing how assisted human reproduction is funded, from private to state funded.

Although the introduction of IVF programs was initially slow, the number of cycles and the units performing them rapidly increased in the early eighties. During that time, there were calls by the public, politicians and the professionals for the processes to be closely regulated.

This regulatory process became highly fragmented and was often dictated by political, ethical and religious factors of the time. Governments of the US, UK and Australia initiated inquiries into the implications of techniques that required the direct manipulation of gametes, such as IVF. These inquiries dragged on for years and became intimately entwined with debates over abortion, foetal research and state funding. The conclusions of the inquiries still impact on the way that IVF is practised, funded and monitored.

In 2002, the European Community announced that a directive would come into place that would allow the standardisation and improvement of the quality of service and care for establishments that process or store human cells and tissue. This directive became European Law in April 2006 and applies to every unit in Europe⁵⁰. A key component is a requirement that each unit must introduce a quality management system. Introduction of the European Tissue Directive has changed the focus of many laboratories from an outcome centred approach to one of process centred. The quality of the process can be monitored and audited allowing the outcome to be improved. This may be a significant turning point where the unit may try to improve the process of AHR rather than focusing on their league position (the outcome). If the units are to change their working practices to reflect a more quality driven environment rather than a performance based one, should the national registries alter what they monitor to reflect the changing environment.

As stated previously, the status of regulation in the UK, Australia, the US will now be considered as these countries have practiced AHR for and have had registries in place for the longest period of time. The Irish situation will also be discussed.

3.3.1. United Kingdom

It took six years following the birth of Louise Brown, the first IVF baby, for the UK to set up the 'Committee of Enquiry into Human Fertilisation and Embryology', headed by Dame Mary Warnock. The report of this committee, released in 1984, concluded that these techniques were to be regarded as an established form of treatment for infertility. It recommended "... new legislation, that would set out legal limits on assisted reproduction, embryo research and the setting up of a licensing authority"⁵¹. In 1985, the Medical Research Council (MRC) and the Royal College of Obstetricians and Gynaecologists (RCOG) founded the Voluntary Licensing Authority (VLA), which would act as a temporary licensing authority until the statutory body came into being. The 'Human Fertilisation and Embryology Act' was passed in 1990, with the Human Fertilisation and Embryology Authority (HFEA) beginning its responsibilities in 1991. One of the HFEA's duties was to issue a Code of Practice and "maintain a register of those receiving treatment and born as a result of treatment, and also its composition"⁵².

3.3.2. Australia

Regulation in Australia followed in a similar vein to the UK with state parliaments deriving their own set of conclusions. IVF was permitted and regulatory agencies were set-up. Australia introduced the Reproductive Technology (Clinical Practices) Act in 1988. National reporting was handled by the National Perinatal Statistics Unit (NPSU), which also dealt with the reporting for New Zealand.

3.3.3. United States

Regulation in the US decided to take a different stance. In 1973, the landmark decision of *Roe v Wade*, established that most laws against abortion violate a constitutional right to privacy, thus overturning all state laws outlawing or restricting abortion⁵³. Subsequent commissions headed by well-known opponents of abortion and foetal research stopped all federal research funding, which effectively stopped funding for IVF research. Whereas the UK and Australia encouraged regulated provision of IVF services and research, the US system did not and IVF in the States went 'commercial'. In 1981, US pioneers such as Dr. Howard Jones and Dr. Joseph Schulman left respected positions and were willing to give up federal funding to set up their own private IVF units. Over the next five years, the number of units offering AHR treatments increased rapidly and a lack of government decision allowed exploitation and unscrupulous practices to develop in the US. One such practice involved a clinician who deceived patients into believing they were pregnant and then informed them that they had miscarried. The same clinician impregnated women with his own sperm⁵⁴. A Virginian AHR unit advertised high pregnancy rates when in fact they had not achieved any pregnancies at all.

In 1986 patient concerns prompted the US Congress, under the auspices of the ‘*Office of Technology Assessment*’, to look into these practices. The recommendations of this committee, the Wyden Report, were published in 1989. It proposed federal regulations so that units would have to provide specific data to a national registry and data would be made publicly available. In 1992, the “*Fertility Clinic Success Rate and Certification Act (FSRCA)*” was signed into US law and implemented in 1997. Its purpose was to “*provide consumers with reliable and useful information about the efficacy of AHR services offered by fertility clinics and to provide states with a model certification process*”⁵⁵. The responsibility of collating and publishing the data fell to the Society for Assisted Reproductive Technology (SART) and the Centres for Disease Control (CDC).

The methodology of monitoring and reporting in the US is still considered by many in Europe and by US patient groups to do little to help stem the commercialism of the US market⁵⁶⁻⁵⁸. Direct federal governmental regulation in the US is limited to the aforementioned “*Fertility Clinic Success Rate and Certification Act of 1992*”. There are many state laws regarding the provision and access to AHR services but individual states have varied regulatory role’s (from the extent to which assisted reproduction services will be covered by health insurance, to regulations dictating parental rights and obligation’s)⁵⁹. There is a distinct perception of an ‘*ad-hoc*’ or ‘*laissez-faire*’ approach to regulation in the US, reinforced by contradictory and often flagrant and unusual conditions⁶⁰. AHR in the US remains for the most part, directly unregulated with no legislation, unlike many of its European counterparts.

3.3.4. Ireland

AHR in Ireland is an rapidly developing specialist medical field but lacks state regulation. It is highly unlikely that a regulatory framework will be introduced in Ireland in the near future. The Irish Medical Council has issued guidelines but this amounts to one paragraph. For something as emotive as this basic human right, surely it is the government’s responsibility to ensure the industry is acting responsibly and to monitor their services. Prospective AHR patients may select units based on their reported success rate^{14;15}. Irish units report their own rates and since there is no standardisation between units, the reported performance results are not comparable and may be open to manipulation.

The following is the content regarding reproductive medicine in the most recent edition of the guidelines (2004)⁶¹:

24.5 In-vitro fertilisation (IVF)

Techniques such as IVF should only be used after thorough investigation has failed to reveal a treatable cause for the infertility. Prior to fertilisation of an ovum, extensive discussion and counselling is essential. Any fertilised ovum must be used for normal implantation and must not

be deliberately destroyed. If couples have validly decided they do not wish to make use of their own fertilised ova, the potential for voluntary donation to other recipients may be considered.

In March 2000 an Irish “Commission on Assisted Human Reproduction” (CAHR) was established by the then Minister for Health and Children to “*prepare a report on the possible approaches to the regulation of all aspects of assisted human reproduction and the social, ethical and legal factors to be taken into account in determining public policy in the area*” ¹. This report was published in 2005 and contains valuable information on the current state of play of assisted reproduction in this country.

The report makes 40 recommendations with regard to the regulation of AHR services in Ireland. These recommendations concern regulation, best practice guidelines for AHR treatment and guidelines on the freezing of embryos, donor programs and surrogacy, research and accessibility. Recommendations 1, 2 and 3 of the report in particular are relevant to this dissertation:

1. *A regulatory body should be established by an Act of the Oireachtas to regulate AHR services in Ireland.*
2. *National statistics on the outcome of AHR techniques in Ireland should be compiled and made available to the public.*
3. *Longitudinal studies of children born as a result of AHR should be established, in accordance with standard ethical/legal requirements and with the consent of families, in order to facilitate long-term monitoring.*

In April 2005 this report was submitted to government. It was referred to the government all party committee on health. This group have failed to make any progress on the implementation of the guidelines and are calling for “further public debate”.

3.4. AHR Monitoring

Throughout the world there are hundreds of assisted human reproduction units, providing hundreds of thousands of couples with millions of cycles. If we focus in on one country and look at one unit, we find that this unit provides similar services to all the other units over the world. The patients are similar, with similar problems and treated with similar procedures. How do potential patients compare units within that country? What do these potential patients compare? How do units in the same country compare themselves to units in other countries?

The main reporting value for each national registry is the success rate: i.e. the chances of the couple conceiving at a particular unit. However it has many guises such as: live birth rate, pregnancy rate, live singleton delivery rate. There is much debate about the various numerators and denominators that make up this calculation ⁶²⁻⁶⁸.

Various organisations attempt to record these rates and report them to the World Health Organisation, who in turn report on the state of global infertility and AHR. In Europe, the European IVF-Monitoring program (EIM), a subcommittee of the European Society for Human Reproduction and Embryology (ESHRE) publish data annually. One of EIM's findings in 2002 was that "*quality of data differs between countries*" ⁶⁹. They commented that there were major differences in data collection systems, coverage, definitions and validation. Of the twenty-five countries reporting for 2002, twelve had data collection systems and could report complete coverage of IVF cycles (Belgium, Croatia, Denmark, Finland, France, Hungary, Iceland, Netherlands, Norway, Slovenia, Sweden, Switzerland and the UK). In total, there were 770 units but only 80% of these reported data to EIM. They warn that "*as the data presented here are incomplete and generated through different methods using different definitions in different countries, interpretation of the data must be done with some caution*" ⁶⁹. If this is the case, can this information actually be used for comparison?

3.5. AHR Funding and Provision

“There is an assumption that a consumerist approach to healthcare will drive quality improvement.”⁷⁰

The arrival of the first IVF baby, Louise Brown, in 1978 heralded a brave new world. The ability to produce an embryo *in-vitro* was the moment that childless couples were waiting for and some governments feared. Two years later came Candice Reed, Australia's first test tube baby. Eighteen months later, Elizabeth Carr came into being in the United States. By 1983, nearly 150 babies had been produced by *in-vitro* techniques. Although the success rates were low and costs were high, clinicians around the world were being inundated by requests from infertile couples for treatment. Units realised that they were in a position to satisfy a deep and latent demand. If units could supply the IVF services, then the infertile couples would utilize those services – regardless of price⁷¹. The desire for a child is simply that strong. A steady stream of pioneering IVF units were set up and the ‘test-tube infant industry’ was born.

Year	Countries	Units	Total AHR Cycles
1997 - ⁷²	18	482	203,893
1998 - ⁷³	18	521	232,443
1999 - ⁷⁴	22	538	258,460
2000 - ⁷⁵	22	569	279,267
2001 - ⁷⁶	23	579	289,690
2002 - ⁷⁷	25	631	324,238

Table 3-1. IVF Centres and Cycles in Europe.

By 2004, more than one million Americans underwent some form of fertility treatment, an industry that is worth over \$3 billion⁷⁸. It is estimated that there have been in excess of three million children born from AHR techniques worldwide⁷⁹. The market of AHR varies from country to country and is a sophisticated but often fragmented, specialised-niche service industry¹⁴. This fertility market place is competitive, dense and expanding. In the UK, over a 4 year period (1996-2000), there was a 50% increase in the number of patients treated with a 33% increase in the number of AHR units⁸⁰. In the US, the number of AHR procedures has increased from 2,389 in 50 units in 1985 to 61,284 in 1998⁸¹ to 122,872 in 400 units in 2003⁸². Europe utilises AHR techniques to a much wider extent than in the US. In 2002, there were nearly 325,000 cycles of AHR (IVF, ICSI, and frozen embryo transfers) performed in 631 units in over 25 countries across Europe⁸³ as illustrated in table 3-2. There were 65,000 children born as a direct result of AHR in Europe alone.

This utilisation of fertility treatment is directly linked to the provision by the state (or insurance) and reflected by the fact that the per-capita use is three times greater in France, Netherlands, Norway and

Sweden and five times greater in Denmark, Finland and Iceland than in the US ⁸⁴. Table 3-1 illustrates where there is national provision of funding for AHR, uptake is considerably higher. It should be noted that Denmark has a similar national population to Ireland. Germany changed their reimbursement procedure in 2004, and now couples must cover 50% of the cost.

Country	Fresh cycles per million	State Funding	Source
Denmark	1,791	Yes (6 cycles)	ESHRE ⁷⁷
Sweden	1,003	Yes (6 cycles)	ESHRE ⁷⁷
Australia	973	Yes (4 cycles)	NPSU ⁸⁵
Netherlands	914	Yes (3 cycles)	ESHRE ⁷⁷
Norway	861	Yes (6 cycles)	ESHRE ⁷⁷
Belgium	860	Yes (6 cycles)	ESHRE ⁷⁷
Finland	840	Yes (6 cycles)	ESHRE ⁷⁷
Germany (2003)	837	Yes (4 cycles)	ESHRE ⁷⁷
France	784	Yes (3 cycles)	ESHRE ⁷⁷
UK	466	Partial	ESHRE ⁷⁷
Germany (2004)	457	No	ESHRE ⁷⁷
Switzerland	440	No	ESHRE ⁷⁷
US	414	No	SART ⁸²
Ireland	303	In-direct	IFS

Table 3-2. Number of fresh cycles per million inhabitants.

Many European countries provided some funding for these services and where there is a large provision of funding, there is a larger uptake of these services by the population (for example Denmark). Equally, as the uptake increases and more units open to provide services, it becomes necessary to introduce regulations and to introduce monitoring and reporting of these services.

Ireland had five centres in 2002 completing 1519 cycles of IVF and an estimated population of 4,062,235. Ireland's population is comparable to the Nordic countries of Norway, Finland and Denmark, yet these countries have three times the volume of cycles per million population than Ireland. Denmark has 1791 cycles per million in comparison to 303 per million in Ireland ⁶⁹. The difference is that these countries have well funded programs which make extensive use of their national data registries. The public attitude to AHR is possibly more forward thinking. An estimate for the number of cycles in Ireland for 2005 was approximately 2500 in seven centres. Figure 3-1 illustrates the distribution of AHR units in each of the twenty-five European countries.

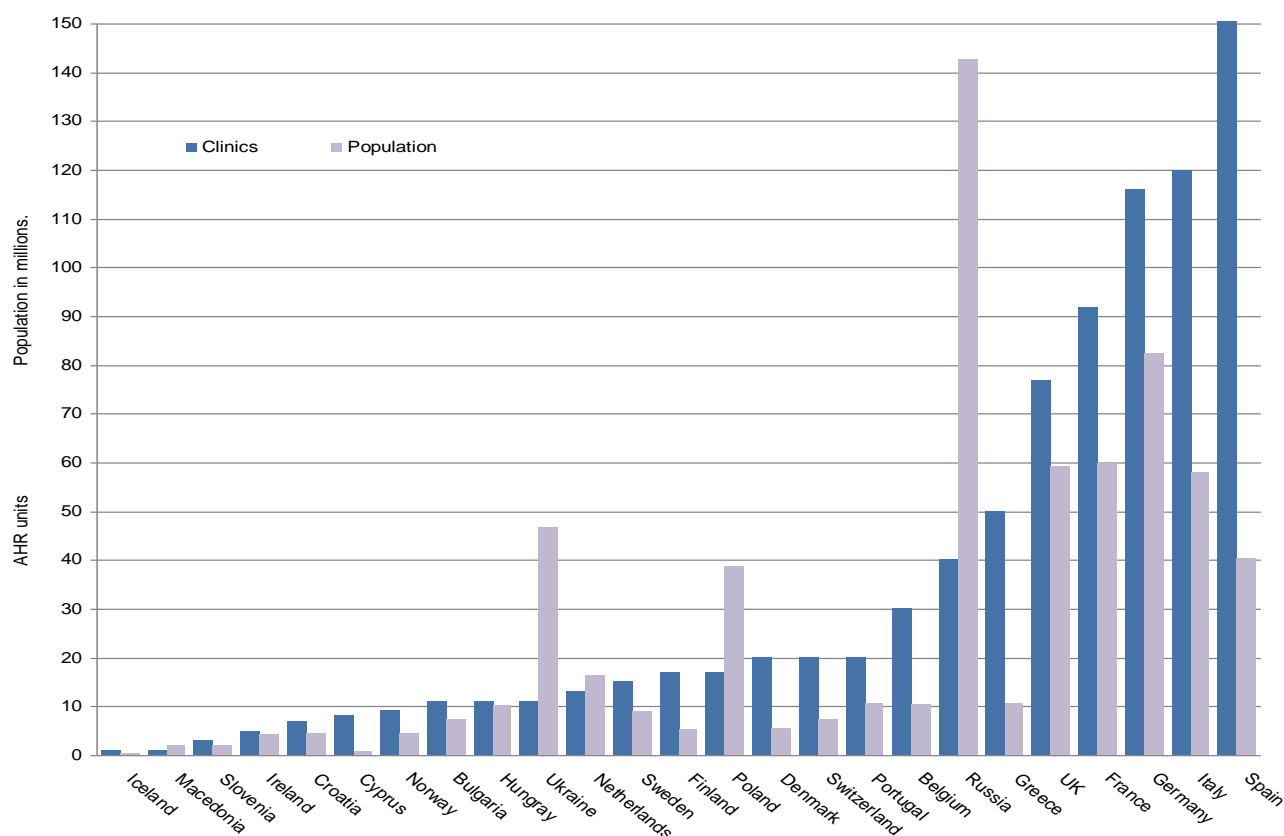


Figure 3.1 IVF Units by European country (modified from EHSRE data ⁷⁷).

Potential patients seeking AHR will refer to national figures if they wish to compare units in their own country. Few patients want to compare intercountry figures but many professionals do. Many countries will publish their figures annually on a per-unit basis, such as the UK or the US, but others, such as Germany or Australia, publish their figures on a national basis. These per-unit reporting systems form the basis of performance league tables.

Ireland, like the UK, provides free healthcare for its citizens. Yet one in six of the adult population have problems in conceiving and require medical intervention ⁸⁶. Similar to the UK and the US, there is an attitude within Ireland that infertility is not a disease or medical problem and therefore it is not provided for by the state. Therefore, all units in Ireland are privately funded. However there is indirect funding of AHR: patients are able to reclaim tax on medical treatments and have their drugs funded through the drugs payment scheme (DPS).

Being able to reproduce and have a family is considered a basic human right, as defined by the European Convention on Human Rights – signed by the Irish Government in 2003 ⁸⁷. Are the countries that provide little or no public funding for AHR treatments denying their citizens their human rights?

3.6. Summary of Chapter 3

Assisted human reproduction widely used to help couples overcome infertility using techniques such as intra-uterine insemination, *in-vitro* fertilisation and intra-cytoplasmic sperm injection. These techniques have significant ethical, moral, legal, social and economic implications for the patients, professionals involved as well as society. With the development of AHR techniques, several countries began to introduce guidelines and directives in an attempt to regulate AHR services. Part of the regulatory process was to develop registries to monitor and report on these services. The three main key countries in the early development of AHR regulatory processes as well as the origins of their registry was illustrated. A brief look at Irelands regulations regarding assisted human reproduction are also covered. Some of the issues surrounding monitoring, funding and the provision of AHR techniques are also discussed.

For the first part of the dissertation, whether AHR national registries accomplish the balance between monitoring performance and quality, we must first look at what performance is and the various issues surrounding performance league tables.

4. Chapter 4 – Monitoring and Publishing Clinical Performance Data

4.1. How do we define Performance?

Healthcare performance indicators can be defined as “*statistics or other units of information which reflect, directly or indirectly, the performance of the healthcare system in maintaining or increasing the well-being of its target population.*”⁸⁸. Performance itself is a measurement of output or the activity of a unit intended to accomplish some desired result⁸⁹. Therefore in AHR, performance is the measurement of the outcome of the treatment.

4.2. Performance Indicators & League Tables

A major concern for providers of health services has been how to measure the quality of healthcare⁹⁰. One of the ways in which quality of care is assessed is taking routinely collected data and analysing it quantitatively. Monitoring key performance clinical indicators such as mortality rates and publishing the data in a league table format to allow for comparison is common in the US and other countries.

Healthcare performance data from providers is routinely published in the form of 'league tables'. League tables can be defined as “a technique for displaying comparative rankings of performance indicator scores of several similar providers”⁹¹. They are principally used by healthcare regulators and providers when no standard against which to judge performance has been set. Their purpose is two-fold (1) identify providers whose performance scores are appreciably greater or lower than expected and (2) show the range in variation between providers⁹². Therefore, the intent to publishing league tables was to ensure “... where there are large and unexplained variations in performance, every effort is made to find out why, and work is put in place to bring about an early improvement”⁹³.

In the UK, performance measures for the NHS were first published in 1983. When clinical governance grew in popularity in the early nineties, several roles were identified for comparative performance data^{12;92}.

As indicators of the performance of health authorities as purchasers

As indicators of the performance of general practitioners (fundholders)

As market information for purchasers

As benchmark data for providers themselves to assess comparative performance.

Even as the UK government announced the details of NHS Performance (League) Tables, flaws were obvious. The Joint Consultants Committee and Central Consultants and Specialists Committee in 2000 were concerned that “...league tables do not provide an accurate measure of the quality of clinical care and could mislead the public”¹². They informed the public little about the quality and effectiveness of treatment and focused on monitoring performance activity and timing instead. Another failing was the quality of the data used. Of the 389 NHS trusts in England, only 70% had indicator values based on “data of adequate quality”. A further 10% had “data of mediocre quality” and 16% of Trusts did not pass the data test (based on completeness)¹². Hospital Episodes System (HES) provided the data for the clinical indicators.

The goals of monitoring healthcare service performance indicators was initially to provide patients with more information¹². Publication of healthcare clinical performance indicators by the NHS in the late nineties was an effort to give patients improved quality of care, choice and provider accountability⁹². Six high performance indicators were published that were intended to improve (1) health, (2) fair access, (3) effective delivery of appropriate healthcare (4) efficiency, (5) patient and carer experience

and (6) health outcomes of NHS care. These indicators were not meant to be direct measures of quality but were to be used to draw attention to issues that may need further investigation or action.

The implication is that publication will enable purchasers of healthcare services to better select providers and encourage these providers to improve quality. Various indicators have been used but emphasis is placed on process variables, for example mortality in surgical procedures, as an indicator of outcome. Collating data allows comparisons to be made on supposedly similar data over time intervals, with benchmarks, or with other healthcare providers. Comparisons reveal variations and variations imply rankings. The assumption is that the indicators reflect quality and these variations in the indicators reflect variations in quality⁹⁴. Several analytical and statistical techniques have been used to help the various users to make sense of league tables but a haphazard approach to using league table data has been suggested with few reports on the impact of publication⁹⁴.

Comparisons of performance are not just about snapshots of clinical practice. They should convey changes in clinical performance over time. Yet a reported problem of performance league tables is one of separating genuine change from statistical artefact. This is clearly demonstrated in a study of UK AHR units and their rankings in published league table's³⁹. It was found that a unit's live birth rates confidence intervals were unusually wide, especially middle-ranked units. There was a high degree of doubt associated with live birth rates rankings. Comparison of rates over a two-year period suggested significant changes in a unit's ranking are not associated with an equally significant positive or negative movement in the live birth rate ranking of that unit.

When performance data reveals variations between different service providers in published performance data, this may be because of *real* differences in quality. But, as the AHR league table example illustrates, one must consider other causes of variation including:

- (1) Problems with measurement such as inappropriate or insensitive data sources and definitions of processes or outcomes, indicators that are too narrow to reflect the service provided and changes in data recording procedures or differences in data recording between providers.
- (2) The presence of case mix and other causes such as clinical or sociodemographic issues. Case-mix being the *"measure of the types of cases being treated by a particular health care provider that is intended to reflect the patients' different needs for resources"*⁹⁵.
- (3) Statistical variability falsely leading to identifying outliers for 'praise' or 'blame', or obscuring real differences and hiding poor performers.
- (4) Poor data quality, often incomplete or inaccurate, which seriously undermines conclusions from the data.

It is important to consider the unintended harms that arise from the process of data measuring, collecting and publishing data^{96;97}, such as:

Convergence, aiming for average quality, rather than excellence.

Gaming, changing behaviour to gain strategic advantage.

Misrepresentation, such as 'data mining', changes in data recording and fraud.

Myopia, obsession with short-term goals.

Ossification, reluctance to experiment with new technologies to lessen the risk of poor performance.

Suboptimisation, prioritising narrow objectives that are organisation-specific over broader, interorganisational strategic goals.

Tunnel vision, focusing on areas assessed at the expense of non-assessed areas.

Bullying and intimidation of staff to improve reported performance.

Interpreting performance data presents three problems: (1) the need for appropriate and suitable indicators, (2) the need for case mix and risk-adjustment and (3) the need to reduce statistical variability. However, the need for high-quality data is paramount. Poor quality data will compound the inherent problems of interpretation of performance data and will distort any conclusions drawn from performance reports.

4.3. Public Release of Performance Data

The release of performance data can be traced back to London in the 1860's when Florence Nightingale published standardised mortality data on patients who had been operated on. This ended because of adverse reports by the Royal College of Surgeons in 1896. In the UK, it was left to self-monitoring by the medical profession to guarantee the quality of clinical care until the mid-1990's when the UK government introduced its '*Patient Initiatives*' for public accountability, raising performance and greater choice.

The United States led the way in the public release of healthcare data largely because of the way that their healthcare is funded. The disclosure of information about quality of care in the UK was strongly influenced by the 'report-card' movement in the US ⁷⁰. Report cards were expected to improve accountability of service providers, stimulate improvements in quality and encourage service users and purchasers to access high-quality providers ⁹⁸. But there are well recognised risks: (1) a tendency for organisations to concentrate their efforts on the reported outcomes, (2) a preoccupation with brief reporting cycles at the expense of long-term strategic planning and (3) the potential for misrepresenting or even falsifying data ^{97;99}. These risks are well reported in AHR ⁶.

The most commonly cited reason for the public release of health care performance data in the USA is that it will enable patients to select '*high-performing providers*' and avoid '*poorly-performing ones*' ⁹⁰. The release of data in countries such as the UK, relates more closely to public accountability than to market competition. This statement can only apply where there is public funding of the service (such as the National Health Service within the UK). However, there is no or partial funding for AHR in the UK and it is highly dependent upon the NHS Trust - "*the postcode lottery*" ¹⁰⁰. Many patients are forced into the competitive private sector rather than going on a long waiting list for state funded AHR ⁶.

4.4. Key Questions in Relation to Public Release of Performance Data

Concerns about the meaningfulness of the information which is released to the public is a concern for professional bodies, especially the questionable nature of the validity, reliability and case-mix or risk-adjustment of the data. Based on the US experience, three important questions must be asked about the public release of performance data:

- (1) Do health care users want more information on healthcare providers? In general terms, the lay public express extensive but often contradictory questions ^{90;101}.
- (2) Can the public use the information they are provided with? Individual and group purchasers often have problems making sense of healthcare data provided to them and are not readily able to integrate this data into their decision making ^{90;102;103}.
- (3) Does publicly released data have any impact on patient actions and resulting provider behaviour? There is little evidence to suggest that purchasers (individual or group) access the information available to them ^{90;102;104}, but evidence does exist that it can influence provider behaviour. Examples include the withdrawal of operating privileges of surgeons, implementation of new services and introducing quality improvement projects ^{90;105;106}.

Much of the health information publicly released in the US and the UK is centred on performance of hospitals, in particular surgical complications and mortality statistics ^{70;107}. This information means little to the public. Patients do not expect to die when they go into hospital to undergo a surgical procedure. They are more interested in the quality of care they receive, the pain they will have to undergo or whether they are discharged correctly ⁹⁰. Thus, patients differ from health care professionals in their priorities for, and there expectations of healthcare ¹⁰⁸. Information released must be what patients want, can understand and will use.

4.5. Key Problems in Relation to Public Release of Performance Data

The intent of publishing outcomes of healthcare providers is to 'provide information to the public who pay for and use health services and supporting patients' ability to choose where they will be treated'¹⁰⁹. In practice however, fulfilling this intent is far from simple. There are three main problems:

- (1) Developing a means of assessing outcomes that provides comparable information which reliably allows patients to distinguish between 'good' and 'bad' performers. It must effectively do so by capturing differences in case mix and with enough power that differences do not arise by chance³⁹.
- (2) Embedding this information within a system that leads to genuine improvements in quality by those underperforming, rather than opportunistic behaviour towards recording or work undertaken designed solely to improve what is being reported^{25;110}.
- (3) The system captures only a small fraction of the overall work of the healthcare provider and the information stored is largely out-of date. Broder's investigation of surgical quality indicators in California revealed that only 12% of procedures were recorded and most of the recorded information was five year's old²⁴.

Routine data has limited explanatory power and is associated with considerable methodological problems such as: (1) incomplete or missing data, (2) lack of adequate adjustment for confounding factors (case mix/ risk adjustment), (3) risk of over interpretation of data and (4) failure to understand the 'play of chance' and miscoding/variation in coding practice^{111;112}. These were the main reasons cited when the British medical profession resisted the call for consultant specific death rates to be made public. In response to the proposal to publish performance indicators, they argued that "*no measure could provide the required case-mix or risk adjustment*"¹². Previously, Keogh also argued that "*without adequate risk adjustment, clinicians may be tempted to avoid high-risk patients*"¹¹³.

Increasing amounts of healthcare performance data are placed in the public domain. But there is little supporting evidence of the impact this data has had on quality or its effects on the processes and outcomes of care²⁰.

4.6. Potential Advantages & Disadvantages of Publishing Performance Data

Placing key data in the public domain can motivate greater scrutiny of practice and enable a reduction in the variation of quality of care ^{111;114}. Publication can be a means of realising key political and cultural objectives of transparency and openness of healthcare by forming part of the framework of accountability ¹¹⁵. One of the commonly cited reasons for the release of performance data is to improve quality within healthcare. However, many (US) hospitals make no effort to improve quality, as 'adequate' performance is considered enough – although cost of quality improvements was also an important reason ¹⁹.

There are three main reasons to support publishing clinical performance data ¹¹⁶:

(1) *To stimulate action.*

A commonly stated reason is to encourage clinicians and managers to act to improve quality of care but performance measurement cannot guarantee quality alone. However a "name and shame" policy will focus on poor performers rather than encouraging actual improvements. Publishing data may only introduce a set of minimally acceptable standards with managers looking to remove 'poor' performers rather than promoting 'good' performance.

(2) *To promote public trust.*

A primary concern of patients using a health service is that they will be safe ¹¹⁷. In the UK, during the mid-1990's, public confidence in the medical profession's ability to govern itself was undermined by high-profile cases (for example, Harold Shipman and the Bristol tragedy). Following these cases, the ability for the medical profession in the UK to self-govern and audit was heavily criticised and allowed a re-evaluation towards one where the NHS would be "accountable to patients, open to the public and shaped by their view" ¹¹⁸. The government, through publication of performance data, was trying to reassure the public the health service was accountable, it's dealings transparent and open and mechanisms were in place to ensure patient safety ^{107;118}.

(3) *To support patient choice.*

In the US, "informing patients is a key means to improving the quality of care" ²¹. However, this can be directly linked to the consumerist nature of American health care. By publishing performance data, it was hoped to drive the emphasis from quality control by government imposed targets to quality driven by patient demand. This ideology is one of the supporting pillars of modern quality management, where quality is defined as "conformance to patient requirements" ¹¹⁹. In the UK, general practitioners traditionally acted as agents to interpret,

provide or promote access to information that patients needed to make an informed decision. Publishing performance data should allow an improvement in the agents' performance or enable patients to become more involved in the decision making process ²⁰.

Objectives of a clinical indicator program can be broken down into internal and external:

- (1) *Internal* Providing information for learning and quality improvement efforts by identifying possible areas of good and poor practice.
Marketing provider services to patients/ purchasers and to recruit/ retrain staff.
- (2) *External* Enabling purchasers and patients to make informed healthcare choices.
Providing data for external regulation and performance management.
Promoting public accountability.
Providing epidemiological and other public health data for clinical research.

The release of healthcare performance indicators in the UK has now become a regular event. The UK government, keen to promote choice and accountability in the NHS, launched the '*Patient Choice Initiative*' in 2002. Initially confined to coronary heart disease care, it measured performance and published these indicators as well as offering patients a choice of provider ¹²⁰. Magee looked at the public views on these issues. There was agreement by the public focus group that performance should be monitored in some way with publication of comparative data as "*unavoidable*" and "*potentially valuable*". It was becoming part of society to monitor performance, such as within the police and education. But performance measurement often resulted in negative opinions towards the league tables that were created from the indicators. Although aware that indicators could lead to an improvement in standards, the group highlighted the possible negative effects of '*naming and shaming*', particularly the decrease in the morale of staff and heavier demand for services ¹²⁰.

The (British) public were ambivalent about the value of performance indicators and "*has little awareness of or enthusiasm for hospital league tables*", but some form of public monitoring was both necessary and desirable ¹²⁰. The US public is familiar to the healthcare market place because of funding issues when compared to UK counterparts. In the UK, the public has historically relied on their general practitioner to make choices on their behalf. This role of the general practitioner as an 'agent' between patient and healthcare

The quality agenda in healthcare often confuses the quantity and quality of performance indicators – the complexity, diversity, importance and number of different indicators causes confusion, dissipation of effort and the "*paralysis of analysis*" ¹²¹.

4.7. Avoiding the Harmful Effects of Publishing Performance Data

Mason and Street considered how effective publishing outcome data is by drawing on literature from the US and UK and looking at the strategy employed ¹¹⁶. If the public has a 'right to know' about health services, then several key issues will have to be considered when publishing performance data:

- (1) *"Recognise that publishing inadequately constructed, measured and interpreted quality indicators will have equivocal benefits".*

Performance statistics are often produced from data recorded for other purposes and thus are not 'fit for purpose'. Special care must be given to primary data collection with a clear definition of data specification and objectives. However, there is a danger of overloading the system with useless or irrelevant data. A sign in Einstein's office read *"Not everything that counts can be counted: not everything that can be counted counts"* ¹⁰⁹.

- (2) *"Recognise that different users have different informational needs".*

Different user groups require various levels of data aggregation (patient, health professional, manager, purchaser and government). A requirement of the developing consumerist healthcare culture is that we will have to become better at providing relevant information if patient choice is to be promoted.

- (3) *"Work with each target group to develop valid quality indicators, and decide their use, rewards and sanctions".*

To encourage trust among both public and staff and to get users to work towards shared goals. Key principles of clinical governance must be employed (research, consultation, development, feedback and piloting).

- (4) *"Understand user's modes of access to information".*

If valid information for allowing informed patient choice has been developed, we must ensure that it reaches all levels of society rather than just the educated middle classes. For example, patient groups can be involved in the design of output formats - they prefer low levels of aggregation of data and access by a trusted intermediary (such as a general practitioner should be encouraged) ¹¹⁶. Internet access should be utilised to the full.

(5) *"Resist the temptation to over-simplify".*

No single approach to performance management is likely to be supreme ¹¹¹. In the UK, hospitals are ranked on a 'star-rating' basis to allow for easy comparison by the public. These star ratings are based on a multitude of indicators, few of which are to do with quality of care. Hospitals are given a ranking of 1 star for poor through to 5 for good. However, criticism has come from both the public and professionals for compressing such a large variation of causes into a simplistic ranking. This approach can send discouraging and counter-productive signals to staff and simplistic messages to the public.

Inevitably the media will highlight poor performing organisations which will lead to erosion of public trust and to these organisations finding it difficult to attract and keep high-calibre staff ¹²². This leads to a situation where *"beating the system, not improving quality, becomes the aim of the game"* ¹¹¹ and *"performance measurement...may pervert behaviour and engender an adversarial and defensive culture detrimental to quality"* ¹¹¹. This observable fact has become known as 'Goodhart's Law' ¹²³.

"Any observed statistical regularity will collapse once pressure is placed on it for control purposes."

4.8. What are the effects of releasing the information to the user groups?

The public disclosure of clinical performance data can serve various roles for its assorted audiences and services a rich pattern of formal and informal accountability ¹²⁴. Given the scale of resources directed at the collection and processing of performance data, it is notable there is a rarity of evidence on the benefits and drawbacks of public disclosure. Marshall found that out of several hundred active performance reporting systems, only seven had been subjected to any formal evaluation in peer-reviewed literature. Nearly all research into the consequences of public disclosure is derived from the US ¹²⁵.

Healthcare policymakers have long argued that there is an inherent imbalance in access to, and understanding of, healthcare information between providers of healthcare and users of healthcare ^{126;127}. There are three main users of publicly released performance data: (1) the patients, (2) the providers and (3) the regulators. The release of performance data regarding healthcare indicators is used by the different groups for a variety of purposes. Healthcare providers, specifically those operating in competitive markets, are responsive to the publication of comparative performance information ^{16;105;125}. Publication of this information can prompt a positive response from healthcare providers.

A rigorous review of the ‘*New York Cardiac Report Card*’ scheme on the impact of public reporting on health outcomes, found that risk-adjusted mortality decreased by 41% when the state department began publishing mortality and complication data ¹⁰⁶. But, the study attracted serious controversy for the reduction in the mortality rate. It was suggested that the reduction was due to: the ‘out-migration’ of high-risk individuals ¹²⁸, an artefact of poor quality data ¹²⁹ or inadequate risk-adjustment ²⁵.

4.8.1. Use of Performance Data by Patients

A commonly cited occurrence is that although patients report that they wish to gain increased access to comparative performance data ^{101;102}, when it is made available they rarely seek it out and fail to incorporate it into their decision making process ^{17;18}. There is little evidence to inform us of what (if any) information the public want or how they would use it. Research in the US, where performance information has been published for more than a decade ¹²⁴, has shown that the public are not using the available information to make informed choices ^{23;130}. This differs from the release of AHR data where the public actively seek it out and base many of their decisions on this data ¹⁴. A range of explanations has been volunteered to explain the lack of use by patients:

- (1) A limited window of opportunity to search for clinical information between onset of illness and the need for healthcare ¹³¹. In AHR, this does not occur as the users will actively search for a unit’s performance data before making a decision to commit (if a choice exists).

-
- (2) Comprehension problems, e.g. interpreting if high or low values on an indicator show good or poor performance ¹³². This has been a major problem when publishing AHR data due to the complexity of the data, the multilayered interactions of case-mix and the understanding technical terms. Many of the registries are adapting the presentation of the data for members of the public so it is more accessible. But by simplifying the presentation, the public can interpret the data wrongly.
 - (3) Difficulties around understanding technical terms and quantitative data ¹³³.
 - (4) A general lack of trust in the data provided by government agencies ¹³⁴.
 - (5) Preference for making decisions on the basis of informal information supplied by family / friends rather than official sources ¹⁷.
 - (6) Lack of motivation stemming from a perceived limited choice of alternative providers within a reasonable travelling distance from home ²².

Studies have shown that the prospective AHR patients main source of information on quality and clinical performance was based upon informal information (such as family and friends recommendations), past experiences and the views of their practitioner. Limited publicity of the indicators as well as the complexity of the data was cited for the lack of awareness in interest amongst the public. In the UK, Health Councils believe that patients would be more interested in data on processes rather than outcomes.

In his study of performance data indicators in Scotland (CRAG), Mannion concluded that patients rarely sought out or used clinical performance data and that hospitals were less responsive to the release of the data than US counterparts. This is due to the difference in the way that healthcare is funded in the US with the US operating different incentives for healthcare providers. Poor performance may result in a loss of revenue as purchasers moved to those providing a higher standard of quality. In the UK, there is a reduced choice in provider as well as the state providing overall funding rather than private organisations – there is less accountability in comparison to the United States.

4.8.2. Use of Clinical Performance Data by Providers

Mannion's study of the public disclosure of comparative clinical data in Scotland, found that the clinical resource and audit groups' (CRAG) indicators were rarely used by any of the stakeholder groups ¹²⁴. The CRAG indicators vary by speciality but have several common features. They are based on linked data sets with each indicator having a minimum patient threshold of inclusion, allow for random variance and indicators are standardised to control for aspects of case-mix.

Although CRAG data raised quality issue awareness amongst hospital staff and drew attention to issues requiring further attention, the data was not routinely incorporated into formal clinical governance arrangements and rarely served as a catalyst for initiating improvements. No attempts

were made to discuss the information amongst other local authorities or to utilise the data for benchmarking or developing best practice. Indicators had a low-level of dissemination amongst the hospitals and front-line staff were unaware of their existence. It was however, routinely disseminated amongst trust boards, senior consultants and chief executives. Senior clinicians reported that the data lacked credibility amongst the professions which prevented quality improvement efforts. Credibility issues centred on data quality issues such as incomplete and inaccurate coding, inadequate case-mix adjustment and long-delays in feedback.

There was a widely held view that indicators would be more beneficial if they comprised process rather than outcome data. Process indicators are in general, easier to interpret and once failures are identified, can provide clear guidance on what must be remedied to improve quality ¹²⁴.

In their evaluation, they identified three key areas for the explanation of the limited impact of performance data.

(1) Dissemination.

Poor dissemination of the data can impact upon the effectiveness of such data and is an often ignored component in the design of performance indicator systems. Although senior hospital staff are aware of performance data, the awareness and use of data amongst junior staff and patients is limited at best. Other sources of information could be used to form judgements on the performance of providers ¹³⁵. Recommendations for the improvement of dissemination were:

Provision of supporting material to aid interpretation of the data.

Presenting information in a variety of formats that are tailored to the needs of different end users.

Use of informal communication channels such as seminars, professional networks and patient groups.

Web-based dissemination.

(2) Credibility.

Reliable assessments of quality and clinical performance are severely hampered by the quality of the data, incomplete or inconsistent coding and poor or missing risk adjustment. A drawback to indicators being used for quality improvement is the delay in publishing the data and a compromise between refining data and its publication is required. Recommendations for the improvement of credibility were:

Consultation of staff and patients in the development of indicators.

Developing independent systems for auditing the quality of data used to construct the indicators.

Using customised clinical information systems rather than relying on administrative returns.

Applying sophisticated methods of risk-adjustment.

Keeping the indicators under constant review.

Providing training in the collection, analysis and use of clinical data.

Minimising delays by collecting and releasing data electronically.

4.8.3. Use of Clinical Performance Data by Regulators

Patients may use clinical performance data as a guide to selecting healthcare providers and clinicians. The providers and clinicians may use it as a guide for improvements in quality and safety and to fulfil public accountability. Regulators will use the data for accountability purposes such as licensure and certification programs and evaluating organisations for whom they act as a supervisory authority ¹³⁶.

Regulators in most circumstances are responsible for collating and publishing the performance data, this is especially true in AHR. Publication of league tables to rank performance in public sector services such as healthcare, education and crime is popular and this popularity suggests that they are easily interpreted and valued by their subscribers ⁹¹.

Monitoring and publishing healthcare clinical performance data that is poorly done or completed in isolation may result in skewed observations of the performance indicator's ¹³⁶. To combat these distorted perceptions of the data, standardisation of data collection, aggregation and reporting must be introduced.

4.9. The School League Table Analogy

Analogies are often drawn between the effects of education and healthcare league tables. The dysfunctional effects that the league tables have in education were highlighted in a study presented at the European Educational Research Conference in 2000¹³⁷. This study considered the comparison between two systems: one with league tables (English primary schools) and one without (Scottish primary schools). Key findings highlighted included:

English schools were more likely to concentrate on meeting their targets at the expense of other important objectives.

The target setting and testing process had a narrowing effect on the curriculum in England.

English schools were more likely to concentrate resources on “borderline children”, those close to reaching the threshold who would improve their league position.

English schools particularly thought that the target setting and testing process had increased the ‘blame culture’.

The authors concluded that performance indicator systems can have dysfunctional behavioural and significant managerial implications. Careful consideration should be given to the unintended consequences of league tables¹³⁸. The impact of a lower ranking reduces the amount of funding available to that school, they are less likely to be able to retain or recruit high calibre staff, they are unable to maintain facilities and unable to maintain a high standard of educational quality²⁹.

There is a tendency for organisations to concentrate their efforts on reported outcomes with a preoccupation with short-term reporting cycles. This is at the expense of long term strategic planning and introduces the potential for misrepresenting or even falsifying data^{97;99}.

One can immediately see the direct analogy between healthcare and education. Education authorities focus on meeting their targets by concentrating resources, at the expense of other important objectives, on children who will improve their league position. A presumption can be at the denial of children who are less likely to do so. Private AHR units will often select couples who have a better prognosis and are thus more likely to improve the units ranking. Public AHR units may be unable to recruit these better prognosis couples and thus have a lower ranking. This creates a false impression of the degree of performance and quality between private and public units. Of the two units mentioned at the start of this chapter (section 4.3), one was private and one public...success rates differed by nearly fifty percent¹³⁹.

4.10. Summary of Chapter 4

Chapter four described the issues surrounding the monitoring of clinical performance data and the subsequent release of the data in a league table format. The rationale of releasing such data was to assess comparative performance, provide information for patients and professionals and to improve quality and accountability amongst providers. We identified that variations in league table position may be due to actual differences in quality, but we must also consider that there is significant influence from other areas such as statistical variability, poor data quality, case-mix skewing and use of inappropriate or insensitive data sources and definitions. We also mention other unintended harms from the process of monitoring and publishing performance data.

It was discussed that although there are advantages to support publishing clinical performance data, there are issues that have to be considered when monitoring and publishing comparative data.

The various user groups of comparative performance information will respond differently to the release of the information. Healthcare policymakers suggest that there is an inherent imbalance in access to, and understanding of, healthcare information between providers of healthcare and users of healthcare. A brief discussion of the use of the data by patients, providers and regulators was covered.

The next section will consider more closely performance in relation to assisted human reproduction registries.

5. Chapter 5 – Performance in AHR

5.1. Definitions of Performance In Assisted Reproduction

There are few standards which allow the comparison of fertility centres and their IVF programs ¹⁴⁰. In countries that have national data registers for AHR programs, information on success rates has become this solitary standard. In the UK and the US, this information is available from the reporting authority, examples of the reports can be found in Appendix 5. These success rates have become the main indicator that is monitored and published by national data registries. The public equate these performance indicators with quality. AHR units may report their success rate in their own literature and web-sites without standardisation or validation. This performance indicator is normally stratified by age and pathology and the definition varies. Some registries publish success rates on a per-unit basis (such as the UK and the US) and others as a national figure (such as Germany and Australia).

Most regulatory agencies for AHR only include certain fertility procedures in their report. This varies between countries and there may be historical or political reasons behind this. The two types normally reported are IVF and ICSI, but would include the source of gametes used, as this may bias the outcome of the cycle (especially in the case of donor oocytes). The procedure of IUI has historically not been reported. However in 2005 for the first time in Europe, the EIM and ESHRE began to request these figures.

The definition of 'success rates' requires re-addressing. Unfortunately, there is no clear agreement by the fertility community and it is a subject of much debate ^{62;65-68;141-145}. Variations may exist in defining both the numerator and the denominator for each variable. The numerator refers to the final measurement of outcome. However there are several possible outcomes.

After the embryo transfer stage of IVF, there is a two week waiting period before the patient performs a pregnancy test. If negative, they may come back for more treatment or for a consultation to discuss their options. If positive, they have an early pregnancy ultrasound scan to detect the presence of a foetal heart beat(s) and the number of gestational sac(s) present. If present, it is considered a clinical pregnancy. If the patient had performed a positive pregnancy test but lacked the gestational evidence upon ultrasound, it would be considered a biochemical pregnancy. If a clinical pregnancy exists, the patient and unit normally depart company. Patients will often attend their own clinician for obstetric care.

The completeness of the success rate data is reliant upon the patients informing the unit of the cycle outcome and resultant pregnancy outcome. Units exert a lot of time and effort into tracking down outcome data from patients who are otherwise "*lost-to-follow-up*". In the UK, it is a stipulation of the treatment that the patient contacts the unit upon knowing the outcome of the pregnancy. With the exception of several Nordic countries, most countries do not have unique national identifiers and cross-linked registries that allow for easy follow-up.

Some units may manipulate their management and reporting practices to alter reported performance data. This manipulation can be difficult to detect and report. A common method is the under reporting of started cycles of which there are various methods ²: (1) not reporting cycles that start but are subsequently cancelled for medical reasons, (2) not reporting cycles that start but are subsequently cancelled for non-medical reasons, (3) not deciding the type of treatment until the response to the drugs is assessed, (4) not reporting the cycles that start stimulation but are then stopped for poor response but continue down-regulation to re-start with a higher dose of stimulation after re-achieving down-regulation and (5) not reporting the cycles that start but then get converted to IUI for poor response. Other practices include: increasing the number of embryos transferred, cancelling cycles inappropriately, discouraging cryopreservation of supernumerary embryos, hyper-stimulation of the ovaries to maximise the number of oocytes collected to possibly life threatening levels.

The following sections will review the different denominators used to calculate performance in AHR. In each case, 'live birth' represents a birth event, for example, singleton, twins or other high order delivery.

5.1.1. Live birth rate per cycle started.

The live birth rate per cycle started indicator includes all patients who have started a cycle. A simple enough statement but this definition breaks down easily. Where does the 'cycle' actually begin?. Does it begin when the couple decide to start a cycle? When the clinician indicates this? When they begin the down-regulation drugs? When they begin the stimulation drugs? Registries generally indicate that it is normally when the patient commences the stimulation drugs, as it is at this point that patients become 'committed' to a cycle.

This is a key stage where many units can 'manipulate' their figures by not registering a cycle until the unit observes how the patient responds to the drugs – if she responds well the unit can go ahead with the cycle, if not they can convert to a different type of treatment or cancel the cycle altogether. Units can push the stimulation drugs quite hard (i.e. give higher doses) to retrieve more oocytes. But in doing so, run the risk of serious complications. Some registries attempt to prevent this by insisting that, to be included as an active cycle, the cycle must be registered within a certain amount of time (such as 3-5 days) of beginning the stimulation drugs regime.

5.1.2. Live birth rate per oocyte collection.

The live birth rate per oocyte collection indicator includes all patients who have follicles of sufficient size in which oocytes may be recovered and who have completed this procedure (even if no oocytes are recovered). It now becomes more difficult to manipulate figures, but not impossible. If low oocyte numbers are recovered, such as less than three, the patient may be converted to a different treatment

or cancelled. This is now less routine as registries tend to record the recovery procedure, irrespective of the number of oocytes obtained.

5.1.3. Live birth rate per embryo transfer.

The live birth rate per embryo transfer includes all patients who have reached the point where embryos have been transferred to the uterus, thus defining the treatment as complete. Most cycles who have obtained fertilised oocytes will have a transfer, however an embryo transfer may be dependent upon the quality of the embryos obtained. There is no universal or clearly defined embryo grading scheme. It is entirely up to the unit whether or not the embryos obtained are of sufficient quality to be transferred back to the uterus. Units may transfer embryos even if they are of poor quality, as patients often feel this 'completes' the cycle – other units may only return high quality embryos and cancel the cycle if there are none.

5.2. Assisted Reproduction Data Registries

AHR is a complex and dynamic field. The process of monitoring and reporting it is an equally complex one with continual improvements in medicine, treatment, cost-benefits, national legislation and ethical debates continually changing practices. All the groups involved (patients, professionals, politicians, media and regulators) require up-to-date and relevant data.

There is a belief by European professionals that although the monitoring of performance data is an essential role of a national registry, it must be able to demonstrate that quality is equally important^{140;146-148}. Unit's must be able to provide a high quality service with good success rates but not as a luxury service to only those that can afford it. Several European countries, such as Belgium, have shown that when funding is available for the provision of services, the uptake increases dramatically¹⁴⁹⁻¹⁵¹. With the commercial aspect removed, the focus becomes centred on quality rather than performance.

5.2.1. What are the goals of an AHR registry?

A main driving force behind units monitoring and recording data was to show their performance in respect to clinical pregnancy rates or live birth rates. This would have begun as an exercise in proving to themselves they could carry out procedures effectively. Interest and popularity for AHR grew exponentially, especially in the UK and the US. As funding was often non-existent – a commercial industry developed. Units wanted to show prospective patients that their 'product' was better than their competitors. Performance data became more critical to the success of the unit.

As regulations came into force, national registries were developed so that a level playing field could be created. However, this has actually had an opposite effect^{2;3;6;39}. Reports based on data from national registries allowed the creation of league tables indicating which units were the best and worst. Units became ranked upon their performance. Many patients will relate a unit's performance (success rates) with its quality (the safety, efficacy, risk of treatment) and units have developed ever more sophisticated means in an attempt to improve their rank.

A national registry should be able to provide:

- (1) complete and comprehensive documentation of all relevant data regarding treatment and its outcome.
- (2) provide analysis of the data.
- (3) a national quality standard.
- (4) quality control that can identify deficiencies within the system quickly.
- (5) information to the public, professionals and the regulatory authority.
- (6) be open and transparent.

5.2.2. AHR Registry Methodology

When establishing a national data registry, two types of methodology can be employed: (1) an annual reporting system, where an annual report is produced based upon a cohort of data covering treatments for a set-time period (retrospective) and (2) an individual, direct system of collating the information before the outcome is known (prospective) ¹⁵². The annual reporting system is cheaper and simpler, but suffers from data validation problems and time-lag. Data cannot be collected until the end of the second year as the outcome of the pregnancy will not be known for nine months following treatment. The individual cycle reporting system is more expensive and complicated but does not suffer as much from problems of data validation or time-lag. It is also greatly reduces the problem of data manipulation.

There are four main categories of data currently recorded (excluding demographic information) for most national data registries: (1) results of direct treatment (pregnancy rates etc), (2) pregnancy outcome, (3) side-effects for the women and (4) child development problems. Each group becomes progressively more difficult to monitor and report. Each registry has developed various means of gathering the data. As it becomes more difficult to collect data from each group, the data set becomes less complete. For example, the outcome of the deliveries such as detailed information on infant weights, malformations, perinatal deaths requires a different methodology of monitoring and collating the required data. In the UK, a requirement of treatment is to inform the unit of the outcome of the cycle. However, once the couple have had their initial foetal heart scan, it becomes very difficult to follow-up each individual case. Some couples may not want the obstetrician to know the child was conceived using artificial techniques or are lost to follow-up. Fertility unit staff invest a significant amount of time into tracking this information ¹⁵³. Countries such as Sweden have cross-linked IVF registries with birth registries via unique citizen identification, therefore it becomes easier to follow-up outcomes.

Databases can be designated as 'in-house', 'commercial' or 'bespoke'. In the past, units resorted to constructing their own system, which allowed a specific system tailored to the needs of the unit to be built. This method is fraught with disadvantages, it is time-consuming, inadequate programming skills can result in serious design flaws and ultimately the system becomes more costly than purchasing a commercial system. Commercial systems, although appearing initially costly due to their specialised nature, the outlay can be recouped by large units within a year due to increased efficiency and productivity ¹⁵⁴.

Data has in the past been transferred from unit to authority in paper format via the postal system. This method has increasingly become inefficient and error generating due to the rapidly increasing number of cycles being carried out. The HFEA in the UK has five paper based forms that are required for each registration of a couple and each cycle on which they embark (Appendix 4). It is then double-data entered by two separate individuals at the HFEA. Teams from the regulatory authority audit the

information for errors and completeness. As the uptake of units introducing commercial database systems has increased, several of the regulatory authorities have begun to introduce electronic data interchange (EDI) to allow the required information to be sent electronically from the database itself.

EDI allows dissimilar database systems to communicate with the reporting authority through a common messaging standard such as XML (eXtensible Markup Language)¹⁵⁵. This method greatly increases the quality of data stored and reduces processing time required to audit and validate this data. It reduces the manpower time required in both unit and regulatory authority. A survey of British AHR units in 1997 found that all but two were interested in EDI as a method of transferring the required information to the regulatory authority¹⁵⁵. The UK has recently decided to introduce an EDI system. Units that perform more than 50 cycles per year will now have to submit data through the EDI route from January 2007¹⁵⁶. Units that currently do not have a commercial database are to be provided with a free computer and the relevant software. A similar system is in place in the US and Germany.

5.2.3. AHR Registry Funding

Substantial funding and research are directed towards the establishment and development of computerised healthcare records. The UK alone will have spent £20 billion on its IT upgrade to link general practitioners and hospitals by its introduction in 2014¹⁵⁷. The regulatory authority in the UK (HFEA) had an annual budget of over £10 million in 2005¹⁵⁸. Assisted conception is reportedly worth \$3 billion in the US, over \$900 million in the UK and nearly \$12 million in Ireland^{7;8}. Yet the databases used by the units and the national registry they report to are often neglected, with little commercial software available until recently¹⁵⁴.

In 2005, European Society for Human Reproduction and Embryology (ESHRE) surveyed its members about the '*Ideal Infertility Computer System*'¹⁵⁹. Although nearly 75% of the units had computerised records system, 45% were dissatisfied with their existing system. Three-quarters of the units had a budget of \$12,500 or less to purchase their system. A basic microscope used in a lab costs \$8,000, an ultrasound scanning machine \$50,000 and an ICSI microscope \$100,000. Are the database systems employed by the units considered as important?

As the issues of quality management become more important, coupled with the regulatory authorities requiring more information from the units for the purposes of reporting and auditing, infertility database systems are having a greater role within the unit. Regulatory and reporting authorities such as SART in North America, NPSU in Australia and New Zealand, DIR in Germany and HFEA in the UK are requiring larger and larger quantities of data from the units.

National AHR registries are funded from three sources: (1) the units themselves, registries may charge units on a per-cycle basis, (2) national fertility societies may often fund or partially fund registries and (3) government may fund or partially fund registries.

Units are now beginning to realise that an efficient and user friendly AHR database system is integral for its successful running. It should be a key resource and as essential as the microscope or ultrasound scanner. Advantages of an infertility computerised records system include: (1) increasing overall efficiency of the unit, (2) increased time spent on quality care due to more efficient processing of information and (3) enhanced capabilities for quality control and research through computerisation of data recording and analysis.

5.2.4. AHR Registries – USA (SART)

The US registry, co-managed by the Centre for Disease Control (CDC) and Society for Assisted Reproductive Technology (SART), informs prospective patients in its annual report introduction that its goal is to provide the information required to answer two questions: (1) what are my chances of having a child by AHR? and (2) where can I go to get this treatment”⁸². The first question is probably the most common one asked by the patient to the clinician so it makes sense that this should be what the registry should be attempting to answer. But SART seems to focus on this with little quality or safety information provided.

The American Society for Reproductive Medicine (ASRM) and SART started an IVF registry in 1984, originally to look at the incidence of congenital abnormalities with success rates being a secondary consideration. It was agreed by ASRM and SART that success rates would be anonymous and collated into one national figure “*presenting the data in a format which would make it impossible for anyone to identify and compare one clinic with another and to ensure patient confidentiality and discourage clinics from altering their figures or being too selective in choosing patients*”⁵⁸. As the number of units increased rapidly in the US, unscrupulous practices developed due to a lack of government regulation. Increasing patient concerns forced the federal government to introduce the Fertility Clinic Success Rate and Certification Act in 1992, although it was not implemented until 1997. The act had the intention of instilling honest disclosure of success rates and the implementation of quality assurance. This law required that “*...each AHR program shall annually report to the Secretary through the Centres for Disease Control and Prevention pregnancy success rates achieved by such program through each assisted reproductive technology and the identity of each embryo laboratory used by such program, and whether the laboratory is certified or has applied for certification.*”⁵⁵

In 1994, a national accounting firm was employed by the CDC / SART to help develop a unit specific, outcome based reporting process. The process was abandoned within a year due to disinterest from the units themselves and a lack of resolve from SART to enforce compliance . Further problems developed when SART attempted to introduce other methods for data verification, such as in 2000

when SART informed the units that the (token and often sporadic ⁵⁷) onsite reviews were to be scrapped and self-review of medical and laboratory records were to be introduced. In the 2005 report of 2003, the self-review process had ceased and a SART validation committee visited 39 of the 399 reporting units. All AHR units are meant to report their data to SART for compliance with the FCSRCA, however 10% of units do not report or withdraw their data – these units result's are not listed in the annual report. SART maintains a registry of the AHR units known to be in operation for any one year and tracks opening and closings.

SART distributes database software and instructions to the AHR units and using this software, the units enter the requested data regarding patients, treatment and outcome. As with many other AHR registries, data is organised with one record per treatment with multiple treatments from individual patient not being linked. SART adopted a prospective reporting system in 2000 with units submitting treatment registration details before the outcome is known, using an internet based system to process the submissions ¹⁶⁰. The prospectively reported data is linked to the submitted end of year data. SART then compiles and reviews the data and identifies error's, which the units are asked to resolve. Once the data has been submitted, reviewed and corrected, ten percent of units are selected for site visit data validation. Criteria for selection are established at the beginning of the year so there is no bias from the submitted data. Site visits are meant to identify problem area's in the data collection process rather than to identify data manipulation. SART activities and recommended timeline are illustrated in table 5-1. Funding for the US registry is provided by SART members on a per cycle basis and an annual fee. There is no government funding of the registry.

Activity	Timeline
Art cycles are performed	Jan-Dec, Year 0
Data collection	
SART distributes data collection materials to clinics	January, Year 0
SART distributes any updates to the data system to clinics	by September, Year 1
Clinics submit data to SART	December, Year 1
SART compiles clinic data and submits to CDC	February, Year 2
SART and CDC review data and ask clinics to reconcile errors	February–March, Year 2
SART submits final national dataset to CDC (cycle-level data)	April, Year 2
SART submits final clinic tables dataset to CDC (aggregate data)	June, Year 2
Data validation	
CDC selects sample of reporting clinics for validation	March, Year 2
SART teams conduct site visits for all selected clinics	April–June, Year 2
SART and CDC review validation data	June, Year 2
Data analysis and publication	
CDC conducts analysis, develops graphics and text	April–July, Year 2
CDC, Division of Reproductive Health conducts initial proof of numbers in each clinic table	June–July, Year 2
CDC, ASRM, SART, RESOLVE participants review drafts of the report	July–August, Year 2

CDC editorial staff review and edit national report, format clinic tables and appendices and conduct editorial proof for entire report	July–September, Year 2
Desktop publisher lays out report for CDC	September–October, Year 2
Desktop version of report proofed by CDC editorial staff	October–November, Year 2
Report cleared for publication by CDC science director	November, Year 2
Files forwarded to printer and CDC web site team	November, Year 2
Report published, printed version and on CDC web site	December, Year 2
Final proof of web site against printed publication	December, Year 2
Report release and dissemination	January, Year 3

Table 5-1. Activities and time line in the SART reporting process ¹⁶⁰.

The CDC has responsibility for data analysis, authoring and publishing the annual report ⁵⁵, both printed and web-site versions of the report are made available. The request for print copies has declined in the last four years while hits on the website have increased dramatically ¹⁶⁰. The report is aimed at prospective AHR patients with the data being presented in a simple and straightforward manner.

The US has one of the largest numbers of AHR units in the world (399) and this brings its own set of problems in regards to data collection and data reporting. SART and CDC recognised early on that explicit deadlines and guidelines for data submission and explicit definitions for various criteria and terminology were required. Presentation of complex data in a simple manner also proved difficult and SART conducted focus groups of current and prospective AHR patients. They were generally satisfied but areas of confusion were reported, especially when understanding clinical and statistical terminology. Even basic indicators caused confusion, some patients found it difficult to understand differences between “live birth per cycle”, “live birth per retrieval” and “live birth per transfer” ¹⁶⁰.

SART and CDC are currently researching mechanisms to link treatment cycles performed on the same patient. This would allow the evaluation of AHR usage patterns and the development of cumulative patient rates. To do this, unique patient identification numbers would need to be developed as is the case in the Nordic countries.

5.2.5. AHR Registries – UK (HFEA)

The Human Fertilisation and Embryology Authority (HFEA) was set-up in 1991 as an act of Parliament to issue a Code of Practice and “maintain a register of those receiving treatment and born as a result of treatment, and also its composition” ⁵². By law, units that process and/or store human gametes for use in treatment or research must be licensed by the HFEA. The centres must document the procedures they carry out and a person responsible is registered with the HFEA. They must retrospectively register patients (although they are not given a unique personal identification number) and every treatment that is carried out. The HFEA records each oocyte that is recovered and the outcome of any embryos created. HFEA is self funding on a per cycle basis, they are an independent

authority and therefore do not receive any governmental funding. In the UK, the HFEA is perceived as a government department.

The UK system is similar to the US. Paper forms have been used since 1999 to request information regarding patient registration, treatment details and treatment outcome for each completed (appendix 12). The forms are sent retrospectively to HFEA where data is double entered by two separate individuals and electronically compared. A third person identifies any errors and corrects them. A validation engine with over 800 rules is run to check the accuracy of the information before it is moved to a live data warehouse where it is normalised for greater efficiency and reporting, see figure 5.1. The recorded information is validated by site inspections and published annually (appendix 4, figure 13.1).

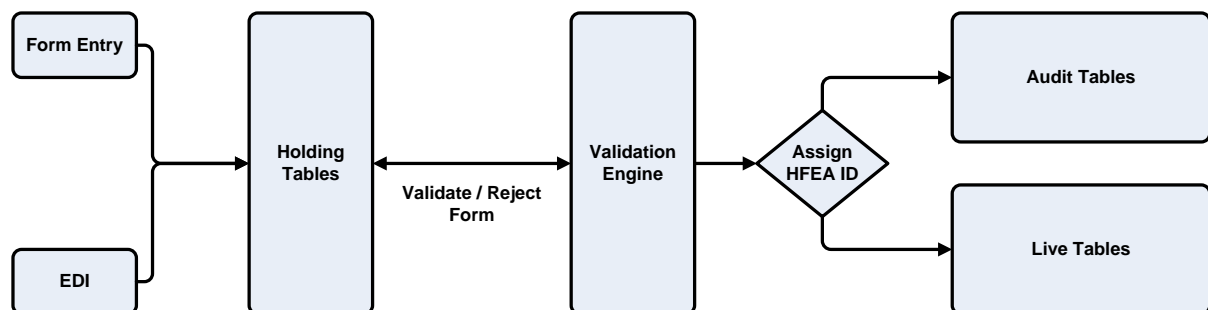


Figure 5-1. HFEA registry database structure

HFEA is introducing electronic data interchange (EDI) and is due for completion in 2007. If a unit undertakes more than fifty cycles in a year then it will have to submit information through the EDI route. Most of the units in the UK are now using the EDI system in a pilot or live mode. The paper forms are being replaced with re-designed electronic off-line forms which can be checked for basic validity at the point of entry and then sent across a secure network to HFEA for further validation checks and subsequent import into the Register. Because of the HF&E Act, all software development is undertaken in-house. Each unit is to be provided with a computer and a secure connection by HFEA where they may enter the data directly. For those units with electronic patient records or data management systems, the software suppliers have written an interface to the HFEA software to provide the required data automatically.

In addition to the data register, HFEA have another key system called the 'Centres Database' which is used to store all the information about a unit - where they are, who works there, and what type of licence they have at any point in time for example. This is linked to the Register to ensure that all treatments are covered by a valid licence.

5.2.6. AHR Registries – Australia (ANZARD)

Australia was the second country to have a live birth by assisted conception in 1980. There are now seventy units in Australia and New Zealand with 25,000 fresh IVF procedures and 20,000 frozen cycles creating 7,000 children every year. It is estimated that an AHR infant is born every ninety minutes in Australia ¹⁶¹.

The regulatory and accreditation body in Australia and New Zealand is the Reproductive Technology Accreditation Committee (RTAC). It has the power to close units who do not abide by the regulations it imposes. It is mandatory for units to provide data for the Australian and New Zealand Assisted Reproduction Database (ANZARD). ANZARD is managed by the Australian Institute of Health and Welfare's National Perinatal Statistics Units (NPSU) ^{85;161}. The NPSU is a university based, independent organisation and data collection is funded by the Fertility Society of Australia (FSA). Units submit data electronically on a six monthly basis and the Australian government has access to national figures relating to AHR. RTAC utilises the data to undertake regular audits and collect information relating to success rates and adverse outcomes.

ANZARD records data on a variety of techniques and contains details of *“all pregnancy and birth outcomes, including mode of delivery, birth status, birthweight, gestational age, plurality, perinatal mortality, congenital abnormalities and maternal morbidity”* ¹⁶¹. Data are collected at each fertility unit at the time of treatment and provided to the NPSU within six months. Follow-up data are collected by unit staff and forwarded to the NPSU within twelve months.

Units in Australia and New Zealand have data management systems and provide high-quality data electronically. The paper based reporting system was phased out at the end of 2002. The new method of data collection was designed with the intention of establishing a fully electronic system for reporting outcomes of treatment. The data is used to generate the NPSU annual report, summary reports for RTAC and to provide units with regular internal reports for comparison with national figures. Annual reports provide national figures only with individual unit results not being made publicly available.

This mimics the German system whereby units know their own figures and can use national figures as a benchmark. Unlike the German system, a nationwide free database system has not been issued and units are expected to extract the specified data from their existing systems. The set consists of 75 points of data ⁸⁵. Extracted data for treatments is submitted on a six monthly basis in the form of a spreadsheet (appendix 2). This data is forwarded by either email attachment or by compact disc. There is no mention of encryption or other security issues regarding the submission of data in the ANZARD explanatory notes ¹⁶². Upon receipt at NPSU, the data is checked and imported into the ANZARD database. The whole spreadsheet is re-submitted once outcomes are known, twelve months after initial submission.

The NPSU state that the main purposes of their annual report is to place in the public domain: (1) information on AHR treatment cycles and resulting pregnancy outcomes, (2) evidence of quality improvement through monitoring AHR practices, (3) information to set standards for accreditation and monitoring of AHR units and (4) information for national and international comparisons.⁸⁵

AHR treatments are partially funded by the state through the Medicare health system. Patients are reimbursed 50% of the \$6000 cost. There is no upper limit on the number of cycles a couple can be reimbursed for. In 2005, the government was planning to introduce capping the number of cycles that are funded to a "*maximum of three (in total) for women over 42 and three annually for women below that age*"¹⁶³. However, this proposal looks unlikely to proceed due to protests from patient groups.

5.2.7. AHR Registries – Nordic Countries

The Nordic countries (Sweden, Finland, Denmark, Norway) are considered to be at the forefront of monitoring and reporting of AHR treatments. The incidence of elective single embryo transfers is also highly encouraged in an attempt to reduce multiple birth rates. A key component of the Nordic registries is the cross linkage between AHR registries and other medical registries to allow for validation and follow-up studies.

In Sweden, the first AHR child was delivered in 1982. Since 1987, Swedish law has required all AHR units to provide summary reports on results of treatments. The reports are sent to the independent Centre for Epidemiology at the National Board of Health and Welfare, who prepare an annual summary. The reports do not contain unit specific information due to the possibility of the public being misled by misinterpreting the data. This case is strengthened by the negative experience from the UK and the US¹⁶⁴. As with other countries, these reports are widely used by the public, professionals and regulators. Swedish authorities discussed using a system of direct reporting of individual cycle data but decided such a system would be expensive and require a separate authority. The annual summary forms are revised annually to take into account any changes in AHR developments and recently the forms have been adjusted to conform with the information required by the EIM. Sweden has found that the simple approach of annual summary reports works very reliably and currently have no plans to change their reporting method¹⁶⁴. Cross-linkage of the AHR registry with the existing Medical Birth Registry, the Cancer Registry and the Registry for Malformations uses a unique ten digit personal identification number given to all Swedish citizens.

In Denmark since 1994, all AHR treatment data is reported on a statutory basis to the Danish National Board of Health (Sundhedsstyrelsen¹⁶⁵). Units also provide the Danish Fertility Society with the same data as the National Board of Health does not publish results. The reporting system is on an individual treatment cycle basis using a personal identification number to allow for cross linkage with birth registers¹⁶⁶. Individual cycle data was reported using a paper format until 2004 when an electronic version was introduced.

In Finland, indirect monitoring of births from AHR treatments has been recorded since 1990 using the Medical Birth Registry and unique personal identification numbers ¹⁶⁷. From 1992, cumulative AHR statistics, based on initiated treatment cycles, have been recorded by the Finnish Society of Obstetrics and Gynaecology. In 1994, the responsibility for data compilation was taken over by the National Research and Development Centre for Welfare and Health (STAKES - *Sosiaali ja terveystieteen tutkimus ja kehittämiskeskus* ¹⁶⁸). Data collection is voluntary and collected using the EIM data forms (appendix 9). Annual publication of results is given at a national level rather than on an individual unit basis ¹⁶⁹.

5.2.8. AHR Registries – Belgium (BELRAP)

Data regarding AHR has been recorded voluntarily since 1989 in Belgium. In 1993, the BELRAP association (Belgian Register for Assisted Procreation) was developed and continued being a voluntary organisation with more than 90% of cycles being recorded (on a prospective, cycle-to cycle basis) ¹⁷⁰. In 1999, the registration of cycles became mandatory due to new legislation.

The College of Physicians in Reproductive Medicine (College van Geneesheren Reproductieve Geneeskunde – CPRM) then became the regulator and was given the responsibilities of registration, validation and auditing IVF activities within Belgium. BELRAP's expertise and their voluntary effort was preserved by integrating it as part of the CPRM ¹⁴⁹. In 2001, BELRAP developed an online registration system for a more complete record.

In 2003, new regulations came into place regarding the number of embryos that could be returned to the uterus. The new law came about due to a study, where data was provided directly from the registry ¹⁵⁰. It indicated that if funding was introduced for the provision of cycles in combination with a single embryo transfer directive in women under 36, the state might actually save money in the long term, based on savings from the reduction in multiple births and subsequent neo-natal care.

The government decided to provide funding for 6000 cycles in the first year, if single embryo transfers occurred in those cycles where patients meet appropriate criteria (such as female age). In the second year, due to the dramatically increased uptake of cycles, the government had to provide funding for 12,000 cycles (*data from lecture by Dr Martine Nijs at the Irish Fertility Society Annual Meeting 2006*). The effect this has had on the reduction of multiple pregnancies has yet to be studied in Belgium. In countries where single embryo transfer is encouraged (such as Sweden and Finland), there has been a dramatic drop in the multiple birth rate with little or no reduction in success rates ¹⁷¹⁻¹⁷³.

5.2.9. AHR Registries – Germany (DIR)

Germany has been practicing AHR since 1985. At that time, 742 cycles had been completed in five centres, all of which were university based. According to the latest ESHRE report, Germany now is the largest provider of assisted conception services in Europe, 116 units providing nearly 70,000

cycles in 2002⁷⁷. From an early stage, the Germans had employed a database called “*Fertibase*”, which was superseded by in 1997 by “*Rec-Date*”. The registry is known as Deutsches IVF Register (DIR) and all units are provided with the software free of charge. DIR is not a compulsory register. However, professional regulations developed by the Doctor's Chamber of Germany in 1998 required that all cycle data be forwarded to the registry. All centres now report their data to DIR – even though it is voluntary. DIR is administered by the German Society of Obstetrics and Gynaecology (DGGG) and the German Society of Gynaecological Endocrinology and Reproductive Medicine (DGGEF). DIR has its own infrastructure with costs covered by the units with a charge €2.50 per cycle¹⁷⁴. Compare this to the UK where the charge is €150¹⁵⁸.

Data is published on an annual basis, but units receive profiles every three months. The registry works on a cycle-by-cycle prospective data collection basis with the data being published on a national basis rather than on a per-unit basis.

The German Embryo Protection Act (Embryonenschutzgesetz Deutsches¹⁷⁵) was introduced in 1990 to protect and prevent the unwanted destruction of the embryo and attempt to reduce the incidence of multiple births¹⁷⁶⁻¹⁷⁸. Unfortunately, it has had the opposite effect on the latter. All oocytes collected are inseminated however, the Act only permits the subsequent culture of three fertilised oocytes which have to be returned to the uterus. Any additional fertilised oocytes must be cryopreserved for future use thus reducing the number of supernumerary embryos created which in other jurisdictions may have been cryopreserved. A fertilised oocyte is one where a maternal and paternal pronucleus can be observed on the day following insemination, once these fuse and the process of cell division begins, the subsequent structure is termed an embryo. Ethically, an embryo may be considered a separate entity whereas a fertilised oocyte would not as the paternal and maternal genomes have not fused - this is the underlying philosophy behind the Act. By forcing units into replacing the cultured fertilised oocytes, Germany now has one of the highest multiple rates in Europe with forty percent of children born through assisted conception being from multiple births¹⁷⁴. This policy effectively blocks the selection of embryos for transfer, prevents elective single embryo transfer, reduces success rates and increase multiple birth rates¹⁷⁴. The Embryo Protection Act was developed to help prevent this but data from the registry indicates otherwise.

Germany recently changed its regulations regarding the provision of funding for AHR. Prior to 2004 four cycles were provided for by the state, but now patients are only reimbursed for 50% of the cost of treatment for a maximum of three cycles. Figures from the German registry indicate that the number of couples undertaking AHR has halved from 80,434 in 2003 to 37,633 in 2004¹⁷⁴.

5.2.10. AHR Registries – France (FIVNAT) & Switzerland (CH-FIVNAT)

The first IVF infant in France, Amandine, was born in February 1982⁶⁹. In 2002, there were 92 units in France, performing nearly 60,000 treatments every year¹⁷⁹. The French National Data Registry,

FIVNAT (Fécondation In Vitro National) was set-up in 1986. It is a voluntary system and in 2002, only 59 of 92 centres reported data ¹⁸⁰.

The Swiss National Data Registry (FIVNAT-CH) is based upon the French registry and all 20 of the AHR units participate voluntarily and fund the register by means of a fee based on the number of cycles initiated. FIVNAT-CH is managed by the Swiss Society for Reproductive Medicine (Schweizerische Gesellschaft für Reproduktionsmedizin) and publishes an annual report ¹⁸¹.

Although information has been recorded since the first IVF success in 1986, it wasn't until 1991 that a more structured framework was developed. The main aim was to “*provide quality data about assisted reproductive technologies for scientists, politicians, the media, and last but not least, patients*” ¹⁸². Since 1997, regular audits of all units occur to validate the quality and consistency of the collected data.

Although the number of units in Switzerland is relatively high for its population (2.7 per million), its uptake of services is relatively low (440 per million). This has been linked to the lack of reimbursement and strict regulatory framework imposed in Switzerland, which is similar to the regulations in place in Germany and Italy ¹⁸³.

5.3. What is being monitored by the registries?

Where national AHR registries exist in Europe, they either have their own defined datasets or work towards collecting the information that EIM requests on an annual basis for their report '*Assisted reproductive technology in Europe. Results generated from European registers by ESHRE*'^{69;77;184-187}. These reports aim to "collect process and publish regional data for Europe on direct clinical results". One of the biggest problems in collating data from twenty-five European countries is quality of data and the lack of standardisation. Only half possess national data registries with the rest either in the process of developing them, restructuring their existing registries or they do not have one. EIM concluded in their last report that "data collection systems, coverage, definitions and validation are different" and "the data presented...is incomplete and generated through different countries, interpretation of the data must be done with some caution"⁷⁷.

I was able to obtain the data forms that are used by the European IVF Monitoring consortium to gather the data (Appendix 1). These are sent to representatives of each of the twenty-five countries in the European Union. Data to complete the forms are requested from the representative from either the existing national registry or from the individual units. Where regulations requiring the mandatory provision of data to a national registry exist, it can be assumed that reporting between the units to the registry is standardised, such as the UK. Where voluntary registers exist, such as France and Germany, for the centres that provide their data to the registry, we can assume that data is standardised but not all units will provide their data to the register. Where no registers exist, standardisation is non-existent, such as in Ireland.

As part of the dissertation research, and using contact details from the EIM / ESHRE website, I contacted the representatives from the twenty-five countries that took part in the 2005 review of 2002⁷⁷. The aim was to establish which countries have national data registries and if so what data was recorded. I also contacted Australia (ANZARD), Canada (CARTR) and the United States (SART). The information is summarised in table 5-1.

Country	Replied?	National Registry?	Dataset Provided?
Belgium	Yes	Yes	No
Bulgaria	No	No	-
Croatia	No	No	-
Cyprus	No	No	-
Denmark	Yes	Yes	Yes (in Danish)
Finland	Yes	Yes	Yes
France	Yes	Yes	Yes
Germany	Yes	Yes	No
Greece	Yes	Being developed	EIM data only
Hungary	No	No	-

Iceland	No	No	-
Ireland	Yes	No	EIM data only
Italy	Yes	Being developed	EIM data only
Macedonia	No	No	-
Netherlands	Yes	Yes	No
Norway	Yes	Yes	No
Poland	No	No	-
Portugal	Yes	No	EIM data only
Russia	Yes	No	EIM data only
Slovenia	No	No	-
Spain	No	Being developed	-
Sweden	Yes	Yes	No
Switzerland	Yes	Yes	EIM data only
Ukraine	No	No	-
United Kingdom	Yes	Yes	Yes
Australia	Yes	Yes	Yes
Canada	Yes	Yes	Yes
USA	Yes	Yes	Yes

Table 5-2 National registries in selected countries.

Data requested from the units for their national registry or for the EIM report (if no national registry exists) can be broken down into four sections:

5.3.1. Demographic information

Demographic information that the registries record would contain information regarding patient details such as name and date of birth, registration numbers, relevant medical history, previous obstetric history and reproductive pathology. There is a multitude of identification and registration numbers required by the databases. In Nordic countries, unique national identification follow an individual from the cradle to the grave. Using this system, there is less chance of error and a better use of cross linked data registries to provide epidemiological reports ^{167;188;189}.

5.3.2. Treatment details including outcome

Treatment data regarding a patients cycle would generally contain the largest amount of information. The type and volume of data recorded becomes varied dependent upon the country. It would consist of the stimulation phase (drugs and dosage used), the laboratory phase (oocyte and embryo data) and the transfer and outcome phase (conclusion of the treatment cycle). Examples of the type of data recorded are summarised in table 5-2.

Demographic	Stimulation	Laboratory	Transfer / Outcome
name	type of treatment	oocytes exposed	embryos transferred
date of birth (age)	down regulation type	fertilisation rate	day of transfer
social security	FSH dosage	triploidy rate	transfer method
clinic ID	GnRH medication	degeneration rate	difficult of transfer
ethnicity	gamete source	cleavage rate	treatment outcome
residency	follicular size	'good' embryos	pregnancy outcome
obstetric history	endometrial size	cryopreservation	foetal hearts
prior treatment	oocytes recovered	complications	implantation rate
diagnosis	sperm source		delivery outcome
FSH level	cancellation reason		number born
	complications		weight / sex
			complications
			malformations

Table 5-3. Examples of data stored by AHR registries.

Outcome of the treatment is perhaps one of the most controversial, debated and inconsistent data fields recorded in AHR ^{63-68;144;190-197}. Each registry records different aspects of the data available from the actual outcome (at foetal heart scan to the delivery event), number of births (single, twins or more), type of birth to infant details. The French registry, FIVNAT (Fécondation In Vitro National), gives extensive selections for pregnancy failure and divides these into first, second and third trimester pathologies.

Details of cancellations of treatment are recorded within these sections such as low or high response to stimulation, inadequate endometrial response, concurrent illness or withdrawal due to psychological, financial or family reasons.

5.3.3. Side-effects for the women.

Registries may record side-effects of the treatment process that involve the female partner. HFEA's data forms do not ask for any of this information with the exception of *'egg collection being abandoned due to risk of OHSS'*. SART's database seems to give a significant degree of response for recording of complications such as *'hemorrhage requiring transfusion'*, *'moderate or severe hyperstimulation'*, *'medication side effect'*, *'anaesthetic complication'*, *'psychological stress'*, *'infection'* and *'death'*. SART's accompanying data recording instructions ¹⁹⁸, give concise definitions for the requested data, where HFEA do not. Canada, France and Australia give variations.

5.3.4. Child malformations and developmental problems.

As part of the follow-up of children born from AHR, registries may request information regarding any abnormalities, malformations or developmental problems. Due to a lack of global consensus of what should be recorded for physical and mental abnormalities for children, registries record variable amounts of data. This may be due to difficulties in following-up children after delivery by the units themselves. Some registries only ask that any malformations be described. There has been much concern and conflicting studies regarding the incidence of malformations and the development of children born from AHR ever since its introduction¹⁹⁹⁻²⁰⁴. Key to providing and maintaining confidence in the public is to establish that children born as a result of AHR are no different from those conceived naturally.

5.4. Issues in AHR Performance League Tables

In HFEA's report (2002-03), a unit in London was reported as having a success rate of 58.5% whereas one in Berkshire reported the lowest – 10.3% ¹³⁹. An article in the UK's Daily Mail about published success rates, quoted Claire Brown (of the patient support group, Infertility Network UK) as saying *"units with lower success rates may simply treat older women, more complex cases or be NHS units that have less choice over their patients. It is difficult, if not impossible, to compare success rates as there are so many factors, such as the makeup of the patient group, that can affect the rate."* ⁵.

The unit that had the highest success rate in the UK also reported one of the highest multiple birth rates (36%) ²⁰⁵. They replaced three embryos (the maximum allowed in the UK) in 39% of IVF cycles in comparison to less than 10 % in other units. In HFEA's inspection report of the unit, they found that 70% of IVF treatments were not reported to HFEA within the recommended fifteen weeks.

A report in New Scientist in 2002 indicated there was often commercial pressure on units to achieve a high ranking in the league table ³. This is pushing units to select better prognosis patients, recommend IVF where it isn't necessary and to transfer more embryos than is required. The shift towards selecting younger women and increasing the number of embryos to be transferred has led to a dramatic increase in the incidence of multiple gestation pregnancies. In the United States, multiple births occur in 39% of AHR cycles. This compares to 26% of cycles in Europe (2002) ⁸⁴. In comparison, the multiple birth rate of naturally conceived children is 1.5% ²⁰⁶.

The prospective parents may consider a set of twins or triplets (or more) an instant family, but multiple pregnancies have serious health and financial implications for parents, offspring and the state. Mothers are at higher risk from complications resulting from multiple pregnancy such as high blood pressure, haemorrhages and pre-eclampsia. Infants born from multiple gestation pregnancies are more likely to be premature, require a caesarean delivery, have low birth weights, may require extended stays in neonatal units, have birth defects or neurological problems and may require specialist schooling as a result of these problems. The cost of raising multiple-birth children may not only be a financial one; substance abuse, violence and divorce are more common in families who have children from a multiple pregnancy ^{3;207-210}. Increased costs to the state or health insurers also increases dramatically for each child born from a multiple birth. Ledger analysed the costs to the NHS of multiple birth's after IVF treatment in the UK and found that the total direct costs (maternal and infant costs) were substantially higher for multiple births than for singleton's (singleton: £3,313: twin: £9,122: and triplet: £32,354) ²¹¹.

Since many couples who are looking to employ the services of AHR units rely on published success rates rather than recommendations from their own clinician, it is necessary to consider the influence that publishing AHR performance data has had on quality.

Many national registries who collate and interpret AHR data for the purposes of monitoring treatments publish their findings in the academic press. Where regulations exist, there is often a requirement to publish data as an annual report, such the UK's '*Human Fertilisation and Embryology Authorities Annual Report*'²¹² or the US's '*Assisted Reproductive Technology Success Rates 2003 - National Summary and Fertility Unit Reports*'⁸². These reports state that they are "*not be used for comparison or for the production of 'league tables'*"^{213;214} but are often used for that purpose by public and professionals alike. As with other public sector performance indicators, the league table format was meant to allow for improved quality, accountability and greater choice for patients. However, it has only illustrated which units have the superior success rate's and which have poor ones. This culture of naming and shaming only highlights a units ineffectiveness in performance, resulting in a drop of confidence amongst patients, reduced state funding and low staff morale. This hostile environment allows a negative situation to develop where the opposite of quality improvement occurs. The poor performing units may simply be acting more responsibly in their patient selection, giving access to all that ask for it and in the techniques used. Patients not accepted in high performing AHR units due to their patient selection criteria (due to a lower probability of success) will search out units that will accept them for treatment. This only lowers the poorly performing units success rates further and increases the gap between high and low performing units.

This is one of the major criticisms of performance league tables. They are being used to nurture an environment where unscrupulous processes may develop such as the selection of good prognosis patients to improve league position. This creates an illusion of a better performing unit than its competitors and by association, a higher quality service to its patients.

For privately funded AHR units, improvement of their success rate by possibly untruthful or fraudulent means rather than through genuine quality improvement, may become more important than the purpose of the AHR unit – "*effective management of the couples infertility, irrespective of the outcome*"²¹⁵. The focus becomes centred on the provision of the end product, a child, at any cost rather than management of the actual medical pathology. It becomes commercial, a business rather than a healthcare service.

There are several possible detrimental outcomes of this type of management such as (1) multiple or high order pregnancies where there is considerable risk of serious medical conditions developing or even death for both mother and child, (2) the patient developing ovarian hyperstimulation syndrome, a potentially life-threatening side-effect of stimulation drugs or other infections or complications, (3) serious adverse incidents occurring due to pressures exerted on staff for higher performance figures and cost reduction management .

AHR data registries have a responsibility to report their findings to the public, professionals and to the regulators. But as a healthcare service, it must remember the prime principle of medicine, "*Primum non nocere*" (first do no harm). Registries must collate, analyse and publish information that users

require, in a easy to understand format but it must also act as an instrument to improve quality and standards.

This information, specifically success rates, can be classified into *real* (live birth rate (LBR) in all infertile couples seen at the unit), *actual* (couples actually treated in the unit) and *reported* (results that the unit offers to prospective patients and reports to statutory or voluntary bodies). These 'reported results', are assumed to have credibility as they are published in the regulatory bodies official documents. They have comparability with other units presenting in the same report. The unit will appear to have accountability by virtue of being included in the report. Data is broken-down into geographical regions, standardised reporting formats (such as LBR per started cycle, LBR per oocyte collection and LBR per embryo transfer) as well as the stratification by age ranges.

However, the results are often not comparable. Artificial skewing of reported results may not be equivalent to the 'actual' or 'real' results and hence improve the units league position by deception ². In a study looking at the reliability of league tables of AHR units, Marshall concluded that "*when there are substantial differences between institutions, ranks are extremely unreliable statistical summaries of performance and change in performance, particularly for smaller institutions*" ³⁹. Various criteria can induce artificial skewing of performance data (whether intentional or not) such as patient selection criteria ²¹⁶⁻²¹⁸. Privately funded AHR units may treat patients that may be willing to pay more for a supposed '*better quality*' treatment and hence may select better prognosis couples to maintain their high league position. Publicly funded AHR units operate on a 'treat-all' basis. In the UK, the National Institute of Clinical Excellence (NICE) reported that some level of funding should exist for assisted conception ⁹. NICE recommended that the NHS should allow a minimum of one to two cycles but many financially restricted health authorities are refusing to implement the NICE guidelines and are not providing free treatment ²¹⁹. A survey by a UK infertility support group found that 75 % of patients had been forced to pay for some or all of their infertility treatments and investigations ²²⁰. Less than 20% had their treatments fully funded by their local authority. This forces prospective patients into the competitive private sector due to inadequate funding ⁶. Business experts have warned that fertility treatment costs, allowed to continue uncapped and unregulated, will soon become the preserve of the rich and follow the route of the US-system⁷, "*... where it is similar to a high end jewellery market*" ²²¹.

Where reported results have been stratified for risk-adjustment or case-mix in an attempt to prevent manipulation by patient selection, problems have been reported ³⁹. There are often insufficient numbers to allow for statistically relevant interpretation when multiple variables are introduced and hence results generally only stratify for age. Units vary widely in the number of cycles they process and therefore cannot be compared equally, ranging from 30-2000 ^{82,158}. As reported for other healthcare league tables, over- complication in the presentation of data which has been adjusted for case-mix hampers the interpretation of the data by both public and professionals alike.

5.5. Summary of Chapter 5

This chapter has looked at the definitions of performance that are currently used in assisted human reproduction registries. A review of selected AHR registries, their goals, methodology and funding was also considered. An in-depth summary of what registries are actually monitoring is presented

The final subsection of this chapter reviewed the current issues that impact upon AHR data registries, with particular reference on the publishing of performance data and the effect it has on patients and treatment.

Having reviewed performance in assisted human reproduction, we can now begin to present the other side of the equation – quality.

6. Chapter 6 - Quality in AHR

6.1. How do we define 'Quality'?

In the past, quality was seen as an expression of the superiority of a product. A 'quality' product may have cost more, used better materials and manufactured to a higher specification²²². Hence 'quality' often meant 'luxury'.

From a basic product manufacturing perspective, quality can be defined as "*conformance to manufacturer specifications*", specifications defined and based on the manufacturers experience of what the customers want. In service industries, businesses tried to define the quality of the services according to certain specifications. These have been defined and then refined by management but derived from opinions and the approval of customers.

When the focus is entirely oriented towards the customer's views and opinions, quality became defined as "*fitness for use*"²²³. This change in perspective is described as a switch from a "product out" company to a "market-in" company. Quality now became defined as "*conformance to customer requirements*"¹¹⁹.

Modern quality management has its roots in the manufacturing industries, where the philosophy is one of Total Quality Management (TQM). One of the most relevant statements about quality and its modern application, from Deming, is that "*Good quality does not necessarily mean high quality. It means a predictable degree of uniformity and dependability with a quality suited to the market*"²²⁴. However, healthcare requires us to go further than the concepts relating to the manufacturing industries. A framework built around "*duty of care*" and "*best practice*" must be combined with the "*conformance to customer requirements*" to provide a quality of services that can meet the customer's needs and expectations. These services must be effective, efficient and safe²²².

Put simply, quality describes the goal of satisfying requirements. But since quality is specifically linked to best practice and conformance to customer requirements, in healthcare these requirements change as customers' expectations rise. In the private healthcare sector, in which most AHR units exist, the patients expectation's rise due to competition within the market. Doing the bare minimum is no longer enough. In order to attract more patients, the unit's must do more of something or charge less. Charging less is rarely an option due to economies of scale. Businesses (i.e. units), must offer more of a product for the same price – more oocytes, more embryos and ultimately higher success rates. The optimisation of processes (such as fertilisation, culture and cryopreservation) should ultimately produce higher success rates.

6.2. Is there a single parameter of quality in AHR?

*"Not everything that counts can be counted: not everything that can be counted counts."*¹⁰⁹

In the UK, the government introduced star ratings for healthcare institutes based upon a set of performance indicators which are set by the Healthcare Commission (Commission for Healthcare Audit and Inspection). These indicators are made up of four elements: (1) key targets, (2) patient focus, (3) clinical focus and (4) capacity and capability focus. The institutes are rated from zero stars to three stars.

They have been widely criticised by groups such as the British Medical Association¹², however the British government insists that they provide an essential ingredient in the NHS modernisation program.

Could something similar be developed for AHR based on these groupings. Is there a single parameter of excellence that can be derived and a star rating given for quality and performance?

A recent debate in Human Reproduction Journal (the periodical of ESHRE), discussed "*What is the most relevant standard of success in assisted reproduction*"^{63-68;144;190-197}. The debate centred around the most appropriate endpoint after AHR techniques and could one single standard of success cover the complexity of AHR.

As the title and the resultant debate showed, the focus seemed to be on the monitoring and reporting of 'success', i.e. the live birth rate and the various numerators and denominators that define the calculation. As we have previously discussed, this is the significant criterion that AHR prospective patients will ask for and use when selecting AHR units^{14;15}. Therefore it is a relevant marker of success for patients. But, performance does not equate quality. Interestingly in this debate, there was a clear distinction in the views of authors from countries who had AHR services funded and aimed towards single embryos transfers^{68;197} and those that didn't, especially the US^{191;196}.

The US groups state that the "decision that a twin birth is a complication and that the only acceptable outcome of infertility treatment is a single live birth, is unnecessary and unsympathetic to couples who require AHR...in order to achieve a pregnancy"¹⁹¹. Countries such as Finland who encourage single embryo transfers have shown that pregnancy rates remain constant and the financial cost of an extra AHR procedure is less than the estimated costs for the postnatal care of twin pregnancies¹⁹⁷.

Where there is no provision for funding for AHR, there may be a tendency to optimise the chances of success by having multiple embryos transferred. If success is defined as live birth deliveries, there is an effort by some providers to transfer multiple embryos in an effort to maximize their publicly reported success rates. This viewpoint questions the value of reporting on a unit-specific basis because reporting success in terms of live birth rates is resulting in increased competition among units with

multiple gestation an unfortunate consequence ^{225;226}. In the US, transferring large numbers of embryos is common practice. In 2001, only 6% of AHR cycles transferred single embryo's whereas 66% of cycles transferred three embryos, 32% of cycles transferred four embryos and 11% of cycles involved the transfer of five or more embryos ²²⁷.

A single parameter of excellence comprising safety, risk and efficacy aspects is the ultimate goal of reporting AHR programs. However, due to the complexity of IVF programs – no single parameter can be defined. A Danish group suggested the minimum use of three standard parameters for reporting successful programs that should cover the distinct phases of an IVF cycle (1) *stimulation (pre-in-vitro)*, (2) *laboratory (in-vitro)* and (3) *embryo transfer and outcome (post-in-vitro)* ¹⁴⁴. By selecting three standard parameters for each phase of treatment we give a better reflection of the whole process (the quality) rather just the outcome (performance), which rewards units who have high success rates. Table 6-1 summarises the parameters which the Danish group considered. The three phases are discussed in the following subsections.

PHASE	NUMERATOR	DENOMINATOR
STIMULATION	OOCYTES	ASPIRATION
	EMBRYOS	OOCYTE
	TRANSFERS	ASPIRATIONS
	IMPLANTATIONS	OOCYTE
LABORATORY	IMPLANTATIONS	TRANSFERRED EMBRYO
	ONGOING IMPLANTATIONS	TRANSFERRED EMBRYO
	SINGLETON ONGOING	
	PREGNANCY	TRANSFER
TRANSFER-OUTCOME	DELIVERY	INITIAITED CYCLE
	DELIVERY	TRANSFER
	DELIVERY	TRANSFERRED EMBRYO
	DELIVERY	OOCYTE
	SINGLETON LIVE BIRTH	INITIAITED CYCLE
	SINGLETON LIVE BIRTH	TRANSFER
	SINGLETON LIVE BIRTH	TRANSFERRED EMBRYO
	SINGLETON LIVE BIRTH	OOCYTE

Table 6-1. Recommendations for standard monitoring parameters ¹⁴⁴.

6.2.1. Stimulation (pre in-vitro).

Stimulation parameters will reflect the stimulation drug regime and the oocyte recovery. Calculations such as the number of oocytes per aspiration would indicate the intensity of the hormone stimulation and may reflect a balance between risk of OHSS and obtaining a satisfactory number of oocytes. Embryos per oocyte relates to the fertilisation rate. Transfers per aspiration will reflect the number of

cancellations pre-oocyte recovery. One parameter not mentioned would be oocytes per total dose (of stimulation drug) which may reflect ovarian reserve. The Danish group recommend oocytes per aspiration as the optimal parameter for this phase.

6.2.2. Laboratory (in-vitro).

Reflects the quality of the laboratory process and product, the embryo. The laboratory process of AHR is a complex and often dynamic area. Laboratory monitors should be able to reflect the various stages through the laboratory from insemination type, fertilisation and abnormalities in fertilisation such as triploidy, embryo development, transfer and degeneration of the embryos and embryo cryopreservation. The relevant optimal parameter suggested is the number of ongoing implantations (gestations with foetal heart beat) per transferred embryo which considers the number of implantations and the quality of the transferred embryo.

6.2.3. Embryo Transfer and Outcome (post in-vitro).

This is the final phase and considers embryo transfer and eventual outcome of treatment for those that have had a transfer. If the treatment results in a positive pregnancy test, there is an argument that events post-foetal heart scan should be the end of the monitoring process as care is switched to the obstetrician. The unit has no more influence on the outcome of pregnancy. The relevant parameter here follows on from the laboratory stage with deliveries per transferred embryo. This indicator encourages single embryo transfers with high quality embryos. Delivery rates do not take into consideration aggressive hormone stimulation, so live birth rates do not accurately reflect all stages of the treatment.

Interestingly the Danish group do not recommend the breakdown of success rates by infertility diagnosis as they have little impact on the results and due to the large numbers required for statistical interpretation. They do however recommend that the data should be stratified for the age of the women as this impacts on all of the three phases.

6.3. What Could be Monitored by the Registries to Better Reflect Quality?

Since the inception of IVF, the crude pregnancy rate has been the definite indicator of treatment outcome in IVF. The ultimate goal was to achieve the highest success rate, which was considered to reflect a unit's exceptional clinical performance which in turn would provide prestige to the centre and maximise business in a competitive AHR marketplace.

There have been many attempts to define what the most relevant standards should be but there has been little agreement within the field ^{140;193;194}. Literature exists as to what can be considered 'good clinical practice' within AHR ¹⁶². Many practices within the field are derived from evidence based guidelines and much has been written about how to achieve quality within a unit. But little of this is monitored by national registries who focus on success rates. This outcome centred approach has developed from patients wanting to know what their probability of conceiving is if they attend a particular unit. Patients will focus on a unit's highest success rate value and apply it to their own chance of success, which unfortunately is not the case. Every couple is different and hence their probability of conceiving is different. If this is the case, are success rates a relevant indicator for registries to monitor?

We can group the processes, actions and decisions that the unit may make that can affect a cycle of AHR. There are also other external factors that can affect the cycle which the unit has only partial control over. These parameters are based upon what will affect the quality, efficacy and safety of the cycle for the patient. Some may directly or indirectly affect the performance (the outcome) of the cycle for the couple. However, we are concentrating on the what could be monitored by registries to allow a better representation of quality within the unit as opposed to their performance.

A process centred approach to quality and performance monitoring rather than outcome centred is recommended. Monitoring relevant indicators from the three phases of treatment (stimulation, laboratory and conclusion) should hopefully provide a more balanced approach to representing quality rather than just indicating a unit's performance.

A national registry of AHR for Ireland should be able to reflect the complete picture of quality and performance. What are the possible indicators that national registries could be monitoring to give a more rounded, holistic representation of quality of an individual unit within a country?

The following are possible indicators that registries could monitor in an effort to give a better reflection of quality within AHR.

6.3.1. Patient selection criteria

Patient selection criteria is key to a successful AHR service. It will improve the performance of the unit but selecting patients who are likely to conceive will reflect on quality on a national level. Diagnosis and treatment are the fundamentals of medicine and being able to give patients different options is essential. In AHR, selecting patients who have a high probability of conceiving will increase the unit's performance. Conversely having a 'treat all' policy may give false hope to couples who have little chance of conceiving and hence could be considered ethically wrong. A balanced approach to patient selection criteria will therefore reflect on the unit's quality of clinical care. Establishing national criteria would seem the logical approach to prevent one unit gaining an unfair advantage over another. This can be clearly seen in public versus private units in the UK where private units have a higher league position in comparison to those that are public^{5,7,212}. Where provision of funding exists, patient selection criteria would allow cost effectiveness of treatment. Guidelines for selection criteria have been published in the UK by NICE and RCOG but are not mandatory⁹.

There are several factors that could be monitored in the absence of national mandatory selection criteria. These all have been shown to have an impact on the chances of conceiving.

- (1) Female age. Data from registries indicate that the IVF pregnancy rate declines from forty percent in women in their early thirties to less than five percent in their forties. Most regulatory authorities impose an upper age limit of 42-45. This is more to do with complications and risks in pregnancy than chances of conceiving. Women are born with all their gametes and hence any oocytes recovered are the same genetic age as her. The chromosomal quality of the oocytes and therefore the quality of embryos declines with age.
- (2) Female body mass index (BMI), where a body mass index of less than 19kg/m² or greater than 29kg/m² will impact upon fertility. Some units impose upper and lower BMI limits.
- (3) Follicle stimulating hormone (FSH) levels relate to ovarian reserve and therefore the response to the stimulation drugs. A higher FSH level (for example levels of greater than 20mIU/ml) will have a diminished response, poorer quality and a lower number of oocytes. Some units impose an upper limit for treatment.
- (4) Reproductive pathology and diagnosis impact on the probability of conceiving. Some pathologies such as tubal damage or poor sperm parameters are suited to IVF or ICSI (respectively) and have a better chance of success where as premature menopause or genetic conditions are harder to treat successfully.
- (5) Infertility duration and previous obstetric history. The longer the duration, the less chance of conceiving. If the couple have conceived before, they have a higher chance of conceiving through AHR.
- (6) Other factors such as fitness, smoking, alcohol intake, drug use (recreational and medicinal), medical, psychological, and occupational history of the couple may also impact on treatment and probability of success.

6.3.2. Cycle Cancellation

Many AHR treatments are cancelled before they reach embryo transfer. In the US in 2003, 20% of cycles started did not have an embryo transfer⁸². There are various points during the treatment at which a cycle can be cancelled. Simply quoting the number of cancelled cycles as a single value allows little interpretation of a unit's protocols. It is essential that cycles are classified as to why they were cancelled. We can group these into cancellations in to the stimulation phase (pre oocyte recovery) and laboratory phase (post oocyte recovery).

6.3.2.1 Stimulation Phase Cancellations.

During the stimulation phase, treatment may be cancelled if cysts develop or if there is inadequate down-regulation. A main reason for treatment cancellation is poor or over-response to stimulation drugs. If insufficient follicles are developing or the size of these follicles are low, it is likely that a low number of oocytes will be recovered or that they will be of very poor quality and unlikely to fertilise. Even if the treatment cycle proceeds as far as oocyte recovery, there is a chance that no oocytes will be recovered (recovery failure). Registries will generally only record a cancelled cycle once the patient begins the stimulation drugs.

This is a key indicator to monitor and can be a reflection on the unit's stimulation protocol. A high cancellation rate for over-responders may indicate the unit is acting aggressively in its stimulation in an attempt to recover a higher number of oocytes and possibly putting patients at risk of OHSS. However, it could also indicate the unit is being over cautious in its stimulation and cancelling patients who would otherwise proceed to oocyte recovery. A high cancellation rate for low-responders may portray a unit's reluctance to proceed with a cycle unless the couple is responding well.

6.3.2.2 Laboratory Phase Cancellations.

During the laboratory phase, treatment may be cancelled if no oocytes fertilise or there are no embryos to transfer. If the number of oocytes recovered, oocytes exposed to sperm, the number fertilised and other various factors are monitored, we can establish the quality of patients and the laboratory staff expertise. Poor prognosis patients, poor treatment criteria or poor laboratory practice may be reflected in these indicators.

6.3.3. Incidence of Complications

A variety of complications can occur during an AHR treatment process. The complications arising from treatments can be categorised as follows²²⁸:

-
- (1) Complications associated with the stimulation drugs such as medication side effects, psychological stress and ovarian hyperstimulation (OHSS).
 - (2) Surgical complications associated with egg retrieval such as infection, haemorrhage and anaesthetic complications.
 - (3) Complications arising from a resulting pregnancy such as miscarriage, ectopic pregnancies or intra-uterine death, gestational diabetes and hypertension, placental previa or abruption, pre-eclampsia.
 - (4) Complications of producing an infant with abnormalities, malformations or learning difficulties.

Of these, OHSS is perhaps the most common complication of AHR treatment. Ovarian hyperstimulation syndrome can be a serious pathology brought about by the ovaries being over stimulated by the follicle stimulating drugs. In most cases it may require a short hospital stay but can result in death^{229;230}.

6.3.4. Multiple Birth Rate

The incidence of multiple pregnancies and births is one of the biggest complications and concerns in AHR at the present moment in time. In the United States, multiple births occur after 39% of IVF cycles and 26% of cycles in Europe (2002)⁸⁴. This may be due to high number of embryos returned to the uterus in the US in comparison to Europe. For naturally conceived children, the multiple birth rate is 1.5%²⁰⁶. In Europe, there is a higher provision of state funding for AHR and healthcare, including maternity and post-natal, in comparison to the health insurance system in the US. Is there less accountability in the States for multiple pregnancy and post-natal care due to the way that the health services are funded? Achieving a pregnancy at almost any cost was initially the aim of AHR but with improved stimulation protocols and a better understanding of the laboratory aspects, there is now a need to dramatically reduce multiple births by replacing fewer but higher quality embryos. The possible health, financial and social implications for both mother and children born from multiple pregnancies is a major cause for concern. It is estimated that there are 500,000 AHR cycles performed annually around the world resulting in about 100,000 ongoing pregnancies. The global incidence for twinning and for high order multiple pregnancy resulting from AHR is 25% and 3% respectively. Thus, the 100,000 pregnancies will result in 72,000 singletons, 50,000 twin children and 9,000 triplet children (total 131,000). If we assume an incidence of 10% of severe complications per child belonging to a set of twins or high order multiple pregnancy, this means that each year, AHR is responsible for approximately 6,000 severely disabled children alone^{150;231;232}. Many of these could have been avoided if elective single embryo transfer (eSET) is introduced.

Replacing a high number of embryos was once thought to relate to higher success rates but the introduction of elective single embryo transfers, especially in Europe, has proved that this is not the case²³³⁻²³⁹. Adoption of eSET is becoming more routine in Europe but is sporadic in the States^{240;241}. In the Nordic countries and other European countries, governments provide funding for cycles but

insist upon eSET for patients under forty. A good embryo cryopreservation program is required in conjunction with eSET in women where criteria gives a good indication of a successful outcome of a singleton delivery.

Most units will provide an early pregnancy scan for couples who have tested positive. This information is relatively easy to record for all couples although definitions and timescales for early pregnancy scans vary between countries.

6.3.5. Adverse Incidents & Reporting

A major concern for patients is the occurrence of ‘mix-ups’ or laboratory errors while processing the gametes and handling embryos. Laboratories have human staff and therefore are prone to error, especially if understaffed or overworked. While serious adverse incidents are rare, they do occur. Two women had the wrong embryos replaced in Leeds in the UK in 2002²⁴². This incident led to a wide ranging report that recommended witnessing of laboratory procedures and the reporting of adverse incidents²⁴³. As part of the new EU Tissue Directive, adverse reactions and incidents will now have to be reported to the competent authority⁵⁰. In Ireland, this will be the Irish Medicines Board (IMB)²⁴⁴. Definitions of adverse reactions and incidents:

(1) Serious Adverse Reaction (SAR):

*“Any unintended response including a communicable disease, in the donor or in the recipient associated with the procurement or human application of tissues and cells that is fatal, life threatening, disabling, incapacitating or which results in, or prolongs hospitalisation or morbidity.”*²⁴⁴

(2) Serious Adverse Event (SAE):

*“Any untoward occurrence associated with the procurement, testing, processing, storage or distribution of tissue and cells that might lead to the transmission of a communicable disease, to death or life-threatening, disabling or incapacitating conditions for patients or which might result in, or prolong, hospitalisation or morbidity.”*²⁴⁴

Although the IMB give definitions for ‘reactions’ and ‘incidents’, they do not specify or give examples. This will cause problems as it will be down to the individual units to determine if something should be reported or not. A high incidence of events will reflect badly on a unit’s quality, irrespective of performance. But, reporting of events is meant to indicate problems and prompt a review and suggest possible solutions so that they do not occur again and in turn improve quality. Monitoring events may be particularly useful in revealing quality problems that are not susceptible to outcome monitoring such as near misses, unwanted outcomes, or unnecessary resource use²⁴⁵.

6.3.6. Laboratory aspects

Monitoring laboratory indicators of AHR will give a good indication of the quality of staff, expertise, equipment and conditions employed within the laboratory. All laboratories should monitor parameters for quality control and assurance and it would not be necessary for a registry to collate all data. But there are several key parameters that could be monitored that would give a good indication of quality within an AHR laboratory. These should follow the recovered oocytes through the laboratory to their conclusion of being transferred (the 'best' embryo), being cryopreserved for future use (remaining good quality embryos) or 'discarded' (unfertilised, abnormal or poor quality oocytes / embryos). These parameters will also be a reflection of a unit's patient selection criteria.

oocytes recovered	good quality embryos to transfer
oocytes exposed to sperm	embryos to cryopreserve
oocytes fertilised normally	blastocyst development
oocytes fertilised abnormally	oocytes discarded
fertilised oocytes to cryopreserve	fertilised oocytes discarded
fertilised oocytes cleaving on day 2	embryos discarded
embryos cleaving on day 3	degenerate oocyte / embryo rate

6.3.7. Staff to Cycle Ratio

The number of staff within a unit could be a relevant parameter to monitor the quality of care for patients. Low numbers of staff for a given workload will cause staff to become overworked, overtired and overstressed. This creates a 'toxic' working environment, leading to the potential for serious adverse incidents especially amongst embryologists. There would be a lack of time for training and continued professional development leading to a reduction in the quality of clinical theory and practice.

A review of embryologists working hours and time management by the Association of Clinical Embryologists (ACE) in 2002 found that 71% units in the UK were understaffed which increased workloads to the point at which errors were more likely to occur. Table 6-2 illustrates the differences between the number of actual versus required embryologists for treatment cycles.

Total AHR Cycles	Actual embryologists	Required embryologists
1-200	1.5 (1-2)	2 (1.59)
201 – 400	2.7 (1-4.5)	3 (3.20)
401 – 600	3.8 (2-5.5)	5 (4.80)
601 – 800	5.1 (4.5-5.5)	6 (6.40)
801 – 1000	5.5 (4-6.5)	8 (8.00)
>1000 (1200)	7.25 (6-8.5)	10 (9.60)

Table 6-2. Embryologists workload in comparison with actual and required ²⁴⁶.

The number of staff in the disciplines that make up an AHR unit could be compared to the number of cycles carried out for a given year. High staff to cycle ratios could lead to a reduction in waiting times, faster turn-a-round for administrative work, reduced 'bottle-necks' in investigation and treatment, reduced stress in the workplace, more time for research, training, education and improved clinical practices.

6.3.8. Miscellaneous & Ancillary Services

Although other factors or ancillary services may not impact on a couples chance of conceiving through AHR, the quality of service they receive as they go through treatment may improve the psychological and emotional state of the couple. These aspects may need not be monitored by registries but listings of the these services could be provided such as: (1) provision of ancillary services, for example counsellors, dieticians or alternative medicines, (2) accreditation and professional memberships, (3) staff qualifications and experience, (4) patient satisfaction audits and (5) miscellaneous items, for example unit location, availability of car parking, payment facilities.

6.4. Summary of Chapter 6

The definition of quality is specifically linked to best practice and conformance to customer requirements, in healthcare these requirements change as customers' expectations rise. The possibility of defining quality in assisted human reproduction by a single indicator is considered. We find this to be unlikely due to complexity and variation in the processes involved. However, we can illustrate that there are three phases to the treatment process. By selecting an appropriate indicator from each phase, we can hopefully give a better representation of the overall process of AHR (quality) rather than just the performance (outcome).

Although we cannot move away from indicators of performance completely, as this is the information that the patients look for but by building in the other phase indicators, a better balance between the two may be provided by the registries. Possible indicators that therefore could be monitored to give a better indicator of quality, are reviewed.

In the next chapter, we shall consider the current situation in Ireland and recommend a series of interim proposals to quickly fulfil the critical need for a registry. A longer term series of generic proposals are also recommended. They provide a foundation to provide a more stable national data registry that can provide a balance of monitoring and publishing of quality and performance for the various user groups.

7. Chapter 7 - Proposals for an Irish AHR Data Registry

7.1. AHR Databases In Ireland

European countries are asked to submit their AHR data to the European IVF Monitoring (EIM) special interest group of ESHRE. This data is then collated and published annually. Each country has a representative on EIM who collates the data on a standard form (appendix 1). Data is provided by the national registry and if none exists, it is requested directly from the units by the representative. Data provided by the units themselves may not have been audited and validated.

Data collection has been running since 1997 (published in 2001¹⁸⁵) with the latest report covering 2002 (published in 2006⁷⁷). Ireland has been providing data to EIM since 1999, when five units operated but only three reported data for 1338 treatment cycles. In 2002, there were five units reporting data for 1912 treatment cycles. In 2006, it was estimated that there are seven units in operation carrying out approximately 2500 fresh cycles (data from IFS annual meeting, 2006).

A national data registry for AHR in Ireland does not exist. Individual units have a selection of databases that they would use for recording data. The databases are a mix of in-house, bespoke and commercial, these are illustrated in table 7-1.

AHR Unit	Location	Type
Clane Assisted Conception Unit	Clane	In-house
Cork Fertility Centre	Cork	Commercial
Galway Fertility Unit	Galway	Bespoke
Human Assisted Reproduction	Dublin	Bespoke
Kilkenny Fertility Unit	Kilkenny	In-house
Merrion Fertility Clinic	Dublin	Commercial
Sims Fertility Clinic	Dublin	Commercial

Table 7-1. Irish fertility units and type of database.

Of the seven units that currently operate in Ireland, only three publish their results: Merrion Fertility Clinic, Human Assisted Reproduction Ireland (HARI) and The Sims Clinic, all Dublin. The Merrion Fertility Clinics results are published as part of the National Maternity Hospital's annual report. HARI also publish their results as part of the Rotunda Hospital's annual report. The annual reports, although available publicly, are difficult to interpret due to the volume of other (non-AHR) information presented. HARI also publish results for 2003 on their website. However, these are based on pregnancy rate only but there is no definition of "*pregnancy rate*" included. Pregnancy rate is broken down into "*per cycle started*", "*per collection*" and "*per transfer*". There is no stratification for female age, multiple birth rate or complications.

The Sims Clinic's results for 2003-2005 are presented on their website. They are stratified by age and include a multiple pregnancy rate breakdown but do not include the number of embryos transferred.

Results for clinical pregnancy rate are given on a “*per embryo transfer*” basis only (defined as foetal heart at seven weeks). The “*per embryo transfer*” is the figure that the patient identifies with the most, being referred to as ‘*the take home baby rate*’, but it also represents the highest success rate figure for a unit. It only includes cycles that have completed an embryo transfer so excludes all other cycles which have been cancelled.

Table 7-2 indicates the AHR units in Ireland who publish their ‘success rates’.

AHR Unit	Success rates published?	Internet ?
Clane Assisted Conception Unit	No	Yes
Cork Fertility Centre	No	No
Galway Fertility Unit	No	No
Human Assisted Reproduction Ireland.	Yes, on website and as part of hospital annual report	Yes
Kilkenny Fertility Unit	No	Yes
Merrion Fertility Clinic	Yes, as part of hospital annual report	Yes
Sims Fertility Clinic	Yes, on website	Yes

Table 7-2. Irish fertility units and success rates.

7.2. Proposals for an Irish AHR Registry

For AHR in Ireland, the next few years is a critical time. The regulatory vacuum that currently exists cannot carry on indefinitely. With regulation, there will be a requirement for monitoring. If the AHR community is seen to be active in attempting to regulate and monitor itself, it can hopefully instil a degree of confidence within the public and politicians. The development of a national registry that can balance quality and performance indicators may enable an improvement in the provision of services for all and provide a basis for instilling confidence in the public.

An Irish national data registry should allow quality and performance benchmarking for the units that operate in Ireland. It should allow a system to show the units are acting responsibly and are accountable to their patients. Key components of quality management, accreditation and codes of practice could be built into the system. It is important not to let a system develop where commercialism has a stronghold and a high league table position becomes critical to a unit's success rather than the quality of service it provides for its patients. Although it is unlikely that a performance league table format would develop in Ireland, it is important to discourage such a system from the start. Instead, the development of a system where quality of care and efficacy of treatment and safety are the key parameters reported should be encouraged

The Irish Registry should be able to:

- (1) show patients they should expect a level of quality and professionalism as standard not allow itself to develop a philosophy of publishing data based solely on performance: it should be based upon the quality of clinical care patients rather than performance.
- (2) focus on improving the quality of clinical care to provide a better service to the patient.
- (3) be able to generate its own consistent national figures from a reliable source rather than relying upon sporadic and possibly inaccurate, erroneous or falsified data produced by the units.
- (4) integrate electronic data transfer techniques and Internet technologies to reduce error, decrease the time-lag for publishing data and increase the availability of the data.
- (5) help in the development of guidelines and codes of practice and change the way that AHR is funded (as in Belgium).
- (6) build and preserve confidence in AHR among patients, professionals and society by providing accurate and up-to-date data.

We cannot expect a national data registry to be created immediately so the proposals are separated into interim and long term. The introduction of an interim registry will enable the basic foundations to be laid. Standards and classifications can begin to be developed. Developing a specific registry with the capability of electronic data transfer between the AHR units' own databases and a central registry will require a longer term approach.

7.3. Interim Proposals

An interim system must be easy to set-up, low-cost, low maintenance and units must feel that they do not have to set aside large amounts of time to collate the required data. It is necessary to create a foundation for data monitoring with a view to developing a bespoke system later. Creating a specific, bespoke database system would be ineffective for a short interim period. Existing national registries were developed from paper systems whereby units completed paper forms which were then sent to the registry and entered. This created a large volume of work for both unit and registry. As the number of cycles increased the volume of work increased exponentially, as did the potential for error. Starting an Irish system like this would be a backward step. The interim registry would have to be developed on software that all units currently use.

Australia's ANZARD system utilises spreadsheets that the units complete in a six month cycle and send to NPSU for entry. The spreadsheet is then resubmitted twelve months after initial submission when outcomes are known. This system is not as effective as direct electronic data transfer would be but is more effective than submitting paper forms. The data is collected retrospectively so units could still manipulate the data. The more effective prospective system would be desirable, this would require real-time registration via a secure system (such as the UK system). In the short term, the retrospective system would be acceptable to generate reliable data for both a national report and data for the EIM report

An interim proposal for an Irish Registry would be one based upon a similar system. However, there are several difficulties that would have to be overcome before a system could be developed. The Irish Fertility Society (IFS) might provide a central role in this. Difficulties include:

- (1) The need for agreement by all units in the Republic of Ireland of the data fields to be monitored. Defining these data fields by the IFS using internationally recognised classification would be required. Duplicating (with permission) Australia's criteria's, standards and definitions and adapting them for the Ireland would accelerate this process. See table 7-3 for recommendations on a dataset.
- (2) The need for agreement by all seven units to provide data to the registry. Many of the Irish units are overstretched and underfunded. Units may not want to provide data due to the increased workload it might create. Units cannot be forced to provide data unless by a regulatory authority with legal powers of enforcement. The registry would be ineffective if only a few units were providing data. However, there is a desire to see a registry introduced in Ireland (Irish Fertility Society annual meeting, 2006).
- (3) Who would collate, interpret and publish the data? Ideally no one unit or Government department should deal with the data. Australia use an independent University based body, the Australian Institute of Health and Welfare National Perinatal Statistics Units (NPSU). Could a

similar group in Ireland provide this role? For example the Department of Public Health, Medicine and Epidemiology, University College Dublin.

- (4) Who would fund the work? Australia's registry is funded by the Fertility Society of Australia. The Irish Fertility Society would be unable to provide such funding due to the small size (780 members ¹⁶¹ to Ireland's 130). Government funding or funding from charging on a per-cycle basis (which is commonplace) might be required if funding from the IFS is unavailable. .

Table 7-3 is a recommendation for a dataset for an interim Irish registry. It is adapted from the Australia's ANZARD data registry ²⁴⁷. It would cover all AHR treatment cycles, including intra-uterine inseminations. The dataset below does not include any fields in regards to donor gamete cycles but these could be easily developed. No direct identifying information would be included and the registry would operate under strict confidential guidelines and managed indepent of HR units and government influences. However a unit, patient and cycle identifier would need to be included for tracking, validation and auditing reasons.

FIELD NAME		DESCRIPTION	NOTES	TYPE
1	UNIT	Unit identifier	Supplied by registry	NUMBER
DEMOGRAPHICS				
2	PAT_ID	Unit ID/Medical Record Number	Unique ID for this patient. Would need to be clarified by units. Recommend combination of unit and female PPS number	CHARACTER
3	FDOB	Female patient date of birth		DATE
4	PDOB	male partner date of birth		DATE
5	CYCLE_ID	Cycle ID		CHARACTER
6	CAUSE_1	Infertility Cause	Primary cause of infertility, as defined by Hull & Rutherford ²⁴⁸	CODE
7	CAUSE_2	Infertility Cause 2	Secondary cause of infertility, as defined by Hull & Rutherford ²⁴⁸	CODE
8	CAUSE_3	Infertility Cause 3	Tertiary cause of infertility, as defined by Hull & Rutherford ²⁴⁸	CODE
9	N_PPRGLES	Previous preg. < 20 wks	Include all known pregnancies less than 20 weeks in the female partner	NUMBER
10	N_PPRGMRE	Previous preg. >= 20 wks	Include all known pregnancies reaching 20 weeks	NUMBER
STIMULATION PHASE				
11	RX_TYPE	Treatment type	Treatment types would need to be defined by IFS	CODE
12	CX_TYPE	Cancellation type	Cancellation types would need to be defined by IFS	CODE
13	CX-DATE	Cancellation date	Cancellation date	DATE
14	CYC_DATE	Cycle date	Date of beginning FSH stimulation drugs.	DATE

15	TOT_DOSE	Total FSH dose	Total FSH dose irrespective if cancelled	DATE
16	OPU_DATE	OPU date	Date of oocyte pick-up, leave blank if no OPU performed	DATE
17	N_EGGS	Number of eggs retrieved	Number of eggs retrieved at OPU. Include any immature oocytes that are identified	NUMBER
18	SP_SITE	Site of sperm used	Site of sperm extraction. ejaculated, epididymal (whether by open biopsy or by PESA), testicular, bladder	CHARACTER
19	SP_PERSN	Sperm from which person	Husband/partner (h), known donor (k), Anonymous Donor (a)	CHARACTER
LABORATORY PHASE				
20	N_INSM_IVF	Number of eggs IVF inseminated	Number of eggs treated with IVF. I.e. do not count ICSI oocytes	NUMBER
21	N_INSM_ICSI	Number of eggs ICSI inseminated	Number of eggs treated with ICSI. I.e. do not count IVF oocytes	NUMBER
22	N_FERT	Number of eggs fertilized normally	Number of eggs fertilised normally. That is exhibiting two pronuclei between 16-20 hours post insemination	NUMBER
23	N_TRIP	Number of eggs fertilized abnormally	Number of eggs fertilised abnormally. That is exhibiting three or more pronuclei between 16-20 hours post insemination	NUMBER
24	N_ODEGEN	Number of eggs degenerate	Number of eggs degenerate that were inseminated	NUMBER
25	N_EDEGEN	Number of eggs degenerate	Number of embryos degenerate that were normally fertilised	NUMBER
26	ASS_HATC	Assisted hatching	Answer yes where assisted hatching in any form has been performed on any of the embryos (transferred or not).	CHARACTER
27	N_ZYGTHW	Number of fertilised oocytes thawed	Number thawed with intention of performing an embryo transfer if they survive.	NUMBER
28	N_EMBTHW	Number of cleavage embryos thawed	Number of cleavage stage embryos thawed with intention of performing an embryo transfer if they survive.	NUMBER
29	N_BLTHW	Number of blastocysts thawed	Number of blastocysts (greater than 4 days culture from fertilisation) thawed with intention of performing an embryo transfer if they survive.	NUMBER
30	ET_DATE	Embryo transfer date	Leave blank if no embryo transfer.	DATE
31	N_ZYG_ET	Number of fertilised oocytes transferred	Number of fertilised oocytes (i.e.<4 days since fertilisation) transferred	NUMBER

32	N_EMB_ET	Number of cleavage embryos transferred	Number cleavage stage embryos (i.e.<4 days since fertilisation) transferred	NUMBER
33	N_BL_ET	Number of blastocysts transferred	Number of blastocyst embryos (i.e. >4 days since fertilisation) transferred	NUMBER
34	N_ZYGFROZ	Number of frozen fertilized oocytes frozen	Number of fertilized oocytes frozen, i.e. exhibiting two pronuclei, or day-1	NUMBER
35	C_ZYGFRZ	Reason for fertilized oocyte freezing	Would need to be defined by IFS	CHARACTER
36	N_EMBFROZ	Number of cleavage stage embryos frozen	Number of zygote or cleavage stage embryos (i.e.<4 days since fertilisation) frozen	NUMBER
37	N_BLFROZ	Number of blastocysts frozen	Number of blastocyst embryos (i.e. >4 days since fertilisation) frozen	NUMBER
OUTCOME PHASE				
38	PR_CLIN	Clinical pregnancy	To be defined by IFS, but would be gestational artifacts observed at 7 week scan	CHARACTER
39	PR_END_DT	Date pregnancy ended	This is the date on which delivery, miscarriage or termination takes place.	DATE
40	N_FH	Number of fetal hearts	Number of foetal hearts seen on first ultrasound (intrauterine only)	NUMBER
41	PR_ECTOP	Ectopic pregnancy	If this pregnancy is an ectopic pregnancy, or a combined ectopic and uterine (heterotopic) pregnancy, enter "yes".	CHARACTER
42	MAT_COMP	Maternal complications of pregnancy	To be defined by IFS using international classification	CHARACTER
43	N_DELIV	Number of babies delivered after 20 weeks	Include all liveborn and stillborn babies. If N_FH (number of fetal hearts seen) > 0 this field must be completed.	NUMBER
44	CS	Caesarean delivery	Caesarean delivery planned or emergency.	CHARACTER
45	BAB1_OUT	Baby 1 outcome		CHARACTER
46	BAB1_SEX	Baby 1 sex		CHARACTER
47	BAB1_WT	Baby 1 weight		NUMBER
48	BAB1_ABN	Baby 1 abnormality	To be defined by IFS using international classification	CHARACTER
49	BAB1_NND	Baby 1 date of neonatal death		DATE
50	MORB_ADM	Admitted with ART morbidity	Admitted to hospital with any condition excluding any pregnancy-related issues, that could be in any way related to fertility treatment. e.g. OHSS, infection or	CHARACTER

			bleeding	
51	MRB_OHSS	OHSS	Cause of morbidity OHSS? , type moderate or severe	CHARACTER
52	MORB_INF	Morbidity detail	To be defined by IFS using international classification	TEXT

Table 7-3. Recommended Dataset for an Interim National Irish AHR Registry , adapted from Australia's ANZARD ²⁴⁷ .

7.4. Long-term Proposals

7.4.1. Proposal 1 – Regulation.

Registries can get units to provide data either voluntary or a regulatory authority can make it a mandatory process. A voluntary system will work well but only if all units provide data, otherwise the data becomes skewed making the data incomparable and unusable. Different systems have developed throughout Europe. Several countries have introduced registries where it is voluntary to provide data to the registry, for example in Germany there is 100% coverage of the units by the registry. Others have penalties, such as listing the units who do not provide their data, such as the US. In the UK, it is a requirement of the HFEA licence to practice to provide data and failure to do so can result in licence withdrawal, closure of the unit, large fines and possible prosecution ²⁴⁹.

A long term proposal would be the requirement of regulations indicating the mandatory monitoring and publishing of quality and performance data by all units practicing AHR. If all units were prepared to forward agreed data to an independent group, then this may be unnecessary.

7.4.2. Proposal 2 – Standardisation

Standardisation is the key to comparing quality and performance. You can only compare like with like. In an ideal world, all units would use the same procedures, media and equipment. However this is impractical, procedures and techniques are dynamic and are altered to suit their environment. If we cannot standardise procedures, we can propose that definitions and terminology are standardised. With less than ten units, this could be relatively straightforward. Datasets and the data definitions used would need to be standardised from international classification schemes and agreement through the Irish Fertility Society and the AHR units.

7.4.2.1 EIM Standard Dataset

The EIM consortium are working to define what the minimum data-set should be for an AHR database to allow for greater standardisation across Europe, however this is unlikely to be ready for several years (*personal communication*). I would recommend making full use of this data-set once available. As suggested in the interim proposals, building on existing datasets already in use, such as ANZARD, and adapting them to Irish requirements is recommended. Introduction or adaptation of guidelines used by other professional bodies, such as the (1) IVF Laboratory Standards, Association of Clinical Embryologists ²⁵⁰, (2) Fertility Guidelines, National Institute of Excellence ⁹, (3) Andrology Guidelines for Good Practice ²⁵¹. Other factors that would require standardisation before an effective registry could be developed would include:

7.4.2.2 Classification of Reproductive Pathology

Many registries, especially on a national level, will attempt to stratify performance on the infertility diagnosis. While this seems logical for patient's, to be done effectively, it requires large numbers of patient's and treatment's for the recorded data to be considered statistically relevant due to the complexity of infertility pathology. Added difficulties include different environmental and population differences, for example we cannot compare data from the Finnish population with a Spanish population, unless for epidemiological studies. Different reproductive pathologies also impact more on specific ethnic groups. As many couples have multi-factorial reason's for their inability to conceive, it becomes more difficult for the registries to successfully provide relevant and accurate data. Where the population utilises AHR in large numbers, accurate information can be correlated. A review of coding of infertility by Hull and Jenkins in 2002, broke down the multitude of infertility causes in a classification system²⁴⁸. In Ireland, with the relatively low uptake of treatment, data stratified by diagnosis could not be statistically relevant. However, adoption of these classifications by a national Irish registry is recommended so that individual unit data could be pooled and used for general reporting rather than linking to performance or quality indicators

7.4.2.3 Embryo Grading

Since the first IVF baby in the late 1970's, literally millions of embryos have been observed at every level but as of yet, there is no standard embryo grading system. With elective single embryo transfers and more efficient embryo cryopreservation programs being introduced in European centres in a bid to reduce the multiple pregnancy rate, the quality and definition of a 'good' and 'bad' embryo are becoming more relevant. If seven units are using seven different grading systems (it is more likely to be a seven variations on two or three schemes), we cannot compare embryo quality.

By developing a national embryo grading scheme, data can be pooled to illustrate which embryos have the potential to implant and develop. Selection of these embryos may lead to higher incidence of single embryo transfers and possibly a reduction in multiple births.

7.4.3. Proposal 3 – Funding

AHR in Ireland is predominantly self-funded by the patients. The current estimated cost of one cycle of AHR is €3500 - €4000 but this is likely to rise dramatically due to the implementation of the European Tissue Directive and its associated costs. Although AHR is not covered by health insurance, patients are able to indirectly reclaim AHR costs from tax on medical treatments and have their drugs funded through the drugs payment scheme (DPS). This in-direct funding of AHR is welcomed but a more direct approach is required if we are to bring about a change in the way that AHR operates in Ireland. Either having the AHR treatments fully funded by health insurance or being fully funded by government are two options. As in other comparable population sized countries such

as Denmark and Belgium, when state provision is made available under certain criteria, the uptake of AHR increases dramatically. If state funding was to be made fully available, this could remove the commercial element from AHR in Ireland. By insisting upon elective single embryo transfers if funding is made available, the costs could partially be recovered by savings made in a reduction of multiple birth overheads (such as maternal and neo-natal care). This system worked exceptionally well in Belgium^{150;252}.

7.4.4. Proposal 4 – Monitoring & Reporting

7.4.4.1 Prospective Data

The interim system proposed is based upon retrospective data collection, as used in Sweden and Australia. This system is ideal in the short-term but it does not prevent possible manipulation of data by the units themselves (intentional or unintentional). It is recommended that a prospective reporting system be developed, whereby treatment cycles are registered when the patient begins their stimulation drug regime. The US system indicates that a treatment cycle must be registered within three days of starting the stimulation drugs to be included. Paper reporting systems are being scrapped and the introduction of an electronic data interchange system is being introduced in many registries to allow for more efficient delivery of data, a reduction in data inaccuracies and a reduction of validation effort required by the registry authority. Many registries are now providing units with dedicated software, terminals and secure connections to facilitate EDI. For units with existing commercial data management systems, software suppliers can develop an interface to the registry software to provide the required data automatically, thus reducing the effort and potential for inaccuracies further. Out of the seven AHR units operating in Ireland, three have commercial data management systems (refer to table 7-1).

7.4.4.2 Personal Identification Number

The introduction of unique personal identification numbers (PIN) could allow for future cross linking with other registries. The use of PIN's in the Nordic countries is widespread, Sweden introduced a system in 1947 (known as '*personnummer*') and Finland in 1964 (*henkilötunnus*).

By being able to track the patient and their collective treatments rather than just the individual treatment cycles, would allow the development cumulative national performance rates. To facilitate this monitoring, three unique identifiers would need to be introduced for each treatment:

- (1) Unit identification. A unit identifier could be a simple digit (1-7) uniquely identifying each individual unit so that the treatment location can be recorded.
- (2) Patient identifier. A patient identifier has to be unique to the individual. The use of the personal public service number (PPS) would be recommended. The number is automatically allocated to

everyone born in Ireland since 1971 and to those who commenced or were in employment since 1979²⁵³. The legal use of the number is supported by the '*Social Welfare (Consolidation) Act, 1993 (Section 223)*'²⁵⁴ and the '*Data Protection Act 1988*'²⁵⁵. It is extensively used for public services such as education, health, housing, social welfare and tax purposes. The number is not widely used in the private sector, limited to processes that lawfully require it, such as transactions with public services where the private sector will be acting as the agent of a public body entitled to collect and retain the number.

- (3) A cycle identifier. A treatment cycle identifier would be a number related to the number of AHR treatment cycles the patient has undergone.

By using the PPS number, future integration with other registries is guaranteed.

7.4.4.3 National Reporting

As recommended in the interim proposals, an independent body would be necessary for monitoring, collating, interpreting and publishing the AHR data. To improve public confidence in AHR, employing an independent body rather than having a government department would be key. It is recommended that any monitoring and publishing of data provide a balance between the quality (the safety, risk and efficacy of the actual process) and the performance (the efficiency in producing the product of the process) of treatments provided to patients. To prevent a focus on performance developing, it is essential that an Irish national registry adopts a reporting scheme based upon publishing data only on a national basis. As in Germany and Australia, individual unit data should be made confidentially available, under strict usage guidelines, to the AHR units to allow for comparison against national data.

7.4.4.4 Internet Presence

The development of an internet website is recommended to improve the dissemination of information. Detailed information of national figures, guidelines and regulations (if any) along with individual unit information regarding staff, contact details, downloadable leaflets and forms etc., will help inform the public and maintain confidence in AHR within Ireland.

7.5. Summary of Chapter 7

This section shows that an national AHR data registry does not exist in Ireland at present. We also demonstrate either the lack of, or inconsistencies in, the reporting of data for all the units currently operating in Ireland. If data is available, it focuses primarily on the performance of the unit. The unregulated provision of AHR services cannot continue indefinitely and with regulation comes a requirement for monitoring. The interim proposals would allow for a registry to be quickly developed with a view to the retrospective recording of relevant quality and performance data. A possible dataset is suggested.

We also recommend that an independent, non-governmental body, such as the Public Health, Medicine and Epidemiology Department at University College Dublin collate, interpret and publish information relating to the quality and performance of AHR services in Ireland. Funding for the interim registry could be provided from the Irish Fertility Society and other interested parties.

Long term proposals suggested centre on the development of five key areas: regulation, standardisation, funding, monitoring and reporting.

8. Chapter 8- Conclusion

This dissertation had two main objectives: (1) to determine if assisted human reproduction national data registries accomplish a balance between the monitoring and reporting of performance and quality, and (2) to define a set of proposals for an assisted human reproduction national registry for Ireland.

In attempting to answer the first objective, it was necessary to present information relating to clinical performance data, what indicators AHR registries are currently monitoring and reporting on and what quality indicators could be used to give a better representation of the whole AHR treatment process. Background information was presented on AHR regulation in relation to registries as well as a review of several AHR registries.

I found that there is a diverse spectrum of indicators and methodology in which registries monitor and report on. No two registries are alike and their evolution was dependent upon the ethical and political status of the registries country of origin.

Performance related indicators in healthcare, often presented in a league table format to allow for comparison between similar providers, have been routinely used to measure quality for the use by the public, professionals and regulators. Their purpose was to allow for improved dissemination of information and greater choice for the public and to improve the quality of care and accountability by the providers. They are widely praised for setting standards but equally criticised for not providing an accurate measure of quality and misleading the public.

A reported problem of performance league tables is one of separating genuine quality differences from statistical artefacts. This is especially apparent in AHR data published in the UK where significant movement in a unit's league position is not associated with an equally significant positive or negative change in the unit's performance indicator (the success rate). Performance league tables can suffer from problems caused by using inappropriate data sources, the presence of case-mix, statistical variability and poor data quality.

Other reported negative issues of using data based on performance league tables in AHR is one of unintended harms arising from the process of monitoring, interpreting and reporting the data. For example: changing behaviour to gain a strategic advantage (*gaming*), aiming for average quality rather than excellence (*convergence*), data manipulation and data fraud (*misrepresentation*), obsession with short term goals (*myopia*) and bullying or intimidation of staff to improve reported performance.

Performance league table reporting systems in AHR are centred on the achieving a high success rate (performance) rather than representing the overall quality, safety, risk and efficacy of AHR treatment.

The purpose of an AHR unit is to effectively manage a couples reproductive pathology in order that they may conceive, irrespective of the eventual outcome. Not all couples may fall pregnant, even after several cycles – 50% of couples who embark on fertility treatment never conceive²⁵⁶. Studies show that 25% of patients who undergo a first IVF cycle refrain from further treatment²⁵⁷. Therefore, does publishing the unit's success rate succeed in informing the public of this? Partially, yes. It allows the public to derive a unit's performance, their efficiency, i.e. how many people delivered a live term infant of those that reached a particular stage in a cycle. But we gain no real information on a unit's quality, its efficacy or the safety aspects of the treatment, for example, if the patient had been admitted to hospital for several weeks due to OHSS or if the unit is understaffed. The success rate, however defined, only delivers a performance indicator of the unit. Use of performance indicator league tables only helps concentrate the public view that a high league position equates to good quality. The use of success rates as the sole or most important measure of quality in an IVF centre is therefore misguided¹⁴⁰.

Registries need to begin monitoring other indicators so that confidence and trust can be built and maintained amongst patients, professionals and society. This is especially important in Ireland. By publishing units performance in a manner that allows league tables to be built, possible unethical practices and manipulation of data to improve league position may be developed and encouraged (*misrepresentation*)^{2;3;6;39}. An improved league standing equates to a higher market place position. The league table format, whose early goal was to provide information so couples could make informed decisions support the commercialisation of the fertility industry. National reporting of unit specific pregnancy rates has lead to patients use of these league tables to assess what the patients believe to be a unit's quality¹⁴.

Ultimately, if a National Data Registry is to provide patients with information which is balanced, fair and holistic – the media and prospective patients will still demand success rates on a per-unit basis. It is critical that data is published on a national basis as the number of cycles that each unit in Ireland performs are too small to allow for fair statistical comparison.

Do assisted human reproduction national data registries accomplish a balance between the monitoring and reporting of performance and quality? If the national registry publishes data on a per-unit basis, whether intentional or not, it encourages a performance related environment to develop rather than a quality one. If the national registry publishes data on a national basis rather than per-unit there is less tendency for a commercial system to develop and hence the focus is on quality and a better provision of AHR for the patient.

To answer the second objective of the dissertation, to present proposals for an Irish assisted human reproduction registry, an simpler and cheaper interim system of retrospective recording of data would lay the foundation for a prospective future registry. This registry would record patient and cycle information prospectively using personal identification numbers via an electronic data interchange

system. Annual reports on a national basis, via an independent body, rather than on an individual unit format and provide an equal balance between quality and performance indicators will allow Ireland to develop an unbiased and impartial national AHR registry.

9. Appendix 1 EIM Data Sheets

European IVF monitoring (EIM) 2003

Module 0

Number and size of clinics

IVF clinics (units) in the country

	Number
Total number of clinics in the country	
Total number of clinics reporting to the National Register	

Size of the clinics.
(Based on the total annual number of IVF, ICSI, FER and ED combined)

	Number of clinics
< 100 cycles	
100 – 199 cycles	
200 - 499 cycles	
500 – 1,000 cycles	
> 1,000 cycles	

Page 2 of 8

Figure 9.1. Number and size of units.

European IVF Monitoring (EIM) 2003

Name of country

Name and full address of contact person.

Telephone

Fax

E-mail:

Please return prior to 15th of april 2006 to
ESHRE Central Office
Van Aakenstraat 41
B-1850 Grimbergen,
Belgium
Tlf : + 32 2 269 09 69
FAX : + 32 2 269 56 00
E-mail : bruno.vandeneede@ESHRE.com

Page 1 of 8

Figure 9.2. Country Details.

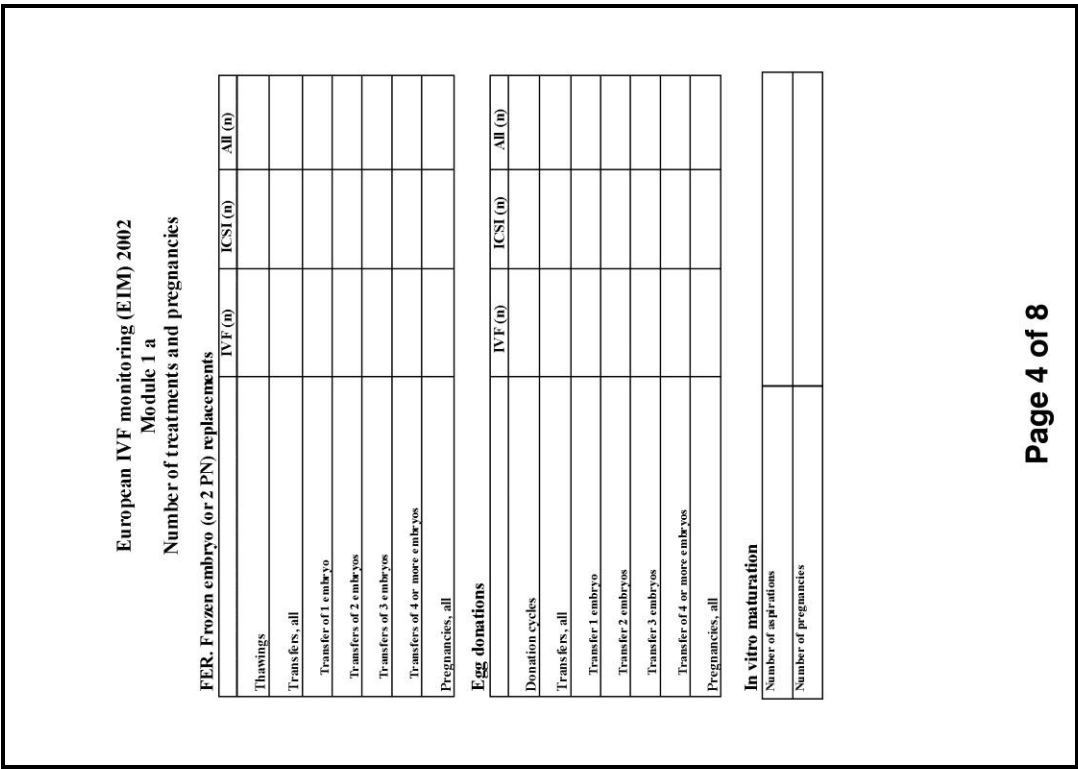


Figure 9.3. Number of treatments and pregnancies 1.

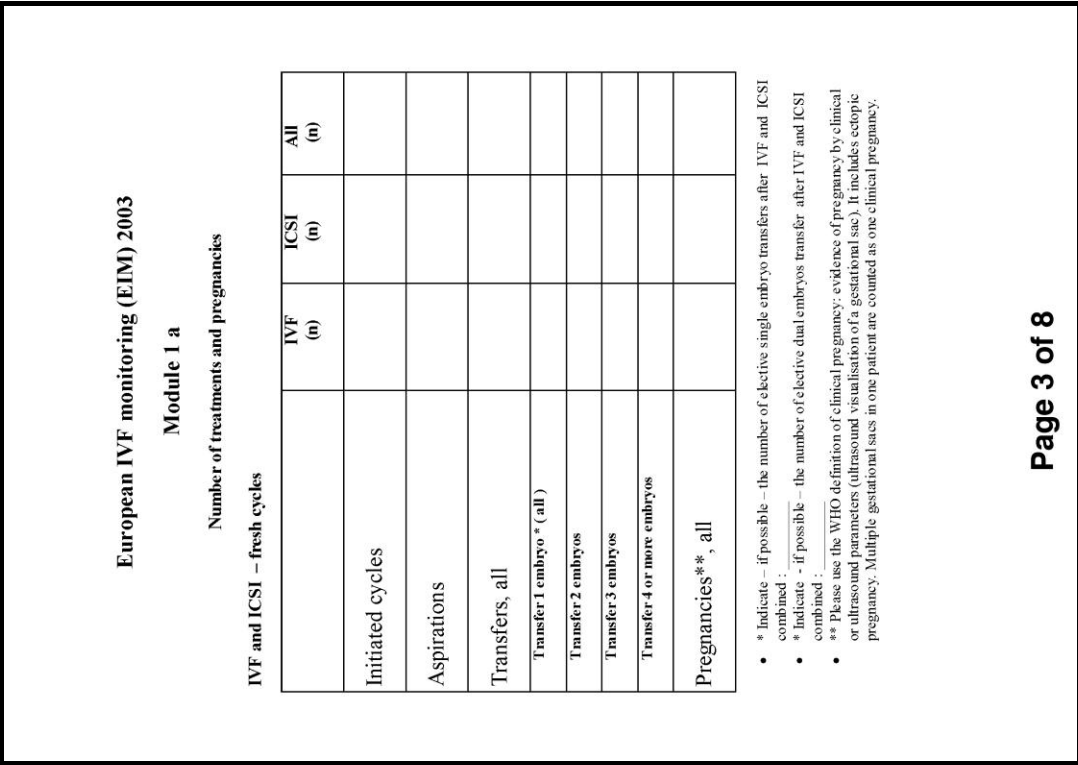


Figure 9.4. Number of treatments and pregnancies 2.

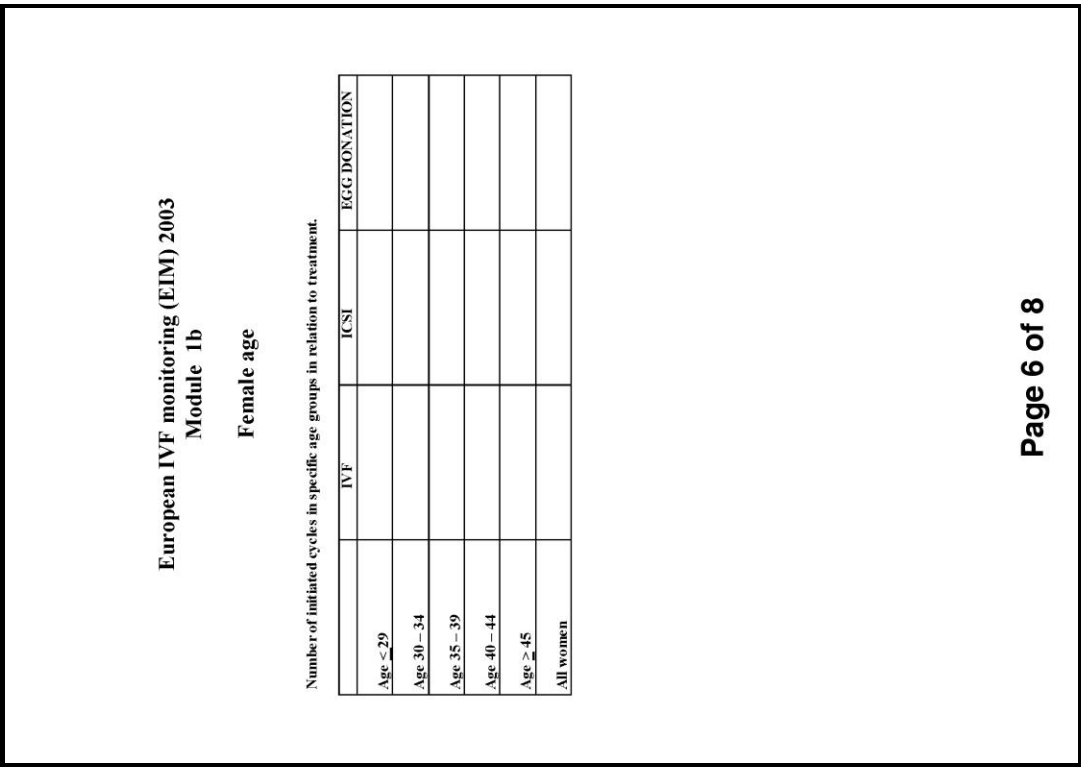


Figure 9.5. Female Age.

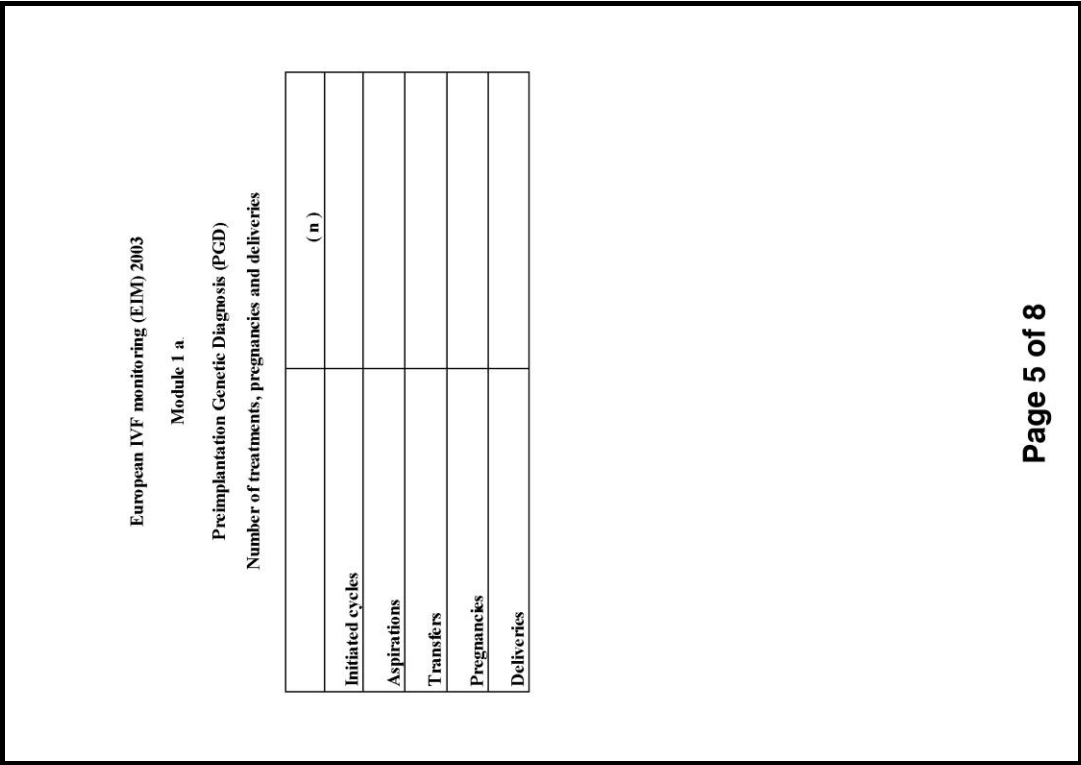


Figure 9.6. Preimplantation genetic diagnosis.

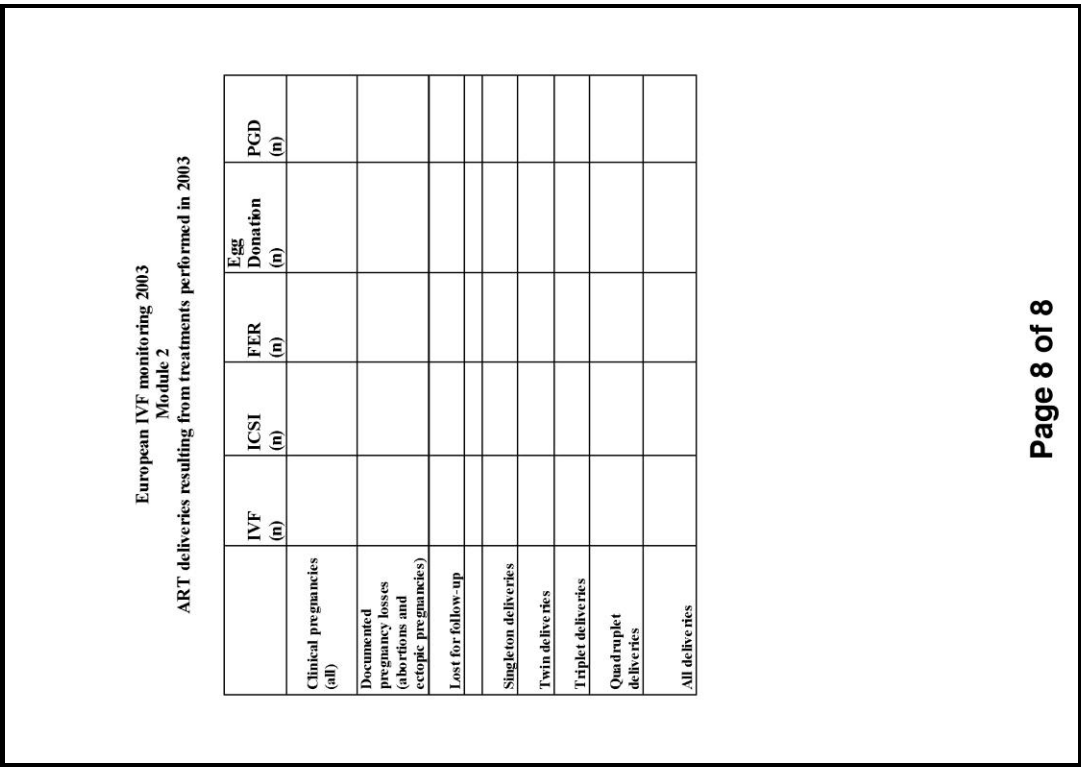


Figure 9.7. AHR deliveries resulting from treatment.

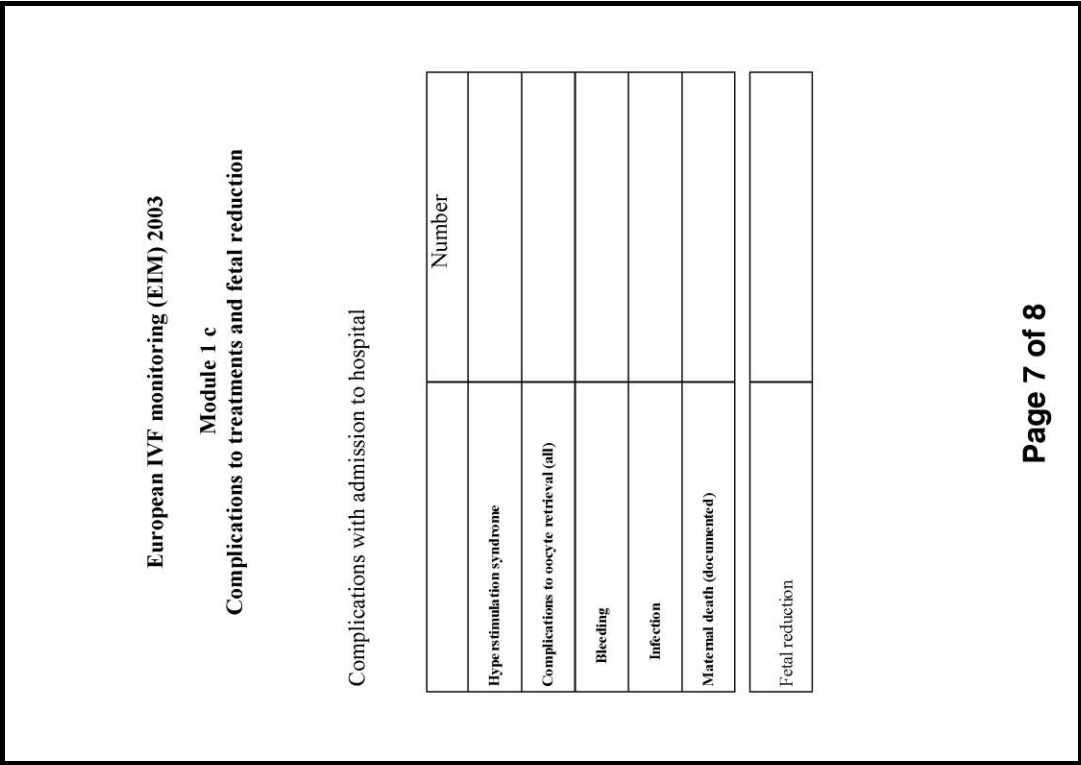


Figure 9.8. Complications & foetal reductions.

10. Appendix 2 ANZARD (Australia) Data Collection Examples

		20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
	ANZARD EXAMPLES	OpU_date	n_egg	n_donate	n_recov	n_gift	n_test	sp_persn	op_perin	rt_bort	n_rigt	ass_hate	emb_cimp	n_cihaw	n_bithaw	n_date	n_emb_d	n_emb_lst	n_cifroz	n_emb_lst	n_cifroz	n_emb_lst	n_cifroz	n_emb_lst	n_cifroz	n_emb_d	n_emb_d	n_emb_d	n_emb_d	n_emb_d	n_emb_d
	Description	OpU_date	Number of eggs	Number of eggs donated	Number of eggs recovered	Number of eggs gifted	Number of eggs tested	Type of person seen	Operation performed	Right or left?	Assisted hatching?	Precipitation	Embryo implanted?	Number of embryos transferred	Number of embryos thawed	Date of intercourse	Number of embryos donated	Number of embryos listed	Number of embryos frozen	Number of embryos listed	Number of embryos frozen	Number of embryos listed	Number of embryos frozen	Number of embryos listed	Number of embryos frozen	Date of end of pregnancy?	Number of pregnancies	Number of pregnancies	Number of pregnancies	Number of pregnancies	Number of pregnancies
	Example No.																														
1	Straightforward OPU & Transfer	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	n					
2	Natural cycle OPU	24/03/2002	02	00	00	00	02	00	e	h	01	n	n	00	00	00	26/03/2002	01	00	n	00	00	00	00	00	n					
3	OPU and transfer with blastocysts	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	29/03/2002	00	02	n	02	02	00	00	00	n					
4	OPU & transfer with ICSI & PESA	24/03/2002	12	00	00	00	12	p	h	09	n	n	n	00	00	00	26/03/2002	02	00	y	05	00	00	00	00	n					
5	OPU & Transfer with mixed IVF/ICSI	24/03/2002	12	00	00	00	06	06	e	h	09	n	n	00	00	00	26/03/2002	02	00	y	05	00	00	00	00	n					
6	Canceled cycle																														
7	No oocytes retrieved at OPU	24/03/2002	00																												
8	Failed fertilisation	24/03/2002	12	00	00	00	12	00	e	h	00			00	00																
9	OPU and transfer with blastocysts	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	n					
10	OPU & Transfer with ectopic	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	y	16/04/2002	0	y		
11	OPU & Transfer with miscarriage	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	y	16/04/2002	1	n	n	n
12	OPU & Transfer with term pregnancy	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	y	19/12/2002	1	n	n	n
13	OPU & Transfer with twins	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	y	16/04/2002	2	n	n	n
14	OPU & Transfer with OHSS	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	y	16/04/2002	1	n	n	n
15	OPU & Transfer with other complications	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	y	16/04/2002	1	n	n	n
16	FET with cleaved embryos								e	h		n	n	00	04	00	26/03/2002	02	00	n	00	00	00	00	00	y	16/04/2002	1	n	n	n
17	FET with frozen blastocyst								e	h		n	n	00	04	00	29/03/2002	00	02	n	00	00	00	00	00	y	16/04/2002	1	n	n	n
18	FET with cleaved embryos thawed and then grown to blastocyst								e	h		n	n	00	04	00	26/03/2002	00	02	n	00	00	00	00	00	y	16/04/2002	1	n	n	n
19	OPU & Transfer with PGD	24/03/2002	12	00	00	00	12	00	e	h	09	y	n	00	00	00	26/03/2002	00	02	n	02	02	00	00	00	n					
20	OPU & Transfer with Assisted Hatching	24/03/2002	12	00	00	00	12	00	e	h	09	y	y	00	00	00	29/03/2002	00	02	n	02	02	00	00	00	n					
21	IVF with oocytes donated: The donor	24/03/2002	12	12																											
22a	IVF with oocytes donated: The recipient with fresh transfer				12	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	y	16/04/2002	2	n	n	n
22b	IVF with oocytes donated: The recipient and freeze all				12	00	12	00	e	h	09	n	n	00	00	00															
22c	IVF with oocytes donated: The recipient with thaw transfer								e	h		n	n	00	02	00	26/03/2003	02	00	n	00	00	00	00	00	y	16/04/2002	2	n	n	n
23	Embryo donation													00	00	00			00	00	n	00	00	04	00						
24a	Embryo receipt with no transfer													00	00	00			00	00	n	00	00	00	00						
24b	Embryo receipt and transfer												n	04	03	00	26/03/2003	02	00	n	00	00	00	00	00	n					
25a	Embryo import into unit													04	00	00			00	00	n	00	00	00	00						
25b	Embryo export from unit													00	00	00			00	00	n	00	00	04	00						
26	Embryo disposal													00	00	00			00	00	n	00	00	00	04						
27a	Oocyte cryostorage: freeze all	24/03/2002	12	00	00	00	00	00																							
27b	Oocyte cryostorage: thaw and transfer	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	26/03/2002	02	00	n	05	00	00	00	00	n					
28	Immature oocytes with hCG treatment only and in vitro maturation.	24/03/2002	12	00	00	00	12	00	e	h	09	n	n	00	00	00	02/04/2002	02	00	n	05	00	00	00	00	n					
29	Oocyte cryopreservation																														

Figure 10.1. ANZARD data collection example.

[illegible]

Figure 10.2. ANZARD data collection example.

11. Appendix 3 SART (US) Data Collection Details

SART CORS VERSION 8 DATA COLLECTION FORMS
FORM ONE: PATIENT INFORMATION

Patient Demographic Section		Select all that apply <ul style="list-style-type: none">• American Indian or Alaska Native• Asian• Black or African American• Hispanic or Latino• Native Hawaiian or Other Pacific Islander• White• Unknown / Not Observed
Last Name: <input style="width: 150px;" type="text"/>	First Name: <input style="width: 100px;" type="text"/> MI: <input style="width: 20px;" type="text"/>	
Social Sec #: <input style="width: 100px;" type="text"/>	Ethnicity: <input style="width: 100px;" type="text"/>	
Date of Birth: <input style="width: 40px;" type="text"/> / <input style="width: 40px;" type="text"/> / <input style="width: 40px;" type="text"/>	Clinic Patient ID: <input style="width: 100px;" type="text"/>	
Partner Demographic Section		Select all that apply <ul style="list-style-type: none">• American Indian or Alaska Native• Asian• Black or African American• Hispanic or Latino• Native Hawaiian or Other Pacific Islander• White• Unknown / Not Observed
Last Name: <input style="width: 150px;" type="text"/>	First Name: <input style="width: 100px;" type="text"/> MI: <input style="width: 20px;" type="text"/>	
Sperm Donor Identity Unknown: <input type="checkbox"/>	Ethnicity: <input style="width: 100px;" type="text"/>	
Patient Residency Section		
US Resident: <input type="checkbox"/> Yes <input type="checkbox"/> No		Select all that apply <ul style="list-style-type: none">• American Indian or Alaska Native• Asian• Black or African American• Hispanic or Latino• Native Hawaiian or Other Pacific Islander• White• Unknown / Not Observed
Zip Code: <input style="width: 100px;" type="text"/>		
City: <input style="width: 100px;" type="text"/>	State: <input style="width: 30px;" type="text"/>	
Country: <input style="width: 100px;" type="text"/>		
Patient Contact Section (Optional)		
Address: <input style="width: 200px;" type="text"/>		
Home Phone: (<input style="width: 20px;" type="text"/>) - <input style="width: 100px;" type="text"/>		
Work Phone: (<input style="width: 20px;" type="text"/>) - <input style="width: 100px;" type="text"/>		

Working
Page 1

Figure 11.1. Patient information.

SART CORS VERSION 8 DATA COLLECTION FORMS
FORM TWO: PATIENT HISTORY

Couple Information Section	
Pt. Name: <input style="width: 150px;" type="text"/>	
Pt. Social Sec #: <input style="width: 80px;" type="text"/>	Date of Birth: <input style="width: 80px;" type="text"/> Partner Name: <input style="width: 100px;" type="text"/>
Clinic Index Section	
Clinic Cycle ID: <input style="width: 100px;" type="text"/>	Clinic Patient ID: <input style="width: 100px;" type="text"/>
Patient History Section	
Gravidity: <input style="width: 40px;" type="text"/>	Prior Full Term (≥ 37 wks) Births: <input style="width: 40px;" type="text"/>
Prior Preterm (< 37 wks) Births: <input style="width: 40px;" type="text"/>	Prior Spontaneous Abortions: <input style="width: 40px;" type="text"/>
Surgical Sterilization: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown	

Working
Page 2

Figure 11.2. Patient history.

SART CORS VERSION 8 DATA COLLECTION FORMS
FORM THREE: PATIENT DIAGNOSIS

Patient Name: Clinic Cycle ID:

Prior Treatment Section
 Prior Gonadotropin Cycles: Prior Frozen ART Cycles (transfers):
 Prior Fresh ART Cycles (starts):

FSH Section
 Patient Maximum FSH: mIU/ml ☐ Unknown Lab Upper Normal mIU/ml

Reason for ART Section (check all that apply)

<input type="checkbox"/> Male Infertility	<input type="checkbox"/> Tubal	<input type="checkbox"/> Uterine Factor
<input type="checkbox"/> History of Endometriosis	<input type="checkbox"/> Tubal ligation, not reversed	<input type="checkbox"/> Other
<input type="checkbox"/> Ovulation Disorders / Polycystic Ovaries PCO	<input type="checkbox"/> Hydrosalpinx (in place)	<input type="checkbox"/> Unexplained
<input type="checkbox"/> Diminished Ovarian Reserve	<input type="checkbox"/> Other tubal disease (no hydrosalpinx)	

Working
Page 3

Figure 11.3. Patient diagnosis.

SART CORS VERSION 8 DATA COLLECTION FORMS
FORM FOUR: ART TREATMENT

Patient Name: Clinic Cycle ID:

Patient Medication Section
 Cycle Start Date: Clomiphene ☐ Total mgs ☐ Agonist flare
☐ Unstimulated FSH ☐ Total IUs ☐ Agonist suppression
☐ Antagonist suppression

ART Treatment Section

Oocyte Source <input type="checkbox"/> Autologous (Patient) <input type="checkbox"/> Donor Oocyte <input type="checkbox"/> Donor Embryo	Oocyte State <input type="checkbox"/> Fresh <input type="checkbox"/> Thawed	Transfer Method <input type="checkbox"/> Transcervical (IVF) <input type="checkbox"/> Zygotes to Tubes (ZIFT) <input type="checkbox"/> Gametes to Tubes (GIFT)
---	--	--

Gestational Carrier: ☐ Embryo Banking: ☐ Approved Research: ☐

Treatment Occurred as Intended: ☐ Yes ☐ No

Cancellation and Complications Section
 Cycle Cancelled: ☐ Cycle Cancel Date: Reason Cancelled:
 Complications Related to: Hospitalization Occurred: ☐ Yes ☐ No

Select complications or none if none

<input type="checkbox"/> None	<input type="checkbox"/> Anaesthetic complication
<input type="checkbox"/> Hemorrhage requiring transfusion	<input type="checkbox"/> Psychological stress
<input type="checkbox"/> Moderate Hyperstimulation	<input type="checkbox"/> Infection
<input type="checkbox"/> Severe Hyperstimulation	<input type="checkbox"/> Death
<input type="checkbox"/> Medication side effect	<input type="checkbox"/> Other

Select one (Only) if cancelled cycle = Yes
☐ Low Response (Fresh Only)
☐ High Response (Fresh Only)
☐ Failure to Survive Thaw (Frozen Only)
☐ Inadequate Endometrial Response (Frozen Only)
☐ Concurrent Illness
☐ Withdrawal (Psychological)
☐ Withdrawal (Financial)
☐ Withdrawal (Family)
☐ Withdrawal (Other)

Working
Page 4

Figure 11.4. AHR treatment.

SART CORS VERSION 8 DATA COLLECTION FORMS
FORM FIVE: DONOR AND RETRIEVAL DATA

Patient Name: Clinic Cycle ID:

Donor Medication Section
 Donor ID #: Clomiphene: ☐ Total mgs ☐ Agonist flare
☐ Unstimulated FSH: ☐ Total IU's ☐ Agonist suppression
☐ Antagonist suppression

Retrieval Section
 Pt. Retrieval Date: Oocytes Retrieved (Pt): Embryos Thawed:
 Dnr. Retrieval Date: Oocytes Retrieved (Dnr.): Donor Shared: ☐

Andrology Section
 Sperm Source: Collection Method:

Micromanipulation Section
 ICSI: Assisted Hatching:
 PGD:

Select one

☐ Partner

☐ Donor

☐ Mixed

Select one

☐ All Mature Oocytes

☐ Some Oocytes

☐ None

Select one

☐ All Transferred Embryos

☐ Some Embryos

☐ None

Select one

☐ All Transferred Embryos

☐ Some Embryos

☐ None

Select one

☐ Ejaculation

☐ Aspiration

☐ Biopsy

☐ Electroejac.

☐ Retrograde Ejac.

Working
Page 5

Figure 11.5. Donor and retrieval data.

SART CORS VERSION 8 DATA COLLECTION FORMS
FORM SIX: TRANSFER AND OUTCOME DATA

Patient Name: Clinic Cycle ID:

Transfer Section
 Transfer Attempted: ☐ Transfer Date:
 # of Fresh Embryos to Uterus: # of Oocytes to Tubes:
 # of Fresh Embryos to Tubes: # of Fresh Embryos Cryopreserved:

Thawed Transfer Section
 # of Thawed Embryos to Uterus: # of Thawed Embryos Re-Frozen:
 # of Thawed Embryos to Tubes:

Treatment Outcome Section
 Outcome of Treatment:
 U/S Test Performed: ☐ U/S Date: Max. Fetal Hearts (on U/S):
 Therapeutic Reduction: ☐ Yes ☐ No ☐ Unk Therapeutic Reduction Date:

Select one

☐ Not Pregnant

☐ Biochemical

☐ Ectopic

☐ Clinical Intrauterine Gestation

☐ Heterotopic

☐ Unknown

Working
Page 6

Figure 11.6. Transfer and outcome data.

SART CORS VERSION 8 DATA COLLECTION FORMS
FORM SEVEN: DELIVERY INFORMATION

Patient Name: Clinic Cycle ID:

Pregnancy Outcome Section
 Outcome of Pregnancy: Date of Outcome:
 Information Source: Number Born:

Birth Section

	Live / Still	Gender	LBs/Ozs Grms Ozs Weight		Birth Defects	Neonatal Death
One:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input type="checkbox"/> Yes <input type="checkbox"/> Unk <input type="checkbox"/> No
Two:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input type="checkbox"/> Yes <input type="checkbox"/> Unk <input type="checkbox"/> No
Three:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input type="checkbox"/> Yes <input type="checkbox"/> Unk <input type="checkbox"/> No
Four:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input type="checkbox"/> Yes <input type="checkbox"/> Unk <input type="checkbox"/> No
Five:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input type="checkbox"/> Yes <input type="checkbox"/> Unk <input type="checkbox"/> No
Six:	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 40px;" type="text"/>	<input style="width: 100px;" type="text"/>	<input type="checkbox"/> Yes <input type="checkbox"/> Unk <input type="checkbox"/> No

Legend:

- Only required for cycle starts after 12/31/2002
F for Female
S for Stillbirth
Or
Unk for Unknown
- L for Live Birth
or
S for Stillbirth

Select one

- ☐ Livebirth
- ☐ Stillbirth
- ☐ Spontaneous Abortion
- ☐ Therapeutic Abortion
- ☐ Maternal Death Prior to Birth
- ☐ Outcome Unknown

Select one

- ☐ Patient (verbal only)
- ☐ Patient (written)
- ☐ Attending physician or hospital (verbal only)
- ☐ Attending physician or hospital (written)

Indicate all that apply for each infant born

- ☐ None or Unknown, or
- ☐ Genetic Defect
- ☐ Cleft Lip or Palate
- ☐ Neural Tube Defect
- ☐ Cardiac Defect
- ☐ Limb Defect
- ☐ Other Defect

Pounds in this box

Ounces or grams in this box

Working
Page 7

Figure 11.7. Delivery information.

12. Appendix 4 HFEA (UK) Data Forms

HUMAN FERTILISATION AND EMBRYOLOGY AUTHORITY

PLEASE WRITE CLEARLY IN BLACK INK USING BLOCK CAPITALS

Female Patient Registration Centre: Form R

1. This form.* ☐ Is registering a new patient ☐ Replaces all details previously registered ☐
To replace or correct a previous form, complete section 2 and all relevant sections ☐ Corrects or changes details already registered ☐
2. This form is notifying corrections to form R (if applicable)

3. Form completed on day month year

A Donor Information Form must also be submitted for Egg Donors

4. Female Patient No. Person HFEA ID (if known)
Previous Patient No. (if changed) Donor No. (if applicable)
Current Forename(s)
Current Surname
Surname at birth (if different from current)
Date of Birth: day month year
Town or district of birth
Country of birth
NHS Number for UK resident (if known)
OR Passport/ID Card Number
Country of issue

5. Patient ethnic group Please see guidance notes for current list of ethnicity codes

6. This patient* ☐ Currently has a partner ☐ - please complete a Partner Registration Form
☐ Is currently without a partner ☐

7. Patient/Donor Previous Obstetric History
Total no. of previous spontaneous pregnancies Total no. of live births
Total no. of previous IVF pregnancies Total no. of IVF live births
Total no. of previous DI pregnancies Total no. of DI live births

8. Cause of infertility (more than one may apply) *
Tubal Disorders ☐ Endometriosis ☐ Uterine problems ☐ Menopausal ☐
Ovulatory disorder (inc. PCO) ☐ Ovarian failure ☐ Other endocrine disorder ☐ Genetic disorder ☐
No male partner ☐ Same sex partner ☐ Unexplained ☐ Other ☐

9. Last UK clinic for a new patient/donor treated elsewhere (if known)

v2005 * Tick as applicable

Figure 12.1. Female Patient Registration.

HUMAN FERTILISATION AND EMBRYOLOGY AUTHORITY

PLEASE WRITE CLEARLY IN BLACK INK USING BLOCK CAPITALS

Partner Registration Centre: Form P

1. This form.* ☐ Is registering a new partner ☐ Replaces all details previously registered ☐
To replace or correct a previous form, complete section 2 and all relevant sections ☐ Corrects or changes details already registered ☐
2. This form is notifying corrections to form P (if applicable)

3. Form completed on day month year

A Donor Information Form must also be submitted for Sperm Donors

4. Partner No. Person HFEA ID (if known)
Previous Partner No. (if changed) Donor No. (if applicable)
Current Forename(s)
Current Surname
Surname at birth (if different from current)
Date of Birth: day month year
Sex* Male ☐ Female ☐
Town or district of birth
Country of birth
NHS Number for UK resident (if known)
OR Passport/ID Card Number
Country of issue

5. Partner ethnic group Please see guidance notes for current list of ethnicity codes

6. Cause of male infertility (more than one may apply) *
None - female infertility ☐
Semen Problems ☐
Antisperm antibodies (sperm inhibited) ☐
Azoospermia (no sperm) ☐
Oligospermia (low sperm count) ☐

7. Last UK clinic for a partner previously registered elsewhere (if known)

8. This person is the current partner for female Patient No.
Patients Current Surname

v2005 * Tick as applicable

Figure 12.2. Partner Registration.

PLEASE WRITE CLEARLY IN BLACK INK USING BLOCK CAPITALS

NHS FERTILISATION & EMBRYOLOGY AUTHORITY

IVF Treatment & Embryo Creation/Use Centre: Form **T**

1. This form: * Is recording a new treatment ☐ Replaces all details previously supplied ☐
To replace or correct a previous form, complete section 2 and all relevant sections ☐ Corrects or changes details already supplied ☐

2. This form is notifying corrections to/replaces form **T**

3. Form completed on day month year

4. Patient number (or Donor number for egg collection only)
Patient or Donor No. HFEA ID (if known)

Patient Surname

5. Is this patient a surrogate? * No ☐ Yes ☐

6. Donor sperm from Centre: ☐ Sperm Donor Number
Was this sperm imported into the UK? * No ☐ Yes ☐

If yes, what was the associated Special Direction reference?

7. Donor eggs from Centre: ☐ Egg Donor Number
Were these eggs imported into the UK? * No ☐ Yes ☐

If yes, what was the associated Special Direction reference?

8. If donated or stored embryos are being used enter the embryo creation form number.
OR
If donated eggs are being used enter the egg collection/storage form number.
T

9. NHS Funded Treatment Cycle? * No ☐ Yes ☐ If yes, give name of commissioning organisation

10. Stimulation type: * None (natural cycle) ☐ Gonadotrophins ☐ Anti-Oestrogens ☐
Date of last menstrual period (natural cycle) or Drug Administration day month year

Please complete sections 11 and 12 if the patients own eggs are being collected or used.

11. Main reason for intending to produce embryos and/or collecting eggs *
Immediate Patient Treatment ☐ For Research ☐ For Donation ☐
For storing eggs ☐ For storing embryos ☐
Reason for egg/embryo storage* Acute medical treatment ☐ Premature Menopause ☐ Non-medical ☐

12a. Egg collection was abandoned: *
Reason:- Converted to IUI ☐ Female factors ☐ Risk of OHSS ☐ Other ☐

12b. Egg collection was attempted.
Number of eggs collected Egg collection day month year
If no eggs were collected, was this due to a poor response to drugs? * Yes ☐ No ☐

13. Outcome of eggs collected from the patient/donor - total number:
Mixed/Injected Discarded Stored for future use by the patient
Donated for use in Research Donated for use in Treatment

v2005 EDI * Tick as applicable

Figure 12.3. IVF Treatment & Embryo Creation/Use (page 1) .

PLEASE WRITE CLEARLY IN BLACK INK USING BLOCK CAPITALS

NHS FERTILISATION & EMBRYOLOGY AUTHORITY

IVF Treatment & Embryo Creation/Use Centre: Form **T**

14a. FRESH EGGS TABLE
Fresh eggs mixing: day month year

Line	Fresh eggs from (Patient/Donor)	Treatment Type (IVF, ICSI or (Partner/Donor) GIFT)	Sperm from (Partner/Donor)	Number of Embryos Developed
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

14b. PREVIOUSLY FROZEN EGGS TABLE
Frozen eggs mixing: day month year

Line	Frozen Eggs (Patient/Donor)	Treatment Type (IVF, ICSI or (Partner/Donor) GIFT)	Sperm from (Partner/Donor)	Number of Eggs Thawed	Number of Embryos Developed
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

14c. EMBRYOS CREATION & USE TABLE
Embryo(s) traw: day month year
Please don't include fresh & frozen embryos on the same line

Line	Number of embryos from above	Frozen embryos (Donor)	Number of embryos thawed (Donor)	Screening type (PGS/PGD/HLA)	Assisted hatching technique	No. embryos transferred to patient	Elective single embryo transfer?	No. of embryos discarded
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Embryo transfer: day month year

14d. EGG(S) STORAGE/DONATION TABLE
Egg Freezing/Donation: day month year

14e. EMBRYOS STORAGE/DONATION TABLE
Embryo(s) freezing/Donation: day month year

Line	Number of embryos stored for patient use	No. embryos being stored for patient use	Dev. Stage ZPN	No. embryos donated for research
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Figure 12.4. IVF Treatment & Embryo Creation/Use (page 2) .

PLEASE WRITE CLEARLY IN BLACK INK USING BLOCK CAPITALS

IVF Treatment & Embryo Creation/Use (Page 3)

Centre: Form T

15. Reason why no embryos were transferred if embryos were developed and/or available after thawing*

Risk of OHSS ☐ Abnormal development ☐ As a result of positive genetic test ☐ Failed thaw ☐ Other ☐

v2005 EDI

* Tick as applicable

Figure 12.5. IVF Treatment & Embryo Creation/Use (page 3) .

PLEASE WRITE CLEARLY IN BLACK INK USING BLOCK CAPITALS

Pregnancy Outcome

Centre: Form O

1. This form: * ☐ Is reporting a new outcome ☐ Replaces all details previously supplied ☐ For corrections/changes complete section 2 and all relevant sections below.

2. This form is notifying corrections to/replaces form O

3. Form completed on: day month year

4. Patient No. Patient HFEA ID (if known)

Patient Surname

5. This form is reporting additional fetal hearts to those recorded on form O

6. This outcome is a result of the following treatment type: * IVF ☐ Donor Insemination ☐

Date of successful treatment cycle to which outcome relates: day month year

7. Number of gestational sacs with detected fetal pulsation

8. Lost to follow up * ☐ Reason

	Fetal Heart 1	Fetal Heart 2	Fetal Heart 3
9. Pregnancy outcome * Fetal Heart 1			
Gestation weeks <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Miscarriage * <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ectopic pregnancy * <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Termination * <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reason <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Embryo reduction * <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reason <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Baby born	Baby 1	Baby 2	Baby 3
Live Birth * <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Still Birth * <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neonatal Death * <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Weight (grams) <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sex * M <input type="checkbox"/> F <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Delivery: dd <input type="text"/> mm <input type="text"/> yyyy <input type="text"/>	dd <input type="text"/> mm <input type="text"/> yyyy <input type="text"/>	dd <input type="text"/> mm <input type="text"/> yyyy <input type="text"/>	dd <input type="text"/> mm <input type="text"/> yyyy <input type="text"/>
NHS Number <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
11. Baby's forename(s) <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Registered surname <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
12. Congenital abnormalities (if present)			
<input type="checkbox"/> No anomaly observed *	<input type="checkbox"/> No anomaly observed	<input type="checkbox"/> No anomaly observed	<input type="checkbox"/> No anomaly observed
<input type="checkbox"/> Uncertain - further review required *	<input type="checkbox"/> Further review required	<input type="checkbox"/> Further review required	<input type="checkbox"/> Further review required
<input type="checkbox"/> Yes - anomaly observed *	<input type="checkbox"/> Yes - anomaly observed	<input type="checkbox"/> Yes - anomaly observed	<input type="checkbox"/> Yes - anomaly observed
13. Baby's Town of birth <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Country of birth <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

v2004

* Tick as applicable

Figure 12.6. Pregnancy Outcome.

13. Appendix 5 Examples of AHR Unit Reports

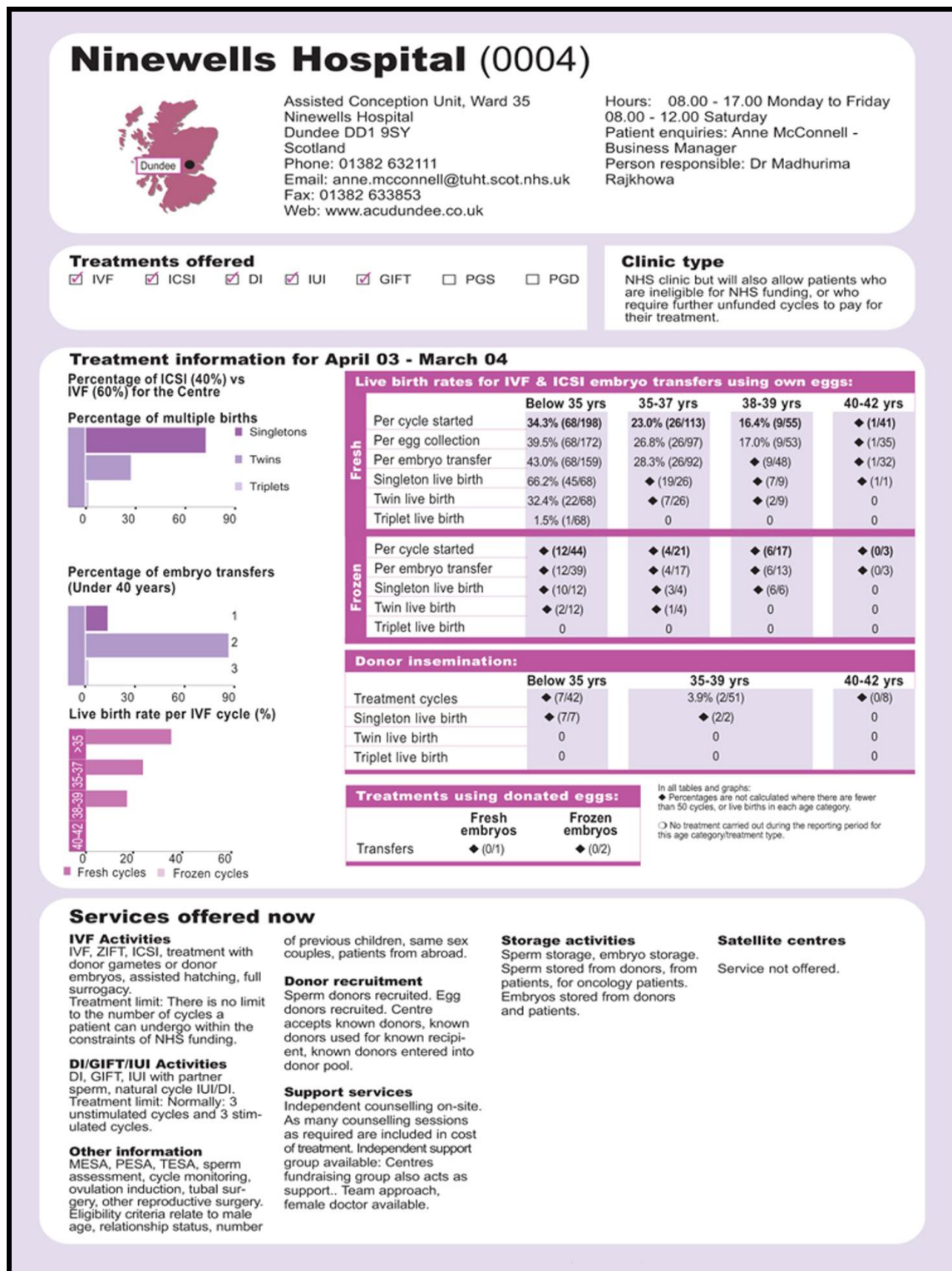


Figure 13.1. Example of unit information from the UK registry.



Boston IVF Waltham, MA

Clinic Summary Report

Print

Close

Year: 2004

All Treatment Types

Treatment Type	Procedure Frequency	Diagnosis Frequency
IVF	>99% ICSI 33%	Tubal factor 9% Other factor 33%
GIFT	<1% Unstimulated 1%	Ovulatory dysfunction 0% Unknown factor 27%
		Diminished ovarian reserve 0% Multiple factors
		Endometriosis 4% Female only 4%
		Uterine factor 2% Female and male 6%
		Male factor 15%

Data Verified by: Michael M. Alper, MD

Hide 43-44

Fresh Embryos From Non-Donor Oocytes	<35	35-37	38-40	41-42	43-44
Number of cycles	940	630	686	279	137
Percentage of cycles resulting in pregnancies	33.0	31.0	24.3	15.4	5.8
Percentage of cycles resulting in live births	28.7	24.9	18.8	9.3	4.4
(Reliability Range)	(25.8 - 31.6)	(21.5 - 28.3)	(15.9 - 21.7)	(5.9 - 12.7)	(1.0 - 7.8)
Percentage of retrievals resulting in live births	30.1	27.3	21.9	11.5	5.6
Percentage of transfers resulting in live births	32.1	29.1	23.5	13.0	6.7
Percentage of cycles with elective single embryo transfer	2.4	0.7	0.5	0	0
Percentage of cancellations	4.6	8.6	14.0	18.6	21.2
Implantation rate	22.9	19.8	13.0	7.2	2.4
Average number of embryos transferred	2.2	2.3	2.9	3.1	3.7
Percentage of pregnancies with twins	33.2	28.2	21.0	20.9	2 / 8
Percentage of pregnancies with triplets or more	2.3	4.1	6.6	2.3	0 / 8

Thawed Embryos From Non-Donor Oocytes	<35	35-37	38-40	41-42	43-44
Number of transfers	185	87	65	20	8
Percentage of transfers resulting in live births	26.5	27.6	26.2	10.0	4 / 8
Average number of embryos transferred	2.1	2.1	2.4	2.0	2.5

Donor Oocytes (all ages)	Fresh Embryos	Thawed Embryos
Number of transfers	144	106
Percentage of transfers resulting in live births	43.1	27.4
Average number of embryos transferred	2.0	2.1

Current Clinic Services and Profile

Current Name:	Boston IVF				
Donor egg?	yes	Gestational carriers?	yes	SART Member?	yes
Donor embryo?	no	Cryopreservation?	yes	Verified lab accreditation?	yes
Single Women?	yes				

Caution: Patient characteristics vary among programs; therefore, these data should not be used for comparing clinics.

© Copyright 2005 RSTI, Inc and OPRG, LLC NY, NY All Rights Reserved.

Figure 13.2. Examples of unit information from the US registry.

14. References

- (1) Report of The Commission on Assisted Human Reproduction. 2005. Department of Health and Children.
- (2) Sharif K, Afnan M. The IVF league tables: time for a reality check. *Hum Reprod* 2003; 18(3):483-485.
- (3) Westphal SP. IVF league tables encourage bad practice. *New Scientist* [2002 Available from :<http://www.newscientist.com/article/dn2523.html>
- (4) Faber K. IVF in the US: multiple gestation, economic competition, and the necessity of excess. *Hum Reprod* 1997; 12(8): 1614-1616.
- (5) Wheldon J. Revealed: Gulf in success rates of IVF clinics. *Daily Mail* [2005 Available from :http://www.dailymail.co.uk/pages/live/articles/health/womenfamily.html?In_article_id=349759&in_page_id=1799
- (6) Winston R. League tables of in vitro fertilisation clinics misinform patients. *BMJ* 1998; 317(7172):1593.
- (7) Mounting cost of IVF is pricing out the poor. *Daily Mail* 2006 Mar 23.
- (8) Spar DL. A Cluster of Cells. *The Baby Business*. Harvard Business School Publishing; 2006. 31-68.
- (9) National Institute for Clinical Excellence. CG11 Fertility - Full guideline. 2004.
- (10) Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Internet [2001 Available from :<http://www.nap.edu/catalog/10027.html>; <http://www.iom.edu/?id=12736>
- (11) Davila F. What is an acceptable and specific definition of quality health care? 2. *Proc (Bayl Univ Med Cent)* 2002; 15(1):84-85.
- (12) British Medical Association. Clinical Indicators (League Tables) - Discussion Document. 2000. London, British Medical Association.
- (13) International variation in Assisted Reproduction Technology practice and data collection. 2005.
- (14) Lass A, Brinsden P. How do patients choose private in vitro fertilization treatment? A customer survey in a tertiary fertility centre in the United Kingdom. *Fertil Steril* 2001; 75(5):893-897.
- (15) Marcus HJ, Marcus DM, Marcus SF. How do infertile couples choose their IVF centres? An Internet-based survey. *Fertil Steril* 2005; 83(3):779-781.
- (16) Davies HTO. Public release of performance data and quality improvement: internal responses to external data by US healthcare providers. *Qual Health Care* 2001; 10:104-110.
- (17) Mennemeyer ST, Morrissey MA, Howard LZ. Death and reputation: how consumers acted upon HCFA mortality. *Inquiry* 1997; 34:117-128.
- (18) Marshall MN, Shekelle PG, Brook RH, Leatherman S. Public reporting of performance data: lessons from the USA. *J Health Services Research and Policy* 2000; 5:1-2.
- (19) Luce JM, Thiel GD, Holland MR, Swig L, Curran SA, Luft HS. Use of risk adjusted outcome data for quality improvement by public hospitals. *J Med* 1996; 164(5):410-414.

-
- (20) Marshall MN, Davies HTO. Public release of information on the quality of care: how are health services and the public expected to respond. *J Health Services Research and Policy* 2001; 6(3):158-162.
 - (21) Baker DW, Einstadler D, Thomas CM. Mortality trends during a program that publicly reported hospital performance. *Med Care* 2002; 40(10):879-890.
 - (22) Schneider EC, Epstein AM. Use of public performance reports: a survey of patients undergoing cardiac surgery. *JAMA* 1998; 279:1638-1642.
 - (23) Schneider EC, Lieberman T. Publicly disclosed information about the quality of health care: response of the US public. *Qual Health Care* 2001; 10:96-103.
 - (24) Broder MS, Payne-Simon L, Brook RH. Measures of surgical quality: what will patients know in 2005? *BMJ* 2004; 328:152-153.
 - (25) Schneider EC, Epstein AM. Influence of cardiac surgery performance reports on referral practices and access to care: a survey of cardiovascular specialists. *New England Journal of Medicine* 1996; 335:251-256.
 - (26) Goldstein H, Myers K. Freedom of information: towards a code of ethics for performance indicators. 2005. Institute of Education.
 - (27) Goldstein H. Using pupil performance data for judging schools and teachers: scope and limitations. 2001. Institute of Education.
 - (28) Goldstein H. Assessing the performance of schools: limits and league tables. 2005. Institute of Education.
 - (29) Goldstein H. League tables and schooling. 2005. Institute of Education.
 - (30) Goldstein H, Spiegelhalter DJ. League tables and their limitations: statistical issues in comparisons of institutional performance. 2005. Institute of Education, MRC Biostatistics Unit.
 - (31) Kupka MS, Dorn C, Richter O, Felberbaum R, van d, V. Impact of reproductive history on in vitro fertilization and intracytoplasmic sperm injection outcome: evidence from the German IVF Registry
1. *Fertil Steril* 2003; 80(3):508-516.
 - (32) Kallen B, Finnstrom O, Nygren KG, Olausson PO. In vitro fertilization (IVF) in Sweden: risk for congenital malformations after different IVF methods
4. *Birth Defects Res A Clin Mol Teratol* 2005; 73(3):162-169.
 - (33) Kallen B, Finnstrom O, Nygren KG, Olausson PO. In vitro fertilization (IVF) in Sweden: infant outcome after different IVF fertilization methods
2. *Fertil Steril* 2005; 84(3):611-617.
 - (34) Nyboe AA, Erb K. Register data on Assisted Reproductive Technology (ART) in Europe including a detailed description of ART in Denmark
1. *Int J Androl* 2006; 29(1):12-16.
 - (35) Andersen AN, Westergaard HB, Olsen J. The Danish in vitro fertilisation (IVF) register
3. *Dan Med Bull* 1999; 46(4):357-360.
 - (36) Gissler M, Klemetti R, Sevon T, Hemminki E. Monitoring of IVF birth outcomes in Finland: a data quality study
7. *BMC Med Inform Decis Mak* 2004; 4:3.

-
- (37) Tiitinen A, Gissler M. Effect of in vitro fertilization practices on multiple pregnancy rates in Finland
3. Fertil Steril 2004; 82(6):1689-1690.
- (38) Gissler M, Louhiala P, Hemminki E. Nordic Medical Birth Registers in epidemiological research
3. Eur J Epidemiol 1997; 13(2):169-175.
- (39) Marshall EC, Spiegelhalter DJ. Reliability of league tables of in vitro fertilisation clinics: retrospective analysis of live birth rates. BMJ 1998; 316(7146):1701-1704.
- (40) W.H.O. WHO definition of health. Official Records of the World Health Organisation [1998 [cited 1 A.D. Aug. 23]; 2:[100]Available from
:http://www.who.int/m/topicgroups/who_organization/en/index.html
- (41) Templeton A. Infertility-epidemiology, aetiology and effective management. Health Bull (Edinb) 1995; 53(5):294-298.
- (42) R.C.O.G. Evidence-based Fertility Treatment. 1 ed. London: RCOG Press; 1998.
- (43) Beltsos AN, Fisher S, Uhler ML, Clegg ED, Zinaman M. The relationship of the postcoital test and semen characteristics to pregnancy rates in 200 presumed fertile couples. Int J Fertil Menopausal Stud 41(4):405-411.
- (44) Van Balen F, Verdurmen JE, Ketting E. Age, the desire to have a child and cumulative pregnancy rate. Hum Reprod 1997; 12(3):623-627.
- (45) Stovall DW, Toma SK, Hammond MG, Talbert LM. The effect of age on female fecundity. Obstet Gynecol 1991; 77(1):33-36.
- (46) DeCherney AH, Berkowitz GS. Female fecundity and age. N Engl J Med 1982; 306(7):424-426.
- (47) Royburt M, Avrech O, Fisch B. Age related decline in female fertility--factors? Fertil Steril 1994; 62(5):1092-1094.
- (48) Frank O, Bianchi PG, Campana A. The end of fertility: age, fecundity and fecundability in women. J Biosoc Sci 1994; 26(3):349-368.
- (49) Martin SP. Diverging fertility among U.S. women who delay childbearing past age 30. Demography 2000; 37(4):523-533.
- (50) European Union. Directive 2004/23/EC. Internet [2006 Available from
:http://europa.eu.int/eur-lex/pri/en/oj/dat/2004/l_102/l_10220040407en00480058.pdf
- (51) Select Committee on Science and Technology. Regulation of assisted reproduction - Warnock Committee. Internet [2005 Available from
:<http://www.publications.parliament.uk/pa/cm200405/cmselect/cmstech/7/704.htm>
- (52) Office of Public Sector Information. Human Fertilisation and Embryology Act 1990. Internet [2000 Available from
:http://www.opsi.gov.uk/acts/acts1990/Ukpga_19900037_en_2.htm#mdiv5
- (53) Wikipedia. Roe v. Wade. Internet [2006 Available from
:http://en.wikipedia.org/wiki/Roe_v._Wade
- (54) Wikipedia. Cecil Jacobson. Internet [2006 Available from
:http://en.wikipedia.org/wiki/Cecil_Jacobson
-

-
- (55) Centre for Diseases Control and Prevention. Fertility Clinic Success Rate and Certification Act. Pub. L. 102-493, 42 U.S.C. 263a-1 et seq. 1992.
- (56) Chang WY, DeCherney AH. History of regulation of assisted reproductive technology (ART) in the USA: a work in progress
2. Hum Fertil (Camb) 2003; 6(2):64-70.
- (57) International Council on Infertility Information Dissemination (INCIID). A History of IVF Statistics. Internet [2004 Available from
:<http://www.inciid.org/article.php?cat=advocacy&id=229>
- (58) DeCherney AH, Werlin L. IVF Registry and Validation: The U.S. Experience. Internet [2003 Available from :<http://www.resolvecolorado.org/resources/articles/3/>
- (59) The President's Council on Bioethics. Reproduction and Responsibility: The Regulation of New Biotechnologies. Internet [2004 Available from
:http://www.bioethics.gov/reports/reproductionandresponsibility/chapter2.html#_edn95
- (60) Chang WY, DeCherney AH. History of regulation of assisted reproductive technology (ART) in the USA: a work in progress Hum Fertil (Camb) 2003; 6(2):64-70.
- (61) Irish Medical Council. A Guide to Ethical Conduct and Behaviour. 2004.
- (62) Min JK, Breheny SA, MacLachlan V, Healy DL. What is the most relevant standard of success in assisted reproduction? The singleton, term gestation, live birth rate per cycle initiated: the BESST endpoint for assisted reproduction. Hum Reprod 2004; 19(1):3-7.
- (63) Healy D. Damaged babies from assisted reproductive technologies: focus on the BESST (birth emphasizing a successful singleton at term) outcome. Fertil Steril 2004; 81(3):512-3, discussion.
- (64) Westphal SP. The BESST way to judge the success of IVF clinics. New Sci 2004; 181(2430):7.
- (65) Davies MJ, Wang JX, Norman RJ. What is the most relevant standard of success in assisted reproduction? Assessing the BESST index for reproduction treatment. Hum Reprod 2004; 19(5):1049-1051.
- (66) Griesinger G, Dafopoulos K, Schultze-Mosgau A, Felberbaum R, Diedrich K. What is the most relevant standard of success in assisted reproduction? Is BESST (birth emphasizing a successful singleton at term) truly the best? Hum Reprod 2004; 19(6):1239-1241.
- (67) Messinis IE, Domali E. What is the most relevant standard of success in assisted reproduction? Should BESST really be the primary endpoint for assisted reproduction? Hum Reprod 2004; 19(9):1933-1935.
- (68) Wennerholm UB, Bergh C. What is the most relevant standard of success in assisted reproduction? Singleton live births should also include preterm births. Hum Reprod 2004; 19(9):1943-1945.
- (69) Nyboe AA, Gianaroli L, Felberbaum R, de MJ, Nygren KG. Assisted reproductive technology in Europe, 2001. Results generated from European registers by ESHRE. Hum Reprod 2005; 20(5):1158-1176.
- (70) Marshall MN, Hiscock J, Sibbald B. Attitudes to the public release of comparative information on the quality of general practice care: qualitative study. BMJ 2002; 325.
- (71) Spar DL. The Quest to Conceive - Attacking An Ancient Affliction. The Baby Business. Harvard Business School Press; 2006. 1-30.

-
- (72) Nygren KG, Andersen AN. Assisted reproductive technology in Europe, 1997. Results generated from European registers by ESHRE. European IVF-Monitoring Programme (EIM), for the European Society of Human Reproduction and Embryology (ESHRE). Hum Reprod 2001; 16(2):384-391.
- (73) Nygren KG, Andersen AN. Assisted reproductive technology in Europe, 1998. Results generated from European registers by ESHRE. European Society of Human Reproduction and Embryology. Hum Reprod 2001; 16(11):2459-2471.
- (74) Nygren KG, Andersen AN. Assisted reproductive technology in Europe, 1999. Results generated from European registers by ESHRE. Hum Reprod 2002; 17(12):3260-3274.
- (75) Nyboe AA, Gianaroli L, Nygren KG. Assisted reproductive technology in Europe, 2000. Results generated from European registers by ESHRE. Hum Reprod 2004; 19(3):490-503.
- (76) Andersen AN, Gianaroli L, Felberbaum R, de MJ, Nygren KG. Assisted reproductive technology in Europe, 2001. Results generated from European registers by ESHRE. Hum Reprod 2005; 20(5):1158-1176.
- (77) Nyboe AA, Gianaroli L, Felberbaum R, de MJ, Nygren KG. Assisted reproductive technology in Europe, 2002. Results generated from European registers by ESHRE. Hum Reprod 2006.
- (78) Spar DL. A Cluster of Cells - Mechanics of the Modern Fertility Market. The Baby Business. Harvard Business School Press; 2006. 31-68.
- (79) BBC News. More than 3m babies born from IVF. Internet [2006 Available from :<http://news.bbc.co.uk/2/hi/health/5101684.stm>
- (80) Human Fertilisation and Embryology Authority. Human Fertilisation and Embryology Authority Eighth Annual Report and Accounts. 1999. London, Her Majesty's Stationary Office.
- (81) Centre for Diseases Control and Prevention. Assisted Reproductive Technology Success Rates 1998 - National Summary and Fertility Clinic Reports. 2000.
- (82) Centre for Diseases Control and Prevention. Assisted Reproductive Technology Success Rates 2003 - National Summary and Fertility Clinic Reports. 2005.
- (83) Assisted reproductive technology in Europe, 2002. Results generated from European registers by ESHRE. Hum Reprod 2006.
- (84) Katz P, Nachtigall R, Showstack J. The economic impact of the assisted reproductive technologies. Nat Cell Biol 2002; 4 Suppl:s29-s32.
- (85) National Perinatal Statistics Unit, Fertility Society of Australia. Assisted reproduction technology in Australia and New Zealand 2003. 2006.
- (86) RCOG. Evidence-based Clinical No. 2: the initial investigation and management of the infertile couple. London: RCOG Press; 1998.
- (87) Council of Europe. European Convention on Human Rights Act 2003 (Ireland). Internet [2003 Available from :<http://www.irishstatutebook.ie/gen222003.html>
- (88) Boyce NW. Potential pitfalls of healthcare performance indicators. Med J Aust 2002; 177(5):229-230.
- (89) Wikipedia. Performance. Internet [2006 Available from :http://en.wikipedia.org/wiki/Performance_%28disambiguation%29
-

-
- (90) Davies HTO, Marshall MN. Public disclosure of performance data: does the public get what the public wants? *Lancet* 1999; 353:1639-1640.
- (91) Adab P, Rouse AM, Mohammed MA, Marshall T. Performance league tables: the NHS deserves better. *BMJ* 2002; 324(7329):95-98.
- (92) NHS Executive. Quality and Performance in the NHS: High Level Performance Indicators and Clinical Indicators. Internet [1999 Available from :<http://www.performance.doh.gov.uk/indicat/nhsci.pdf>
- (93) NHS Executive. Quality and Performance in the NHS. Performance Indicators: July 2000. HSC 2000/023. 2001. Department of Health.
- (94) Nutley S, Smith PC. League tables for performance improvement in health care. *J Health Serv Res Policy* 1998; 3(1):50-57.
- (95) Connecticut Dept of Health. Definition of Case Mix. Internet [2006 Available from :<http://www.dph.state.ct.us/OPPE/sha99/glossary.htm#C>
- (96) Davies HTO. Performance management using health outcomes: in search of instrumentality. *J Eva Clin Prac* 1998; 4(4):359-362.
- (97) Smith P. On the unintended consequences of publishing performance data in the public sector. *Int J Public Adm* 1995; 18:277-310.
- (98) Marshall MN, Shekelle PG, Leatherman S, Brook RH. Dying to know: public release of comparative data in health care. 1278-1282. 2000. London, Nuffield Trust.
- (99) Dranove D, Kessler D, McClellan M, Satterthwaite M. Is more information better? The effects of report cards on health care providers. 2002. Cambridge, National Bureau of Economic Research.
- (100) BBC News. Babies by postcode. BBC News [1999 Available from :www.news.bbc.co.uk/hi/english/health/newsid_283000/283916.stm
- (101) Edgman-Levitan S, Cleary PD. What information do consumers want and need ? *Health Affairs* 1996; 16:42-56.
- (102) Hibbard JH, Jewett JJ. Will quality report cards help consumers? *Health Affairs* 1997; 16(218):228.
- (103) Hibbard JH, Jewett JJ, Legini MW, Tusler M. Choosing a health plan: do large employers use the data? *Health Affairs* 1997; 16:172-180.
- (104) Gabel JR, Hunt KA, Hurst K. When employers choose health plans: do NCQA accreditation and HEDIA data count? New York: Commonwealth Fund; 1998.
- (105) Longo DR, Land G, Schrmann W, Fraas J, Hoskins B, Howell V. Consumer reports in health care: do they make a difference in patient care? *JAMA* 2006; 278:1579-1584.
- (106) Hannan EL, Siu AL, Kumar D, Kilburn H, Chassin MR. The decline in coronary artery by passgraft surgery mortality in New York State. *JAMA* 1995; 273:209-213.
- (107) NHS Executive. Quality and Performance in the NHS. 1999. London, Department of Health.
- (108) Chassin MR. Quality of health care 3: improving the quality of care. *New England Journal of Medicine* 1996; 335:1060-1063.
- (109) McKee M. Not everything that counts can be counted; not everything that can be counted counts. *BMJ* 2004; 328:153.
-

-
- (110) Green J, Wintfield N. Report cards on cardiac surgeons: assessing New York States approach. *New England Journal of Medicine* 1995; 332:1229-1232.
- (111) Davies HTO, Lampel J. Trust in performance indicators? *Qual Health Care* 1998; 7(3):159-162.
- (112) McKee M, Hunter D. Mortality league tables: do they inform or mislead ? *Qual Health Care* 1995; 4(1):5-12.
- (113) Keogh BE, Dussek JE, Watson D, Magee P, Wheatley D. Public confidence and cardiac surgical outcome. Cardiac surgery: the fall guy in medical quality assurance. *BMJ* 1998; 316(7147):1759-1760.
- (114) Marshall MN, Shekelle PG, Davies HTO, Smith PC. Public reporting on quality in the United States and the United Kingdom. *Health Affairs* 2003; 22(3):134-148.
- (115) Davies HTO. Falling public trust in health services: implications for accountability. *J Health Services Research and Policy* 1999; 4(4):193-194.
- (116) Mason A, Street A. Publishing outcome data: is it an effective approach ? *J Eva Clin Prac* 2006; 12(1):37-48.
- (117) Carlisle D. How the Government broke its Bristol Inquiry Pledge. *Health Serv J* 2004; 114(5930):12-13.
- (118) NHS Executive. *The New NHS: Modern, Dependable*. 1997. Leeds, Department of Health.
- (119) Crosby N. Crosby and Definition of Quality. Internet [2004 Available from :<http://deming.eng.clemson.edu/den/archive/2001.04/msg00089.html>]
- (120) Magee H, Davis LJ, Coulter A. Public views on healthcare performance indicators and patient choice. *J R Soc Med* 2003; 96:338-342.
- (121) Keogh BE, Spiegelhalter DJ, Bailey A, Roxborough J, Magee P, Hilton C. The legacy of Bristol: public disclosure of individual surgeons' results. *BMJ* 2004; 329(7463):450-454.
- (122) Mannion R, Davies HTO. Impact of star performance ratings in English acute hospital trusts. *J Health Services Research and Policy* 2005; 10(1):18-24.
- (123) Goodhart CAE. *Monetary Theory and Practice. The UK Experience*. London: Macmillan Press Ltd.; 1984.
- (124) Mannion R, Goddard M. Public disclosure of comparative clinical performance data: lessons from the Scottish experience. *J Eva Clin Prac* 2003; 9:277-286.
- (125) Marshall MN, Shekelle PG, Leatherman S, Brook RH. What do we expect to gain from the public release of performance data? A review of the evidence. *J Am Med Assoc* 2000; 283:1866-1874.
- (126) Haas-Wilson D. Arrow and the information market failure in health care: the changing content and sources of health care information. *J Health Polit Policy Law* 2001; 26(5):1031 - 1044.
- (127) Robinson JC. The end of asymmetric information. *J Health Polit Policy Law* 2001; 26(5):1045-1053.
- (128) Omogigui NA, Miller DP, Smith P, Peters L. Outmigration for coronary bypass surgery in an era of public dissemination of clinical outcomes. *Circulation* 1996; 93:27-33.

-
- (129) Ziegenfuss JTJ. Editorial: Health care quality report cards receive grade incomplete. *Am J Med Qual* 1996; 11:55-56.
- (130) Marshall MN, Shekelle PG, Leatherman S, Brook RH. The public release of performance data: what do we expect to gain? A review of the evidence. *JAMA* 2000; 283(14):1866-1874.
- (131) Hibbard JH, Sofaer S, Jewett JJ. Condition specific performance information: assessing salience, comprehension and approaches for communicating quality. *Health Care Financing Review* 1996; 18(1):95-109.
- (132) Vaiana ME, McGlynn EA. What cognitive science tells us about the design of reports for consumers. *Med Care Res Rev* 2002; 59(1):3-35.
- (133) Robinson S, Brodie M. Understanding the quality challenge for health consumers: the Kaiser / AHCPR survey. *Jt Comm J Qual Improv* 1997; 23:239-244.
- (134) Bentley JM, Nash BD. How Pennsylvania hospitals have responded to publicly released reports on coronary artery bypass graft surgery. *Jt Comm J Qual Improv* 1998; 24:40-49.
- (135) Goddard M, Mannion R, Smith P. Assessing the performance of NHS hospital trusts. The role of 'hard' and 'soft' information. *Health Policy* 1999; 48:119-134.
- (136) The Joint Commission's Public Policy Initiative on the Development of a National Performance Measurement Strategy. Discussion Brief : Audio Conference with Joint Commission President. Internet [2006
- (137) Tymms P, Wiggins A. Dysfunctional effects of public performance indicator systems: a comparison between English and Scottish Primary Schools. *European Conference on Educational Research* 2000.
- (138) Tymms P, Wiggins A. Schools' experience of league tables should make doctors think again. *BMJ* 2000; 321:1467.
- (139) Human Fertilisation and Embryology Authority. Human Fertilisation and Embryology Authority. 11th Annual Report & Accounts 2002 - 2003. 2003. London, Her Majesty's Stationary Office.
- (140) Alper MM, Brinsden PR, Fischer R, Wikland M. Is your IVF programme good? *Hum Reprod* 2002; 17(1):8-10.
- (141) Davies MJ, Wang JX, Norman RJ. What is the most relevant standard of success in assisted reproduction? Assessing the BESST index for reproduction treatment. *Hum Reprod* 2004; 19(5):1049-1051.
- (142) Land JA, Evers JL. What is the most relevant standard of success in assisted reproduction? Defining outcome in ART: a Gordian knot of safety, efficacy and quality. *Hum Reprod* 2004; 19(5):1046-1048.
- (143) Bhattacharya S, Templeton A. What is the most relevant standard of success in assisted reproduction? Redefining success in the context of elective single embryo transfer: evidence, intuition and financial reality. *Hum Reprod* 2004; 19(9):1939-1942.
- (144) Pinborg A, Loft A, Ziebe S, Andersen AN. What is the most relevant standard of success in assisted reproduction? Is there a single parameter of excellence? *Hum Reprod* 2004; 19(5):1052-1054.
- (145) Tiitinen A, Hyden-Granskog C, Gissler M. What is the most relevant standard of success in assisted reproduction?: The value of cryopreservation on cumulative pregnancy rates per single oocyte retrieval should not be forgotten. *Hum Reprod* 2004; 19(11):2439-2441.

-
- (146) Alper MM. In vitro fertilization outcomes: why doesn't anyone get it? *Fertil Steril* 2004; 81(3):514-6, discussion.
- (147) Mortimer D. A critical assessment of the impact of the European Union Tissues and Cells Directive (2004) on laboratory practices in assisted conception. *Reprod Biomed Online* 2005; 11(2):162-176.
- (148) Bhargava PM. On the critical assessment of the impact of the recent European Union Tissues and Cells Directive. *Reprod Biomed Online* 2005; 11(2):161.
- (149) De Sutter P, Dhont M. National experience with elective single embryo transfer - Belgium. In: Gerris J, Olivennes F, De Sutter P, editors. *Assisted Reproductive Technologies: Quality and Safety*. Taylor & Francis; 2004. 113-118.
- (150) Gerris J, De SP, De ND, Van RE, Vander EJ, Mangelschots K et al. A real-life prospective health economic study of elective single embryo transfer versus two-embryo transfer in first IVF/ICSI cycles. *Hum Reprod* 2004; 19(4):917-923.
- (151) Katz P, Nachtigall R, Showstack J. The economic impact of the assisted reproductive technologies. *Nat Cell Biol* 2002; 4 Suppl:s29-s32.
- (152) Nygren K. International registries of assisted reproductive technologies. *Current Practices and Controversies in Assisted Reproduction*. World Health Organisation; 2001.
- (153) National Perinatal Statistics Unit, Fertility Society of Australia. Supplement to Assisted reproduction technology in Australia and New Zealand 2003. 2006. *Assisted Reproduction Technology Series No 9*.
- (154) Van der Berg R. Information technology aspects of assisted conception. In: Serhal P, Overton C, editors. *Good Clinical Practice in Assisted Reproduction*. Cambridge; 2004. 310-318.
- (155) Keay SD, Corrigan E, Wardle PG, Hull MG, Jenkins JM. Electronic transfer of mandatory infertility information: survey of opinion of licensed treatment centres. *Hum Fertil (Camb)* 2000; 3(1):11-12.
- (156) Tellis D. Electronic Data Interchange in the UK. 1-8-2006.
- (157) BBC News. NHS IT upgrade. Internet [2006 Available from :<http://news.bbc.co.uk/2/hi/health/5084886.stm>
- (158) Human Fertilisation and Embryology Authority. Human Fertilisation and Embryology Authority. 14th Annual Report & Accounts 2005 - 2006. Internet [2006 Available from :http://www.hfea.gov.uk/cps/rde/xbcr/SID-3F57D79B-C3C36B94/hfea/2006-07-11_Annual_Report_Accounts_-_Final.pdf
- (159) Jenkins J. Ideal Infertility Computer System. Internet [2005 Available from :<http://www.ecit.info/epr/ECITSurveyJune2005.pdf>
- (160) Schieve LA, Wilcox LS, Zeitz J, Jeng G, Hoffman D, Brzyski R et al. Assessment of outcomes for assisted reproductive technology: overview of issues and the US experience in establishing a surveillance system. *Current Practices and Controversies in Assisted Reproduction*. World Health Organisation; 2001.
- (161) Fertility Society of Australia. FSA Information Booklet. 2005.
- (162) National Perinatal Statistics Unit, Fertility Society of Australia. Assisted reproduction technology in Australia and New Zealand: Explanatory notes. 2006.
-

-
- (163) IVF.net. Australia to cut IVF funding. Internet [2005 Available from :<http://www.ivf.net/content/page-o1396.html>
- (164) Nygren K. The Swedish Experience of Assisted Reproductive Technologies Surveillance. Current Practices and Controversies in Assisted Reproduction. World Health Organisation; 2001.
- (165) Sundhedsstyrelsen. Danish National Board of Health. The IVF Registry. Internet [2006 Available from :http://www.sst.dk/Informatik_og_sundhedsdata/Registre_og_sundhedsstatistik/Beskrivelse_af_registre/IVF_register.aspx?lang=en
- (166) Nyboe AA, Erb K. Register data on Assisted Reproductive Technology (ART) in Europe including a detailed description of ART in Denmark. Int J Androl 2006; 29(1): 12-16.
- (167) Gissler M, Klemetti R, Sevon T, Hemminki E. Monitoring of IVF birth outcomes in Finland: a data quality study. BMC Med Inform Decis Mak 2004; 4:3.
- (168) STAKES. National Research and Development Centre for Welfare and Health (STAKES). Internet [2006 Available from :<http://www.stakes.fi/EN/index.htm>
- (169) STAKES. Quality report of the OSF publication series. IVF Statistics. Relevance of statistical data. Internet [2006 Available from :<http://www.stakes.fi/EN/Tilastot/qualityreports/ivflaatuseloste.htm>
- (170) De SP, Lejeune B, Dhont M, Leroy F, Englert Y, Van SA. [Ten years follow-up of medically assisted procreation in Belgium]. Rev Med Brux 2004; 25(3):160-165.
- (171) Hamberger L, Hardarson T, Nygren KG. Avoidance of multiple pregnancy by use of single embryo transfer. Minerva Ginecol 2005; 57(1):15-19.
- (172) Bergh C, Kjellberg AT, Karlstrom PO. [Single-embryo fertilization in vitro. Maintained birth rate in spite of dramatically reduced multiple birth frequency]. Lakartidningen 2005; 102(46):3444-7, 3449.
- (173) Saldeen P, Sundstrom P. Would legislation imposing single embryo transfer be a feasible way to reduce the rate of multiple pregnancies after IVF treatment? Hum Reprod 2005; 20(1):4-8.
- (174) IVF Data Collection: The German Experience. 2005.
- (175) German Embryo Protection Act (October 24th, 1990): Gesetz zum Schutz von Embryonen (Embryonenschutzgesetz-ESchG) Hum Reprod 1991; 6(4):605-606.
- (176) Beier HM, Beckman JO. Implications and consequences of the German Embryo Protection Act. Hum Reprod 1991; 6(4):607-608.
- (177) Michelmann HW, Hinney B. Ethical reflections on the status of the preimplantation embryo leading to the German Embryo Protection Act Sci Eng Ethics 1995; 1(2):145-150.
- (178) Augst C. Regulating dangerous futures: the German Embryo Protection Act of 1990-- legislation in risk society. Soc Leg Stud 2000; 9(2):205-226.
- (179) Nyboe AA, Gianaroli L, Felberbaum R, de MJ, Nygren KG. Assisted reproductive technology in Europe, 2002. Results generated from European registers by ESHRE. Hum Reprod 2006.
- (180) Cohen J. Regulation of assisted reproductive technology: the French experience. In: Brinsden P, editor. Textbook of in vitro fertilisation and assisted reproduction. Parthenon Publishing Group Ltd; 2005. 667-671.
-

-
- (181) Schweizerische Gesellschaft für Reproduktionsmedizin. FIVNAT-CH Annual Report 2002. 15-1-2004.
- (182) Van den BM, Hohl MK, De GC, Stalberg AM, Limoni C. Ten years of Swiss National IVF Register FIVNAT-CH. Are we making progress? *Reprod Biomed Online* 2005; 11 (5):632-640.
- (183) Van den BM, Hohl MK, De GC, Stalberg AM, Limoni C. Ten years of Swiss National IVF Register FIVNAT-CH. Are we making progress?. *Reprod Biomed Online* 2005; 11(5):632-640.
- (184) Nyboe AA, Nygren KG. Assisted reproductive technology in Europe, 1998. Results generated from European registers by ESHRE. *Hum Reprod* 2001; 16(11):2459-2471.
- (185) Nyboe AA, Nygren KG. Assisted reproductive technology in Europe, 1997. Results generated from European registers by ESHRE. *Hum Reprod* 2001; 16(2):384-391.
- (186) Nyboe AA, Nygren KG. Assisted reproductive technology in Europe, 1999. Results generated from European registers by ESHRE. *Hum Reprod* 2002; 17(12):3260-3274.
- (187) Nyboe AA, Gianaroli L, Nygren KG. Assisted reproductive technology in Europe, 2000. Results generated from European registers by ESHRE. *Hum Reprod* 2004; 19(3):490-503.
- (188) Gissler M, Louhiala P, Hemminki E. Nordic Medical Birth Registers in epidemiological research. *Eur J Epidemiol* 1997; 13(2):169-175.
- (189) Andersen AN, Westergaard HB, Olsen J. The Danish in vitro fertilisation (IVF) register. *Dan Med Bull* 1999; 46(4):357-360.
- (190) Buckett W, Tan SL. What is the most relevant standard of success in assisted reproduction? The importance of informed choice. *Hum Reprod* 2004; 19(5):1043-1045.
- (191) Dickey RP, Sartor BM, Pyrzak R. What is the most relevant standard of success in assisted reproduction?: no single outcome measure is satisfactory when evaluating success in assisted reproduction; both twin births and singleton births should be counted as successes. *Hum Reprod* 2004; 19(4):783-787.
- (192) Germond M, Urner F, Chanson A, Primi MP, Wirthner D, Senn A. What is the most relevant standard of success in assisted reproduction?: The cumulated singleton/twin delivery rates per oocyte pick-up: the CUSIDERA and CUTWIDERA. *Hum Reprod* 2004; 19(11):2442-2444.
- (193) Heijnen EM, Macklon NS, Fauser BC. What is the most relevant standard of success in assisted reproduction? The next step to improving outcomes of IVF: consider the whole treatment. *Hum Reprod* 2004; 19(9):1936-1938.
- (194) Land JA, Evers JL. What is the most relevant standard of success in assisted reproduction? Defining outcome in ART: a Gordian knot of safety, efficacy and quality. *Hum Reprod* 2004; 19(5):1046-1048.
- (195) Min JK, Breheny SA, MacLachlan V, Healy DL. What is the most relevant standard of success in assisted reproduction? The singleton, term gestation, live birth rate per cycle initiated: the BESST endpoint for assisted reproduction. *Hum Reprod* 2004; 19(1):3-7.
- (196) Schieve LA, Reynolds MA. What is the most relevant standard of success in assisted reproduction?: challenges in measuring and reporting success rates for assisted reproductive technology treatments: what is optimal? *Hum Reprod* 2004; 19(4):778-782.

-
- (197) Tiitinen A, Hyden-Granskog C, Gissler M. What is the most relevant standard of success in assisted reproduction?: The value of cryopreservation on cumulative pregnancy rates per single oocyte retrieval should not be forgotten. *Hum Reprod* 2004; 19(11):2439-2441.
- (198) SART. Clinic Outcome Reporting System: ART data recording instructions. Internet [2004 Available from : <http://www.sartcors.com/V8CaseDefs.html>
- (199) Van Balen F. Development of IVF children. *Dev Rev* 1998; 18(1):30-46.
- (200) Wennerholm UB, Bergh C. Obstetric outcome and follow-up of children born after in vitro fertilization (IVF). *Hum Fertil (Camb)* 2000; 3(1):52-64.
- (201) Colpin H, Soenen S. Parenting and psychosocial development of IVF children: a follow-up study. *Hum Reprod* 2002; 17(4):1116-1123.
- (202) Merlob P, Fisch B. Neonatal outcome and congenital malformations in children born after IVF. *Hum Reprod* 2002; 17(11):3004-3005.
- (203) Ludwig M. Development of children born after IVF and ICSI. *Reprod Biomed Online* 2004; 9(1):10-12.
- (204) Rimm AA, Katayama AC, Diaz M, Katayama KP. A meta-analysis of controlled studies comparing major malformation rates in IVF and ICSI infants with naturally conceived children. *J Assist Reprod Genet* 2004; 21(12):437-443.
- (205) Human Fertilisation and Embryology Authority. Assisted Reproduction and Gynaecology Centre: Success Rates. Internet [2006 Available from : <http://212.49.193.187:443/Clinic.aspx?cliniccode=0157&tab=Rates&menu=ivfgraph>
- (206) Multiple Birth Foundation (UK). Multiple Birth Foundation. General Information. Internet [2006 Available from : <http://www.multiplebirths.org.uk/media.asp>
- (207) Robarge JP, Reynolds ZB, Groothuis JR. Increased child abuse in families with twins. *Res Nurs Health* 1982; 5(4):199-203.
- (208) Hansen KK. Twins and child abuse. *Arch Pediatr Adolesc Med* 1994; 148(12):1345-1346.
- (209) Groothuis JR, Altemeier WA, Robarge JP, O'Connor S, Sandler H, Vietze P et al. Increased child abuse in families with twins. *Pediatrics* 1982; 70(5):769-773.
- (210) Multiple Births Canada. Implications on Child and Family Health. Internet [2006
- (211) Ledger WL, Anumba D, Marlow N, Thomas CM, Wilson EC. The costs to the NHS of multiple births after IVF treatment in the UK. *BJOG* 2006; 113(1):21-25.
- (212) Human Fertilisation and Embryology Authority. Human Fertilisation and Embryology Authority. 14th Annual Report & Accounts 2005 - 2006. 2005. London, Her Majesty's Stationary Office.
- (213) Deech R. HFEA press release. 2-12-1997. Human Fertilisation and Embryology Authority.
- (214) Jenkins J. New website for ART success rates in USA. Progress Educational Trust . 4-5-2006.
- (215) Anon. Information versus choice in infertility treatment. *Lancet* 1999; 353(9168):1895.
- (216) Edwards RG, Fishel SB, Cohen J, Fehilly CB, Purdy JM, Slater JM et al. Factors influencing the success of in vitro fertilization for alleviating human infertility. *J In Vitro Fert Embryo Transf* 1984; 1(1):3-23.
-

-
- (217) Sharif K, Elgendy M, Lashen H, Afnan M. Age and basal follicle stimulating hormone as predictors of in vitro fertilisation outcome. *Br J Obstet Gynaecol* 1998; 105:107-112.
- (218) Templeton A, Morris JK, Parslow W. Factors that affect outcome of in vitro fertilisation treatment. *Lancet* 1996; 348:1402-1406.
- (219) BBC News. NHS refuses couples IVF treatment. Internet [2005 Available from :http://news.bbc.co.uk/2/hi/uk_news/england/hampshire/4695773.stm
- (220) Kerr J, Brown C, Balen AH. The experiences of couples who have had infertility treatment in the United Kingdom: results of a survey performed in 1997. *Hum Reprod* 1999; 14(4):934-938.
- (221) Fleming N. Fertility treatment 'to be only for the rich'. *The Telegraph* 2006 Mar 29.
- (222) Mortimer D, Mortimer ST. Quality and Quality Management. *Quality and Risk Management in the IVF Laboratory*. Cambridge; 2005. 24-44.
- (223) Landesberg P. In The Beginning, There Were Deming and Juran. *The Journal for Quality and Participation* 1999;(6):59-61.
- (224) W.Edwards Deming Institute. Definition of Quality. Internet [2006 Available from :<http://www.deming.org/>
- (225) Grifo J, Hoffman D, McNamee PI. We are due for a correction...and we are working to achieve one. *Fertil Steril* 2001; 75(1):14-17.
- (226) Jones HW, Schnorr JA. Multiple pregnancies: a call for action. *Fertil Steril* 2001; 75(1):11 - 13.
- (227) Centre for Diseases Control and Prevention. Assisted Reproductive Technology Success Rates 2001 - National Summary and Fertility Clinic Reports. 2003.
- (228) Kennedy R, British Fertility Society. Risks and complications of assisted conception. Internet [2005 Available from :<http://www.britishfertilitysociety.org.uk/public/factsheets/conceptionrisks.html>
- (229) BBC News. UK woman killed by rare IVF risk. Internet [2005 Available from :<http://news.bbc.co.uk/2/hi/health/4440573.stm>
- (230) Donnellan E. Irish Times Article - Inquiry call after woman on IVF treatment dies. Internet [2004 Available from :<http://www.ireland.com/newspaper/ireland/2003/0208/4109510605HM6ROTUNDA.html>
- (231) Wennerholm UB, Bergh C, Hamberger L, Lundin K, Nilsson L, Wikland M et al. Incidence of congenital malformations in children born after ICSI. *Hum Reprod* 2000; 15(4):944-948.
- (232) Wennerholm UB, Bergh C. Obstetric outcome and follow-up of children born after in-vitro fertilisation (IVF). *Human Fertility* 2000; 3:52-64.
- (233) De ND, Gerris J. Single embryo transfer - state of the art. *Reprod Biomed Online* 2003; 7(6):615-622.
- (234) De SP, Van der EJ, Coetsier T, Dhont M. Single embryo transfer and multiple pregnancy rate reduction in IVF/ICSI: a 5-year appraisal. *Reprod Biomed Online* 2003; 6(4):464-469.
- (235) Germond M, Primi MP, Umer F, Chanson A, Wirthner D, Senn A. Number of transferred embryos: how to reduce multiple pregnancies. *Ann N Y Acad Sci* 2004; 1034:93-100.

-
- (236) Gerris J, De SP, De ND, Van RE, Vander EJ, Mangelschots K et al. A real-life prospective health economic study of elective single embryo transfer versus two-embryo transfer in first IVF/ICSI cycles. *Hum Reprod* 2004; 19(4):917-923.
- (237) Giorgetti C, Chabert-Orsini V, Barry B, Chinchole JM, Franquebalme JP, Hans E et al. [Elective single embryo transfer: a justified policy for selected patients]. *Gynecol Obstet Fertil* 2006; 34(4):317-322.
- (238) Hamberger L, Hardarson T, Nygren KG. Avoidance of multiple pregnancy by use of single embryo transfer. *Minerva Ginecol* 2005; 57(1):15-19.
- (239) Hyden-Granskog C, Tiitinen A. Single embryo transfer in clinical practice. *Hum Fertil (Camb)* 2004; 7(3):175-182.
- (240) Gleicher N, Weghofer A, Barad D. A formal comparison of the practice of assisted reproductive technologies between Europe and the USA. *Hum Reprod* 2006; 21(8):1945-1950.
- (241) Nygren K, Andersen AN, Felberbaum R, Gianaroli L, de MJ. On the benefit of assisted reproduction techniques, a comparison of the USA and Europe. *Hum Reprod* 2006; 21(8):2194.
- (242) BBC News, BB. Embryo mix-up at IVF hospital. Internet [2002 Available from :<http://news.bbc.co.uk/2/hi/health/2367705.stm>
- (243) Toft P. Independent review of the circumstances surrounding four adverse events that occurred in the Reproductive Medicine Units at The Leeds Teaching Hospitals NHS Trust, West Yorkshire. 22-6-2004. Department of Health.
- (244) Irish Medicines Board. Guide to Reporting Tissue and Cell Serious Adverse Reactions and Serious Adverse Events Associated with Tissue and Cells. 2006. Irish Medicines Board.
- (245) Crombie IK, Davies HT. Beyond health outcomes: the advantages of measuring process. *J Eval Clin Pract* 1998; 4(1):31-38.
- (246) Are you working too hard ? 2003.
- (247) National Perinatal Statistics Unit, Fertility Society of Australia. Assisted reproduction technology in Australia and New Zealand: Minimum Data Set. 1-1-2002.
- (248) Rutherford AJ, Jenkins JM, Hull MG. Hull and Rutherford classification of infertility. *Human Fertility*. 5(1 Suppl):S41-5, 2002 Feb. *Human Fertility* 2002; 5(1 Suppl):S41-5.
- (249) Human Fertilisation and Embryology Authority. Code of Practice (6th Edition). 2005. London, Her Majesty's Stationary Office.
- (250) Association of Clinical Embryologists. ACE Laboratory Accreditation. 2002.
- (251) Association of Biomedical Andrologists. Laboratory Andrology - Guidelines for Good Practice. Internet [2004 Available from :<http://www.andrology.pwp.blueyonder.co.uk/ABAGuidelines1.0.pdf>
- (252) Gerris J. IVF and ICSI reimbursed in Belgium. *J Assist Reprod Genet* 2004; 21(5):135.
- (253) Wikipedia. Personal Public Service Number. Internet [2006 Available from :http://en.wikipedia.org/wiki/Personal_Public_Service_Number
- (254) Government of Ireland. Social Welfare (Consolidation) Act, 1993 (Section 223). Irish Statute Book Database [2006 Available from :<http://www.irishstatutebook.ie/ZZA6Y1998S14.html>
-

-
- (255) Government of Ireland. Data Protection Act 1988. Irish Statute Book Database [2006
Available from :<http://www.irishstatutebook.ie/ZZA25Y1988.html>
- (256) Stolwijk AM, Wetzels AM, Braat DD. Cumulative probability of achieving an ongoing pregnancy after in-vitro fertilisation and intracytoplasmic sperm injection according to a women's age, subfertility diagnosis and primary or secondary subfertility. Hum Reprod 2000; 15(1):203-209.
- (257) Osmanagaolu K, Tournaye H, Camus M, Vandervorst M, Van Steirteghem A, Devroey P. Cumulative delivery rates after intracytoplasmic sperm injection: 5 year follow-up of 498 patients. Hum Reprod 1999; 14:2651-2655.