Investigation and Assessment of the ‘Assumed’ Over-Ordering of Pathology Tests in a Private Hospital-Based Pathology Laboratory

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I owe my deepest gratitude to my parents, who have given me not only the opportunity of an education, but instilled in me the values of hard work and dedication, without which this MBA could not have been completed.

Finally, I dedicate this dissertation to my boyfriend, Paul, who always believed in me.
Abstract

Dissertation Topic:
This dissertation relates to the investigation and assessment of the ‘assumed’ over-ordering of pathology tests in a private hospital-based Pathology Laboratory.

Objectives of Study:
To review if there was in fact over-ordering of tests especially at weekends, to assess why his was happening, and who this could be attributed to, and if it could be controlled and/ addressed.

Nature and Scope of Research Undertaken:
A pluralistic approach was executed in relation this study whereby secondary data was obtained through management, business, medical pathology, operations and technology channels, informal discussions with colleagues, and data extrapolation from the Meditech Hospital Information System (HIS). As some of the activities outlined in this study had been under investigation and Action Plans were put in place at the very early stages including IT blocks, education re-correct ordering, and awareness re test costs.

Additional Meditech data relating to the breakdown of tests, the areas where the tests were being ordered, and the consultants/ medical specialties responsible for the test ordering was also obtained and reviewed, as well as process review via Process Mapping and FMEA. Five medical consultants from the areas attributed to ordering the most tests or influencing the test ordering procedures in the Hermitage Medical Clinic were selected for In-Depth Interviews.

Results:
Data from May 2014 was analysed and this level of activity was assessed to ensure it was representative of the year as a whole. No apparent trends indicating over-ordering of tests were observed. The tests ordered were also representative of the patient cohort in the hospital, the areas the tests were ordered from, and the requesting clinicians. The number of biochemistry Full Profiles was highlighted however and this was discussed during the In-Depth interviews (IDIs).

Conclusions:
Over-ordering in essence is not taking place in the Hermitage Medical Clinic. Some situations could not be ruled out explicitly given the complex nature of the patients’ clinical presentations but the Consultants interviewed did have good knowledge and awareness with respect to test ordering processes.

Contribution made to the Knowledge of the Topic Investigated & Further Study:
The lack of definitive, reliable secondary data relevant to this study was apparent very early on and this study aims to highlight issues with potential for address, contribute information for improvement, while serving as a platform for further study particularly in relation to Pathology Laboratories and the private healthcare system in Ireland.
Declaration

I declare that no portion of the work referred to in this dissertation has been submitted in support of an application for another degree or qualification of this or any other university or institute of learning. Furthermore, all the work in this dissertation is my own, unless referenced in the text as a specific source and included in the bibliography.

Signed: __________________________

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Confidentiality Clause: Restricted Access Document

Please note this document is a Restricted Access Document and therefore the details contained herein must be treated in strict confidence. Where possible, person’s details have been anonymised, especially those relating to patient details, date of birth, hospital number, and clinicians. All details herein have been assessed in a professional manner and opinions documented are primarily for research purposes. This dissertation has been carried out with the support of Hospital Management and discussed with the CEO. As many of the details may positively impact the hospital itself and are documented as part of Chapter 6: Conclusions, Recommendations & Future Applications of Learning, these will be further discussed with relevant hospital parties following submission. As author of this dissertation, I acknowledge that the data analysis was executed in as rigorous a manner as possible and I deem the dissertation an accurate reflection of the research carried out. Additional information which supports this study is available upon request and in compliance with the Hospital’s Ethics Policy. Interest has been expressed in relation to publication of some of the details, which may lead to modification of the report to illustrate modalities in the dissertation but maintain confidentiality of the report and persons identified therein. This will also involve acknowledgement and review by the Dissertation Supervisor and Dublin Business School.

Signed: ____________________________

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Glossary of Terms

Connecting for Health  NHS-wide computer network (UK)
CRP  C-Reactive Protein
EBLM  Evidence Based Laboratory Medicine
ED  Emergency Department
FBC  Full Blood Count
FMEA  Failure Modes and Effects Analysis
FP  Full Profile
GRADE  Grading of Recommendation Assessment, Development and Evaluation
HIS  Hospital Information System
HMC  Hermitage Medical Clinic
IDI  In-Depth Interview
LP  Liver Profile
Meditech  Hospital Information System i.e. computer system built around a laboratory-specific platform which enables documentation of patient demographics through all stages of hospital visit from admission through to discharge. It therefore enables ordering of tests, retention of patient demographics and clinical details, previous test results, delta checks in association with current results, critical alert capabilities, result reporting, and full audit trail documentation of all stages to track sample progress through the various stages of testing. It also enables retention of clinical information such as nursing notes, physiotherapy, nutrition, pharmacy notes etc as well as other hospital based activities such as finance, materials ordering etc.
NICE  National Institute for Clinical Excellence (UK based entity relating to Clinical Trials, collaboration of data for healthcare-based investigations, information provider for pharmaceuticals, involved in the procurement of national UK purchasing schemes e.g. for medicines for NHS-wide use etc.
NOCA  National Office of Clinical Audit (Irish based entity)
NHO  National Haemovigilance Office (Irish based entity)
RMO  Resident Medical Officer
RP  Renal Profile
TAT  Turn Around Time
w.r.t.  With Respect To
Chapter 1: Introduction

1.1. Research Context

1.1.1. What is Pathology?

Pathology (also commonly known as laboratory medicine) comprises of those services which provide knowledge and diagnostic information for the care of individual patients through the scientific analysis of blood, fluids, tissue and other samples. Pathology services constitute an essential element of clinical services through the contribution they make via the effective prevention, detection, diagnosis, treatment and management of disease. Pathology services have three main elements: pre-analytical which is associated with phlebotomy, logistics, advice on appropriate tests, production of clinical guidelines etc.; analytical which relates to the testing of the samples, and the post-analytical which relates to the interpretation and dissemination of the test result to the requester, provision of additional testing etc. (Carter 2008).

1.1.2. Why is this topic important?

The Pathology Laboratory is an essential element of the healthcare system providing users with pivotal information for the prevention, diagnosis, treatment and management of health and disease. Laboratory results influence up to 70% of medical diagnoses and treatments, as an accurate and rapid diagnosis is the key to accurate, fast and cost effective treatment and good health outcomes. This figure is sometimes disputed as some studies state that laboratory results influence up to 90% of clinical decisions. However, it is generally accepted as 70%. In addition to this argument, more recent assessments suggest that the impact of laboratory medicine varies with the clinical specialty and application (Beastall 2013, Brunetti et al. 2011). Although Beastall 2013 states when used optimally, laboratory medicine generates knowledge that can facilitate patient safety, improve patient outcomes, shorten patient journeys, and lead to more cost effective healthcare, unfortunately the opposite is also true. Thus, when a substandard service is being provided, patient safety may be jeopardised through incorrect sampling,
incorrect patient results being released, inappropriate or negligent care being provided as a result of such, and thus patient outcomes may be negatively impacted. Either individually or more seriously collectively, these factors may ultimately contribute to not only extended patient stays but to patient mortality. Therefore, optimal use of laboratory medicine relies on dynamic and authoritative leadership outside as well as inside the laboratory, with appropriate clinical governance structures in place to address any issues or incidences whereby the provision of pathology services may be jeopardised and sub-optimal services may prevail (Beastall 2013).

As already stated, laboratory results influence up to 70% of medical diagnoses and treatments, and yet government expenditure in relation to laboratory medicine is surprisingly low. Although the global laboratory medicine market reached in excess of $52 billion in 2013, this figure represents <5% of total healthcare expenditure (Beastall 2013). In the UK, the NHS budget is currently approximately £106 billion and laboratory costs are approximately £2.5 billion i.e. 2.3%. In South Africa, approximately 3.5% of provincial budgets are directed towards meeting the costs of pathology services in the public sector (Pillay 2013). Owing to the difficulty in sourcing definitive figures in relation to Ireland (a recurring theme discovered in relation to this dissertation), I have extrapolated crude data based on the aforementioned figures. Therefore, in relation to an Irish Government Publication in 2013, expenditure may be calculated as being between $305 and $464 million expenditure per annum representing between 2.3% and 3.5% of budgetary healthcare expenditure (Irish Government Publication 2013). On account of so few reports and documentation being available in relation to this study, I will refer to the most relevant international reports and studies available. I will subsequently correlate the relevant theories and methodologies associated with the subject matter, themes, and objectives with the ideologies presented herein. In order to commence this matter, may I introduce the most currently relevant benchmark document; the Carter Report.
1.1.3. What is the Carter Report?

The Carter Report carried out in 2008 was an independent report in relation to the review of the Pathology Services in England. The report was a comprehensive thorough report which covered various topics and put forward a number of recommendations in order to enable the Pathology Services in England implement and address changes associated with the evolution of the healthcare system in the UK. The report was internationally accepted as a bench mark for assessment of pathology services in a number of countries as it was deemed as having assessed a true representation of the pathology services in the UK; made enquiries to relevant persons, institutions and organisations; and ultimately presented the report in an honest, concise manner. From this review, the Carter Commission estimated that approximately £500 million could be saved by more efficient use of pathology services i.e. 20% of the expenditure could be saved despite a projected increase of 8-10% in laboratory testing (Carter Report 2008). As will be re-iterated throughout this dissertation, little or no equivalent Irish reports or assessments have been carried out or published.

1.2. What is the rationale for choosing this topic?

This dissertation will centre on the following research question: does the ‘assumed’ over-ordering of bloods, especially at the weekends, in the private hospital, actually occur? This is an area of activity which is proving detrimental as regards resource allocation i.e. phlebotomy and medical scientist time, expenditure, potential risks associated with unnecessary phlebotomy of patients, and non-address of critical alerts due to the sheer number of such being phoned etc. Reports such as the Carter Report, and more over the lack of a similar report relating to the Irish Pathology Services, further fuels my interest in this area.

This dissertation will therefore include quantitative data evaluation from the Meditech hospital information system (HIS), review of the recently implemented Action Research methodologies, employment of process mapping of activities, identification of critical control points and evaluation of such by means of Failure Modes and Effects Analysis.
(FMEA). I hope this report will highlight straight off where unnecessary bloods and samples are being ordered so these may be easily eliminated from the system. Qualitative data evaluation will also be employed in order to identify the persons who are attributed to being responsible with this *assumed* over-ordering, and through In-Depth Interviews (IDIs) I hope to assess the rationale in relation to the *assumed* over-ordering as well as assessment of the actual test ordering practices in the Hermitage Medical Clinic (HMC). Thus when all aspects of the assessments are combined, I will put forward a number of recommendations in relation to test ordering practices which I hope will highlight areas of *assumed* over-ordering, the reasons why this does/ does not happen, who is responsible, is it tied to particular specialties, and how it can be addressed if applicable. Finally, it is anticipated that resources such as financial elements, staffing etc may be released, and ultimately contribute pleotropically to an overall enhanced quality management system and patient safety.

Therefore, the objective of this research is to obtain and compare information in terms of:

- Test ordering practices and procedures
- Decision making process with respect to test selection
- Test ordering involvement
- Test ordering stimuli
- Stakeholder involvement
- Stakeholder responses
- Desirable attributes when ordering a test

1.3. Research Hypothesis

I hypothesise the following in relation to this study:

1.3.1. Some over-ordering does exists in HMC.

1.3.2. Over-ordering has essentially been addressed by and large by means of implementation of Action Research methodologies such as IT Blocks, test frequency ordering controls, correct ordering and labelling procedures e.g. MRSA Swabs, and education re awareness of ordering practices and procedures.
1.3.3. I anticipate the following will be discussed during the IDIs in relation to the ordering of tests:
- Importance of correct tests
- Correct patients-Correct Result
- Identification of critical alerts and notification of such to clinicians
- Quality of tests
- Phlebotomy Risks to Patients
- Timeliness of Turn Around Time with respect to test
- Correct use of resources such as financial aspects and elimination of waste

1.4. Contribution of the Research

This dissertation aims to address the research question and research objectives as set out in Chapter 1. This study aims to highlight issues with potential for address, contribute information for improvement, while serving as a platform for further study particularly in relation to Pathology Laboratories and the private healthcare system in Ireland.

1.5. Suitability of the Researcher

Saunders et al. (2005) stated that the topic selected by a researcher should excite their imagination, benefit them in their specific career goals, and that they should personally understand and be capable of undertaking the research in their selected topic. In my opinion I can confidently comply with such, as for the past eighteen months I have been employed as the Pathology Manager in the Hermitage Medical Clinic, a private hospital here in Dublin. This follows working in the medical laboratory field for the past thirteen years, through which I have gained much knowledge and experience in a rapidly changing professional environment. My current role also coincided with a move from the public sector to the private sector and with it a new found appreciation for the financial aspects of running a laboratory. I am in a privileged position in that I am able to manage the laboratory and take initiative to implement changes and improvements through the acquisition of new analysers, improved technological features such as interfaces from
analysers to the hospital information system (HIS), streamlining of certain activities via LEAN and Six Sigma methodologies etc. (Curatolo et al. 2014, Gijo et al. 2013). In line with a commitment to implementing improvements relative to my laboratory and with a professional respect to my staff, I constantly strive to provide the best possible service to the users of the laboratory services in line with best practice procedures to provide the patients with the right test through reliable test methods, at the right time, and to maintain quality services. I therefore consider myself suitable to investigate this research topic while successfully employing the theories of both ontology and epistemology.

Sadek 2012 states that laboratory workload increases by approx 5% every year and the increasing cost and complexity of tests necessitate an expansion of laboratory budget. The sustainability of laboratory services is dependent on appropriate laboratory utilisation and laboratory professionals who are well positioned to control test utilisation. There are many points where a laboratory professional can contribute in relation to such, including clinician education, test ordering guidelines, and limiting access to certain groups of clinicians. Initially this was the basis of my dissertation and in consultant with my CEO; I have implemented many of the actions I had proposed. As I continue to develop the laboratory services, I now wish to utilise and exploit further theories in relation to sustainability, minimising waste through unnecessary ordering of tests etc, and re-investing these resources into developing the laboratory as a more standalone business venture. Some of the methodologies such as demand management, streamlining of test profiles, and blocking of tests which are not required due to frequency of testing timelines, have been implemented in some futile formats recently i.e. Action Research methodologies, and through reviewing and implementing processes which have been used in other laboratories I hope to further enhance my endeavors.

1.6. Recipient of the Research

The principle recipient of the dissertation is Liverpool John Moore University (LJMU) in conjunction with Dublin Business School (DBS), as the dissertation is being submitted primarily as a significant part of my MBA. The primary recipient in DBS will be my
supervisor, Mr. Gary Bernie, while at a hospital level the main recipient for my research will be the CEO, Mr. Eamonn Fitzgerald. Following discussion in relation to some of the theories and concepts, and with his support in relation to such, I have been requested to attend a number of Medical Advisory Committee (MAC) Meetings which will consolidate the support of the main consultants who I anticipate will drive certain aspects of the project going forward, as well as assist with implementation of some of the recommendations put forward in Chapter 6. The potential financial gains will obviously benefit the shareholders and investors in the hospital, while the streamlined activities will assist my staff members through consolidated working activities, thus freeing up time and resources. Due to the nature of this research, many organisations and individuals have expressed an interest in my research, firstly as it may serve as inspiration to enhance and positively contribute to the daily operations of many medical laboratories, and secondly it may contribute to further studies at a number of different levels.

1.7. Structure of the Research

The structure of this dissertation is as outlined and defined in the DBS Dissertation Handbook 2014. Please refer to Table of Contents in this dissertation in relation to the structure of the study as regards title, headings, appendices, and reference guide.

1.8. Limitations of the Research

I do not anticipate any significant limitations or difficulties in relation to the execution of this dissertation.

I maintain a strong working relationship with the colleagues and consultants I work with, and due to the nature of continual professional development, any consultants I have approached thus far in relation to this project, or indeed any other, have been very open, honest and enthusiastic to assist. All consultants are available on site and may be contacted via phone and email in interim periods if required.
I have already discussed some limitations encountered in relation to accessing some information in relation to this project, and if anything the lack of relevant research will serve to enhance the importance of this research into the Irish healthcare environment.

I am also aware that I may conclude with an all male panel of participants for the IDIs. I don’t anticipate this being a major limitation though, as I have personally never encountered any differences in relation to gender and test ordering practices previously. I have attempted to acquire information from various sources in relation to gender balance at medical consultant level in Ireland and have been able to access little other than Meghen et al. 2013 who correlate with why I may arrive at an all male IDI panel:

‘Medicine was once a male-dominated profession reflecting the male preponderance in medical schools. Subsequently an increase in female undergraduate entry has led to an even gender balance or slight female dominance in medical schools. Decades later, the effects of this changing demographic at undergraduate level should be evident at senior clinical and academic levels. This has not happened, fuelling speculation about possible barriers and discrimination’.

There are no significant cost implications associated with my study apart from my personal time which is committed to the project, and the time the Consultants will, I anticipate, freely contribute (Appendix I: Gantt Chart outlining the Research Plan). The close proximity of the consultants to my place of work will not incur any additional travel expenses.

Finally, it is worth noting the potential limitation in relation to conducting this research by means of the practical efforts which will be required e.g. time management. Although, combining a full time job, an oncall roster, personal activities and an MBA thesis appears daunting, I am committed to executing such in an enthusiastic, diligent manner and so am listing this potential limitation last!
Chapter 2: Literature Review

2.1. Introduction

Literature shows the limited influence of economic evaluations on health care decisions and diagnostic processes. This is verified by the deficiency of relevant published works, leading me to agree with Brunetti et al. 2011 who stated that although there is a trend towards greater use of these studies at the macro level, its use at the meso and micro level remains low. The National Health Service (NHS) in England and Wales and the National Institute for Health and Clinical Excellence (NICE) makes explicit use of economic evaluation for technology appraisal, but local decision makers often follow different decision-making processes. The topics are also usually documented as sub-sections of other reports as opposed to stand-alone documents in their own right.

Brunetti et al. 2011 states that there has been a growth in the number of published economic evaluations. I however thoroughly disagree with this statement, especially given the increased awareness of the importance to evaluate value for money in healthcare in recent years. This is further substantiated by the fact that not only did I carry out an extensive search for reputable, detailed, concise information from various sources relevant to this dissertation but the consultants I interviewed during the In-Depth interviews (IDIs) also lacked the ability to refer to any relevant articles or studies despite holding a wealth of academic knowledge. Thus, elucidation of information relating to this warrants inclusion subject to the objectives of this dissertation. What was also evident from the literature review was that guideline developers around the world take different positions on the role of resource cost and cost-effectiveness in guideline decision making. Only a small proportion of published clinical guidelines have considered economic analyses and these varied widely with their methods. I was unable to find any significant reviews in relation to Ireland and more specifically to the private sector, especially in relation to the current remuneration/re-imbursement packages in place as regards private health insurance etc.
Laboratory medicine is currently experiencing major issues to impact on the quality of future service delivery. Brunetti et al. 2011 defines explicitly the issues encumbering the current pathology laboratory landscape; namely workforce shortages, growth in inappropriate testing, and advancing technology. These factors are in addition to the imposition of performing increased numbers of tests, without a comparable increase in laboratory budgets, despite being affected by economic pressures and enhanced efficiency. Thus I agree with Isouard (2013) who argues that in order to sustain quality of services, a significant change from current practice is recommended, with strong leadership as the principal change driver. These sentiments are also re-iterated by Lord Carter in the Carter Report.

2.2. The Carter Report

The Carter Report was carried out in 2008 to the review the Pathology Services in the UK, a service which employs 25,000 staff and costs the NHS in the order of £2.5 billion a year, representing nearly 4% of total NHS expenditure. The report which is a robust representation of the many facets which contribute to the UK pathology services resulted in twenty discrete recommendations relating to the following eight main topics:

- Quality
- Communication
- User Responsiveness and Information Transparency
- Consolidation
- Workforce Reform
- Tariffs/ Benchmarking
- Commissioning guidance
- Innovation

Most notably in my opinion are the principles defined as the ‘QIPP’ which is the acronym used by the NHS to describe the approach to successfully deliver national and local service and quality objective within the anticipated constraints in future funding. Made up of four interlinked elements: Quality, Innovation, Productivity, and Prevention; together they enable the NHS to deliver on its vision for change and improvement whilst maintaining the quality and range of services people want and need. The report also
alludes to the four pillars of system reform; most notably demand, supply, transactional, and system management; and incentivises responsiveness, quality, and value for money in healthcare (Carter Report 2008).

With respect to this dissertation, the Carter Report refers to a number of topics which are of interest to this dissertation and the objectives associated with such, namely: demand management, ‘variation in requesting patterns’, ‘published data to show that not all results are accessed and used by the requester’, and several witnesses alluding to ‘substantial levels of unnecessary testing’ and ‘unnecessary repeating of tests’ in numerous paragraphs of the report. The report stated that ‘it is claimed that up to 40% of tests requested are unnecessary; again this figure is unsubstantiated’ which illustrates the misconceptions in place in relation to test ordering practices. These topics are discussed in detail in Chapter 5: Discussion as a result of thorough evaluation via the IDIs. The following subsections will introduce the relevant entities, beginning with Demand Management.

2.3. Demand Management

Demand Management relates to the control of testing procedures through the right test on the right patient at the right time to ensure that the proper use of clinical laboratory testing contributes to improved patient care (Lang 2013). Given the aforementioned scenarios as regards patient safety, correct results, efficient utilisation of resources such as finance, elimination of waste etc, the need for demand management of laboratory testing becomes paramount. Pathology laboratories have to formulate strategies to address both under- and over- utilisation of laboratory tests. Increasingly laboratories have to monitor test usage for cost-effectiveness and appropriateness, in the best interests of clinical care and in the spirit of evidence based laboratory medicine (EBLM). Strangely, I agree with Pillay (2013) who infers that very often this may appear counterintuitive for a service in which volume determines income and ultimately financial viability. Assessment of such via the research objectives, test ordering practices and procedures, and decision making processes with respect to test selection will elucidate how robust such process are in HMC.
The increasing demand for care by aging populations and growing numbers of chronically ill individuals (e.g. St. Mark’s Ward over the weekend) may explain the increasing resources for diagnostic investigations. There is also proof that further laboratory investigations may be ordered when an abnormal test result is found, but control of the number of additional tests should always be reviewed and considered. Brunetti et al. (2011) refers to only three main topics in association with demand management; those being the highest standards of care, guidelines recommending supplementary testing, and defensive behavior (e.g. ‘but we always do it this way!’), even though in my personal experience there are many more factors leading to inappropriate investigations. The latter point in relation to defensive behavior is worthy of additional mention here and this will be assessed in association with the IDIs.

Demand Management is not a new concept to most laboratories (Sadek 2012) and I strongly agree with Brunetti et al. 2011 who state that if a test fails to improve or provide a net-improvement in patient-important outcomes, there is no reason to use it. This sentiment was also re-iterated during the IDIs and is discussed in Chapter 5: Discussion. Brunetti et al. 2011 exploits this theory further by referring to guidelines which include transparent considerations around the evidence that is considered, including the evidence about resource use, in order to achieve this outcome. While methods to develop guidelines have steadily improved, they have tended to focus on issues of effectiveness and have not explicitly considered the broader issues, particularly cost (which is obviously relevant in a private hospital setting).

Brunetti et al. 2011 also refer to the sentiments of Pillay 2013, relating the complexity of laboratory investigations increasing significantly to the economic pressures arising from the current socio-economic circumstances, and acknowledging that laboratories are forced to enhance efficiencies, reduce costs by consolidation, integrate into regional networks, and form alliances and partnerships. The latter integration networks and alliances is something I have explored, and via a tripartite arrangement with two sister hospitals, I have been able to exploit significant savings through utilising economies of scale. Evidence of this is also evaluated via the IDIs associated with this study.
Brunetti et al. 2011 also refer to some professionals who seem to seek refuge in a closed environment, focusing on the mere reduction of the cost per tests and less on other efficiency indicators within the laboratory walls. Personally although I have encountered such ‘personality types’, I disagree with this trail of thought and strongly believe we need to approach changes with a multi-pronged approach involving multidisciplinary teams and relevant stakeholders in order to drive change forward. To fully exploit this, we also need to not only reduce the unit cost but also the number of test units we receive, and one such practice to address such is Test Frequency Control.

2.4. Test Frequency Control

Certain biological parameters do not require re-testing within a certain time frequency as the parameters are stable and do not necessarily change. Unfortunately, some clinicians over-order tests during this timeout, resulting in a waste of resources such as phlebotomy and medical scientist staff time, reagent and calibrator waste, financial waste etc. Lack of awareness in relation to this practice therefore warrants inclusion as one of the objectives of this dissertation. Sadek 2012 reports that cancellation of inappropriate, high volume tests has resulted in the most savings without affecting patient care. This is something I have implemented recently in relation to some high volume tests and which I think could be implemented further following discussion at the MAC meetings and through ongoing education and awareness.

Sadek 2012 also describes this phenomenon in relation to the Canadian Diabetes Association’s 2008 Clinical Practice Guidelines which indicate that the diabetic test HbA1C should be tested no more frequently than every three months. The article outlines a number of measures taken to address such including clinician education and introduction of a rule that a test is cancelled by the laboratory if an HbA1C result was reported in the laboratory information system in the previous 90 days. Disparate results were discovered from both measures and the report identified that ideally we need to reach a state where inappropriate testing is not ordered in the first place to avoid sample
collection and processing. To achieve this will require a lot of education and dialogue with clinicians.

A similar approach was later entertained in this study between 2010 and 2012, whereby 31 cancellation rules based on similar principles were implemented in the Canadian laboratories. For the vast majority, between 1 and 8% of the tests were subject to utilisation rules that were cancelled, resulting in cancellation of approximately 61,000 tests per year. The estimated reagent costs of these cancelled tests was approx. $160,000 annually and the reduced workload allowed medical scientists to be deployed to other areas of the laboratory that were experiencing an appropriate increase in workload (Sadek 2012). This is another area to target and assess potential savings with respect to my Pathology Laboratory. It is however imperative to remain flexible in implementing these utilisation rules. Clinicians must be able to request exemptions, if warranted for clinical reasons, by indicating on the requisition or calling the medical scientist. Previous tests results may also be included in the cancellation comment to ensure that the clinician is aware of the latest test results (Sadek 2012). This is also an area to assess as I am not aware of any hospitals with the Meditech hospital information system which has attempted to implement such.

Sadek 2012 also reports demand management methodologies in relation to controlling test utilisation with respect to limiting test ordering to a certain group of clinicians. In the Canadian study, limiting access to ordering HLA-B27 to certain groups of specialists (ophthalmologists, rheumatologists, and orthopaedic surgeons) resulted in a major decrease from 2,500 tests per year to a more appropriate 200 tests per year (Refer also to Appendix II: Demand Management with respect to HLA-B27). Testing has remained stable at the lower level for over five years. I think this could be a viable option in relation to the cohort of consultants in HMC especially in relation to those who order the greatest number of tests as well as those who order the most expensive tests. I also appreciate Sadek 2012’s analogy in relation to stimulating clinician groups to question their ordering patterns by means of changing the ordering clinician culture from that of a ‘fisherman’, casting a wide net of test orders hoping to catch the right test, to that of a
‘hunter’, ordering only the required tests. Realisation of the financial costs associated with Pathology Laboratory testing should realistically drive this latter change of mind set, and so we organically lead onto the financial considerations which may assist with driving such change.

2.5. Financial Considerations-GRADE, EBLM, Cost-Consequences Analysis

This dissertation has already alluded to the deficiency in relation to published matter in relation to this study, and the lack of financial considerations in relation to such is no exception. Of all the articles, reviews etc that I have studied, the Italian-Canadian consortium, Brunetti et al. 2011, puts forward the most concise and applicable methodologies to date, many of which I have not encountered nor been made aware of being utilised in the Irish healthcare setting, with emphasis on the private sector. Such methodologies include a new methodology named Grading of Recommendation Assessment, Development and Evaluation (GRADE), providing an objective evaluation of both the economic value and impact on patient outcomes of laboratory testing. Lack of compliance with Evidence Based Laboratory Medicine (EBLM) principles is also highlighted and this is something I encounter in my routine professional life whereby tests are ordered in an ad-hoc fashion and show limited influence of economic evaluations on health care decisions and diagnostic processes.

Several barriers to the use of economic evaluation in decision-making processes have been identified, and guidelines tend to focus on issues of effectiveness, and have not explicitly considered broader issues particularly cost. EBLM aims to support clinical policy decisions and patient choices regarding the utilisation of laboratory investigations, to improve the care and outcomes of individual patients, and to support the effective use of healthcare resources. Hence, appropriateness, efficiency and effectiveness should be supported by clinical governance policies whereby an accurate economic evaluation in terms of both the costs and effects represent the best use of finite resources based on the most up-to-date evidence (Brunetti et al. 2011).
Brunetti et al. 2011 also discusses the use of cost-consequences analysis, which provides an alternative approach to assess options in tabular form for all the relevant costs, resource use, and consequences. This approach also allows decision makers to input their own values into their own costs and consequences table, which could differ according to the local context. The report also documents the cost effectiveness of some tests such as BNP and the influence it has in patient diagnosis and treatment in relation to chronic heart failure. This again would be worth reviewing in relation to some of the specialties and tests ordered in HMC e.g. in relation to chest pain in ED etc. Brunetti et al. 2011 states there are three main types of economic evaluations: cost effectiveness, cost-utility and cost-benefit analysis. This would provide additional methodologies to enable the review of laboratory services and/ or certain test types in relation to the most relevant. Again, I am not aware of any Irish study in relation to such. However, many of the above mentioned international reviews link financial considerations to best practice procedures, which in many cases lead to improvements, either implemented to address or instigated to respond to Quality Improvement Challenges, which are discussed in the next sub-section.

2.6. Quality Improvement Challenges

It is widely accepted that there are numerous quality improvement challenges and key performance indicators (KPIs) associated with Pathology Laboratories worldwide, and this is substantiated by the accreditation status received and maintained by such. One such KPI relates to accurate and timely test results, which play an important role in patient management, and consequently there is a patient expectation of short testing turnaround times (TATs). Cankovic et al. 2009 argues that baseline data analysis reveals that the greatest challenge to timely result generation occurs in the pre-analytical phase of specimen collection and transport and this has been re-iterated by studies I have also carried out in my laboratory. I have started looking at this analytical prerequisite in more detail following recent LEAN Six-Sigma Training in a hospital setting and in line with the concise methodologies set out by Curatolo et al. 2014. In my opinion it is somewhat difficult to contradict or criticise the widely accepted LEAN methodologies, owing to their fundamental basis being on not only worldwide verification of success to date, but
also the application of common sense that is in my opinion associated with them. Through review of Curatolo et al. 2014 and Cankovic et al. 2009, I agree unreservedly that redesign of pre-analytical processes in line with LEAN principles, resulting in fewer steps results in a markedly increased number of properly collected blood samples, resulting in less time spent addressing such from a medical scientist and phlebotomy point of view. This is a significant quality improvement which very much enhances patient safety and comfort and improves sample TAT. Cankovic et al. 2009 reports that these continuous quality improvements were accomplished by empowered workers in a blame-free environment, and are now being sustained with minimal management involvement. This is also an area I wish to explore with support of hospital management and the MAC.

Thus the elimination of rejected samples as a result of incorrect patient identification, incorrect sample tube, under filled and overfilled tubes decreases the necessity of having to re-order these samples, enhances patient safety and comfort associated with additional unnecessary phlebotomy, and releases the financial constraints associated with this waste of resources (Sciacovelli et al. 2007). In order to identify and assess areas where further quality improvements may arise, tools such as FMEA may be utilised.

2.7. FMEA

Failure Modes and Effects Analysis (FMEA) is a systematic, proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of different failures, in order to identify the parts of the process that are most in need of change. FMEA involves assessment of various stages of the process which include review of:

- Initial mapping of steps in the process
- Failure Modes-what could go wrong?
- Failure Causes-why would the failure happen?
- Failure Effects-what would be the consequences of each failure?
FMEA may be used to assess processes for possible failures, and aims to highlight the potential failures prior to them happening rather than after the failure has occurred i.e. proactive rather than reactive approach. In relation to healthcare, FMEA serves to prevent or reduce the risk of harm to both patients and staff (IHI 2004). In this dissertation FMEA was utilised to assess the risks associated with over-ordering of bloods (Refer to Appendix II: FMEA associated with the Over-ordering of Tests) and this was assessed in association with the critical control points as identified through Process Mapping.

2.8. Process Mapping

Process Mapping is a technique whereby an activity, process or workflow is converted into a visual, step-by-step diagram. Process mapping is an essential element of Quality Management Systems and is used to better understand an existing process and to help develop a more effective one. In this methodology, main activities, information flows, interconnections, and measures are often depicted as a collage on a large sheet of paper, with different colored 'Post-it' notes or slips of paper. This graphic representation allows an observer to 'walk-through' the whole process and see it in its entirety. I re-iterate the sentiments of Rojo et al. 2008 in relation to process mapping within the healthcare sector being infantile in its implementation and utilisation, especially given the diversity and complexity of hospital processes, the implementation and assessment of process mapping would prove very useful. With respect to acquiring additional information in process mapping in the healthcare setting, there are still futile means by which it is being utilised especially in comparison with other industries and sectors. Hospital Process Maps are very complex and variable, and to create a process map, you must understand every step within the process, including the inputs, outputs and resources used. Thus this stage benefits from stakeholder engagement and input from those who are closest to the process (Rojo et al.2008). Common information-gathering techniques include observation, brainstorming and surveys. By understanding the strengths and weaknesses within existing processes, laboratories can solve problems and build better "future state" processes. Process mapping can help to improve productivity, increase efficiency, reduce errors, stimulate sales revenue and enhance user or stakeholder satisfaction. It is widely
accepted that modeling of healthcare processes and subprocesses allows the creation of understandable graphical models, where management and improvements may be more easily implemented and controlled by healthcare professionals (Rojo et al. 2008). The ultimate goal of process mapping is to evaluate the various stages which lead to an improved result (Damelio 2011, King 2006, Trebble et al. 2010).

There are Four Major Steps of Process Mapping:

- **Process identification** - attaining a full understanding of all the steps of a process.
- **Information gathering** - identifying objectives, risks, and key controls in a process.
- **Interviewing and mapping** - understanding the point of view of individuals in the process and designing actual maps
- **Analysis** - utilising tools and approaches to make the process run more effectively and efficiently

Refer to Appendix II: Process Maps of Laboratory Testing in the Hermitage Medical Clinic and Appendix IV: Processing of Specimens and Result Reporting.

2.9. **Support from Hospital Management**

Much of the dissertation thus far relates to various process changes which will not come to fruition without the support of hospital management. Both the Carter Report (2008) and Beastall (2013) strongly advocate the development of strong clinical leadership and management skills. As already mentioned, support is being provided from the CEO and the MAC and I anticipate this will correlate with the reports from Brunetti et al. (2011) in relation to inappropriate and/or ineffective use of laboratory testing and the various barriers to the use of economic evaluation in decision making processes. As with any type of information, decision makers may not have the time or other resources to understand the concepts on which the evaluations are based, or the implications of the findings for the decisions they face. Pillay (2013) also highlights the importance of
laboratory personnel providing feedback on costs and volumes and data on inappropriate requesting to the clinicians. Both of these latter points will be assessed in detail via the IDI’s.

2.10. Building the Pathology Laboratory as a Standalone Business Venture

This dissertation is but a building block in a Departmental Development Process I have instigated and as Pathology Manager, I am aware of the laboratory not only providing a critical service to clinicians, patients etc but also of the revenue that is generated from it. Detailed studies with respect to analysing such as a standalone business model have not been carried out and in order to address such, I have reviewed the questions put forward by Friedberg (2008):

- What is the real business in consideration?
- What are the components to that business that may be affected differently by the predictions?
- What are the key drivers that help direct change in that business?
- What are the key impediments to change?

The business in consideration is not simply performing laboratory testing but rather the delivery of diagnostic medical information to health care providers. Political reasons to provide the service may exist, but essentially, hospital-based laboratories evolve as a business because they have capacity, there is a need, there is a market, and there is a potential revenue flow. Pathology laboratories are providing a service for the key revenue-generating services e.g. surgery, cardiology, orthopaedics, haematology, oncology etc and added revenue as a stand-alone business entity is perceived as the cherry on top (Friedberg 2008, Buljanović et al. 2011).

In order to remain competitive in line with a sustainable model, I agree with Friedberg (2008) who states that long term pressures need to be considered in any assessment of economic predictions and implications and that laboratories, regardless of size, that can
adapt to an evolving medical and technological climate will have the greatest chance of survival. With reference to pathology laboratories, these may include:

- increases in knowledge drive down cost per unit
- competition based only on price leads to commoditisation and often results in a race to the bottom of quality.
- Market dynamics eventually do prevail, as protectionist tactics may work in the short term, but are temporary at best
- Corporate size is not always an asset.

Following completion of this dissertation I hope to review a number of other areas with the purpose of developing the Pathology Laboratory, HMC further and ideally develop it as an independent business venture capable of raising significant revenue by linking with other areas of the hospital as well as developing new clinic activities and revenue-generating streams.

2.11. Conclusion

It is obvious from the proposal thus far that there is much work to do. Of paramount importance is maintaining high-quality patient care while saving money and resources. How well these proposed endeavors will be successful is unknown and as cited by the Danish physicist Niels Bohr (1885-1962) ‘prediction is very difficult, especially about the future’ (Friedberg 2008). Beastall (2013) re-iterates the importance of leadership and the need to ‘add value’ to ensure optimal delivery, use, development and evaluation of services provided for individuals and patient cohorts. This report refers to the use of the mnemonic ‘SCIENCE’ in order to illustrate seven added value concepts or domains: standardisation and harmonization; clinical effectiveness; innovation; evidence-based practice; novel applications; cost effectiveness; and education of others. The assessment of added value in laboratory medicine may be considered against a framework that comprises three dimensions: operational efficiency; patient management; and patient behaviors. It is through a combination of these factors and tools that I anticipate eliminating waste e.g. unnecessary testing etc, streamlining activities, and thus enable the
laboratory to be in a better position to generate additional revenue through offering additional testing, providing additional services such as fertility testing, allergy testing etc.

Fundamentally, the ultimate goal is to improve the quality of healthcare for patients, and practice guidelines may help laboratory professionals change the ordering of investigations to achieve a more rational use of diagnostic tests and achieve a ratio between infinite needs and finite resources. Brunetti et al. (2011) defines implementation of a similar regime by means of providing a summary of the best evidence and transparent recommendations through the development of systematic reviews and guidelines, hopefully defined in a completed thesis.
Chapter 3: Methodology

3.1. Introduction

The main purpose of this research is to assess the ‘assumed’ over-ordering of bloods especially at the weekends; an area of activity which is proving detrimental as regards resource allocation i.e. phlebotomy and medical scientist time, expenditure, potential risks associated with unnecessary phlebotomy of patients, and non-address of critical alerts due to the sheer number of such being phoned etc.

This dissertation will therefore include evaluation of information from the Meditech hospital information system (HIS), employment of process mapping of activities, and identification of critical control points and evaluation of such by means of Failure Modes and Effects Analysis (FMEA). I hope this report will highlight straight off where unnecessary bloods and samples are being ordered so these may be easily eliminated from the system as well as identify areas where LEAN and Six Sigma methodologies will highlight wastage etc (Gijo et al. 2013). This data evaluation will also highlight the persons associated with this assumed over-ordering and through In-Depth Interviews (IDIs); I hope to assess the rationale in relation to over-ordering as well as assessment of the actual ordering practices in the Hermitage Medical Clinic (HMC).

This chapter relating to methodology will explain the most appropriate methods of design, sample selection, data collection and analysis that will be used in order to address the research question and objectives. It will also identify ethical considerations associated with this research.

3.2. Research Questions

The main purpose of this research is to assess the ‘assumed’ over-ordering of bloods especially at the weekends. I hope to review the activities of the Pathology Laboratory, HMC with a view to streamlining some of the activities through LEAN and Six-Sigma
methodologies, eliminating waste through unnecessary orders. This is imperative to private hospitals as there are situations whereby clinicians order tests far beyond the price private health insurers pay for certain procedures i.e. with respect to negotiated package prices for orthopaedic procedures etc, thus making some procedures less cost effective or actually incurring a loss to HMC. It is also important to associate such in relation to clinical governance and I hope to execute such via attendance at the MAC meetings. The main rational for this dissertation is to address and control over-ordering of bloods and maximise financial resources available. Some of the questions set out in the IDIs are formulated to appear repetitive so that by approaching a topic in a number of ways, a comprehensive appreciation of the topic may be obtained.

a) Initial Questions
The objective of these questions is to review the consultant’s background, their medical specialty, number of years they have worked in this specialty and the number of years they have worked in HMC. The question in relation to what countries they have worked in before is to assess what similarities and differences they observe in relation to Ireland and their relevant country, as well as this hospital and any others they have worked in. This background information also assists with conversation relating to the international modalities that I have reviewed and discussed in Chapter 2: Literature review and how they may be applicable and implemented in HMC. The final questions relating to their opinion of the Pathology Services in HMC will set the tone for some of the other questions in relation to such throughout the IDI and hopefully suggestions to address any concerns raised may be discussed during the final set of questions. The questions also serve as ‘opening questions’ to encourage freedom of speech and introduce the various topics that will be covered during the IDI.

b) Test Awareness
This set of questions relates to how often each consultant orders tests, whether the tests are of a generic nature or not, and assess their interpretations in relation to how many tests they ‘think’ they order straight off.
c) Test Problem Recognition Style Questions

The objective of these questions is to assess what tests are being ordered and why? What is the relevance of these tests in association with the patient’s clinical representation? What tests are deemed critical and why? Are tests being ordered and not subsequently being reviewed, and therefore does the answer to this consolidate with the previous question i.e. is a consultant deeming 90% of his tests critical but only looking at say 10%? (This phenomenon was cited in the Carter Report). Who ordered these tests i.e. Consultant, RMO, nurse etc? Are tests being ordered under a consultants name but without his absolute consent? Is it happening or just perceived to be happening? Who is responsible for this? Why is it happening? If it is happening, what kind of controls could be put in place? These questions also serve to assess a consultant’s acceptance of test order control methodologies set out in the Literature Review such as test order frequency controls, computer blocks, EBLM etc.

d) Principle ordering Decision Variables

This set of questions is intended to evaluate the characteristics or variable which a consultant considers when ordering a test. It also takes into consideration internal and external factors that may affect the hospital and its staff i.e. patients, medical scientist, phlebotomy staff etc.

e) If over ordering is taking place, what are the best ways of addressing this issue? What are the action plans that could be proposed as a result of the review? What methodologies can be employed in the Pathology Laboratory, HMC to assist with the minimising of over- and/ or inappropriate ordering of test?

I currently think there is over-ordering of some tests taking place but I am unable to establish evidence to support such so that I may then tackle the issue. This issue has been highlighted in relation to tests ordered on Mark’s Ward over the weekend, but could also be reviewed in relation to ED test e.g. test ordered in relation to initial ‘diagnosis’ and eventual diagnosis.
f) Why is this over- and/or inappropriate ordering of tests taking place and who are the main culprits in relation to such?

Same answer as above. To be verified by review of Meditech HIS data initially and subsequently via In-Depth Interviews (IDIs) with relevant hospital personnel.

g) How much money could be (potentially be) saved in relation to such?

It is difficult to establish a figure in relation to this question. Some of the literature reviews support certain theories and methodologies as being more effective than others, yet few compare the same patient cohorts, medical specialties etc. Political influence may also play a role in some of these previously published manuscripts as well as the difference between the public and private sector. This information has yet to be fully deciphered in Ireland. Elimination of over- and/or inappropriate testing would release money being spent in relation to such. It would also free up staff so they could commit their time to more relevant activities. It could also highlight area which we could look into in relation to generating additional revenue.

h) How could the Pathology Laboratory best be run as a business generating additional revenue?

This would follow on from the above question and could help highlight areas relevant to healthcare which are either not being provided for currently or is not being provided for sufficiently (Buljanović et al. 2011).

3.3. Methodology

There are many channels by which a researcher may carry out their research, but it is imperative that one understands that the quality of the research largely depends on the methodology selected and how exactly it aligns itself with that specific type of research. This research is intended to assess the ‘assumed’ over-ordering of bloods especially at the weekends. For this reason, in conducting this research philosophies associated with interpretivism, positivism, and realism will be adopted within an inductive approach.
using assessment of both quantitative and qualitative data through Meditech data extrapolation and review, Active Research via implementations put in place to address the research objectives, and finally via in-depth interviews. The following paragraphs will explain the reasons for arriving at each option by means of utilising the Research ‘Onion’ for explanatory purposes.

![Saunders Research ‘Onion’](image)

Figure 1: Saunders Research ‘Onion’ as derived from Saunders, Lewis and Thornhill (2009, p.108)

### 3.3.1. Saunders Research ‘Onion’

Saunders Research ‘Onion’ is a generic research methodology which assists a researcher portray issues underpinning the selection of data collection and research methods. There are six stages or layers in the onion, namely philosophies, approaches, strategies, choices, time horizons, techniques, and procedures. The fundamental nature of the research onion relies on the peeling away of the various layers of the onion to arrive at the core, thus giving rise to a logical step-by-step procedure.
3.3.1.1. Research Philosophy:

The first layer of the onion is research philosophy which relates to the development of knowledge, and the character of that knowledge which is developed. The research philosophy one selects contains important assumptions about the way the researcher views the world and this greatly impacts and influences the subsequent research strategy (Saunders, Lewis and Thornhill, 2009).

In conducting this research, I believe more than one philosophy exists due to the multi-factorial nature of the dissertation as well as the art/science of decision making in medical situations. Therefore, the philosophy of interpretivism will be adopted as it believes in understanding human behavior rather than explaining it. I agree with Saunders, Lewis and Thornhill (2009) who maintain that interpretivism:

“advocates that it is necessary for the researcher to understand differences between humans in our role as social actors. This emphasises the difference between conducting research among people rather than objects such as trucks and computers”.

This is intrinsically aligned with my research, which if we revert back to the Literature Review highlights the behavioral aspect of test ordering (Brunetti et al. 2011). Saunders et al. 2005 also refer to the need to explore the intricacies of a given situation (in line with my perceived theory re the over ordering of tests) in order to understand the true reality of that situation. This is ultimately the foundation of interpretivism and is therefore disregarding the requirement to make generalisations that are synonymous with the positivist approach. However, the application and utilisation of realism theories allow for more than one instance of reality to exist (Denscombe 2003). This theory may be associated with this dissertation in line with decision making in medical situations whereby there may be many contributing factors associated with making a decision, some which may be controlled and some which may not i.e. underlying medical condition, genetic predispositions to certain illnesses, pharmacokinetic responses, etc. In my opinion
realism theories also apply due to the strong social component in relation to this dissertation whereby realism recognises that people and their associated behavior pattern cannot be studied in the same way as natural science. This infers that by studying human subjects, it is imperative to understand humans’ socially constructed interpretations and meanings within the context of understanding broader social issues. In summary and somewhat in contrast, realist research still aims to be scientific and associates itself with elaborate theories that should still be verifiable and have some level of generalisability (Fisher 2012).

It is also worth noting that while reviewing the two main elements of research philosophy; it is the theory relating to Epistemology that interests me the most. Again, this is most likely due to my background in medical science in which I seek evidence to support what areas I am looking at or questions I need answered. This branch of philosophy is therefore concerned with the nature of knowledge itself, its possibility, scope, and general basis. More broadly: How do we go about knowing things? Or how do we separate true ideas from false ideas? Or how do we know what is true? Or how can we be confident when we have located ‘truth’? That is not to say ontology is not linked to science but I think it leans more towards differences between ontologies (theories about what is out there) and epistemology (ways to figure out what is out there).

3.3.1.2. Research Approach:

The next layer of the onion is associated with research approach which refers to the method of creating new knowledge or the researcher enhancing their understanding of a subject or topic, namely by ‘inductive’ or ‘deductive’ means. The inductive approach will be used in relation to this dissertation as I believe it best fits with the research objective of this investigation, involves the preparation of a general list of questions and themes to be explored, derives data which I am hoping will be empirical in nature, and has a more flexible structure than the deductive approach. Regarding this approach, I particularly appreciate Saunders, Lewis and Thornhill (2009) sanction which states:
“Research using induction is likely to be particularly concerned with the context in which such events were taking place. Therefore, the study of a small sample of subjects might be more appropriate than a large number as with the deductive approach. As can be seen in Chapter 10, researchers in this tradition are more likely to work with qualitative data and to use a variety of methods to collect these data in order to establish different views of phenomena”

3.3.1.3. Research Strategy:

This layer relates to defining a plan of action in order to proceed with the research and give structure to the next stages by means of the techniques and methods of data gathering which will be employed. This overlaps somewhat with the previous section as regards the use of qualitative analysis through IDIs. It also includes the extrapolation of data from the Meditech system with analysis of such via Microsoft Excel as well as utilising FMEA tools via the IHI website. All work will be carried out by me personally.

Refer to Appendix V: Methodology relating to the Extrapolation of Data from the Meditech HIS relating to this Dissertation

3.3.1.4. Research Choice:

Research Choice is associated with my defending of why I have chosen this particular topic to review and this has been addressed in detail in Chapter 1. As regards defining the research choice in relation to this dissertation, I have selected a pluralistic multi-method methodology involving analysis of secondary data from previous research in relation to this topic, information extrapolated from the Meditech system IT system, and Action Research Plans which have recently implemented to address some of the objectives of this dissertation. In order to obtain a comprehensive library of knowledge on which to evaluate in association with this study, significant additional in-depth information will be
sought through IDI’s. In order to answer the research questions, five medical consultants who are among the largest and most significant users of the Pathology Services will be interviewed and the experience and opinions of the participants will be very important for the research.

By utilising both quantitative and qualitative research methodologies, I anticipate to contribute to an overall appreciation of the subject matter and address the research question and objectives. Through the IDIs in particular, I hope to gain insight into the attitudes, opinions, awareness and knowledge of those involved in test ordering practices in HMC. As this dissertation has raised a number of questions and fuelled much debate thus far, I predict further studies into some of the subsections of the dissertation to take place. This will more than likely result in additional quantitative analyses to assess the implementation of any process improvements or awareness of the issues and risks associated with over-ordering and test ordering practices.

Refer to Appendix V: Methodology relating to the Extrapolation of Data from the Meditech HIS relating to this Dissertation

**3.3.1.5. Time Horizon:**

This layer relates to detail about the time horizon of the research method employed and in relation to this, I have opted to carry out the assessment in a **Cross sectional** manner as this dissertation relates to early stage investigation into this area of pathology and so will be based on a specific number of interviewees and the sample will only be assessed within a very short time frame i.e. once. This type of cross sectional design is best applied to studies focused on finding out the prevalence of a phenomenon, situation, practice or issue in a certain period in time by assessing a cross-sectional cohort of the population. Saunders, Lewis and Thornhill (2009, p.155) also align with this theory by referring to “the study of a particular phenomenon (or phenomena) at a particular time”, otherwise known as a “snapshot”. Conversely, one may also observe the limitation of this
methodology being the inability of measuring change over time. This however will be mentioned in relation to Chapter 6: Recommendations

3.3.1.6. Data Analysis Core of Saunders’ Research Onion

Some additional information to be highlighted in relation to the study includes the following stipulations/ criteria/ factors:

➤ Sampling Criteria:

Due to some limitations such as time and budget, is not possible to collect data from a total population; therefore, the researcher needs to select a sample. As already stated by Boyce and Neale (2006):

“In-depth interviewing is a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation”

and so the first step in the sample selection is to define the population that will best suit this research. As also already stated a review of Meditech data will be extrapolated and five medical consultants who are among the largest and most significant users of the Pathology Services will be interviewed and the experience and opinions of the participants will be very important for the research. The names and contact details of all can be acquired via the CEO’s PA. There are over 200 consultants but I will need to evaluate the relevance of some to the study as not all request laboratory tests based on their specialty.

This therefore supports Saunders, Lewis and Thornhill (2009, p. 233) who refer to non-probability samples as it is impossible to generalize on statistical grounds due to the personal opinions of the consultants as well as the information relying on behavioral practices rather than numerical correlations.
Aspects of **Convenience sampling** will also be employed with respect to this research although the literature criticises this sampling type by arguing that this choice can bring “biases to the sample, meaning that subsequent generalisations are likely to be at best flawed” (Saunders, Lewis and Thornhill, 2009, p. 241). However, this research seeks to assess the ‘assumed’ over-ordering of tests in HMC and so is not intended to generalise test ordering practices in all hospitals.

In essence, the sampling will be of a direct consequence of what tests are ordered on the five weekends in the month of May 2014 and these will be amalgamated with details of the relevant consultant whom ordered the tests. In order to maintain the confidentiality of the consultants, these will be presented in relation to the relevant medical specialty. The top five consultants either directly involved as regards the originator of the test request, or indirectly by means of association with that specific medical specialty, will be selected for IDI. These will be the top requesters of tests as defined by the quantitative data collection from Meditech and therefore be the key individuals associated with the test ordering practices and activity. This should therefore present a valid representation of definitive data drawn down in relation to the actual tests ordered during the month of May and subsequently represent the consultants/ medical specialties associated with the relevant ordering practices.

### 3.3.1.7. Primary Qualitative Data Collection

With respect to *primary* data collection, I initially thought of carrying out quantitative analysis as regards assessing information relating to the over-ordering of tests by means of surveys and questionnaires. However, upon discussion with my supervisor, it was highlighted that this methodology can sometimes be considered futile, especially at Master’s level, and that accessing information by *qualitative* means might be more fruitful in its content and more useful in the long run. This opinion is also substantiated by Boyce and Neale (2006) who infer that:
“In-depth interviewing is a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation. The primary advantage of in-depth interviews is that they provide much more detailed information than what is available through other data collection methods, such as surveys [...] They also may provide a more relaxed atmosphere in which to collect information—people may feel more comfortable having a conversation with you about their program as opposed to filling out a survey” (Boyce and Neale 2006, pp. 2-3).

It is also generally accepted that qualitative methods are more appropriate to enable the acquisition of preliminary data regarding a research area as well as being deemed more exploratory in nature with the goal of providing more insight and understanding as how decisions are made. IDIs are often utilised for executive interviews, interviews about sensitive topics, and for interviews to measure individual comprehension and attitudes toward a new concept. These latter two points may be further exploited owing to the fact that IDIs allow for the exploration of a single individual without the influence of others. Therefore by means of employing qualitative methods, I hope to exploit the advantages of such by means of controlling the search design, focus on specific consultants (i.e. largest users of Pathology Services) and their associated specialties, while also not limiting the IDIs too finely, obtaining relevant useful information from highly respected Medical Consultants in their relevant specialties. Further support for IDIs is documented by Ponterotto (2005) who states that qualitative methods:

“refer to a broad class of empirical procedures designed to describe and interpret the experiences of research participants in a context-specific setting (Denzin & Lincoln, 2000b). Qualitative findings are generally presented in everyday language and often incorporate participants’ own words to describe a psychological event, experience, or phenomenon (Taylor & Bogdan, 1998). More specific defining characteristics of qualitative methods are dependent on the
particular research paradigm undergirding a chosen inquiry approach". (Ponterotto, 2005 p. 128).

The interview format will be semi-structured with some predetermined questions which should lead to relatively detailed answers, and yet be open to additional questions depending on the responses. The questions are designed with an exploratory focus so as to allow the discussion with the interview to flow organically while focusing on various aspects associated with the research questions and research objectives. The interviews will be face-to-face meetings, lasting approximately one hour, and permission to record such will sought to enable the interviews to flow and not be distracted by unnecessary note taking. Refer to Appendix VI: In-depth Interview Questions Blank Template for details of the questions which were employed during the IDIs. The data gathered by means of the IDIs should show gaps or issues in relation to addressing the ‘assumed’ over-ordering in HMC as well as stimulate and promote further study in a number of various areas.

Refer to Appendix VII for In-depth Interview Thematic-Analysis Data Charts and to Appendices VIII through to XII for the In-depth Interview Questions & Answers Sessions for each of the Five Consultants.

It is worth re-iterating at this stage that in order for the Primary Qualitative Data Collection to be comprehensive, most notable in relation to elucidating the most appropriate consultants to interview via the IDIs, a significant quantity of Primary Quantitative Data must be collected by means of the Meditech HIS.

3.3.1.8. Primary Quantitative Data Collection

As alluded to in the previous sub-section, Primary Quantitative Data must be collected by means of the Meditech HIS and this information will include extrapolation of information relating to patient’s name, date of birth, hospital number, date the sample was tested, test requested and location, and consultant. This information includes extrapolation of information relating to the five weekends in the month of May 2014. This month was
selected as it was deemed representative of hospital activity throughout the year i.e. previous 12 months. Owing to the assumption that much over-ordering is attributed to the weekends, the data will be collected in relation to the five weekends only. This involved data collection and extrapolation from the Meditech system for the time period defined i.e. 17.00 on Friday evening to 09.00 on Monday morning for each weekend in May 2014, with the exception of the first weekend in May which was a Bank Holiday and so it data was collated from 17.00 on the Friday evening to 09.00 on the Tuesday morning. Owing to the fact that May 2014 has five weekends leans the study to analysis of a greater collection of information as well as inclusion of a Bank Holiday weekend for assessment purposes.

3.3.1.9. Data Analysis

Data Analysis of the Primary Qualitative Data will take place following the laborious extraction of data from Meditech as indicated in sub-section 3.3.1.8 above, the data will then be downloaded to the hospital computer system and the information is then exported to a data collation file prior to modification by the Meditech Data Mining Program. This converts the data from ‘text data’ to implant it in an Excel Spreadsheet. Initially analysis and review of the data is carried out manually in order to correlate each patient entry with each patient’s main file in the original Meditech HIS to identify the patient’s Consultant. This can be an extremely laborious step but it is vital in order to correlate the information in its totality prior to further data analysis. By linking fields in the Meditech system with another data mining field, correlation is eventually executed electronically. This not only results in faster data correlation but also contributes to less errors being encountered. Once the data is extrapolated and modified into an Excel-compatible format, proper data analysis and review may be executed. This data analysis will mainly revolve around descriptive statistics. However, cross-tabulation analysis will also be conducted along with graphical representation of the output to aid clarification of trends in the data. The graphical illustration carried out will mainly include data relating to the following:

- Top Users of Test Requests
- Analysis of Data by Specialty
Breakdown of Test per weekend

The advantages of using this method of qualitative data collection are that it provides actual documentation illustrating evidence from recent test ordering practices. Thus this data collected from the actual hospital HIS authenticates this study as real as active patient files are being assessed representing actual test ordering practices which may be ascertained as definitive data collection.

Data Analysis of the Primary Qualitative Data will be carried out by reviewing each of the answers and assessing them in relation to various to the consultant’s background, reason for answering such. Where a number of questions were asked in relation to a similar topic, these will be grouped together for a more comprehensive evaluation of the answer. This will also serve as a type of internal data validation tool enabling assessment of the answers in a multi-factorial fashion. Where possible questions will also be cross-tabulated to link in a number of relevant factors which again will substantiate the integrity of not only the IDI questions but also the manner in which the IDIs were executed.

3.3.1.10. Population and Samples

As previously stated, this study will involve actual documentation illustrating evidence from recent test ordering practices. Thus this data collected from the actual hospital HIS authenticates this study as real as active patient files are being assessed representing actual test ordering practices which may be ascertained as definitive data collection. The IDI’s will involve world renowned medical consultants who are active members of the HMC Medical Team. As much as possible the information will be anonymised and the next sun-section will address any ethical concerns relating to this dissertation.
3.3.1.11. Ethics

In my opinion while stating the obvious, Bryman and Bell (2011, p. 122) highlight that ethical issues arise at a variety of stages in business and management research. This statement is undoubtedly true in relation to this dissertation as it relates to hospital information and thus every effort must be made to anonymise confidential details especially those relating to patient details, date of birth, hospital number, and clinicians. Policies and procedures relating to Ethics in the Hermitage Medical Clinic must be adhered to at all times (MAC 2013). In addition, some of the consultants being interviewed are members of the MAC and also are subject to compliance and adherence with the Hospital Code of Conduct, HMC (MAC 2013). I do not however think this will significantly alter their opinions to how they are associated with the HMC, or indeed prevent of inhibit them from expressing their opinions. It is my experience from working with them, they are often quite vocal and expressive in their thoughts, suggestions and recommendations, and I do not expect any less to be experienced during the execution of the IDIs. All details herein have been assessed in a professional manner and opinions documented are primarily for research purposes. As much as possible the information will be anonymised and although the information obtained through interviews is primarily being gathered for dissertation purposes, it would be naïve and useless if recommendations arising from such were not utilised for the benefit of the laboratory and hospital. Participants will be informed in detail about the purpose of this research and will know in advance the information required; therefore, they will decide whether to participate or not. Furthermore, the right of privacy of participants will be respected and the opportunity to refuse answering any question that they consider inappropriate or that they cannot answer according to the hospital’s policies will be maintained.

3.3.1.12. Personal Biases

As I work with these Consultants I will be cognisant of bias on both sides: from my side in relation to the way questions may be broached and even more so in relation to how I may choose to direct the conversation depending on the response, and bias from the Consultant point of view as they may be ‘selective’ in their answers and cognisant of how
the information may be used. However, it is worth noting that both I and the consultants I work with are committed to working in a professional impartial manner, abstaining from Conflicts of Interest, and committed to Continual Improvement in the workplace. My background as already stated is in medical laboratory science and therefore I am stringently associated with evidence based results and so do not think I will behave or be influenced by personal biases. Theories I have already encountered in relation to the literature review already highlight how they be incorporated into laboratories and some of them outline the limitations in relation to the proposed methodologies. In summary, I think this bias on both sides can be controlled by executing the IDI’s in a professional manner with open, honest, fair questions and answers.

3.3.1.14. Cost

There are no significant cost implications associated with my study apart from my personal time which will be committed to the project and the time the Consultants will I anticipate freely contribute. The close proximity of the consultants to my place of work will not incur any additional travel expenses.
Chapter 4: Data Analysis and Findings

4.1. Quantitative Data Analysis and Findings: Tables and Graphs from Meditech Data Extrapolation and Data Analysis

In this section a presentation of the quantitative data analysis is presented. This relates to the gathering of primary information by means of extrapolating information from the Hospital Information System (HIS) to detect trends in relation to the following research objectives, reviewed in line with the theories put forward and discussed in the literature review:

➢ Test ordering practices and procedures
➢ Decision making process
➢ Test ordering involvement

The first data finding is associated with test ordering practices and procedures, namely what tests are being ordered and may be held attributable to the assumed over-ordering. Data is presented in the bar graphs representing each weekend in the month of May 2014, for which there were five including a bank holiday. This month was selected as it was deemed representative of hospital activity in any given month over the previous twelve months. Information relating to verification of this statement was sourced from consultation with the Hospital Financial Cost Accountant who assesses hospital activity month-on-month in association with key data activity parameters such as those defined in Appendix XIII: Hospital Data Activity Information. These activity parameters include Key Performance Indicators such as Average Length of Stay (LOS), Occupancy Rates, and Day Case Beds etc. The actual figures have been excluded from this printed copy but are available for verification if required. This is owing to the sensitive nature of this information in relation to our competitors.
4.1.1. Weekend of the 02/05/2014

The following graph depicts that ward code ACCLG (Mark’s) had the highest number of tests requested, followed by ACC1 (John’s) and then ACCG (Luke’s). The lowest number of tests were requested from Theatre and this is substantiated by few theater procedures being carried out over the Bank Holiday.

Graph 1: Graph showing Tests Requested per Location 02/05/2014

The second graph illustrates the breakdown of tests with the highest number being Full Profiles (FP), followed by CRPs, and then FBC’s.

Graph 2: Graph showing Test Breakdown 02/05/2014
This next graph represents the number of tests per consultant. In order to maintain anonymity, they have been grouped together in relation to Medical Specialty. The individual names of the consultants were however also addressed at this stage to identify those who are the greatest users of the Pathology Laboratory and would be of assistance and contribute to the IDIs. This graph shows that General Medicine and Internal Medicine requested the most tests and this would also be representative of the hospital patient cohort at the time.

Graph 3: Graph showing Tests requested per Consultant/ Medical Specialty 02/05/2014
4.1.2. Weekend of the 09/05/2014

The following graph depicts that again ward code ACCLG (Mark’s) had the highest number of tests requested, followed by ACC1 (John’s) and then ACCG (Luke’s). There was also an increase in Emergency Department (ED) activity.

Graph 4: Graph showing Tests Requested per Location 09/05/2014

The second graph illustrates the breakdown of tests with the highest number again being Full Profiles (FP), followed by CRPs, and then FBC’s.

Graph 5: Graph of Test Request Breakdown 09.05.2014
This next graph represents the number of tests per consultant again verifying the significance of Internal Medicine requests, with Oncology and Cardiology showing similar representations.

Graph 6: Graph showing Tests requested per Consultant/ Medical Specialty 09/05/2014
4.1.3. Weekend of the 16/05/2014

The following graph depicts that again ward code ACCLG (Mark’s) had the highest number of tests requested, followed by ACC1 (John’s) and then ACCG (Luke’s). There was also an increase in Emergency Department (ED) activity.

![Sample number per location 16-05-14](image)

**Graph 7: Graph showing Tests Requested per Location 16/05/2014**

The second graph illustrates the breakdown of tests with the highest number again being Full Profiles (FP), followed by CRPs, and then FBC’s.

![Tests requested 16-05-14](image)

**Graph 8: Graph of Test Request Breakdown 16.05.2014**
This next graph represents the number of tests per consultant with the return of Internal Medicine to prominence, with Cardiology and Internal Medicine following.

Graph 9: Graph showing Tests requested per Consultant/ Medical Specialty 16/05/2014
4.1.4. Weekend of the 23/05/2014

By now a significant trend has emerged with ward code ACCLG (Mark’s) again having significantly more requests than the other clinical areas. A trend is also being seen in relation to ACC1 (John’s) and ACCG (Luke’s). Oncology and Emergency Department (ED) activity remains stagnant when reviewed with the previous weekends.

Graph 10: Graph of Test Numbers per Location 23.05.2014

The second graph illustrates the breakdown of tests with the highest number again being Full Profiles (FP), followed by CRPs, and then FBC’s.

Graph 11: Graph of Test Request Breakdown 23.05.2014
This next graph represents the number of tests per consultant/specialty with the return of Internal Medicine to prominence, with Cardiology second and Oncology third.

Graph 12: Graph showing Tests requested per Consultant/Medical Specialty 16/05/2014
4.1.5. Weekend of the 30/05/2014

This graph further confirms the significant number of tests being requested by ACCLG (Mark’s). The presentation of ACC1 (John’s) and ACCG (Luke’s) respectively is demonstrated for the fourth weekend in a row.

Graph 13: Graph showing Tests Requested per Location 30/05/2014

The second graph illustrates the trend of Full Profiles (FP), followed by CRPs and FBC’s as regards the most significant tests being ordered.

Graph 14: Graph of Test Request Breakdown 30.05.2014
This next graph represents the number of tests per consultant again with the return of General Medicine, Cardiology and Internal Medicine featuring at the top of the test requests.

Graph 15: Graph showing Tests requested per Consultant/ Medical Specialty 30/05/2014
4.1. Qualitative Data Analysis & Findings

In this section, a summary of the main topics conferred during the interviews is presented. Refer to Appendix VII: IDI Thematic Analysis Data Charts for Thematic Analysis Table following Assessment of the main themes of the IDIs. These tables do not represent all of the information gathered but rather represent some of the answers which can be cross-tabulated and correlated for comparison purposes. Full interview information, albeit with shortened answers to some of the questions, are documented in the subsequent IDI Interview Question datasets for each of the consultants.

The first section of the In-Depth Interview (IDI) Questions related to the Consultant’s background, how many years they have been working in this area, and how long they have been working in the hospital. The enquiry relating to the countries in which they had previously worked was to assess if any of the answers to the questions could be assessed in relation to the international practices and methodologies discussed in the Literature Review and subsequently to assess their acceptance or potential acceptance of implementing some of the afore mentioned practices in HMC. A summary of data relating to this section of the IDI’s is presented in Appendix XIII: Assessment of Interviewee Cohort.

Despite interviewees previously working in countries including Ireland, UK, France, New Zealand, USA and the Philippines, responses inferred that ordering practices in all countries are essentially similar, if not the same.

The opinion about the importance of the Pathology Laboratory was held in high regard and generally rated as good, with good test turnaround times (TATs), a very good Phlebotomy Department, and easy accessing of results all being highlighted. One consultant proffered that some over-ordering of Troponins and BNPs may occur, the latter are sometimes ordered daily. A second consultant mentioned that he thought there was excessive ordering of bloods ordered out of hours and at weekends but was unable to definitively say from which clinical area and who was responsible, and therefore this trail of conversation was reneged upon and the information was disregarded. It was also
mentioned that Marks Ward attempt to comply with Consultant Protocols and this may contribute to the over-ordering of bloods. It was suggested that if nurses were given more direction this may cease to be. This may be seen to consolidate with the large number of samples which are received from Marks Ward, especially at the weekends as evidenced from Quantitative Data Collection and Analysis from Meditech, and more over from the day-to-day operations of the Pathology Laboratory. It should not however be overlooked that Marks Ward is also primarily a Haematology and Oncology Ward and so given the medical specialty that is, may contribute to more samples with respect to the associated patient cohort.

The next section of questions related to Test Awareness practices in the hospital. There was general consensus that all interviewees request tests on a daily basis, the majority of which are generic tests such as FBC, FPs, CRPs etc and this was also evidenced in the Quantitative Data assessment. Some discussion did take place in relation to the additional tests ordered and these were intrinsically linked to the medical specialty the consultant was associated with. One interviewee did allude to over-ordering of tests being associated with consultants who are requesting tests beyond their specialty and did validate this statement with regard to this being the exception rather than the rule.

Knowledge of how many tests each consultant ordered per day/ week/ month was not as accurate as I would have thought it would be with only one consultant proffering to estimate the number, the answer which was quite close to the figure obtained in the quantitative analysis data. All interviewees did stipulate confounding factors attributing to the rationale behind test ordering practices, the most obvious being the number of tests ordered is directly proportional to the number of patients. All but one interviewee extended this to the association of additional test being ordered in association with the complexity of the patient’s clinical presentation.

In relation to Test Recognition especially in association with those tests which each interviewee would consider critical, disparate results were obtained ranging from the Cardiologist considering all tests critical, to the Haematologist rating 80% of his tests
critical, General Medicine and Orthopaedics stating the criticality of their tests to be ‘equivocal’, while surprisingly the Emergency Department clinician stating that a ‘small percentage’ of the tests ordered are critical. This will be further explored in Chapter 6: Discussion.

All interviewees strongly emphasised that they check the results of a vast majority of the tests they order with four consultants saying they look at every test. This is in stark contrast to some of the remarks noted in relation to such in the Carter Report 2008 which relate to ‘published data..show[s] that not all results are accessed and used by the requester’.

A mixture of responses was obtained with respect to how aware consultants were in relation to tests being ordered under their name but not required. These responses ranged from a definitive ‘no’ to consultants agreeing it happens but that they ‘don’t consider it an issue’. When further pressed in relation to this topic as regards how often does it happen, responses ranged from ‘I do not support this practice’ to the other end of the spectrum where the response was ‘it occurs as a daily occurrence’.

All interviewees showed a high understanding of the concept of over-ordering but the general response was strongly attributed to nursing staff. This type of question was posed in a number of ways to assess fully who could be responsible for this assumed over-ordering of tests. Some consultants showed empathy in relation to the nursing staff being held accountable for the over-ordering and two consultants in particular alluded to the inexperience of some junior staff nurses. When prompted, it was agreed that the newly appointed Nurse Education Officer should greatly contribute to the education and training of the junior nurses and create greater confidence in nursing staff as a whole. One consultant mentioned over-ordering of thromobophilia screens and suggested this could be due to the recent decrease in unit price; enticing some consultants to order more tests hence the increase in volume/unit number. In order to address such he suggested the need to develop guidelines in relation to the ordering of such, referred to the HSE/Waterford Guidelines, and requested MAC approval for such upon completion. He also
mentioned the perceived over-ordering of paraproteins in relation to some patients associated with his specialty and denoted that these are only required monthly, immunoglobulins could also be brought in-house to reduce costs, and virology requests should also be reviewed as he suspected over-ordering of these tests also which were relatively expensive when unnecessarily ordered.

Despite three consultants erring on the side of ‘need based’ responses in relation to test ordering practices, one consultant’s response inferred a mixture of both ‘want based’ and ‘need based’ while the remaining consultant stated that he ‘errs on the want based’ practice. This could however be held attributable to the associated medical specialty which may involve clinicians to be involved in ‘fishing-type practices’ as opposed to ‘hunter-type practices’ when ordering tests associated with their patient’s presentations.

When discussing the control of test orders, all interviewees supported best practice procedures and the emphasis of exploring the implementation of further processes. Of the five interviewees, four strongly agreed with the implementation of controls such as IT blocks, while one was unsure of the efficacy of implementing such in relation to reducing over-orders. With respect to test order controls via repeat frequency criteria, three strongly agreed while two consultants were unsure. One consultant referred to maximising LEAN processes to eliminate waste in areas other than just Pathology Tests.

Cost was highlighted as a significant concern for two consultants when ordering tests, two consultants stated they were very aware of cost, while conversely one consultant confessed that cost ‘doesn’t even enter my mind’. Again this variance in opinion may be attributable to the medical specialty, but even more so it may in this instance may be indirectly proportional to the urgency of his test ordering practices. This is therefore following discussion with the aforementioned consultant principally linked to his test ordering practices and personal manner. Completely disparate responses were also received when discussing the question relating to how cost of lab tests may influence decision making practices as well and also when assessed in relation to how committed each consultant was to ordering in profiles; the main themes in relation to such are
tabulated in the following table, with additional tables relating to IDI Thematic-Analysis Data Charts available in Appendix VII:

<table>
<thead>
<tr>
<th></th>
<th>Aware of Costs of Tests</th>
<th>Cost influences Ordering Tests</th>
<th>How committed to ordering in Test Profiles are you?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant 1</td>
<td>Yes-very aware</td>
<td>No</td>
<td>Very committed</td>
</tr>
<tr>
<td>Consultant 2</td>
<td>No</td>
<td>Not really</td>
<td>Very committed</td>
</tr>
<tr>
<td>Consultant 3</td>
<td>No</td>
<td>No</td>
<td>Not very committed</td>
</tr>
<tr>
<td>Consultant 4</td>
<td>No</td>
<td>No</td>
<td>Not very committed</td>
</tr>
<tr>
<td>Consultant 5</td>
<td>Quite aware</td>
<td>Yes</td>
<td>Very committed</td>
</tr>
</tbody>
</table>

Table 1: IDI Thematic-Analysis Data Chart showing Cost Awareness Data

The question in relation to the tie-ins of insurance payouts, reimbursement and professional fees and how they may influence ordering practices was one of my favorite questions and my reasons for this will be discussed in Chapter 6. To crudely state the answers in relation to such: three consultants said a definitive no to such influences while two referred to the awareness of certain fees paid in relation to set price operational packages.

When assessing the factors and risks associated with the perceived over-ordering, a mélange of different results were obtained from all consultants. Despite the fact that venepuncture risks associated with the phlebotomy or taking of blood samples should be listed a primary concern with respect to excessive phlebotomy, surprisingly, only one consultant mentioned this. One consultant was adamant in his response to this and volunteered the information vehemently in relation to the following:

1. Venepuncture or phlebotomy risks
2. Financial constraints out-of-hours
3. Finite laboratory time

As Pathology Manager, concern for the laboratory was a welcome respite! Two other consultants mentioned financial constraints in relation to this question.
Questions associated with Test Ordering Variables concerned with what tests a consultant may order and how factors influence this decision were discussed in detail. Some consultants showed a deep understanding of medical science and the factors that affect testing methodologies such as test specificity and test accuracy, while some consultants presented very generic answers in relation to turnaround time etc. All interviewees had to be prompted to mention quality, and surprisingly they all re-iterated that when it came to the quality of tests and tests methods they assumed the Pathology Laboratory took ownership of such, which could be construed as a compliment. As an additional approach to seek further information in relation to this topic, cause and effect influences were examined. Similar answers were obtained in relation to such so this could be considered a form of internal control or method of assessing the validity of the answers received to the similar type of questions.

Little evidence was obtained in relation to whether ordering straight away or waiting a while would result in increased test orders. Three of the consultants said they ordered the test immediately after assessing the patients, one consultant said he sometimes orders straight away but it would depend on whether the patient had presented as an urgent case or as an elective, and the remaining consultant said he could perhaps be prone to over-ordering if under pressure to see patients.

A multi-faceted approach to whether consultants preferred paper-based or electronic-based ordering systems was entertained, and the general consensus was that over-ordering could take place as a result of the ease of ordering electronically. This seems inconsistent with the initial complaints some of the consultants in relation to some aspects of the Meditech system as well as again contrasting with the attractiveness of the access of results especially when accessed in the consultant suites.

In relation to whether consultants order more or less tests depending on whether they are ordering tests in a public or private setting, three consultants said there was no difference in their ordering practices between the two entities, while two consultants alluded to there being no differences and if there were, there would be over-ordering associated with
initial lack of professional competence and experience of the relevant personnel but that this was independent of the actual setting i.e. public versus private.

Despite the fact that three consultants definitively answered no to the influence published articles, conference information, brochures etc could evoke in relation to their ordering practices, the reference to the BCSH Guidelines and articles in relation to the Wells Scores indicates that this may not be the case. The remaining consultant said a definitive yes at first but then reneged and indicated it would depend what the articles say. At no stage did any of the consultants proffer articles in relation to Evidence Based Laboratory Medicine or the information available in relation to the HSE Frequency of Testing information.

A definitive no was also received in relation to any tests which could be deemed to be under-utilised and this is cross-tabulated for assessment with other similar questions and represented in tabular fashion in Appendix VII: IDI Thematic-Analysis Data Charts. This was assessed by means of data extrapolation from Meditech and via the IDI’s and yet is in stark contrast to the Carter Report 2008 which states: ‘low rates of requests may also be worth investigating as they may reveal areas of practice where tests could add value to the diagnosis and treatment of a patient. Analysis of the requesting rates of different practices, and of different doctors within a clinic or practice, may therefore be helpful in improving clinical effectiveness as well as cost-effectiveness use of the pathology services’.

Enquiries relating to the future direction of pathology and healthcare were raised as discussion points and for general information as opposed to definitive questions and direction. One consultant proposed defined practices that are currently important to laboratory practices, sees no great changes in relation to the test ordering procedures, complimented the Pathology Laboratory, and did not have any other issues to raise or discuss. The next consultant had no great thoughts in relation to any of the points raised in this section and was of the opinion that such advances have been made in recent times, that analytical and operational processes have reached a pinnacle and will stabilise or
plateau until the inception of new technology. The third consultant (most senior in years of the lot!) wanted to further embrace technology, highlight correct documentation of all relevant information at all times especially in relation to drug ordering and Kardexes, suggested the use of iPads etc. and remote access of clinical information, review of shift systems in relation to nursing requirements, need to overcome fear of technology and fear of employing a paper-free environment.

The penultimate consultant appeared despondent at this stage of the IDI and appeared to show a laissez-faire attitude to the future possibilities. He stated he foresees test ordering procedures remaining the same, remained resolute in relation to his request for the tests he has requested, and summarised the interview by saying he was very satisfied with the provision of service of the Pathology Laboratory. The last consultant also appeared despondent in relation to the question relating to the conclusion that he thinks healthcare is going down the pan and he therefore has little faith in the decision-making capabilities of government as regards corporate greed etc. He did however put forward a number of procedures having an impact on test ordering procedures going forward such as EBLM, international best practice procedures, evaluation of key performance indicators (KPIs) such as ED D-Dimer and Troponin Evaluations, and streamlining of process flows in association with reimbursement packages. He also highlighted his interest in reviewing the amount of money spent per specialty e.g. ED v’s Orthopods and this was also re-iterated by the third consultant above. Care must be taken in relation to such however, as there may be and inside ‘political’ agenda associated with such on some level!
Chapter 5: Discussion

This chapter includes review and discussion of the research question and research objectives set out in the dissertation according to the results obtained and the literature previously reviewed. An obvious declaration is the re-iteration of how important the research question is as the basis of any research or study. This dissertation centres on the following research question: does the ‘assumed’ over-ordering of bloods, especially at the weekends, in the private hospital, actually occur? This is pragmatically proposed in Section 1.9. of this dissertation in relation to the rationale for choosing this topic.

It is apparent from both the qualitative and quantitative analysis executed in association with this dissertation that over-ordering of tests is occurring. However, it is also obvious that it is nowhere near the magnitude that was initially thought. The implementation of the various control mechanisms i.e. Active Research tools, have had a significant impact in relation to the identification and control of some of the testing practices. Owing to the success associated with these, it is generally accepted that they may be expanded to cover additional test ordering practices, especially those related to high volume tests and other expensive tests. Overall the test ordering practices may be deemed quite satisfactory in relation to the patient cohort in HMC and the levels of activity associated therewith. As with all processes however, there is always room for improvement.

It is generally accepted that research questions are quite extensive at the outset of implementing the investigation and the focus becomes more defined as the research becomes more focused. Very often this happens organically rather than being forced. This is very much the case with this study, as although I had a fair idea of how the study might go, I was unsure how honest the interviewees would be and thus how the answers would contribute to a detailed, concise study, as well as proving to be representative of the actual procedures currently being practiced. Hypothesising that over-ordering of tests may be occurring while simultaneously identifying a gap in the literature in relation to such, led to progress of research to identify the objectives and questions to be answered via pluralistic research approach by both qualitative and quantitative data collection. In
Section 1.6., I hypothesised a number of items which I thought would hold true in relation to this study and they are presented as follows:

**1.6.1. Some over-ordering does exist in HMC:** I did not find any significant amount of over-ordering from either the Quantitative or Qualitative Data collection in relation to HMC. I strongly believe this may have been as a result of the Active Research implementations which had recently been put in place. These included IT blocks as regards test frequency controls, appropriate training in relation to correct ordering of Micro swabs etc.

**1.6.2. Over-ordering has essentially been addressed by and large by means of implementation of Action Research methodologies such as IT Blocks, test frequency ordering controls, correct ordering and labelling procedures e.g. MRSA Swabs, and education re awareness of ordering practices and procedures:** This was strongly evident and owing the fact that firstly, there was no resistance to having measures put in place, secondly, no objections to the measures following implementation, and thirdly, there was a general consensus of support in implementing further controls in association with this, these controls will be rolled out to cover other tests also. These implementations especially in association with Frequency Test Controls will be discussed, evaluated and authorised by the MAC.

**1.6.3. I anticipate the following will be discussed during the IDIs in relation to the ordering of tests:**

- **Importance of correct tests:** Yes-but I would have thought this would have featured more in the IDIs

- **Correct patients-Correct Result:** Not in any great detail-looking back this may not have been extensively assessed through the IDIs in great detail and no prompts were given in relation to such either apart from the quality of the actual tests themselves
- **Identification of critical alerts and notification of such to clinicians:** mentioned by some consultants, but the majority review their results on the Meditech HIS.

- **Quality of tests:** I would have thought this would have been mentioned in greater detail but the general consensus was that they had confidence that the laboratory took responsibility for this. I essence, the interviewees had to be prompted in most instances to mention such.

- **Phlebotomy Risks to Patients:** Surprisingly only mentioned by one consultant in relation to the risks associated with over-ordering of tests. I would have thought there would have been a greater emphasis placed on this, especially in relation to Mark’s Ward patients who are not only accountable for the largest number of samples per location for each of the five weekends, but also because these patients are most likely to have poor veins and therefore require more complex phlebotomy techniques.

- **Timeliness of Turn Around Time with respect to test:** this was highlighted in relation to a number of questions and rated higher than I would have thought especially in relation to some specialities.

- **Correct use of resources such as financial aspects and elimination of waste:** Financial implications in relation to the over-ordering of tests were mentioned by a number of consultants. This was however over-shadowed by their lack of awareness in relation to the actual cost of the tests. Some discrepancies of financial awareness and the ensuing repercussions as regards infinite needs yet finite resources were mentioned by two consultants but again, owing to the overall dissimilarities in relation to the financial aspects of laboratory testing, this information is difficult to decipher further.
The basis for this research is related to the assessment of the following objectives and by doing so; answers to the research question are anticipated:

- Test ordering practices and procedures
- Decision making process
- Test ordering involvement
- Test ordering stimuli
- Stakeholder involvement
- Stakeholder responses
- Most wanted attributes when ordering a test

In order to review and assess this dissertation’s results and findings in relation to the research question, research objectives, and Literature Review, the main differences found are summarised below and five main sections are highlighted in particular in relation to the similarities or differences observed/detected with respect to this study and these will be discussed below.

5.1. Evidence of Test Frequency Controls Work

The very basis of this dissertation was assessment of the ‘assumed’ over-ordering of tests in HMC and this assumed activity was alluded to time and again by colleagues. This is intrinsically linked to the following research objectives: test ordering practices and procedures, decision making process, test ordering involvement, and stakeholder involvement.

The Carter Report was introduced Chapter 1 of this dissertation and is cited in various aspects throughout this dissertation. The following citation is of most interest to me as it alludes to the propensity to over-exaggerate aspects of test ordering which are not true: ‘it is claimed that up to 40% of tests requested are unnecessary; again this figure is unsubstantiated’. It is evidenced that this is also not the case in HMC and further points will be discussed to support this. The Carter Report re-iterates that a key inefficiency at present is the lack of demand management. This is alluded to in numerous paragraphs of
the Carter Report as well as referring to several witnesses referring to ‘substantial levels of unnecessary testing’. The Carter Report also associates with another phenomenon which I thought was taking place in HMC; that of unnecessary repeating testing, most notably the Microbiology Swabs which were initially being taken upon the patients’ presentation in the Emergency Department (ED) and then the swabs were being taken upon the patients’ admission to a ward. Owing to the fact that approx. 30% of patients are admitted from ED to a ward this was resulting in a considerable amount of unnecessary testing and orders. A figure of 25% was cited in the Carter Report in relation to over-ordering, yet the figure I obtained was less than 1%. It was also noted that the second swab was not being booked onto the Meditech HIS system correctly and instead an addressograph label was being placed on the swab as opposed to the swab being ordered correctly through the Meditech system. When this issue was detected, training of nursing staff in relation to the correct ordering procedure assisted with the elimination of over-ordering swabs as an IT Block was simultaneously implemented so that when a second order was entered the Meditech HIS alerted you the previous sample being requested. In clinical situations necessitating additional testing, this IT Block could be overwritten but a comment needed to be added by the person requesting the additional swab. The process is also audit traceable with respect to the person’s name via their Meditech log in.

The Carter Report 2008 also refers to several witnesses alluding to ‘substantial levels of unnecessary testing’ and ‘unnecessary repeating of tests’ in numerous paragraphs of the report. Data extrapolated from Meditech supports the following statement in Carter Report which found ‘no robust studies which verify this statement’. The Carter Report also alludes to another phenomenon which I thought was taking place in HMC; that of unnecessary repeating of tests (swabs ED/Ward).

5.2. The Education of Staff in relation to Tests and Test Ordering Practices is Paramount

In further support of the Carter Report, a referral to the UK Healthcare Commission (2005) concluded that:
‘a key challenge facing many pathology services...was the need to improve the level of understanding of pathology services among doctors and other staff using these services. Improved understanding should help users that they are ordering the right tests, providing the right supporting information and correctly interpreting results’.

I absolutely agree with this statement as not only was it evidenced during the IDI’s but I also witness it daily in my current role. Yet again, the emphasis of education, training and awareness cannot be more highlighted. This is further substantiated by the unnecessary testing stemming from a lack of appreciation or awareness on the part of the requesting clinician about the appropriateness of particular tests and the usefulness of the information obtained from the test result. This is made furthermore complicated by the high degree of variability in test repertoire, investigation protocols, and guidelines on the use of pathology services, as well as in the results obtained and reference ranges employed in their interpretation, increasing risks to patients. As laboratory medicine becomes more sophisticated, it is inevitable that the knowledge gap between the consultant and medical scientist grows wider and it is imperative that continuous education and training negates these risks.

Section 2.3. of this dissertation exposes behavior patterns noted in relation to test ordering practices, most notably those documented by Brunetti et al. (2011) who refers to the defensive behavior I refer to as The ‘But We Always Do It This Way!’ Phenomenon in HMC. This also correlates with sentiments in the Carter Report which state:

‘it is reasonable to suppose that some unnecessary testing could be caused by the practice of defensive medicine. It is safer for a clinician to request tests-whether necessary or not-than to have to justify the judgment not to make the request’.

This defensive medicine behavior is also cited as one of the reasons for the higher level of testing in the US, and although this was mentioned by a number of consultants during the IDIs, ironically it was not mentioned by the Consultant who studied in the US. In a similar vein, this phenomenon was subsequently counteracted by some of the responses
in relation to whether their ordering practices were ‘want based’ or ‘need based’. Despite three consultants erring on the side of ‘need based’ responses in relation to test ordering practices, one consultant’s response inferred a mixture of both ‘want based’ and ‘need based’ while the remaining consultant stated that he ‘errs on the want based’ practice. This could however be held attributable to the associated medical specialty which may involve clinicians to be involved in ‘fishing-type practices’ as opposed to ‘hunter-type practices’ when ordering tests associated with their patient’s presentations.

The latter part of the above citation was also addressed by only one consultant who referred to legal malpractice issues which may be associated with medical care and therefore there are instances whereby one may request tests-whether necessary or not-than to have to justify the judgment not to make the request. This aspect of ‘over-ordering’ does not warrant additional address as clinically it may be considered important to rule out certain diagnoses which will attribute evidence to define the primary diagnosis. ‘Assumed’ over-ordering may also incorrectly be associated with an evidence based requirement for additional, often regular, testing to inform the diagnosis, treatment and management of a patient. This was substantiated by both the General Medicine Consultant and the Consultant Cardiologist, who both lamented ‘if I need it, I need it’!

This is an important point to highlight as in certain conditions monitoring a patient over a number of days can show situations of base line parameters required for the patient’s treatment of indeed review of a patient’s situation to assess prognosis or response to certain treatments. Again these situations would not warrant address as regards control of such.

Without doubt, when assessing why actual over-ordering was occurring, the overwhelming sentiment related to another citation also versed in the Carter Report, that being:

‘high levels of tests are more common at night, when the clinicians on call are generally more junior and less experienced’.
This was re-iterated as not only being clinicians as alluded to above but also to nursing staff as evidenced from the IDIs. Therefore greater education of all staff in relation to Tests and Test Ordering Practices is of paramount importance to address some of the issues associated with this investigation.

5.3. There is Little Awareness as regards the Cost Implications of Tests

The investigation surrounding this topic contributes to a growing body of evidence that investigates how little emphasis is placed on the financial aspects associated with laboratory tests. Although cost was highlighted as a significant concern for two consultants when ordering tests, two consultants stated they were very aware of cost, while conversely one consultant confessed that cost ‘doesn’t even enter my mind’. Again this variance in opinion may be attributable to the medical specialty, but even more so it may in this instance may be indirectly proportional to the urgency of his test ordering practices. This is therefore following discussion with the aforementioned consultant principally linked to his test ordering practices and personal manner.

Completely disparate responses were also received when discussing the question relating to how cost of lab tests may influence decision making practices. This was also assessed in relation to how committed each consultant was to ordering in profiles. This latter point is important as a biochemistry Full Profile (FP) includes analysis of 17 individual parameters. However, depending on the actual parameters being required by the consultant, a profile containing fewer biochemical parameters may suffice. The parameters for each of the three main biochemistry profiles are depicted in Appendix XIV: Differences in Test Profiles with respect to Full Profiles, Renal Profiles, and Liver Profiles and so to clarify further, if a consultant only requires potassium on a patient, this may be ordered on its own. If however, a consultant requires a sodium, potassium, and creatinine, it is a waste of resources ordering a Full Profile when a Renal Profile would suffice. The cost difference between ordering a Full Profile and a Renal Profile is €31. Therefore, if we calculate that 828 Full Profiles were ordered during the five weekends in May 2014, at a cost of €58 each amounts to €48,024. If however, we said an estimated
50% of these could be ordered as either Liver Profiles or Renal Profiles, an incredible €25,668 could have been saved. It is imperative that I highlight this is the difference in relation to these tests at the weekends only and the number of these tests ordered routinely during the weekdays is considerably higher than this. This is also one month in 2014 also.

Taking clues from further information discussed during the IDIs in relation to costs, the results depicted in Appendix VII: IDI Thematic Analysis Data Charts in relation to Costs and their Influences, demonstrates that there is little consideration given to costs overall. This is particularly unusual given that the HMC is a private hospital, reliant on active patient attendance and hospital activity, which is also concerned with maintaining itself as a viable financially viable business option. This is confirmed by the consultant who ascertained that eventhough he was very aware of the costs of the tests and very committed to ordering in test profiles, cost didn’t actually influence his test ordering behavior. However upon further analysis, there are two consultants who are on opposite ends of the spectrum as regards test ordering behavior-one is quite aware of costs, admits that cost influences his ordering of tests, and is very committed to ordering in test profiles. In dissimilarity, the other consultant is not aware of costs, is not influenced by the cost of tests, and is not very committed to ordering in test profiles. This difference in attitude may be explained by means of the medical specialties both consultants are associated with the latter being involved in Emergency Medicine whereby he requires rapid aids to diagnosis. It seemed unusual though that he admitted he relies very much on the ‘stories’ patients tell on admission to the Emergency Department and from this he orders tests he thinks are necessary. This is in excess of the tests the nurses have ordered upon the Triage Assessment they carry out upon first review. This is a situation which may be reviewed, but given the nature of Emergency Medicine, and as discussed in relation to eliminating diagnoses to define the primary diagnosis, it may be futile to endeavor to address and control this type of test ordering pattern. Ultimately, if a diagnosis was ‘missed’ due to a test not being carried out, a hefty medical negligence case could soon re-instate the difference between cost and value when it comes to this type of test ordering practice.
As an additional point relating to the test ordering practices of the Emergency Consultant, I further probed during the IDI as to why he relied so heavily on ‘stories’ as opposed to the laboratory tests which I have mentioned numerous times as influencing medical decisions and diagnoses. To this point I was informed that a story can point out numerous factors associated with why the patient has attended the Emergency Department. If however, a doctor relies solely on laboratory tests, or solely radiology scans for that matter, a consultant may become complacent and read into one or few parameters of a testing method and misdiagnose a patient. Therefore, this consultant believed that a more rounded, comprehensive medical review and subsequent diagnosis could be obtained through combining the ‘story’ with the laboratory test, scans etc. Given due consideration, this is an alternative yet plausible approach to diagnosis, to which to consultant retorted ‘you are the drummer in the band, not the lead singer!’

Numerous reports relate to the cost effectiveness of some tests such as BNP and the influence it has in patient diagnosis and treatment in relation to chronic heart failure (Brunetti et al. 2011). This was assessed as part of the IDIs, and owing to the fact that some reports assign it obviously to cardiology; I was intrigued to receive his views in relation to such and was not expecting his disregard of such. Upon review of a relevant paper associated with BNP and a reduction in Echo’s it became apparent the paper was a biased report to influence the waiting time for Echo’s. Similar trails of thought were surmised and these are subject for review in line with Chapter 6.

Another variance I found particularly interesting in the discourse of the IDIs was the following question: ‘how aware of the tie-ins of insurance payout, reimbursement, professional fees etc influence you’re ordering practices??!’ I will admit I was a little unnerved about posing such a question and the intent of the question was to assess if consultants were influenced by the additional reimbursements and professional fees consultants receive in relation to the number of tests they order or are attributed to their name (also note in this clause the questions asked during the IDIs in relation to the ordering of tests under a consultants name and did they give absolute consent for certain
tests to be asked?) However, in total honestly, I accept that the way I posed the question may have deviated from the intended purpose, and so instead of answering the question in association with reimbursements and professional fees, the consultants responded in relation to medical insurance reimbursement such as that for hip operation package reimbursement. All five consultants interpreted the questions in this manner and from gauging their body language and facial expressions; I thoroughly believe they expected this to be my intent. Owing to the sensitive nature of the question in the manner in which I intended, I decided not to diverge from this trail and not rephrase the question. Although I take full responsibility as regards the construction of the questions used in the IDIs, I did not explicitly regard the possibility of this question being interpreted as it was! I thought I was being well versed and well prepared in enabling some questions to be paired together so the answers form a cross-reference and may be analysed in a cross-tabular fashion. It has however increased my interest levels in relation to not only the importance of succinct, concise questions in relation to the questions I created, but also to the manner in which I answer questions, questionnaires etc in the future.

In a distant yet marginally related matter also concerning this topic, I wish to draw attention yet again to the Carter Report which refers to ‘under their new contracts, GPs gain financially from increasing the number of tests they request; predictably this has led to a significant increase in laboratory activity, although there has been no corresponding increase in laboratory funding at a national level’. This may therefore be related to the above topic matter I initially intended to enquire about and I wonder to its application or relevance to Ireland and the HMC?

5.4. There is Little Awareness of the Risks of Phlebotomy

When assessing the factors and risks associated with the perceived over-ordering, a mélange of different results were obtained from all consultants. Despite the fact that venepuncture risks associated with the phlebotomy or taking of blood samples should be listed a primary concern with respect to excessive phlebotomy, surprisingly, only one consultant mentioned this. The risks for a patient exposed to unnecessary phlebotomy
may range from mild discomfort, dizziness, anxiety and light headiness to fainting, hyperventilation and nausea. On the extreme of the scale, and usually only associated with less experienced phlebotomists, are the risks involving nerve damage, arterial nicks, and lymphoedema.

As evidenced from the Quantitative Data Collection, it is extremely obvious that Marks Ward is the clinical area who requests the most samples by far. It was also mentioned that Marks Ward attempt to comply with Consultant Protocols and this may contribute to the over-ordering of bloods. It was suggested that if nurses were given more direction this may cease to be. It should not however be overlooked that Marks Ward is also primarily a Haematology and Oncology Ward and so given the medical specialty that is, may contribute to more samples with respect to the associated patient cohort. Given the fact that there are so many contributing factors as to why Mark’s Ward is associated with the ordering of the majority of tests, an individual review is required to assess the ordering practices of the ward in a separate review.

5.5. Quality of Tests

Questions associated with Test Ordering Variables concerned with what tests a consultant may order and how factors influence this decision were discussed in detail. Some consultants showed a deep understanding of medical science and the factors that affect testing methodologies such as test specificity and test accuracy, while some consultants presented very generic answers in relation to turnaround time etc. All interviewees had to be prompted to mention quality, and surprisingly they all re-iterated that when it came to the quality of tests and tests methods they assumed the Pathology Laboratory took ownership of such, which could be construed as a compliment. As an additional approach to seek further information in relation to this topic, cause and effect influences were examined. Similar answers were obtained in relation to such so this could be considered a form of internal control or method of assessing the validity of the answers received to the similar type of questions.
Chapter 6: Conclusions, Recommendations & Future Applications of Learning

6.1. Conclusions

It is apparent from both the qualitative and quantitative analysis executed in association with this dissertation that over-ordering of tests occurs. However, it is also obvious that it is nowhere near the magnitude that was initially thought.

The Carter Report refers ultimately to the same conclusion I have arrived at, that being the citation that one of the greatest obstacles in relation to healthcare review is the deficiencies in relation to good quality useable data about costs, activity and performance within pathology services. It was also obvious from performing the Literature Review that we are at a massive disadvantage owing to the lack of nationally collected activity, cost and performance data. This in turn proves detrimental when attempting to make comparisons between pathology in various countries, for benchmarking purposes, assessment of compliance with international standards etc. Even if substantial resources were invested to construct such a database, colossal efforts would also be required to necessitate thorough testing through a series of pilot projects, subsequent reappraisal, and validation of data. Undoubtedly, changes need to be implemented if we are to be in a position to address some of the impending changes coming down the road w.r.t. pathology including the advent of the genomic revolution and personalised healthcare. Owing to the fragmented information available in association with operations, finance and other healthcare activities, there is little centrally collected and standardised information associated with pathology or the key elements of the service such as capital investment strategies and the workforce. It is therefore difficult to assess the extent to which the efficiency and effectiveness of the services can be improved, and whether the projected increases in future demand can be accommodated safely.
6.2. Recommendations

It became quite apparent very early in this dissertation that a number of recommendations were already emerging. Some of the recommendations are beyond the scope of address of this dissertation and would only befit large-scale, well funded national projects such as the establishment of national and international databases. Therefore, in order to address some of the issues, I will define herein those that emerged as the most pertinent recommendations which I believe will contribute to the body of knowledge already available, as well as address the deficits observed during the Literature Review and discussed as part of the IDIs.

During the execution of the Literature Review, the deficiency in relation to adequate Irish management studies into healthcare in particular, was an astounding realisation. I do however believe that advancements are being made not only in relation to entities such as the National Haemovigilance Office and the National office of Clinical Audit (NOCA), but these bodies have much work to execute if we are to compete with some of the international research and data collection bodies which exist. The UK has actively implemented a reporting entity in relation to clinical guidance on individual patients, which is drawn from such evidence-based sources as NICE and the National Electronic Library for Health. The NHS National Knowledge Service is building this activity into the Connecting for Health programme in relation to the formulation of best clinical practice, the protection of patients, and the effectiveness of diagnostic testing within patient pathways. I cannot place greater emphasis on the difficulty in obtaining data with respect to this dissertation and healthcare in Ireland in particular. Even Quantitative Data extrapolation from our HIS proved difficult, despite the fact that it is deemed one of the most advanced information technology systems on the market. Collectively, this may contribute significantly to why there are so few significant studies in relation to healthcare in Ireland.

As evidenced from this dissertation, some over-ordering of tests is occurring which raises the question in relation to whether or not this perceived over-ordering could be associated with other areas of healthcare e.g. the ordering of radiology scans, ECHOs etc? Are there
similar studies in relation to such and if so, how much money nationally is potentially wasted through over-ordering? A recent BBC News Story (2014) recently reported that £25m is wasted annually in the NHS on unnecessary consumables alone. This therefore may warrant additional investigation.

A number of relatively small studies were suggested by consultants during the IDIs which when combined would greatly enhance the knowledge library of the HMC in relation to some of the hospital activities. Some of these are linked to elucidation of quality markers in the hospital such as:

- Review of Troponin and BNP orders in relation to Cardiology patients in particular
- Review of Troponin D-Dimer orders in relation to ED patients
- Evaluation associated with the ordering of Full Profiles versus Renal Profiles versus Liver Profiles
- Review of amount of money spent on tests per specialty e.g. ED and orthopods and similarly, review of average elective versus average non-elective pathology tests admission costs
- Review of over-ordering of thromobophilia screens and development of guidelines in relation to the ordering of such, reference to the HSE/ Waterford Guidelines to be included, and MAC approval for such upon completion.
- Review of paraprotein orders which are only required monthly (instigate IT block in relation such), assess if immunoglobulins could also be brought in-house to reduce costs, and virology requests to also be reviewed
- Review of additional revenue generating streams as discussed during the IDIs such as the Fatigue Package, Cholesterol/ Glucose Workups, Warfarin clinics etc.
- Review of tests in Marks Ward at weekends especially in association with FPs, FBCs and CRPs. An assessment of who is actually ordering these tests also due to the sheer numbers of such.
- Risks of phlebotomy to be highlighted to all staff especially in association with the unnecessary ordering of bloods.
Review of test order frequency controls for all tests carried out in HMC especially BNP, CRP and Troponins initially. This review will be instigated in relation to the high volume and high cost tests in anticipation of controlling the cost of such initially.

Review of Consultant protocols: assess who reviewed them and when, seek review by MAC. Subsequently assess compliance with reviewed protocols to detect improvements

The evaluation associated with the ordering of Full Profiles versus Renal Profiles versus Liver Profiles was discussed in Section 5.3. above and could, according to the initial data assessed in this dissertation, have potentially significant financial gains for HMC. This will however, in association with other recommendations, have a significant training component linked to it. The other two reviews would be further investigation to assess if these tests in particular are being over ordered. Additionally, the HSE are in the process of releasing a document in relation to sanctioned repeat testing frequency controls which if suitable, could easily be implemented in the HMC in association with the MAC, owing to the publication’s traceable nature back to the HSE.

The review of tests in Marks Ward at weekends especially in association with FPs, FBCs and CRPs could prove useful as again if could offer further insights to denote if over-ordering or unnecessary tests are being requested. Not only would this have potential financial repercussions, but it would also enhance patient safety and comfort by reducing the exposure to unnecessary phlebotomy.

The Carter Report (2008) also indicates the development of stronger clinical leadership and management skills, including skills in management of change. In order to bring about these changes, we must educate all staff in relation to correct test ordering procedures, relevance of the various tests and indeed the various parameters, tests costs, test frequency controls etc which need to be implemented. This has been proven to be the main catalyst in relation to addressing over-ordering and unnecessary ordering of tests from documents reviewed during the Literature Review. Over-ordering was attributed
mainly to nursing staff and as no nurses were assessed in relation to this study, a review from a nursing point of view may give a sense of balance to the opinions found herein.

One of the greatest benefits of carrying out this dissertation is the enhanced professional rapport developed as a result of the IDI’s. Since I have instigated this dissertation, a more progressive approach to developing the pathology services in association with the consultants and colleagues has emerged. The consultant’s suggestions have been varied and surprising at times, but their honesty and helpfulness must be commended.

This dissertation helped me realise how much more investigation and study we need to execute to fully evaluated and understand our healthcare system, and subsequently address the many issues ‘inherent’ in it. We need to be proactive instead of reactive as regards the various issues in order to positively influence the processes and procedures built in it and only then can we develop a first world healthcare system we can be proud of. We are not required to re-invent the wheel in relation to this as it appears that many of our European counterparts have initiated research in relation to this. Therefore, we should take comfort from the failings of other countries and yet exploit the areas of expertise, knowledge and success which have succeeded.
Chapter 7: Self Reflection on Own Learning and Performance

7.1. Self Reflection

7.1.1. Personal Profile

I understand that personal development is fundamental to becoming a manager and leader, and following some research into what reflective writing actually is, I can appreciate the reflective writing serves to identify personal morals, values and goals and correlate those personal discoveries with professional values and goals.

I have reviewed literature in relation to reflective writing and learning, including brief review of the workings of Kolb, Gibbs, Johns, Brookfield, and Rolfe. I particularly enjoyed reading about Argyris and Schon and their theories in relation to ‘Reflection-in-Action’ and ‘Reflection-on-Action’. I like to think I fall into the category of ‘Reflection-in-Action’ as I like to think on my feet and usually cope well under pressure.

Success comes from the confidence of knowing what your personal strengths and weaknesses are. I acknowledge that it is through this type of self-assessment and self-awareness that I can positively influence my environment, both professional and personal life (refer to Personal SWOT Analysis).

Theories of adult learning recognise the importance of reflection to learning by developing insights and understandings into experiences, and of developing knowledge that can be used in subsequent experiences. In reflection, concrete experience is used as a catalyst for thinking and learning (Jackson et al. 2007).

On a personal note, I think the skill sets I have acquired by virtue of my upbringing such as honesty, loyalty, and integrity, have stood to me in good stead and enable me to be the person I am. I strongly agree with Wright & Goodstein 2007 who state that strength of character is closely linked to virtue and values.
7.1.2. Process

This reflective literature is associated with my time spent researching my dissertation, the topic of which was one that has interested me for quite some time as it relates to an issue I encounter and had previously discussed with my CEO. The fact that is was multifactorial and involved a number of different departments and specialties interested me further. Refining the project was another matter and very early on the project ‘grew legs’ and due to my interest in the subject matter and the people I was encountering during the process, I let the scope of the project expand beyond what it should have. This resulted in temporarily losing sight of what I had initially set out to do, and so it was a harsh lesson learnt in relation to adhering to a project’s scope of work, and the inherent losses that can be made as regards time in particular.

Understanding Saunders Research Onion seemed very laborious initially and I wondered as to the relevance of some of the layers. This made me particularly aware of the philosophies associated with Kolb’s learning styles which I would also have been made aware of during Semester two in year one. As I am of an enthusiastic nature in general, I am usually fairly decisive yet proactive and am resolutely bothered by procrastination. To balance decisiveness and action with a solid plan is something I am now more aware of and will always need to address when approaching future projects.

The strategy of executing In-Depth Interviews is something I am particularly proud of and something I think I did quite well. Some of the Consultants I interviewed can appear daunting characters at times and to not only be able to hold my own but also obtain relevant, useful information relevant to my dissertation is something I am quite proud of. This is recognised by the fact that some of the questions I posed could have ‘ruffled a few feathers’ but fortunately professionalism on both sides won out and no hard feelings were encountered! Further evidence of the experience I gained from the IDIs is the constant contact and correspondence I have had since I carried out the IDIs and this substantiates the study as being not only worthwhile, but also something that has triggered interest and engaged some colleagues to be involved in projects outside their own specialty. This further enhances the ‘awareness factor’ of the overall project for which I am quite proud.
to be associated with. I hope this will contribute further and enhance and encourage others to become involved in the list of recommendations and implementations I have documented.

The level of honesty the consultants imparted was beyond my expectations and quite a few of them commented on my ability to implement change and encouraged me to continue with some of the projects I had instigated since I took up the management role two years ago. This gave me confidence that I am on the right track and reassured me that I had the support of colleagues in times when change can be difficult to bring about. I also sought solace in the level of confidence my colleagues had in me, especially when I began to doubt myself and my own capabilities. The overall process has showed that I support my colleagues and only wanted to bring about change through process improvement for the enhancement of activities for my staff, colleagues and ultimately the patients we diagnose and treat daily.

7.1.3. Use of Sources & Discoveries by Chance

I had assumptions about how the study would evolve and what I thought the outcome would be. Thorough analysis did substantiate some of the assumptions but others caught me off guard. The willingness and openness of the consultants definitely surprised me, in a good way I may add! The study was interesting and I am confident in the data and information I obtained, and feel confident in presenting it to the Medical Advisory Committee of the hospital and that we can lay bare that the assumptions in relation to the over-ordering of tests are unsubstantiated. The fact that this is also supported by the Carter Report which is well regarded internationally further substantiates my study. I am therefore confident that we can move on from the assumptions that were one of the main instigators for this study and instead invest our time into implementing and addressing the other recommendations resulting from the study.

One of the most astounding revelations I found in relation to this study is the lack of credible, relevant healthcare studies there are. This is particularly true as regards Ireland, and not only that but more specifically the private sector. This resulted in moving outside
my discipline to find relevant, reliable sources. Government expenditure information and reports also sparse, which I found extremely surprising, given the healthcare situation in Ireland, especially w.r.t. the finance crisis and the much publicised healthcare system in the media. Much of the Literature Review relied on international studies but even these were sparse in nature.

Once I gained an appreciation for the subject matter at hand, the pendulum swung and I found it difficult to adhere to the scope of work and not lose sight of it. As soon as one data set was reviewed and questions answered, it was easy to go off on a tangent and wonder why X happened and if X was related to Y and then this gave rise to a whole other set of questions. This can also be assigned to my inquisitive nature and the scientist in me that always needs answers.

7.1.4. Personal Learning Developments

When I received a place on the MBA course in 2012, some people thought I was losing my mind in relation to relocating and taking on a new job, a management role, retrain for oncall and commit to an oncall roster, undergo a major assessment by the Irish National Accreditation Board, and starting an MBA all within eight weeks—maybe I was but it shows that hard work is rewarding and sometimes it’s best not to overthink things! People comment on my energy levels and can-do attitude. I have overcome barriers and encouraged a more team-built, multidisciplinary environment in work. People are no longer afraid to ask questions or question certain practices. I would like to think that I contribute to a fun energetic workplace where everyone has a say and the best thing someone can do is put forward a suggestion no matter how small that might solve a problem or encourage thinking outside the box. By bringing people together we can think outside the box and values people’s skill sets, especially those skills or talents that people may not bring to the table initially.

I now feel more aware of part taking in a team and try to put myself forward as team leader less—this encourages others to play a greater role in some projects, sometimes in roles that they may not have put themselves forward for originally. Because I feel more
confident in my role, I think I am better equipped with the skills I learnt in my MBA to support my staff more. I have also been responsible for organising and presenting a lecture series on work related projects to both my own colleagues and colleagues of two other hospitals, as well as part take in internal training programs and education sessions. Owing to some lectures in relation to cultural differences and acceptance last year, I am more aware of cultural differences and this is an area I would like to study more. More confident to offer assistance to members of the Hospital Executive Team and I feel they value my efforts in relation to such. Fellow staff members seem impressed that I have undertaken many projects concurrently with my MBA-staff recruitment, training and educations, tripartite projects, accreditation projects, member of numerous hospital committees, lab renovations, acquisition, verification and interfacing of analysers etc.

7.1.5. What would you change about your process if you had another chance?

There are a number of items I would do differently if I had another chance. I guess that is the genius in relation to learning-you have to experience it, learn it, and then learn what to do next time. Alas, in the immortal words of Albert Einstein, insanity is doing the same thing over and over and expecting different results. If I were to do the dissertation again, I would re define the project in greater detail and adhere to the scope of the project. I would also have asked for more help and not been as afraid to say no to some meetings etc. to utilise my own time better. I am guilty of putting others before myself and then burning the midnight oil to get things done for myself!

7.1.6. What experience have you learned most from and what have you learned?

There are numerous experiences that I have learned from in relation to the dissertation research but to be honest the most important lesson skill set I have developed is increased awareness of personal resilience (Refer to Appendix: Skills Inventory). I strongly agree with Coutu (2002) who infers that resilient people possess three defining characteristics: they coolly accept the harsh reality facing them; they find meaning in terrible times; and they have an uncanny ability to improvise. I like to think I actually excel in these areas and I pride myself on being inventive and ‘think outside the box’. Resilience is
something you realise ‘after’ the fact and this is definitely true, as verified by a previous admission relating to when I started new job, new location, new management level, new analysers, computer system etc. re-training for oncall and participated in on call roster, had an INAB Accreditation Assessment in my department, and started an MBA…all within eight weeks.

A common belief about resilience is that is stems from an optimistic nature. That’s true but only as long as such optimism doesn’t distort ones sense of reality (Coutu 2002). Personally I am known for being of a fairly content disposition. Coutu (2002) also states that ‘more than education, more than experience, more than training, a person’s level of resilience will determine who succeeds and who fails. That’s true in the cancer ward, its true in the Olympics, and its true in the boardroom’. I definitely agree with respect to cancer recovery as I have seen it time and again whereby a person’s attitude with respect to the diagnosis and treatment is as important as the knowledge of the consultant or efficacy of the drugs.

It is widely accepted that increased personal and organisational resilience is also important when considering interconnectedness of modern organisations, where disruptions can have significant and widespread impacts. Following discussion with some colleagues recently, I acquired an interest in the area of resilience in association with healthcare workers and it is a topic that has very much piqued my interest. From an initial fleeting interest, I have now realised that it may be a learning tool which could potentially be utilised as an additional Teaching Objective for nursing staff who are at the forefront of patient care in the hospital. Coutu 2002 has published many documents relating to resilience with respect to the healthcare sector, with emphasis in relation to staff being more resilient in order to provide service and care to patients. Howard et al. 2010 refer to resilience as the capacity for, or outcome of successful adaptation despite challenging or threatening circumstance, in association with the difference in people’s responses to stress and adversity.
A second one of my favorite subjects is the topic of emotional intelligence which Coutu (2002) refers to how many theories associated with resilience just make good sense, and therefore may infer a stronger tie with emotional intelligence than was initially thought? I am cognisant of such-emotional intelligence through early reading of situations and the ability to preempt and address any potential issues. Emotional intelligence has been documented to lead to better leadership with respect to enhancing communication with staff. Also, preempting some staff issues and adapting, controlling and managing such can attenuate any potential risks further down the line especially in situations which could lead to attrition risks as regards staffing etc. For organisations, there is a financial and ethical impetus to reduce strain, given the voluminous evidence showing that occupational stress can lead to physical and psychological disorders that reduce job performance and drive up health insurance costs (Kammeyer-Mueller et al. 2009). This ties in with my previous trail of thought in relation to resilience and healthcare staff as well as the references of Akerjordet and Severinson (2008) who acknowledge emotional intelligence in relation to healthcare professionals by means of supporting leadership that fosters a healthy work environment, creates inspiring relationships based on mutual trust. Clinical leaders characterized by self-awareness and supervisory skills, who exhibit characteristics of emotional intelligence, positively influence organisational, staff and patient outcomes. Thus creating favorable work climates characterized by resilience, innovation and change. It is also associated with positive empowerment processes as well as positive organisational outcomes.

The need for effective leadership has become paramount to meet the challenges of the 21st century and a growing number of academics and senior managers have come to realise the importance of emotional intelligence for effective leadership (Dulewicz, Higgs 2003). Furthermore, they state that the higher one advances in an organisation, the more important emotional intelligence becomes. This is further substantiated whereby it has been proven that correlation and regression analyses revealed that higher emotional intelligence was associated with higher leadership effectiveness, and that emotional
intelligence explained variance not explained by either personality or IQ (Rosete, Ciarrochi 2005).

7.1.7. Action Plan

I am keen to continue with further professional development and I thoroughly enjoy the people management side of my professional role. Being cognisant of the link between resilience, emotional intelligence and healthcare, I would like to explore this type of avenue as a change from mindset from Pathology Laboratories and MBAs! I like helping people solve problems and am looking forward to progressing my career, both in relation to people management and clinical services. I thoroughly enjoy my current role and although I am extremely content at my level, I do relish a challenge and look forward to any opportunities that present themselves.

7.1.8. Concluding from the experience

Although I thoroughly enjoyed my MBA, attending class part time was a challenge at times owing to work commitments. Working in a hospital doesn’t afford one the luxury of walking out the door at 5pm. At times the course lacked some of the social aspect I would have thought would be associated with a course which places a strong emphasis on networking both socially and professionally.

In summary, I thoroughly enjoyed my MBA and my time at DBS, and planning on how to use the learning gained during that experience I must admit that the professional experience has been very good but personal experience has exceeded this.
7.2. References-Reflective Writing


Gibbs G. Learning by Doing: A Guide to Teaching and Learning Methods

Hilary N. The form, Meaning and purpose of University Level Assessed Reflective Writing. [http://www.coventry.ac.uk/bawe](http://www.coventry.ac.uk/bawe) Retrieved July 2014


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Reflective Writing. University of Reading.
http://www.reading.ac.uk/internal/studyadvice/studyresources/practicalbasedlearning Retrieved July 2014

Guide to Reflective Writing: Learning and Information Services 2011, University of Wolverhampton http.wlv.ac.uk/skills Retrieved July 2014
7.2 Appendix

Appendix I: Skills Inventory

<table>
<thead>
<tr>
<th><strong>Skills Inventory</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Skills</strong></td>
<td><strong>Professional Skills</strong></td>
</tr>
<tr>
<td>Analytical and problem solving skills</td>
<td>Troubleshooting skills</td>
</tr>
<tr>
<td>Flexible &amp; Critical Reading Skills</td>
<td>Enhanced people skills</td>
</tr>
<tr>
<td>Competent in deciphering various methodologies and case files</td>
<td>Greater self awareness</td>
</tr>
<tr>
<td>Good Written Communication</td>
<td>Effective team member &amp; team leader</td>
</tr>
<tr>
<td>Interpersonal skills, intercultural sensitivity and understanding</td>
<td>Personal discipline</td>
</tr>
<tr>
<td>Organisational skills and multitasking skills</td>
<td>Complete multi-tasks simultaneously</td>
</tr>
<tr>
<td></td>
<td>Resilient</td>
</tr>
</tbody>
</table>

Table showing Personal Skills Inventory Analysis
### Appendix II: Table showing Personal SWOT Analysis

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Achievements</td>
<td>Can get bored easily</td>
</tr>
<tr>
<td>People Management Skills</td>
<td></td>
</tr>
<tr>
<td>Diligent Work</td>
<td></td>
</tr>
<tr>
<td>Attitude Sensitive to the Needs of Others</td>
<td></td>
</tr>
<tr>
<td>Open minded and willing to learn</td>
<td>Some IT skills to be learnt</td>
</tr>
<tr>
<td>Very good multi-tasker</td>
<td></td>
</tr>
</tbody>
</table>

### SWOT Analysis

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking Opportunities</td>
<td>Work very long hours</td>
</tr>
<tr>
<td>Willing to assist others and take on tasks delegated to me by members of the Hospital Executive Team</td>
<td>A lot of projects merging at the same time</td>
</tr>
<tr>
<td>Eager to learn</td>
<td>Need to develop IT skills</td>
</tr>
</tbody>
</table>

Table showing Personal SWOT Analysis
Chapter 8: Bibliography

8.1. Journal Articles


Janssens, P, & Wasser, G 2013, 'Managing laboratory test ordering through test frequency filtering', *Clinical Chemistry & Laboratory Medicine*, 51, 6, pp. 1207-1215, Academic Search Complete, EBSCOhost, viewed April 2014


Lang, T 2013, 'Laboratory demand management of repetitive testing - time for harmonisation and an evidenced based approach', *Clinical Chemistry & Laboratory Medicine*, 51, 6, pp. 1139-1140, Academic Search Complete, EBSCOhost, viewed Mar 2014


Pillay, TS 2013, 'Containing costs in the era of National Health Insurance--the need for and importance of demand management in laboratory medicine', * South African Medical Journal*, 1, p. 24, Academic OneFile, EBSCOhost, viewed April 2014.

Plebani, M 2013, 'Harmonization in laboratory medicine: the complete picture', *Clinical Chemistry and Laboratory Medicine*, 4, p. 741, Academic OneFile, EBSCOhost, viewed April 2014


Wick, M, & Marchevsky, A 2011, 'Evidence-Based Principles in Pathology: Existing Problem Areas and the Development of "Quality" Practice Patterns', *Archives Of Pathology & Laboratory Medicine*, 135, 11, pp. 1398-1404, Academic Search Complete, EBSCOhost, viewed April 2014

8.2. Books


8.3. Reports


9.4. Internet Sources


Chapter 9: Appendices

Appendix I: Research Plan

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<thead>
<tr>
<th>Activity</th>
<th>Start Date</th>
<th>Finish Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Searching for secondary data</td>
<td>05/05/2014</td>
<td>06/06/2014</td>
</tr>
<tr>
<td>Reading secondary data</td>
<td>12/05/2014</td>
<td>20/06/2014</td>
</tr>
<tr>
<td>Creating data collection instruments</td>
<td>16/06/2014</td>
<td>25/06/2014</td>
</tr>
<tr>
<td>Administrating data collection instruments</td>
<td>25/06/2014</td>
<td>09/07/2014</td>
</tr>
<tr>
<td>Analyzing primary data</td>
<td>04/07/2014</td>
<td>18/07/2014</td>
</tr>
<tr>
<td>Writing the early drafts</td>
<td>14/07/2014</td>
<td>08/08/2014</td>
</tr>
<tr>
<td>Analyzing comments on drafts by supervisor</td>
<td>11/08/2014</td>
<td>15/08/2014</td>
</tr>
<tr>
<td>Revisions of drafts</td>
<td>15/08/2014</td>
<td>20/08/2014</td>
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<tr>
<td>Printing and binding</td>
<td>20/08/2014</td>
<td>22/08/2014</td>
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</table>
Appendix II: Demand Management with respect to HLA-B27

Sadek 2012 reported demand management methodologies in relation to controlling test utilisation with respect to limiting test ordering to a certain group of clinicians. In the Canadian study, limiting access to ordering HLA-B27 to certain groups of specialists (ophthalmologists, rheumatologists, and orthopaedic surgeons) resulted in a major decrease from 2,500 tests per year to a more appropriate 200 tests per year.

In order to assess this with respect to the Hermitage Medical Clinic, I extrapolated the number of HLA-B27 requests ordered from 01/01/2013 to 31/2/2013 from the Meditech system. In total only nine orders were received, one of which was subsequently cancelled and a different test ordered i.e. haemochromatosis test. With regard to the ordering clinicians, there were two tests ordered by rheumatology and one ordered by orthopaedics. The cancelled test had been ordered by gastroenterology and the remaining five tests were ordered through Internal Medicine and Cardiology. When the patients’ files were reviewed, the latter HLA-B27 tests (n=5) were ordered in association with other auto-immune tests as part of an assessment panel, and therefore would be deemed satisfactory when taken into consideration with the patients’ clinical picture. I therefore would not deem this area to be worthwhile for further study in the Hermitage Medical Clinic for HLA-B27 tests but the methodology is worth considering w.r.t. other high volume and/ or high cost tests.
Appendix III: FMEA associated with the Over-ordering of Tests
Appendix IV: Process Maps of Laboratory Testing in the Hermitage Medical Clinic
Appendix V: Processing of Specimens and Result Reporting.
Appendix VI: Methodology relating to the Extrapolation of Data from the Meditech HIS relating to this Dissertation

Log onto Meditech HIS via User ID and personal Password
Select <1: Lab HER Hermitage Laboratory Live>
Select <10: Laboratory>
Select <52: Management Reports>
Select <51: order entry Log>
Select dates for review e.g. <02/05/2014>, Tab <05/05/2014>
Select times for review e.g. <1700> [indicating start time of extrapolation], Tab <0900> [indicating end time of extrapolation]
Select report type for review e.g. <CDEF> [indicating C: CANCELS; D: DUPLICATES; E: ERRORS; F: FILED REQS PROVIDER EDITS],
Select <Print on> and then type <DOWNLOAD>
When it arrives at <CHOICES> select <BOTH> for ‘Page Banners’ and ‘Form Feeds’. This will instigate the data collection and extrapolation from the Meditech system for the time period defined i.e. 17.00 on Friday evening to 09.00 on Monday morning for each weekend in May 2014, with the exception of the first weekend in May which was a Bank Holiday and so it data was collated from 17.00 on the Friday evening to 09.00 on the Tuesday morning. Owing to the fact that May 2014 had five weekends lent the study to analysis of a greater collection of information as well as inclusion of a Bank Holiday weekend for assessment purposes. By selecting <DOWNLOAD> the information may be exported to a data collation file prior to modification by the Meditech Data Mining Program. This converts the data from ‘text data’ to implant it in an Excel Spreadsheet. Initially analysis and review of the data was carried out manually in order to correlate each patient entry with each patient’s main file in the original Meditech HIS to identify the patient’s Consultant. This proved extremely laborious and subsequently led to further data analysis. By linking fields in the Meditech system with another data mining field, correlation was eventually executed electronically. This not only resulted in faster data correlation but also contributed to the less errors being encountered.
Once the data was extrapolated and modified into an Excel-compatible format, proper data analysis and review could be executed and graphical illustration carried out, including:

- Top Users of Test Requests
- Analysis of Data by Specialty
- Breakdown of Test per weekend
- Cost of tests per Specialty
Appendix VII: In-depth Interview Questions-Blank Template

Specialty:
Date:
Initial Notes:
  ➢ Highlight confidentiality of answers
  ➢ Anonymous interviewees as much as possible.
  ➢ May come back to seek clarification if necessary.
  ➢ Will try and address any issues which are discussed.
  ➢ Some questions may appear repetitive-just to look at different angles
  ➢ I have gathered some information in relation to some ordering patterns but may ask
    questions just for clarification purposes.

Initial Questions
Can you please tell me about your background in your chosen specialty?
How many years have you been working in this specialty?
How many years have you been working for this hospital?
Can you please tell me which countries you would have worked in previously?
What would you consider to be the main similarities and differences with how tests are
ordered in these countries?
Can you please tell me your opinion about the importance of pathology testing in this
hospital?

Test Awareness
How often do you order tests?
Usually ‘generic’ type tests e.g. FBC, FP etc. or more specialised tests?
How many tests would you say you order daily/ weekly/ monthly?

Test Problem Recognition Style
How many (percentage or otherwise) of the test orders you order are ‘critical’? Can you
support/ justify your answer?
Would you therefore say you ‘do not look at’ X% of the test you order?
Are you aware tests may be ordered under your name but may not be required?
Does it/ how often does it happen that tests ‘may’ get ordered without your ‘absolute’ consent e.g. nurse ordering a test e.g. FBC ‘just in case’?
Are you involved/ do you support the practice of ordering certain tests over a period of days e.g. FBC for five days post op/ procedure? Why do you do this?
What do you think over ordering means?
Do you think unnecessary test orders are placed in the hospital in general? If so, by who?
Why? What would you do to control this?
Who do you think over-ordering may be associated with: Consultants, RMO’s, Nurses?
Do you think you err on the side of ‘need based’ or ‘want based’ tendencies when ordering tests?
What are your thoughts in relation to control of test orders associated with test ordering frequency criteria, computer blocks e.g MRSA, EBLM etc? Any other factors in your opinion?
How aware of the cost of lab tests are you? How much is an FBC €21? FP €58? Swab Culture €21? Cardiac Profile (AST & CK) €32
Does the cost of lab tests influence you decision making when ordering tests?
How committed are you to ordering tests in profiles i.e. renal profile €27 versus FP €58 or ordering tests in two phases where possible i.e. initial screening tests and subsequent more specific tests e.g. IgE and then specific RAST tests depending on the results?
How aware of the tie-ins of insurance payout, reimbursement, professional few etc influence your ordering practices??!
What do you think have been the biggest changes in test ordering practices in recent years? (if any?) [Paper-based to electronic ordering, updated test methodologies ESR to CRP, CK, CK-MB, Troponin, HS Troponin etc?
What factors do you think are associated with this ‘perceived’ over ordering?
What risks do you think are associated with this ‘perceived’ over ordering?

**Principle Ordering Decision Variables**
What characteristics or variables are important for you when ordering a test?
In order of importance, can you list the five main factors you take into consideration when ordering tests?
Cause-Effect Relationship of the Similarities/ Differences of Test Ordering Behaviour
What do you think influences your ordering behavior?
How long does it take you from the first time that you feel that you need to order a test to finally going through with the order? Do you think that ordering immediately results in you perhaps over-ordering?
Do you think you order more or less tests on an electronic order system or on an electronic platform e.g. through Meditech? Does the request format i.e. paper or electronic influence your decision making at all?
Do you think there is a big difference between ordering practices between the public sector and private sector?
Do recent published articles, conference information, brochures, advertisements etc influence your ordering practices?

Different Impact/ Influence of Communication of New Test Info
Any new test you would be interested in?
Any test you think the lab could provide that would eliminate wasted resources e.g. BNPs/ Echocardiograph correlation etc.? Any tests that could generate extra revenue?
Are there any tests that you think are under utilised?

Future
Where do you think pathology and healthcare in a wider sense is going?
What type of test ordering procedures do you see having an impact in the future?
How do you think the practice could be better managed?
Is there anything more you would like to add concerning this subject?

Thank you for your cooperation.
Appendix VIII: IDI Thematic-Analysis Data Charts

<table>
<thead>
<tr>
<th></th>
<th>Aware of Costs of Tests</th>
<th>Cost influences Ordering Tests</th>
<th>How committed to ordering in Test Profiles are you?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant 1</td>
<td>Yes-very aware</td>
<td>No</td>
<td>Very committed</td>
</tr>
<tr>
<td>Consultant 2</td>
<td>No</td>
<td>Not really</td>
<td>Very committed</td>
</tr>
<tr>
<td>Consultant 3</td>
<td>No</td>
<td>No</td>
<td>Not very committed</td>
</tr>
<tr>
<td>Consultant 4</td>
<td>No</td>
<td>No</td>
<td>Not very committed</td>
</tr>
<tr>
<td>Consultant 5</td>
<td>Quite aware</td>
<td>Yes</td>
<td>Very committed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Ordering of Tests Straight away may result in over-ordering?</th>
<th>Preference of Electronic or Paper Based Request Forms?</th>
<th>Difference in ordering Practices between Public and Private?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant 1</td>
<td>Y</td>
<td>Electronic</td>
<td>No difference</td>
</tr>
<tr>
<td>Consultant 2</td>
<td>Y</td>
<td>Electronic</td>
<td>No difference</td>
</tr>
<tr>
<td>Consultant 3</td>
<td>Y</td>
<td>No preference either way</td>
<td>Depends on level of experience of person ordering the tests</td>
</tr>
<tr>
<td>Consultant 4</td>
<td>N</td>
<td>No preference either way</td>
<td>No difference</td>
</tr>
<tr>
<td>Consultant 5</td>
<td>Sometimes</td>
<td>Paper</td>
<td>Order less in the private sector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Do recent publications influence your ordering Practices?</th>
<th>Any new tests you would be interested in?</th>
<th>Any tests or clinics that you think would increase revenue?</th>
</tr>
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<tbody>
<tr>
<td>Consultant 1</td>
<td>No</td>
<td>In house Micro</td>
<td>No</td>
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<tr>
<td>Consultant 2</td>
<td>Slightly</td>
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<td>Warfarin Clinic</td>
</tr>
<tr>
<td>Consultant 3</td>
<td>No</td>
<td>No</td>
<td>Chest Pain Clinic, Fatigue Packages</td>
</tr>
<tr>
<td>Consultant 4</td>
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<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Consultant 5</td>
<td>No</td>
<td>HS Troponin</td>
<td>HS Troponin</td>
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<tr>
<td>Consultant</td>
<td>Aware of Risks associated with Tests</td>
<td>Aware of Insurance Payouts, reimbursement, professional fees etc?</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Consultant 1</td>
<td>None mentioned</td>
<td>Aware of loss making procedures/ processes</td>
<td></td>
</tr>
<tr>
<td>Consultant 2</td>
<td>Venepuncture, Financial Constraints, Finite Lab Resources</td>
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<td></td>
</tr>
<tr>
<td>Consultant 3</td>
<td>None to Doctor or Patient but some to system</td>
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<td></td>
</tr>
<tr>
<td>Consultant 4</td>
<td>Financial Impact to system</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Consultant 5</td>
<td>None mentioned</td>
<td>No</td>
<td></td>
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<table>
<thead>
<tr>
<th>Consultant</th>
<th>Aware of Costs of Tests</th>
<th>Cost influences Ordering Tests</th>
<th>How committed to ordering in Test Profiles are you?</th>
</tr>
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<tbody>
<tr>
<td>Consultant 1</td>
<td>Yes-very aware</td>
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<td>Very committed</td>
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<tr>
<td>Consultant 2</td>
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<tr>
<td>Consultant 3</td>
<td>No</td>
<td>No</td>
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</tr>
<tr>
<td>Consultant 4</td>
<td>No</td>
<td>No</td>
<td>Not very committed</td>
</tr>
<tr>
<td>Consultant 5</td>
<td>Quite aware</td>
<td>Yes</td>
<td>Very committed</td>
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Appendix IX: Interview Questions-Consultant Cardiologist

Specialty: Cardiology
Date: July 2014

Initial Questions
Can you please tell me about your background in you chosen specialty? Cardiology
How many years have you been working in this specialty? 11 years
How many years have you been working for this hospital? 2 years
Can you please tell me which countries you would have worked in previously? UK & France
What would you consider to be the main similarities and differences with how tests are ordered in these countries? There aren’t any
Can you please tell me your opinion about the importance of pathology testing in this hospital? Good experience. Some over-ordering of Troponins and BNPs, the latter are sometimes ordered daily.

Test Awareness
How often do you order tests? daily
Usually ‘generic’ type tests e.g. FBC, FP etc. or more specialised tests? Troponins, BNPs, FBCs and CRPs. FBCs quite good w.r.t. cardiology but more so with other specialties.
How many tests would you say you order daily/ weekly/ monthly? Difficult to categorically assess straight off as very patient dependent. If a cardiology patient was admitted the bloods would be ordered daily, and so the number of tests ordered is directly proportional to the number of cardiology patients admitted.

Test Problem Recognition Style
How many (percentage or otherwise) of the test orders you order are ‘critical”? Can you support/ justify your answer? All cardiology tests ordered are considered critical. Don’t order an awful lot but those ordered would be specific and necessary.
Would you therefore say you ‘do not look at’ X% of the test you order? *Look at vast majority of them mainly due to Meditech access in Suite.*

Are you aware tests may be ordered under your name but may not be required? *This may happen but I wouldn’t consider it a major issue. Practice is fairly tightly controlled in general.*

Does it/ how often does it happen that tests ‘may’ get ordered without your ‘absolute’ consent e.g. nurse ordering a test e.g. FBC ‘just in case’? *Again, this may happen but I wouldn’t consider it a major issue. Practice is ok at the moment and w.r.t. cardiology, it is often better to have more tests than insufficient number of tests. This way you can plot the course of patient’s prognosis etc over a number of days. [Interviewee alluded to legal aspects of treatment which I questioned further in relation to if this is a factor when ordering tests. Interviewee stated that ‘any deficiencies in clinical care make it a legal issue’. Again, the interviewee stated he is happy with current ordering practices.*

Are you involved/ do you support the practice of ordering certain tests over a period of days e.g. FBC for five days post op/ procedure? Why do you do this? *Sometimes. Practice is ok in order to monitor prognosis over a number of days. Admission bloods should be controlled at the time of admission.*

What do you think over ordering means? *Test not indicated*  
Do you think unnecessary test orders are placed in the hospital in general? If so, by who? Why? What would you do to control this? *Most are justified.*

Who do you think over-ordering may be associated with: Consultants, RMO’s, Nurses?  
*Most are justified.*

Do you think you err on the side of ‘need based’ or ‘want based’ tendencies when ordering tests? *Need based*  
What are your thoughts in relation to control of test orders associated with test ordering frequency criteria, computer blocks e.g MRSA, EBLM etc? Any other factors in your opinion? *Don’t have an issue with blocks. Note BNPs do not need to be done daily. Not sure of exact repeat frequency. Perhaps on admission and discharge could suffice.*

How aware of the cost of lab tests are you? How much is an FBC €21? FP €58? Swab Culture €21? Cardiac Profile (AST & CK) €32 *Quite aware. Some blood tests very expensive to carry out.*
Does the cost of lab tests influence you decision making when ordering tests? Yes-big time.

How committed are you to ordering tests in profiles i.e. renal profile €27 versus FP €58 or ordering tests in two phases where possible i.e. initial screening tests and subsequent more specific tests e.g. IgE and then specific RAST tests depending on the results? Very committed to ordering RP instead of FP etc. Don’t have an issue with this but probably not overly associated with cardiology.

How aware of the tie-ins of insurance payout, reimbursement, professional fees etc influence you’re ordering practices??! No, not relevant

What do you think have been the biggest changes in test ordering practices in recent years? (if any?) [Paper-based to electronic ordering, updated test methodologies ESR to CRP, CK, CK-MB, Troponin, HS Troponin etc? Practices have improved but so has my experience of what tests are ordered and why. Initially would have thought that more tests would be ordered in the private hospital setting due to technology investments etc but this is counteracted by the cost of the tests etc and so in reality less tests are ordered. Paper-based to electronic ordering-prefer paper record just for convenience-sometimes Meditech can prove difficult when ordering tests.

What factors do you think are associated with this ‘perceived’ over ordering? Convenience of ordering easily

What risks do you think are associated with this ‘perceived’ over ordering? None really. Sometimes I grumble about abnormal results in that although you think it is one thing, it turns out the results show something else. But to be honest this is a good thing as it leads to better patient care and reassures you that it is better to diagnose things sooner rather than finding out later.

Principle Ordering Decision Variables

What characteristics or variables are important for you when ordering a test? TAT and specificity of test, and characteristics of test esp. w.r.t. Troponin which detects cardiac arrest after 2 hours as opposed to it’s predecessor CK which shows it after 4 hours.

In order of importance, can you list the five main factors you take into consideration when ordering tests? Same as previous question
Cause-Effect Relationship of the Similarities/ Differences of Test Ordering Behavior

What do you think influences your ordering behavior? *Patient presentation*

How long does it take you from the first time that you feel that you need to order a test to finally going through with the order? Do you think that ordering immediately results in you perhaps over-ordering? *Usually order straight away as may need to see what changes over time. Given the nature of cardiology, it is best obviously to have a diagnosis before the situation unfolds i.e. cardiac arrest-sentinel event-immediate ordering-help diagnosis.*

Do you think you order more or less tests on an electronic order system or on an electronic platform e.g. through Meditech? Does the request format i.e. paper or electronic influence your decision making at all? *Not really*

Do you think there is a big difference between ordering practices between the public sector and private sector? *Early in my career I thought there would be. I thought private hospitals would order more tests owing to the availability of advancements in technology and availability of more sophisticated tests but this isn’t the case, if any I order less. [tie in with costs important.]*

Do recent published articles, conference information, brochures, advertisements etc influence your ordering practices? *No [Discussed TC’s attendance at recent conference re BNPs and Echos but Interviewee didn’t see any great advantage of this study]*

Different Impact/ Influence of Communication of New Test Info

Any new test you would be interested in? *HS Troponin*

Any test you think the lab could provide that would eliminate wasted resources e.g. BNPs/ Echocardiograph correlation etc.? Any tests that could generate extra revenue? *HS CRP*

Are there any tests that you think are under utilised? *No*

Future

Where do you think pathology and healthcare in a wider sense is going? *Don’t know*
What type of test ordering procedures do you see having an impact in the future? *Staying pretty much the same*

How do you think the practice could be better managed? *Managed quite well in HMC. Governed a lot by Consultants either directly or indirectly.*

Is there anything more you would like to add concerning this subject? *Introduction of HS Troponin and HS CRP*

**Thank you for your cooperation.**
Appendix X: Haematology

Specialty: Haematology
Date: July 2014

Initial Questions
Can you please tell me about your background in you chosen specialty? Haematology
How many years have you been working in this specialty? 20 years
How many years have you been working for this hospital? 6 years
Can you please tell me which countries you would have worked in previously? UK & Ireland
What would you consider to be the main similarities and differences with how tests are ordered in these countries? V little, little stricter in UK out of hours
Can you please tell me your opinion about the importance of pathology testing in this hospital? Out of hours & weekends too many tests ordered. Nurse driven. Marks ward-consultant protocols give nurses more direction.

Test Awareness
How often do you order tests? Daily-not everything-CRP not needed daily.
Usually ‘generic’ type tests e.g. FBC, FP etc. or more specialised tests? One day specialist tests.
How many tests would you say you order daily/ weekly/ monthly? 30-50 per week. Day unit is 15 patients per day/ 60 per week.

Test Problem Recognition Style
How many (percentage or otherwise) of the test orders you order are ‘critical’? Can you support/ justify your answer? FBCs-a lot for chemo patients and out patients. 80% of FBCs ordered are for adjusting chemo
Would you therefore say you ‘do not look at’ X% of the test you order? Look at FBC on everyone
Are you aware tests may be ordered under your name but may not be required? Yes-
nurses
Does it/ how often does it happen that tests ‘may’ get ordered without your ‘absolute’
consent e.g. nurse ordering a test e.g. FBC ‘just in case’? FBCs over 3 or 4 days-as per
protocol
Are you involved/ do you support the practice of ordering certain tests over a period of
days e.g. FBC for five days post op/ procedure? Why do you do this? Sometimes. Chemo-
U&E daily.
What do you think over ordering means? Asking for same test too frequently and not
changing diagnosis
Do you think unnecessary test orders are placed in the hospital in general? If so, by who?
Why? What would you do to control this? Yes-over-ordering of thromobophilia screens-
need to develop guidelines. Nurses and Consultants-education and protocols needed.
Who do you think over-ordering may be associated with: Consultants, RMO’s, Nurses?
Nurses and Consultants-education and protocols needed Control needs to be consultant
driven and nurse educated.
Do you think you err on the side of ‘need based’ or ‘want based’ tendencies when
ordering tests? Need based
What are your thoughts in relation to control of test orders associated with test ordering
frequency criteria, computer blocks e.g MRSA, EBLM etc? Any other factors in your
opinion? Don’t have an issue with blocks.1. Paraproteins monthly. 2. Virology over
ordered. 3. Immunoglobulins over ordered.
How aware of the cost of lab tests are you? How much is an FBC €21? FP €58? Swab
Culture €21? Cardiac Profile (AST & CK) €32 Not very aware of the individual costs.
€100 max order.
Does the cost of lab tests influence you decision making when ordering tests? Not really
How committed are you to ordering tests in profiles i.e. renal profile €27 versus FP €58
or ordering tests in two phases where possible i.e. initial screening tests and subsequent
more specific tests e.g. IgE and then specific RAST tests depending on the results? Very
committed to ordering RP instead of FP etc. Only order what is needed.
How aware of the tie-ins of insurance payout, reimbursement, professional fees etc influence your ordering practices??! No.

What do you think have been the biggest changes in test ordering practices in recent years? (if any?) [Paper-based to electronic ordering, updated test methodologies ESR to CRP, CK, CK-MB, Troponin, HS Troponin etc? None really. Only order what is needed and order the test personally.

What factors do you think are associated with this ‘perceived’ over ordering? 1. Nurses don’t not want to have the test results for ward rounds. 2. Electronic ordering. 3. Phlebotomy service

What risks do you think are associated with this ‘perceived’ over ordering? 1. Venepuncture risks. 2. Financial constraints especially out of hours. 3. Finite lab time.

Principle Ordering Decision Variables
What characteristics or variables are important for you when ordering a test? Blood count and U&E

In order of importance, can you list the five main factors you take into consideration when ordering tests? 1. Influence of test w.r.t. patient management. 2. Stability/instability of patient. 3. Time of day-am/pm/weekend. 4. Invasiveness of test-blood gas versus O2 sats on finger. 5. Previous results [I enquired as to test result quality and consultant said he assumed quality and test result is right.

Cause-Effect Relationship of the Similarities/Differences of Test Ordering Behavior
What do you think influences your ordering behavior? Patient illness, patient condition, patient age, patient diagnosis

How long does it take you from the first time that you feel that you need to order a test to finally going through with the order? Do you think that ordering immediately results in you perhaps over-ordering? Usually order straight away as ten to see patient, look at previous results, and review what tests are required-test usually ordered within 20 minutes
Do you think you order more or less tests on an electronic order system or on an electronic platform e.g. through Meditech? Does the request format i.e. paper or electronic influence your decision making at all? More ordered electronically

Do you think there is a big difference between ordering practices between the public sector and private sector? No

Do recent published articles, conference information, brochures, advertisements etc influence your ordering practices? 1. Slightly: D-Dimers=Wells score-cut down on scan=Yes. 2.BCSH-pre op coag testing-not a screening test for coagulaopathy-need to assess patients history for history of bleeding disorder.

Different Impact/ Influence of Communication of New Test Info

Any new test you would be interested in? No-none at the moment

Any test you think the lab could provide that would eliminate wasted resources e.g. BNPs/ Echocardiograph correlation etc.? Any tests that could generate extra revenue? Warfarin Clinic.

Are there any tests that you think are under utilised? No

Future

Where do you think pathology and healthcare in a wider sense is going? Evidence Based Laboratory Medicine (EBLM)-objective, reliable results. 2. Accreditation. 3. Lab wide computer systems. 4. Technology-proteomics, DNA analysis, chip technologies, overall may reduce unnecessary treatments.

What type of test ordering procedures do you see having an impact in the future? No great changes

How do you think the practice could be better managed? Managed very well in HMC. Very LEAN system especially w.r.t. staff and resources

Is there anything more you would like to add concerning this subject? No

Thank you for your cooperation.
Appendix XI: IDI: Emergency Medicine

**Specialty**: Emergency Medicine

**Date**: July 2014

**Initial Questions**

Can you please tell me about your background in you chosen specialty? *Emergency Medicine*

How many years have you been working in this specialty? 20 *years*

How many years have you been working for this hospital? 6 *years*

Can you please tell me which countries you would have worked in previously? *UK*

What would you consider to be the main similarities and differences with how tests are ordered in these countries? *Identical*

Can you please tell me your opinion about the importance of pathology testing in this hospital? *Very good*

**Test Awareness**

How often do you order tests? *Daily*

Usually ‘generic’ type tests e.g. FBC, FP etc. or more specialised tests? *Depends on patient presentation, patient age etc. e.g. joint pain-rheumatology tests, ANA etc required.*

Fatigue: *B12 & Folate Chest abdominal pain-regional problems.*

How many tests would you say you order daily/ weekly/ monthly? *Difficult to categorically assess straight off as very patient dependent-number of tests depends on number of patients and complexity at time of presentation. Patient based-logical flow.*

**Test Problem Recognition Style**

How many (percentage or otherwise) of the test orders you order are ‘critical’? Can you support/ justify your answer? *Small percentage as like to obtain a story in relation to the patient as opposed to jumping in ordering tests. Therefore usually approach the patient with Story, Examination, Lab and Radiotherapy-combined results form an ‘intersection of decision tree’.*
Would you therefore say you ‘do not look at’ X% of the test you order? *Look at everything especially re FBC and FPs*

Are you aware tests may be ordered under your name but may not be required? *Not really as have protocols in place for all procedures etc. Not an issue-very occasionally-perhaps once a month. Would recommend review of blood protocols for efficacy and efficiency.*

Does it/ how often does it happen that tests ‘may’ get ordered without your ‘absolute’ consent e.g. nurse ordering a test e.g. FBC ‘just in case’? *Not an issue-very occasionally-perhaps once a month.*

Are you involved/ do you support the practice of ordering certain tests over a period of days e.g. FBC for five days post op/ procedure? Why do you do this? *No*

What do you think over ordering means? *Inappropriate tests which make no material difference to patient care*

Do you think unnecessary test orders are placed in the hospital in general? If so, by who? Why? What would you do to control this? *Yes-there will always be a percentage-Dr’s are under pressure not to miss anything. Every biases lined up to tests.*

Who do you think over-ordering may be associated with: Consultants, RMO’s, Nurses? *Dr.’s and Nurses-mixture of both.*

Do you think you err on the side of ‘need based’ or ‘want based’ tendencies when ordering tests? *Mixture of both*

What are your thoughts in relation to control of test orders associated with test ordering frequency criteria, computer blocks e.g MRSA, EBLM etc? Any other factors in your opinion? *Absolutely. In favour of appropriate testing- Best practice and peer practice-MAC.*

How aware of the cost of lab tests are you? How much is an FBC €21? FP €58? Swab Culture €21? Cardiac Profile (AST & CK) €32 *No. Doesn’t even enter my mind!*

Does the cost of lab tests influence you decision making when ordering tests? *No*

How committed are you to ordering tests in profiles i.e. renal profile €27 versus FP €58 or ordering tests in two phases where possible i.e. initial screening tests and subsequent more specific tests e.g. IgE and then specific RAST tests depending on the results? *Not committed!*
How aware of the tie-ins of insurance payout, reimbursement, professional fees etc influence your ordering practices??! No

What do you think have been the biggest changes in test ordering practices in recent years? (if any?) [Paper-based to electronic ordering, updated test methodologies ESR to CRP, CK, CK-MB, Troponin, HS Troponin etc? No real differences. Nurses order more often.

What factors do you think are associated with this ‘perceived’ over ordering? Consultant level of anxiety, patient levels of expectation, hardwired non-challenged patterns of behavior.

What risks do you think are associated with this ‘perceived’ over ordering? None to Doctor or patient but some to the system e.g. financial. On a macro level, over-ordering affects the operations of the system squeezes the system of resources.

**Principle Ordering Decision Variables**

What characteristics or variables are important for you when ordering a test? Tests-blunt institution, Sensitivity, Specificity.

In order of importance, can you list the five main factors you take into consideration when ordering tests? 1. Diagnosis assistance, 2. Rule out/ rule in specific conditions, 3. Appropriateness of test to condition.[When prompted-Quality and TAT not so much]

**Cause-Effect Relationship of the Similarities/ Differences of Test Ordering Behavior**


How long does it take you from the first time that you feel that you need to order a test to finally going through with the order? Do you think that ordering immediately results in you perhaps over-ordering? Usually order straight away-Nurses usually order as per protocols

Do you think you order more or less tests on an electronic order system or on an electronic platform e.g. through Meditech? Does the request format i.e. paper or electronic influence your decision making at all? No
Do you think there is a big difference between ordering practices between the public sector and private sector? *No-used to blindly order as a junior doctor-order more tests due to lack of experience.*

Do recent published articles, conference information, brochures, advertisements etc influence your ordering practices? *No-not relevant*

**Different Impact/ Influence of Communication of New Test Info**

Any new test you would be interested in? *No*

Any test you think the lab could provide that would eliminate wasted resources e.g. BNP's/ Echocardiograph correlation etc.? Any tests that could generate extra revenue? *Troponins and D-Dimers very important in relation to chest pain. Package cholesterol and glucose workups, fatigue packages also lead to increased Rheumatology Clinic activity.*

Are there any tests that you think are under utilised? *No*

**Future**

Where do you think pathology and healthcare in a wider sense is going? *Down the pan! Don't have much faith in the decision making capabilities of government etc as regards corporate greed etc.*

What type of test ordering procedures do you see having an impact in the future? *Best practice, Evidence Based Laboratory Medicine (EBLM), engage stakeholders, highlight system changes, recommend performance indicators such as ED D-Dimer and Troponin Evaluations, MAC review the process flows and reimbursement packages.*

How do you think the practice could be better managed? *Managed quite well in HMC. Always aware not to send a patient home without being notified of 'red flags'-two categories of alerts-need to review protocols. Email consultant if required-immediate pop up notification in situ.*

Is there anything more you would like to add concerning this subject? *Would be interested in reviewing amount of money spent per specialty e.g. ED v's orthopods e.g. over-ordering of FBCs especially post op etc.*

Thank you for your cooperation.
Appendix XII: IDI: General & Respiratory Medicine

Specialty: General & Respiratory Medicine
Date: July 2014

Initial Questions
Can you please tell me about your background in you chosen specialty? Respiratory Medicine
How many years have you been working in this specialty? 20 years
How many years have you been working for this hospital? 4.5 years
Can you please tell me which countries you would have worked in previously? UK, Northern Ireland, Philippines and New Zealand
What would you consider to be the main similarities and differences with how tests are ordered in these countries? Pretty much the same
Can you please tell me your opinion about the importance of pathology testing in this hospital? Vital-Important to have a lab.

Test Awareness
How often do you order tests? daily
Usually ‘generic’ type tests e.g. FBC, FP etc. or more specialised tests? 60-70% of test orders are very routine: FBCs, CRPs, FPs, ESRs, Coags, urines and swab cultures etc.
How many tests would you say you order daily/ weekly/ monthly? Don’t know. ? patient dependant. If a patient has an average length of stay (LOS) of 4-4.5 days, then bloods will probably be ordered for 3 of these days. However if you have a very sick patient the amount of bloods more than likely will not correlate with this.

Test Problem Recognition Style
How many (percentage or otherwise) of the test orders you order are ‘critical’? Can you support/ justify your answer? Equivocal i.e. may just deem the K+ of a FP profile really critical but that’s not to say the other parameters aren’t important.
Would you therefore say you ‘do not look at’ X% of the test you order? *Practice is to look at results. Have access to Meditech in Suite and so look at approx 90% usually out of historic training practices. Behavioral practice to do so.*

Are you aware tests may be ordered under your name but may not be required? *Yes-nurses*

Does it/ how often does it happen that tests ‘may’ get ordered without your ‘absolute’ consent e.g. nurse ordering a test e.g. FBC ‘just in case’? *Daily occurrence. Order specific tests daily. Lack of experience often contributes to this and as experience increases more confident as to what is required and what is not.*

Are you involved/ do you support the practice of ordering certain tests over a period of days e.g. FBC for five days post op/ procedure? Why do you do this? *No, don’t support it. Depends on what you are looking for.*

What do you think over ordering means? *Essentially auto-ordering test after test.*

Do you think unnecessary test orders are placed in the hospital in general? If so, by who? Why? What would you do to control this? *Yes-lack of experience, lack of supervision, bad habits, no responsible person. Control: Senior person and RMOs.*

Who do you think over-ordering may be associated with: Consultants, RMO’s, Nurses? *Nurses first, RMOs second, all grades with who made by ordering tests outside of their specialty.*

Do you think you err on the side of ‘need based’ or ‘want based’ tendencies when ordering tests? *Want based-but only owing to err*

What are your thoughts in relation to control of test orders associated with test ordering frequency criteria, computer blocks e.g. MRSA, EBLM etc? Any other factors in your opinion? *Ok re frequency criteria-interested to know more about HSE Guidelines. Don’t have an issue with blocks but unsure if this will really reduce over-orders.*

How aware of the cost of lab tests are you? How much is an FBC €21? FP €58? Swab Culture €21? Cardiac Profile (AST & CK) €32 *Unsure of some prices.*

Does the cost of lab tests influence you decision making when ordering tests? *Not really. If you need the test, you need the test.*

How committed are you to ordering tests in profiles i.e. renal profile €27 versus FP €58 or ordering tests in two phases where possible i.e. initial screening tests and subsequent
more specific tests e.g. IgE and then specific RAST tests depending on the results? *Tend to order FP [need to address]*.

How aware of the tie-ins of insurance payout, reimbursement, professional fees etc influence your ordering practices??! *Hip-standard fee. Moral or ethical recourse.*

What do you think have been the biggest changes in test ordering practices in recent years? (if any?) [Paper-based to electronic ordering, updated test methodologies ESR to CRP, CK, CK-MB, Troponin, HS Troponin etc? *The speed test results are available greatly changes the practice of test ordering. It is more streamlined now than before and the technical information available is much greater.*

What *factors* do you think are associated with this ‘perceived’ over ordering? *Verbal requests*

What *risks* do you think are associated with this ‘perceived’ over ordering? 1. *The greatest risk is running out of money and not having the availability of the testing resource. Budget impingements.* 2. *Errors w.r.t. lab mix-ups. 3. Phlebotomy-don’t think about that.*

**Principle Ordering Decision Variables**

What characteristics or variables are important for you when ordering a test? *Knowing when a test result will come back. Bog standard versus unusual. TATs. When questioned re quality, specificity, and accuracy-responded ‘don’t really think of that, rely on companies to get it right.*

In order of importance, can you list the five main factors you take into consideration when ordering tests? *Diagnosis, Reliability/ utility, Availability.*

**Cause-Effect Relationship of the Similarities/ Differences of Test Ordering Behavior**

What do you think influences your ordering behavior? *Time, mood, patient diagnosis, complications re patient’s history.*

How long does it take you from the first time that you feel that you need to order a test to finally going through with the order? Do you think that ordering immediately results in you perhaps over-ordering? *Under pressure may over order.*
Do you think there is a big difference between ordering practices between the public sector and private sector? *No-same persons ordering as working in both sectors. TATs differ though-quicker in private sector. There is also a tendency to order less on out-patients as many of these are self pay. Also due to the complexities of insurance policies you never quite know what people are covered for.*

Do recent published articles, conference information, brochures, advertisements etc influence your ordering practices? *Yes-but it depends on what they tell you!*

**Different Impact/ Influence of Communication of New Test Info**

Any new test you would be interested in? *No*

Any test you think the lab could provide that would eliminate wasted resources e.g. BNPs/ Echocardiograph correlation etc.? Any tests that could generate extra revenue? *No*

Are there any tests that you think are under utilised? *No*

**Future**

Where do you think pathology and healthcare in a wider sense is going? *No great thoughts*

What type of test ordering procedures do you see having an impact in the future? *No great thoughts*

How do you think the practice could be better managed? *Managed quite well in HMC. Greater awareness would positively influence the ordering practices.*

Is there anything more you would like to add concerning this subject? *Not at this moment in time!*

**Thank you for your cooperation.**
Appendix XII: IDI: Orthopaedics

Specialty: Orthopaedics
Date: July 2014

Initial Questions
Can you please tell me about your background in you chosen specialty? Orthopaedics
How many years have you been working in this specialty? 31 years
How many years have you been working for this hospital? 7 years
Can you please tell me which countries you would have worked in previously? UK, France & USA
What would you consider to be the main similarities and differences with how tests are ordered in these countries? Pretty much similar
Can you please tell me your opinion about the importance of pathology testing in this hospital? Good experience. Real time technology as regards ordering tests, accessing results etc. Phlebotomy very good. TATs very good especially w.r.t. blood sciences.

Test Awareness
How often do you order tests? daily
Usually ‘generic’ type tests e.g. FBC, FP etc. or more specialised tests? Mainly generic
How many tests would you say you order daily/ weekly/ monthly? Depends on number of patients in, complexity of patient mix etc.

Test Problem Recognition Style
How many (percentage or otherwise) of the test orders you order are ‘critical”? Can you support/ justify your answer? Mainly elective surgery-therefore only order what is needed.
Would you therefore say you ‘do not look at’ X% of the test you order? Look at all test results-Meditech access in Suite. Also have a pre-Assessment Nurse who I work closely with re accessing results, scheduling patients etc.
Are you aware tests may be ordered under your name but may not be required? No
Does it/ how often does it happen that tests ‘may’ get ordered without your ‘absolute’ consent e.g. nurse ordering a test e.g. FBC ‘just in case’? I do not support this practice. Only need an FBC 48 hrs post op. Use of Nurse Education office will be NB oing forward-need to educate nurses in particular.

Are you involved/ do you support the practice of ordering certain tests over a period of days e.g. FBC for five days post op/ procedure? Why do you do this? I do not support this practice. Only need an FBC 48 hrs post op. use of Nurse Education office will be NB going forward-need to educate nurses in particular.

What do you think over ordering means? Ordering Tests which are not needed

Do you think unnecessary test orders are placed in the hospital in general? If so, by who? Why? What would you do to control this? Nurses

Who do you think over-ordering may be associated with: Consultants, RMO’s, Nurses? Nurses

Do you think you err on the side of ‘need based’ or ‘want based’ tendencies when ordering tests? Need based

What are your thoughts in relation to control of test orders associated with test ordering frequency criteria, computer blocks e.g MRSA, EBLM etc? Any other factors in your opinion? Yes. Surgical patients-pre and post op bloods only. No need for additional orders. Elective surgery Support any areas which contribute to LEAN processes.

How aware of the cost of lab tests are you? How much is an FBC €21? FP €58? Swab Culture €21? Cardiac Profile (AST & CK) €32 Yes. Very aware of costs esp in theatre-operate a LEAN system-very few consumables etc.

Does the cost of lab tests influence you decision making when ordering tests? No

How committed are you to ordering tests in profiles i.e. renal profile €27 versus FP €58 or ordering tests in two phases where possible i.e. initial screening tests and subsequent more specific tests e.g. IgE and then specific RAST tests depending on the results? Very committed to ordering RP instead of FP etc. Only order what is really needed.

How aware of the tie-ins of insurance payout, reimbursement, professional fees etc influence your ordering practices??! To a certain degree-very aware of financial loss making-very lean as regards use of consumables.
What do you think have been the biggest changes in test ordering practices in recent years? (if any?) [Paper-based to electronic ordering, updated test methodologies ESR to CRP, CK, CK-MB, Troponin, HS Troponin etc? Only order tests by electronic means. Only order what is required.

What factors do you think are associated with this ‘perceived’ over ordering? Convenience of ordering easily

What risks do you think are associated with this ‘perceived’ over ordering? None mentioned

**Principle Ordering Decision Variables**

What characteristics or variables are important for you when ordering a test? *Patient presentation, TAT and specificity of test*

In order of importance, can you list the five main factors you take into consideration when ordering tests? *TAT and availability of result*

**Cause-Effect Relationship of the Similarities/ Differences of Test Ordering Behavior**

What do you think influences your ordering behavior? *TATs, Type of surgery and urgency of such, beaurecracy,*

How long does it take you from the first time that you feel that you need to order a test to finally going through with the order? Do you think that ordering immediately results in you perhaps over-ordering? *Depends on whether patient is elective or not-and thus whether they have attended the Pre-Assessment Clinic or not. If attended pre-assessment clinic, then bloods and swabs etc are ordered as per protocol. If not they are ordered in line with the patient’s condition and the protocols.*

Do you think you order more or less tests on an electronic order system or on an electronic platform e.g. through Meditech? Does the request format i.e. paper or electronic influence your decision making at all? *Prefer electronic-have Meditech access in Suite.*

Do you think there is a big difference between ordering practices between the public sector and private sector? *No*
Do recent published articles, conference information, brochures, advertisements etc influence your ordering practices? No

**Different Impact/ Influence of Communication of New Test Info**

Any new test you would be interested in? *Bringing some micro work in house*

Any test you think the lab could provide that would eliminate wasted resources e.g. BNP/s Echocardiograph correlation etc.? Any tests that could generate extra revenue? *No*

Are there any tests that you think are under utilised? *No*

**Future**

Where do you think pathology and healthcare in a wider sense is going? *Embrace technology. Kardex use important. Use of iPads during ward rounds etc NB. Also w.r.t. observations, drug ordering, lab testerview etc. Review of shift systems as regards nursing required. Paperless systems going forwards-use of technology NB as regards capturing data. Need to overcome people’s fear of technology. Review as regards interface with micro discussed and supported by consultant.*

What type of test ordering procedures do you see having an impact in the future? *Staying pretty much the same*

How do you think the practice could be better managed? *Managed well in HMC.*

Is there anything more you would like to add concerning this subject? *No*

**Thank you for your cooperation.**
Appendix XIII: Hospital Data Activity Information

Data Activity Information assessed month-on-month to verify May 2014 is representative as regards activity when reviewed with other months in 2014:

<table>
<thead>
<tr>
<th>KPI Description</th>
<th>2013 result</th>
<th>Jan 14</th>
<th>Feb 14</th>
<th>Mar 14</th>
<th>Apr 14</th>
<th>May 14</th>
<th>Jun 14</th>
<th>Jul 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average LOS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupancy Rates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed days used for calculations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daycase beds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please note: Actual figures have been removed from this table due to the confidential nature of such, but may be discussed with the author if required.
Appendix XIV: Assessment of Interviewee Cohort

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>40-60 years of age; average 49.6 years</td>
</tr>
<tr>
<td>Gender*</td>
<td>All male*</td>
</tr>
<tr>
<td>Specialty</td>
<td>Five specialties selected: General medicine, Emergency Medicine, Orthopaedics, Cardiology, and Haematology</td>
</tr>
<tr>
<td>Nationality</td>
<td>Four Irish, 1 Malaysian</td>
</tr>
<tr>
<td>Duration of each IDI</td>
<td>60-145 minutes; average 80 minutes</td>
</tr>
<tr>
<td>Any incidents to report</td>
<td>No</td>
</tr>
<tr>
<td>Any questions which were not answered</td>
<td>Not really! Most interviewees were very open and honest, were very interested in the study, and were proactive and keen to progress with process and quality improvements</td>
</tr>
</tbody>
</table>

* Meghen et al. 2013 state that ‘medicine was once a male-dominated profession reflecting the male preponderance in medical schools. Subsequently an increase in female undergraduate entry has led to an even gender balance or slight female dominance in medical schools. Decades later, the effects of this changing demographic at undergraduate level should be evident at senior clinical and academic levels. This has not happened, fuelling speculation about possible barriers and discrimination’.
Appendix XV: Differences in Test Profiles with respect to Full Profiles, Renal Profiles, and Liver Profiles

<table>
<thead>
<tr>
<th>Full Profile</th>
<th>Renal Profile</th>
<th>Liver Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>Sodium</td>
<td>Total protein</td>
</tr>
<tr>
<td>Potassium</td>
<td>Potassium</td>
<td>ALT</td>
</tr>
<tr>
<td>Chloride</td>
<td>Chloride</td>
<td>Bilirubin Total</td>
</tr>
<tr>
<td>Urea</td>
<td>Urea</td>
<td>Albumin</td>
</tr>
<tr>
<td>Creatinine</td>
<td>Creatinine</td>
<td>GGT</td>
</tr>
<tr>
<td>Total protein</td>
<td>Estimated GFR</td>
<td>Alkaline Phosphatase</td>
</tr>
<tr>
<td>ALT</td>
<td></td>
<td>LDH</td>
</tr>
<tr>
<td>Bilirubin Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GGT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alkaline Phosphatase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AST</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated GFR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cost: €58          Cost: €27          Cost: €27
Appendix XVI: Total Test Numbers for the five Weekends of May 2014

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.05.2014-05.05.2014</td>
<td>567</td>
</tr>
<tr>
<td>09.05.2014-12.05.2015</td>
<td>685</td>
</tr>
<tr>
<td>16.05.2014-19.05.2014</td>
<td>749</td>
</tr>
<tr>
<td>23.05.2014-26.05.2014</td>
<td>684</td>
</tr>
<tr>
<td>30.05.2014-02.06.2014</td>
<td>428</td>
</tr>
<tr>
<td><strong>Total samples</strong></td>
<td><strong>3113</strong></td>
</tr>
</tbody>
</table>