1-1-2014

Rationalisation of Legionella Urinary Antigen Testing.

Breda Lynch
Royal College of Surgeons in Ireland

Citation
Rationalisation of *Legionella* Urinary Antigen testing

Breda Lynch

A Dissertation submitted in part fulfilment of the degree of MSc Leadership and Management Development, Institute of Leadership, Royal College of Surgeons in Ireland

2014
Rationalisation of *Legionella* Urinary Antigen testing

Masters in Leadership and Management Development

Student ID: 12136239
Submission Date: 14\textsuperscript{th} of May, 2014
Word Count: 16,221
Facilitator: Philippa Withero
# Table of Contents

Abstract vii

Acknowledgements viii

1.0 Introduction 1
   1.1 Introduction 1
   1.2 Rationale for Change 2
   1.3 Nature and Context of the Change 2
   1.5 Leader of the Change 4
   1.6 Aims and Objectives 5
   1.7 Conclusion 6

2.0 Literature Review 7
   2.1 Introduction 7
   2.2 Search Strategy 7
   2.3 Evidence for change 8
      2.3.1 Diagnosis of Legionnaires’ disease 8
      2.3.2 Legionella Urinary Antigen Test: Role in Diagnostics 9
      2.3.3 Potential benefits and pitfalls of Legionella Urinary Antigen Testing 10
      2.3.4 Increasing guideline compliance by clinicians to change ordering behaviour 11
      2.3.5 Rationalisation of test requests 13
   2.4 Conclusion 15

3.0 Methodology 16
   3.1 Introduction 16
   3.2 Discussion of Change Models 16
      3.2.1 Young’s Meta-Model For Change 16
      3.2.2 Kotter’s Change Model 17
      3.2.3 HSE Change Model 18
   3.3 The Change Process: Initiation 20
      3.3.1 Preparing to Lead the Change 20
   3.4 The Change Process: Planning 23
      3.4.1 Building commitment 23
      3.4.2 Determining the detail of the change 27
      3.4.3 Developing the Implementation Plan 28
   3.5 The Change Process: Implementation 28
   3.6 The Change Process: Mainstreaming 29
      3.6.1 Making it “the way we do business”, Evaluating and Learning 29
   3.7 Conclusion 30

4.0 Evaluation 32
   4.1 Introduction 32
   4.2 Pre-change audit 33
      4.2.1 Purpose of pre-change audit 33
      4.2.2 Pre-Change Audit Results 33
      4.2.2 Pre-Change Audit Finance 35
   4.3 Interventions 36
   4.4 Post-change Audit 36
      4.4.1 Post-change Audit Results 36
      4.4.2 Post-change Audit Finance 42
      4.4.3 Survey of NCHDs re Written Intervention 42
   4.5 Critical Analysis 43
      4.5.1 Achieving objectives 43
      4.5.2 Comparison of audit data 44
4.5.3 Retrospective verses real-time audit
4.5.4 Maintaining and Improving on Gains Achieved
4.5.5 False-positive results
4.6 Conclusion

5.0 Discussion and Conclusion
5.1 Introduction
5.2 Success factors
5.3 Areas for improvement
  5.3.1 Communication
  5.3.2 Gap in Stakeholder Analysis
  5.3.3 Delayed recognition of Organisational Culture
5.4 Relevance of the Literature Review in this Change
5.5 Potential Threats and Learning Points
  5.5.1 Power and Influence
  5.5.2 NCHD turnover
  5.5.3 Collaborative team engagement
  5.5.5 Resistance
5.6 Impact of the project
  5.6.1 Impact on the patient
  5.6.2 Impact on clinicians
  5.6.3 Impact on laboratory staff
  5.6.4 Impact on the change agent
  5.6.5 Impact of the project on the organisation and beyond
5.7 Recommendations for future improvements
  5.7.1 Face-to-face interventions are key
  5.7.2 Acknowledge key stakeholders from the beginning
  5.7.3 Obtain high-level support
  5.7.4 Use leverage points where available
5.8 Conclusion

Bibliography

Appendix
Appendix 1
Appendix 2
Appendix 3
Appendix 4
Appendix 5
Appendix 6
Appendix 7
Appendix 8
Appendix 9
Appendix 10
Appendix 11
Appendix 12
Appendix 13
Appendix 14
Appendix 15
Appendix 16
List of Figures

Figure 1: Pre-change Audit 34
Figure 2: Post-change Audit: All orders 37
Figure 3: Post-change Audit – Analysis of tests processed 38
Figure 4: Post-change Audit – Analysis of tests NOT processed 39
Figure 5: Changes in LUA tests requested 41
Figure 6: Changes in LUA tests processed 42
“For changes to be of any true value, they’ve got to be lasting and consistent”

Tony Robbins
Abstract

**Introduction:** Legionnaires’ is a severe pneumonia, the diagnosis of which can be confirmed by a positive *Legionella* Urinary Antigen (LUA) test. The British Thoracic Society has specific guidelines for its use. Incorrect LUA test requests can result in false-positive results while accumulating costs.

**Aims and Objectives:** The aim is the rationalisation of LUA testing. The first objective is to educate clinicians on indications for testing reducing unnecessary orders. The second is to develop a laboratory Standard Operating Procedure (SOP) to screen test requests. The third is to reduce costs. **Methodology:** Rationalisation of laboratory testing can be through clinical education, laboratory administrative methods or a combination. The HSE Model guided the change process. A pre-change audit created urgency, engaged key stakeholders and informed development of the SOP. Face-to-face education was undertaken in H1 & H3, with a written memo distributed to H2. The new SOP was presented to laboratory staff. Post-change audit results were used to mainstream. **Evaluation:** Following change implementation there was a decrease in LUA test requests in H1 & H3 of 17.5% and 15% respectively, but an increase of 2.3% overall. The total reduction in tests processed was 71.5% reducing costs by €2,195.52 and saving 24 hours of laboratory time. **Conclusion and Organisational Impact:** Face-to-face educational interventions are beneficial however administrative methods are most effective when rationalising laboratory test usage. High-level management support and early engagement of stakeholders is key in successful change. Once mainstreamed, a saving of €28,541 and 312 laboratory hours per annum is predicted.
Acknowledgements

I wish to express my gratitude to all those who contributed generously of their time, expert knowledge, experience and support.

I would like to specifically thank the Laboratory Management team who were instrumental in the successful implementation of this change. A special thanks to the Clinical Microbiology Department and Laboratory Scientists who were patient and engaging throughout this collaborative approach to change, in particular to our Surveillance scientist who provided the data for analysis.

I would like to express my thanks to my facilitator for the feedback and encouragement. A particular thanks to my fellow ALS members who created an atmosphere that was conducive to learning and consistently supportive. To my friends and family for their tolerant and ever-listening ears, SFM.
1.0 Introduction

1.1 Introduction

Change is a requirement of organisations across all sectors, healthcare included. Changes are constantly occurring in healthcare in Ireland, some large, such as the launch of the National Clinical Care Programmes in 2010, others small, such as the introduction of a local programme encouraging hand washing. Not every change project is successful, in fact often most reportedly fail (Burnes, 2004a; Ford & Ford, 2010; Higgs & Rowland, 2005; Sirkin et al., 2005) but most changes likely fall on a spectrum between success and failure. NICE recognise that even modest changes can have significant positive patient impact (National Institute for Health and Clinical Excellence, 2007).

The quality of healthcare can be improved by a wide range of interventions bettering professional practice and patient care (Oxman, Thomson, Davis, & Haynes, 1995). In any large organisation such as the Health Service Executive (HSE), any number of these interventions, quality improvement projects or changes will be occurring simultaneously (Cutcher-Gershenfeld, Ernst Kossek, & Sandling, 1998) and are all hopefully toward the shared vision of the HSE, to “enable people lead healthier and more fulfilled lives” (Drumm, 2008).

This thesis will describe the rationalisation of Legionella Urinary Antigen (LUA) testing in four hospitals. In this introductory chapter key concepts will be introduced and the nature and context of the change will be discussed. Chapter 2 evidences the rationale for change through a literature review. A description of the change will follow in the Methods Chapter. In Chapter 4, an evaluation of the results will be presented. The final chapter will be used to critically discuss key findings of the change implementation, results and outcomes as well as provide a commentary on the key concepts as well as make recommendations going forward.
1.2 Rationale for Change

Legionnaires’ disease is a rare condition with an average of 13 cases reported in Ireland per annum (European Centre for Disease Prevention and Control, 2012). In 2012, 1,270 LUA tests were processed in the laboratory in question. Given the test is not 100% sensitive; processing tests without indication increases the incidence of false-positive results (van Walraven & Naylor, 1998). False-positive results negatively impact patient care through exposure to unnecessary antimicrobials or a delayed diagnosis. A further reason to rationalise testing is that unnecessary processing is expensive, as the direct costs of reagents and laboratory scientist time rapidly accumulate (Kwok & Jones, 2005; van Walraven & Naylor, 1998).

Guidelines exist for the indications for Legionnaires’ testing, in the form of the British Thoracic Society (BTS) Guidelines entitled “Management of Community Acquired Pneumonia in Adults” (Lim et al., 2009), Appendix 1. These internationally recognised guidelines are advocated by the clinical microbiology team and form part of the local antimicrobial guidelines, Appendix 2. It was hypothesised that use of the LUA test was often outside the guidelines prior to this change management project and this was proven in the pre-change audit.

1.3 Nature and Context of the Change

Currently the laboratory processes each LUA request if correctly labeled. This initiative will reduce the number of LUA tests processed by both reducing the numbers of test requested through education and increasing guideline compliance, as well as enabling laboratory scientists to screen specimens based on the clinical data provided.

For a project to be successful, the change must be assessed on both merit and overall place within the organisational context (Higgs & Rowland, 2010;
Michel, By, & Burnes, 2013). The HSE National Service Plan 2014 states, "while budgets are being reduced… we are aiming… to maximise efficiencies and ensure that we maintain sustainable levels of service with quality and patient care at the heart of everything we do". This objective is similar to the mission statement of the change agents’ organisation; “[to] provide quality patient care, delivered by skilled and valued staff, through the best use of available resources” (Health Service Executive, 2014). This project fits with local and national ideals by looking to improve the quality of service provision while meeting cost parameters.

The population served by the four acute hospitals and laboratory is approximately 500,000, and 1,160 hospital beds. There are three Consultant Clinical Microbiologists and two Clinical Microbiology Specialist Registrars (SpRs) based in the largest hospital (herein referred to as H1). The two SpRs cover the other three hospitals remotely daily and one consultant spends one day per week in one of the other three hospitals. There are approximately forty microbiology laboratory scientists working in the department, and the laboratory processes approximately 300,000 specimens per annum. This figure increases year on year without an increase in funding or staffing.

The Chief Scientist is a proactive well- respected leader. Together with the clinical microbiology team the laboratory remains at the cutting edge of Clinical Microbiology by embracing change. This is the first laboratory to introduce the LUA test. As a whole, the department presents regularly at local, national and international meetings such as the regional quality conference, or the Irish Society of Clinical Microbiology meeting. This demonstrates the culture of change and quality improvement within the department. Literature demonstrates that a culture of change (Gill, 2011) as well as a readiness for change (Armenakis & Harris, 2002; Palmer, 2004; Smith, 2005) increases the likelihood of successful endeavours.

Interdisciplinary engagement between the clinical microbiologists and the laboratory scientist staff is promoted as evidenced by collaborative research from the department. Multi-disciplinary term engagement improves the quality
and service delivery in healthcare (Borrill, West, Shapiro, & Rees, 1999; Tanco, Jaca, Viles, Mateo, & Santos, 2011).

1.5 Leader of the Change

The change agent is a Clinical Microbiology SpR in H1 and commenced in this role shortly prior to the start of this project. Although leading in this change management project, the change agent has no formal authority over any stakeholder groups, and as a new staff member had little influence in the beginning.

Leadership in an economic crisis is critical, but what leadership style is best? Clinicians and healthcare managers need to adapt in response to the external environment, which at present is economic turmoil. The tenuous balance between quality and cost must be achieved and value-based leadership models, or transformational leadership (Mills & Spencer, 2005) may be the means. Authentic leadership fits with the concept of transformational; those leaders who raise people’s motivation and sense of higher purpose (Gill, 2011). The call for authentic leaders, or those who are seen to be value-based, has arisen from public fatigue of leaders who fall from grace (Gill, 2011).

Distant leadership is an emerging reality (Hay Group, 2011). With the formation of hospital groups and pending independent hospital trusts, remote leadership skills will be required (Department of Health, 2013). In the current structure of the Clinical Microbiology Department, H2, 3 and 4 are managed remotely. Lessons in distant leadership are mainly from industry, but transformational leadership is possible (Gibson & Manuel, 2003; Holtbrügge, Schillo, Rogers, & Friedmann, 2011). Mastering successful communication is a challenge but must be overcome to avoid misunderstandings and loss of commitment (Gibson & Manuel, 2003; Kayworth & Leidner, 2000). Face-to-face engagement with clinicians increases guideline compliance and changes practice more than written interventions alone (O’Brien et al., 2007; Soumerai
et al., 1993), however a key issue arising in this project was how to implement a change across four sites without a personal interaction.

Increasingly frequently in healthcare it is realised that changes and quality improvements often come from front-line staff, not necessarily those in managerial roles (Fleming, Lynch, Heslin, & Ryan, 2008; NHS Leadership Academy, 2011; The King’s Fund, 2011). These emergent leaders, are borne from a situational need (Karp & Helgø, 2008). Furthermore clinical engagement is a powerful tool in service development and improvement (Ham & Dickinson, 2008; “Medical Engagement Scale,” n.d.). Clinicians dictate where budgets as they order tests (Friedman & Katt, 1991; van Walraven & Naylor, 1998; Yeh, 2014) and treat the patients. Clinician and management engagement can control service costs (Ham & Dickinson, 2008; Tanco et al., 2011) and clinical and laboratory specialists collaborating can reduce laboratory costs (Baron et al., 2013).

In summary, the change agent is new member of staff, introducing a change across four locations with no formal authority over any of the stakeholder groups. The change agent is a clinician as well as a laboratory specialist and hopes to bridge the gaps between clinical medicine, laboratory medicine and the laboratory sciences. It is hoped that implementation of this change will teach the change agent core skills to lead change again (Quinn, 2011).

1.6 Aims and Objectives

Aim

The aim of this change management project is the rationalisation of Legionella Urinary Antigen testing within the organisation. The primary objectives are:

- Undertake a pre-change audit to investigate if LUA tests requests are indicated when audited against best practice as well as ascertain compliance with the pre-change Standard Operating Procedure (SOP) by laboratory staff
• Education of clinicians on the appropriate use of the LUA test to reduce orders
• Development of a laboratory intervention to reduce the processing of tests that are likely not indicated
• Reduce costs by rationalising use of the LUA test
• Undertake a post-change audit of clinical and laboratory practice.

1.7 Conclusion

In conclusion, this is a change management project to rationalise LUA testing across four hospitals. In the next chapter, the evidence supporting undertaking will be discussed, as well as a review of the literature pertaining to the available interventions to rationalise laboratory testing.
2.0 Literature Review

2.1 Introduction

Community acquired pneumonia (CAP) is a leading cause of hospital admissions, and a major cause of morbidity and mortality worldwide (Lim et al., 2009). *Legionella* species are an uncommon cause of CAP with the total number of cases per year in Ireland ranging between 7 and 14 (European Centre for Disease Prevention and Control, 2012). Legionnaires’ disease requires the diagnosis of pneumonia with microbiological confirmation. A *Legionella* Urinary Antigen test is one such method.

The aims of this literature review have been to discuss diagnostic methods of Legionnaires’ and critically appraise the LUA test as a diagnostic tool. This will be followed by an appraisal of the literature pertaining to changing the clinical practice of physicians, particularly in the context of adherence to guidelines, local, national or international. Finally, a focused discussion on how to rationalise test requests will follow. The relevant information gathered will be extrapolated and discussed in the organisational context.

2.2 Search Strategy

For this literature review, Pubmed was searched using the search terms (*Legionella* OR legionnaires’) AND antigens, bacterial/urine[MeSH Terms](medical subject heading) and the filters “English language” and “humans”. This resulted in 124 results on 04/12/13. The author also used a similar search strategy in the Cochrane library, MEDLINE and CINAHL plus. Articles were selected by relevance to this topic. This database search was then supplemented with selecting references as utilised by key papers. In total, 28 references were utilised.

A further search using paired MeSH (medical subject heading) terms “cost effectiveness analysis” and “laboratories, hospital/utilization”, yielded 124
results on 19/12/13, reduced to 55 with the use of the filters “English language” and “humans”. Using the key words and phrases, “utilization”, “laboratory” and “improve”, CINAHL Plus was searched on 19/12/13, yielding 39. Similar search techniques were applied in MEDLINE and the references of key papers were also utilised.

The final search was undertaken using “clinician” “compliance” and “guideline” in Emerald insight on 6/3/14 yielding 25 journal results. A similar search in the Wiley library on the same date using the search terms “guideline compliance”, “clinical practice” and “improve” in all fields yielded 243 journal articles. The references of key papers were also utilised.

2.3 Evidence for change

2.3.1 Diagnosis of Legionnaires’ disease

Legionnaires’ disease is a severe pneumonia, often requiring hospital admission. It is difficult either clinically or radiologically to distinguish it from more common causes of pneumonia, such as *Streptococcus pneumoniae* (Mandell et al., 2009; Tan, 2000). There are clinical features, risk factors and biochemical abnormalities that make a diagnosis of Legionnaires’ more likely but are not highly specific (Birkin, Biyani, & Browning, 2011; Mandell et al., 2009).

There are a number of methods by which to confirm a diagnosis of Legionnaires’ disease. The detection of *Legionella pneumophila* in specimens using immunoflourescent microscopy is one method however requires specialist equipment and expertise and is insensitive (Mandell et al., 2009). *Legionella* species could be cultured from clinical specimens, but again requires both specialised media and expertise not be available in all standard laboratories and can take up to fourteen days (Health Protection Surveillance Centre, 2009; Mandell et al., 2009). Antibody detection in serology samples is
specific for Legionnaires’ however requires two blood tests at least four weeks apart therefore not clinically useful (Mandell et al., 2009).

The widespread availability of urine antigen tests has revolutionised the laboratory diagnosis of Legionnaires’. These are immunochromatographic membrane assays that detect Legionella pneumophila serogroup 1 antigen in urine. Legionella pneumophilia serogroup 1 causes 85-90% of human infections (Mandell et al., 2009; Tijet et al., 2010; Yu et al., 2002). These tests are widely available and give a result within minutes, however are not perfect, as will be discussed.

2.3.2 Legionella Urinary Antigen Test: Role in Diagnostics

The manufacturer of the LUA test reports both the sensitivity and specificity as 95% (Alere, n.d.). However, a large meta-analysis of commercially available LUA tests suggested that early publications on sensitivity and specificity may have over-estimated test performance (Shimada et al., 2009). It is now more likely that a positive LUA test, when used in the appropriate clinical setting, diagnoses up to 74% of Legionnaires’ cases (Shimada et al., 2009). This is partially because the tests picks up Legionella pneumophila serogroup 1 only leading to under-diagnosis (File, 2003).

As the LUA test has a high sensitivity but a lower specificity than previously indicated (Shimada et al., 2009) it is a test that should be used to confirm, rather than exclude, Legionnaires’. As with most tests, false positives can occur and have been reported in the literature (Bailleul, 2004; Deforges et al., 1999), in some reports as high as 2.9% (Helbig et al., 2001). This encourages the use of the LUA only when indicated to reduce the risk of false-positive results occurring.
2.3.3 Potential benefits and pitfalls of Legionella Urinary Antigen Testing

There are obvious advantages to using the LUA test. Early diagnosis and treatment improve patient morbidity and mortality as well as lead to early recognition of Legionnaires’ outbreaks (Alvarez et al., 2009). To ensure the diagnosis is not missed, most guidelines empirically cover for Legionella infection in a severe pneumonia or if risks for Legionnaires’ exist (Lim et al., 2009).

The British Thoracic Society (BTS) updated their guidelines on the investigation and management of CAP in 2009 (Lim et al., 2009). Largely respiratory physicians devise these evidence-based guidelines. They stratify pneumonia into mild, moderate and severe using the CURB-65 score\(^1\) and advise microbiological investigations and antibiotic treatment accordingly, Appendix 1. These guidelines recommend that only a severe pneumonia, or a moderate pneumonia with risks for Legionnaires’ should be tested with an LUA. There are exceptions to these guidelines, such as that the CURB-65 score has not been validated for immunocompromised patients or in those under the age of 30 (Health Protection Agency, 2012).

These guidelines although widely accepted throughout the UK and Ireland are not without critics. Wingfield et al published a study demonstrating that on review of hospital admissions CAP, 25% of cases of Legionnaires’ would have gone undiagnosed if these guidelines are (Wingfield et al., 2013). However it has been demonstrated that routine testing for Legionnaires’ is unlikely to be cost effective (Murdoch et al., 2013) as guidelines empirically treat Legionnaires’ in moderate to severe cases.

In the past if Legionnaires’ is out-ruled by a negative LUA test, atypical antimicrobial cover was discontinued (Roger et al., 2010). More recent studies have expressed concerns on narrowing therapy, due to a higher risk of clinical

\(^1\) CURB-65 score: One point for each of Confusion, Urea >7 mmol/L, Respiratory rate >30/min, Systolic blood pressure <90 mmHg and/or Diastolic blood pressure <60 mmHg and Age >65 years
relapse (Falguera et al., 2010). Possible reasons for this relapse would be: failure to treat other serogroups of *Legionella* species not detected by the test (Mandell et al., 2009), the low specificity of the LUA test (Shimada et al., 2009), infection caused by other difficult pathogens to identify (Houck, 2001) such as *Mycoplasma pneumoniae*, or the presence of a mixed infections (Roig et al., 2003).

There has been increasing evidence in recent years that focused treatment for Legionnaires' with a fluoroquinolone, which is not first line in most guidelines, improves outcomes (Bartlett, 2008). Fluroquinolones may hasten recovery (Blázquez Garrido et al., 2005; Griffin et al., 2010; Haranaga et al., 2007) and reduce hospital admission times (Mykietiuk et al., 2005; Sabrià et al., 2005) likely reducing hospital costs.

If Legionnaires' is rare, empirically covered in empiric guidelines and the LUA test is not highly specific and sensitive, is there a benefit to the laboratory providing the test? If antimicrobial therapy is not going to be adjusted with a negative test is there a value in its performance? What is the benefit to knowing the pathogen (Mandell, 2010)? The author finds that as the evidence suggests that focused treatment improves patient outcomes, and as the diagnosis is important from a public health viewpoint, it is reasonable to test using a LUA test but rationalise how and when it is used, thus providing the rationale for undertaking this project.

2.3.4 Increasing guideline compliance by clinicians to change ordering behaviour

Evidence-based medicine and best-practice guidelines aim to improve healthcare and service delivery (Audet, 1990; Chassin, 1990). Clinical guidelines are “*systematically developed statements to assist practitioner[s]… about appropriate health care for specific… circumstances*” (Field & Lohr, 1990). They aim to improve clinical outcomes by limiting deviation from proven effective practices (Audet, 1990; Cabana et al., 1999). Although guidelines may be introduced in a hospital, their success is wholly dependent
on their adoption into practice, which is difficult to obtain (Cabana et al., 1999).

Guideline adherence is likely to be increased if the guideline, such as the BTS guideline, is advocated by a recognised body and supported by local authorities (Dawson et al., 1999). The guideline used at the core of this change project is an “external” guideline, i.e. developed by an external body, but promoted by clinical microbiology and respiratory physicians, therefore is also an internal guideline (Grimshaw & Russell, 1994), Appendix 1&2.

Successful introduction of a guideline into practice requires all the principles of change management such as strong leadership and amplified communication (Grimshaw & Russell, 1994). There are often barriers impeding the adoption of guidelines into practice. The clinician may not agree with the guideline or be aware of its existence. There may be a cultural inertia surrounding change within that organisation (Cabana et al., 1999). Organisational barriers exist and hurdles such as staff turn-over make long term compliance with guidelines difficult to maintain (Brand et al., 2005). Prior to the introduction of a guideline, these barriers must be addressed (Brand et al., 2005; Cabana et al., 1999).

Face-to-face education can change the practice of clinicians and increase guideline compliance (O’Brien et al., 2007). The “social marketing approach” is where face-to-face interactions focus on identifying barriers to change, developing shared objectives by encouraging physician contribution and engage opinion leaders (O’Brien et al., 2007; Soumerai et al., 1993). Many of these concepts are similar to the principles of the HSE Change Model (Fleming et al., 2008). Distribution of hard copies of educational materials only has a small effect on guideline compliance (Giguère et al., 2012), however combined with another intervention can be beneficial.

Improvements in clinical practice and guideline adherence can be obtained through audit and feedback (Jamtvedt et al., 2006; Mandelblatt & Kanetsky, 1995). These interventions, combined with face-to-face educational visits can
accumulate to positively improve the targeted clinical practice (Soumerai et al., 1993). Engaging opinion leaders to communicate a message can improve guideline compliance (Flodgren et al., 2011) and multi-faceted approaches have the most promising data (Prior et al., 2008).

The BTS have a guideline recommending when a LUA test should be ordered. The first change is to encourage clinicians to comply with this international guideline locally promoted. The second change is then to enable the laboratory to screen requests to see if they are in accordance with this guideline.

2.3.5 Rationalisation of test requests

Rationalisation of laboratory testing is a complex process. There is a balance between the need to curtail escalating costs of investigations without negatively impacting on patient care (Friedman & Katt, 1991). Changing clinician-ordering practices can be challenging. Interventions can be classified as administrative or educational (Calderon-Margalit et al., 2005). Administrative methods include restricting certain tests outside “normal” working hours, restricting duplication of tests or holding likely unnecessary tests pending clinical details. These restrictive methods can have negative consequences risking a delayed diagnosis thus adversely affecting patient care (Cherry, 2005). Senior management must acknowledge this risk prior to implementation.

Education is the second type of intervention which can be utilised and can be verbal or written (Calderon-Margalit et al., 2005). Many educational interventions use audit as a tool or feedback mechanism. Bareford and Hayling demonstrated substantial improvements in laboratory ordering by clinicians through the use of positive feedback, such as publicising the overall reduction in ordering on a monthly basis etc (Bareford & Hayling, 1990).
Strategies that focus on changing practice through one intervention only may have a limited impact. Combined administrative and educational interventions are more likely to be successful (Marton, 1985; Smellie, 2012; Solomon, 1998). Assessing the baseline use of a test, implementing a guideline then re-auditing has been shown as an effective means of changing clinician ordering behaviour (Nardella, Farrell, Pechet, & Snyder, 1994; Yeh, 2014) and has influenced the direction of this change project. Dowling et al. undertook a baseline audit of test utilisation, fed-back results to clinicians once then re-audited for a third time and demonstrated that once the second audit had finished, test ordering drifted back to the level of before the intervention (Dowling, 1988). This shows that without repeating audits including feeding the change may fail long-term (Fleming et al., 2008).

Following interventions to change ordering, the results can be variable. Some report the outcome was less than 50% of desired (O’Brien et al., 2007). Others such as Grimshaw et al., demonstrated that a dual pronged approach of education coupled with a laboratory intervention could reduce processing by 50% (Grimshaw & Russell, 1994). Repeatedly stated as a critical success factor is the need for senior management support and engagement (Bareford & Hayling, 1990; Dowling, 1988; Yeh, 2014). Also, organisational barriers (Brand et al., 2005), such as frequent staff turnover, need to be addressed early in the process (Dowling, 1988). A positive approach to auditing, education and feedback is more likely to lead to a long-lasting change (Bareford & Hayling, 1990). Unless these factors occur, changes will be difficult to achieve and maintain (Axt-Adam et al., 1993).

An important question to be asked is why are clinicians over-ordering tests? There are many feasible answers, including lack of awareness of a guideline (Cabana et al., 1999) or fear of missing a diagnosis (Yeh, 2014). Collaboration between clinicians and laboratory specialists can reduce unnecessary testing (Baron et al., 2013; Wu, 1998) ensuring that laboratory resources are used more appropriately (Kwok & Jones, 2005; Nightingale, Peters, Mutimer, & Neuberger, 1994).
2.4 Conclusion

The scope of this chapter has been broad. CAP is a leading cause of hospital admissions; of which Legionnaires’ is a rare but important cause. A discussion on the difficulties in the diagnosis of Legionnaires’ has demonstrated that a LUA test is currently the best available, and that although its sensitivity and specificity are less than ideal, it has a role in practice. Confirmation of Legionnaires’ allows a patient to be switched to a more effective therapy and alerts Public Health officials to a possible epidemiological source. Given the low specificity of the test, it should be undertaken only when there is a clear clinical indication to avoid a false positive result. This is also a cost-effective approach to testing.

Changing clinical practice to adhere to a guideline can be challenging. It is likely that education, the use of opinion leaders as well as audit and feedback will be a combination more likely to lead to long lasting change. The main tools used to rationalising tests requests can be administrative or educational. It is likely that a combination of these tools will be most successful. Alanzo et al., suggest that clinical behaviour can be modified using education, motivation and facilitation, all of which are targeted in both the HSE Change Model and then in this project (Alanzo, Cohen, & Nettleman, 2003; Fleming et al., 2008).
3.0 Methodology

3.1 Introduction

In this chapter, the author will critically discuss three change models that are acclaimed in the literature, followed by a more detailed discussion on the model chosen for this thesis. Then the practical application of that change model translated into practice will be described.

There is a continual clash between change theory and the practicalities of its implementation. Often it is found that models with a sound theoretical basis may not apply in reality (Burnes, 2004c; McAuliffe & Vaerenbergh, 2006; Young, 2011). Numerous models have been developed to guide organisational change, which in itself suggests that there is no superior model accepted by all. Taking strengths from a combination of theories to use in one’s own organisation may be an effective approach to change (Sidorko, 2008).

3.2 Discussion of Change Models

3.2.1 Young's Meta-Model For Change

Young’s Model is formulated by weaving strands from various perspectives on change, e.g. individual verses organisational change, giving a rounded view grounded on a broad literature base. This comprehensive model looks at nine different stages, Appendix 4, many of which are common to other models, for example the “commitment to act” is similar to the “building commitment” stage of the HSE Change Model (Fleming et al., 2008; Young, 2009). It also draws in part from the Deming Cycle, acknowledging the need to “do-check-act” (Deming, 1982) similar to the “Plan-Do-Study-Act” quality improvement tool (Langley et al., 2009). This tool steers the direction of the change as it occurs (Young, 2009). It also indicates to followers that there has been a
demonstrable transformation, voicing the “short-term wins” as lauded by Kotter (Kotter, 1995).

Young’s Meta-Model was not chosen for this thesis as some stages have little relevance to this undertaking. For example, the behavioural “pre-change paradigm” (Young, 2009) component is not applicable to this project. Young hopes that by continually obtaining feedback from service users, areas for improvement will be identified early, avoiding change as a reaction to a “crisis”. The need for rationalisation of LUA testing change was previously identified as an area for improvement and placed on the laboratory management agenda. However it was not tackled until an increase in false-positive results pushed it to the fore, more as a reactive change then a planned event.

Young implies that the role of the leader is to provide the vision without “micro-managing “ issues (Young, 2009). His approach to change is a top-down approach where the change agent has the authority to direct and delegate where appropriate. Firstly, the author does not have direct authority over any stakeholders. Secondly, this dissertation is an action-based organisational development project where the change agent experiences and learns from leading a change. Finally, in healthcare there has been a move to clinical engagement in a shared leadership model replacing a hierarchical top-down approach to management.

3.2.2 Kotter’s Change Model

Kotter’s Change Model gives a map of change that is unidirectional suggesting steps should be followed sequentially, Appendix 5 (Kotter, 1996). Unlike Young’s approach he does not suggest that adjustments need to be made while the change is ongoing. He approaches change as a single event that is going to happen in isolation and once initiated continues until completion. Healthcare is a notoriously dynamic environment where long term-planning is difficult and an adaptive approach to change is crucial
Many organisations, healthcare included, experience both planned and emergent change on a near daily basis (McAuliffe & Vaerenbergh, 2006). Kotter’s Model lacks the audit and re-audit cycles that are seen in Young’s Model and others, to allow for adaptation in a complex environment.

Kotter’s Model discusses how to overcome resistance and obstacles encountered when leading change (Kotter, 1995). Similar to Young, he favours a “command-and-control” approach to leadership (Argyris, 1999). He provides little information on the practicalities of change, such as the previously discussed value of auditing during changes or of useful tools such as a stakeholder analysis.

Kotter’s Model, although famously known for eight steps, can be subcategorised into three: preparation, action and grounding. Compared to the HSE Model, it lacks the initiation stage. It is in this stage that crucial information is gathered prior to commencement. Kotter however, begins his model establishing a sense of urgency for change without discussing the feasibility of its implementation. The HSE Model and Young promote the thorough research of any change project prior to its commencement, including consideration of possible alternatives (Fleming et al., 2008; Young, 2009) to reduce the risk of failure.

### 3.2.3 HSE Change Model

There are numerous reasons for choosing the HSE Change Model. This framework was designed specifically for use in the Health Service Executive (HSE), where this project occurs. It was created from other change models then adapted to suit a healthcare environment (Fleming et al., 2008). One of the key aims in its development was to encourage a “consistent approach to change across the system” (Fleming et al., 2008).
The HSE Change Model should have a certain amount of familiarity and credibility amongst HSE staff. If stakeholders are not familiar with the model itself per se, the language and terminology are easily understood. Designed to be accessible to users, it does not require any prior theoretical management knowledge. It is a step-by-step guide with sufficient detail and supplementary materials to direct a relatively in-experienced change leader (Fleming et al., 2008).

The initial step of the HSE Model is phrased “preparing to lead the change”. This phrasing puts the change agent at the centre of the project. This statement stresses the importance of the change agent and gives ownership to them from the beginning. Ownership and accountability continually emerge as themes throughout the HSE Change Model (Fleming et al., 2008) and throughout change literature in general (Bartkus, 1997; Gill, 2011; NHS Leadership Academy, 2011; Prime Minister’s Strategy Unit, 2004; Strebel, 1996; Young, 2009).

The importance of gaining commitment and preparing for change has been lauded in the literature (Burnes, 2004c; Fleming et al., 2008; Kotter, 1995; Sirkin et al., 2005). The HSE Change Model recognises the importance of these stages, allowing four of the seven steps to focus the change agent on rallying support. The support of high-level management and use of opinion leaders is stressed as key by both Fleming and Kotter (Fleming et al., 2008; Kotter, 1996) and also emerged as a critical success factor from the literature review on changing clinical practice (Bareford & Hayling, 1990; Dowling, 1988; Yeh, 2014).

The HSE Change Model uses the theories of both organisational development and project management (Fleming et al., 2008). The model allows flow between steps, allowing for the collection of information as the change agent progresses to inform the steps forward and make adjustments retrospectively. This takes into consideration that learning occurs during change, allowing the lessons learnt to guide the process (Senge, 1997).
The HSE Change Model addresses cultural differences between employees from different clinical backgrounds, relevant to this project, where this change affects clinicians in general medicine, laboratory clinicians and laboratory scientists. Complex working relationships are a possible reason for resistance (National Institute for Health and Clinical Excellence, 2007). Organisational culture cannot be underestimated when planning for change, (Fleming et al., 2008; Ogbonna & Harris, 1998; Seel, 2000) although there is a lack of well designed research to quantify its effect (Parmelli et al., 2011). A disadvantage of the HSE Change Model is that it does not lend itself completely to the graduated approach to change. However for this project, a graduated approach to change would not be feasible.

The HSE Change Model is comprised of four stages: Initiation, Planning, Implementation and Mainstreaming. The author will describe each of the activities undertaken during each of the stages, Appendix 6.

3.3 The Change Process: Initiation

3.3.1 Preparing to Lead the Change

The change agent commenced work as an SpR in H1, in July 2013. Soon after, the author arranged a meeting with the laboratory management team to discuss undertaking a change project. Various proposals were discussed. The writer chose this change project, the rationalisation of Legionella Urinary Antigen (LUA) testing, for a number of reasons. It had approval of the laboratory management team giving it credibility, as organisational change cannot occur without the permission of those in authority (The Education and Scientific Committee of the Irish Society for Quality in Healthcare, 2006). It was an area of personal interest for the change agent. The aims and objectives were readily decipherable. Finally, the experience of the change agent having worked previously in two other laboratories could be applied in constructing the outline for how the change would be implemented.
Rationalisation of LUA tests had been on the management agenda for a prolonged period of time. Although identified as a potential area for improved use of resources and a cost-management target, other items on the agenda were higher priority. However a recent increase in the number of false positive results highlighted the urgent need for action.

The direct cost of each test from reagents and direct labour can rapidly accumulate (Kwok & Jones, 2005; van Walraven & Naylor, 1998). A positive result has a higher cost requiring referral to a reference laboratory for investigation. Each positive accrues a large indirect cost to the patient by delaying the real diagnosis and the exposure to unnecessary antimicrobials. There is also a significant indirect cost to the clinician, clinical microbiology and Public Health.

Leading the change the author used various tools. To evaluate the scope of the project the aims and objectives were determined as discussed in the chapter 1, and agreed with the project sponsor. The change agent proposed that a reduction in processing of 20% could be achieved with a combination of educational and administrative interventions. This estimate was based on the hypothesis that the rate of Pneumococcal Urinary Antigen positivity is 10% and that the clinical education would reduce orders by a further 10%. A Mini Gantt chart was completed, Appendix 7, to ensure objectives had targeted dates for completion and also agreed with the project sponsor. These tools held the change agent accountable for the project and allowed planning for interventions to be made in advance.

Many tools from the HSEland support website (“HSE First Time Managers Programme,” n.d.) prompt the change agent to analyse the trajectory of the change prior to its implementation. Identification of the urgency for change gives the change the momentum to get started, engage participants (Kotter, 1995) and continue on a successful path, Appendix 8. A “Stakeholder Analysis”, Appendix 9, concentrates the efforts of the change agent into areas where amplified communication to create followership are best directed (Egan, 1994). The stakeholder analysis presented in Appendix 9, was
undertaken at the start of the project. This is an assessment of stakeholders as seen in a moment in time. The interest and influence of stakeholders fluctuates throughout the change period (Freeman, 2010). Change in complex organisations may fail if there is a lack of communication with stakeholders and recognition of personal relationships (Karp & Helgø, 2009). The stakeholder analysis will be discussed in greater detail in the “Building Commitment” stage.

A key step in the initiation stage was the undertaking of an audit. This audit was to test the hypothesis that some LUA tests are ordered without indication, when compared to the BTS guidelines on the management CAP, Appendix 1 (Lim et al., 2009). This audit also reviews practice of laboratory staff in the processing of LUA test requests when compared to the pre-change SOP and guided the development of the SOP.

Completion of a SWOT tool for early identification of risks or issues is important preparation for the task ahead, Appendix 10. The pre-change audit results provided an excellent platform from which to gain support and establish urgency and this strength was used to gain commitment from stakeholder groups across interest levels. The perceived lack of interest from the NCHD/Clinician group was identified early as a threat through this tool. For this reason, engagement with this group was “framed” appropriately, highlighting the benefits of change for them as a group (Conger, 1999; Gill, 2011) as will be discussed later. Through the SWOT it was acknowledged that communication with clinicians in three external sites would be difficult. Initially it was planned that the change agent would speak in two of the four sites however this was later revised and a change agent spoke in one of the sites instead, adopting a change champion to speak in a second.

Formal tools exist to assess the readiness for change (Armenakis & Harris, 2002; Palmer, 2004) within an organisation. The change agent in this project informally assessed this readiness in the laboratory, by gauging through conversation how change had been received on previous occasions (Smith, 2005). As previously mentioned, the microbiology laboratory was frequently
involved in the adoption and incorporation of new technologies into the laboratory. In other areas, such as amongst clinicians, the readiness for change was not assessed. Although tools exist to assess the organisational culture (Konteh et al., 2008), these were not utilised. Recognition of organisational culture and its influence on change is acknowledged intrinsically within the HSE Change Model (Fleming et al., 2008).

3.4 The Change Process: Planning

3.4.1 Building commitment

The change agent has no formal authority over any of the stakeholder groups therefore commitment to the change had to be earned. Leadership can come from those outside designated management roles (Karp & Helgø, 2008) and emerging clinical leaders are increasingly recognised as a means of quality improvement in healthcare (NHS Leadership Academy, 2011; The King’s Fund, 2011). Communication with key groups, many of whom were identified in the stakeholder analysis, Appendix 9, enables creation of a shared vision and fostering of commitment. The importance of communication in any change is indisputable, however it is in the planning stage that investment into consultation will have the highest return. Communication styles and methods were tailored to the target stakeholder groups, with a priority and higher return achieved from face-to-face interventions. This was to be expected from the literature of change management.

The key groups from whom commitment was required are discussed in this section. Many of these groups were outlined in the initial stakeholder analysis. A stakeholder analysis can localise areas from where resistance might occur. Determining areas of resistance prior to commencing upon a change reduces obstacles at a later date. Resistance to change is inevitable (Coghlan, 1993; Scott & Jaffe, 1988). Informal discussions at a ward or laboratory level, as well as formal meetings with key stakeholders are informative and invaluable (National Institute for Health and Clinical Excellence, 2007). These informal
interactions with NCHDs (Non-Consultant Hospital Doctors) and laboratory scientists consistently occurred throughout the four stages paving the way for the change agent to approach things in the larger forums without opposition. Distant leadership, as achieved by phone or email, aimed to build commitment with stakeholders in the absence of face-to-face engagement.

The audit data was used as a key leverage point with all the key stakeholder groups when building commitment. To those stakeholders with high or medium level interest it intensified the urgency for change and dissatisfaction with the status quo (Fleming et al., 2008; Kotter, 1996). With the stakeholder groups whose interest was low, such as the NCHDs, the audit results were used as part of the education for raising interest and explaining the rational for change.

The laboratory scientists are a key stakeholder group with a variable level of interest into the change. Rationalisation of testing and avoidance of processing of tests that are not indicated fits with the ideology of laboratory scientists. Commitment was gained from this stakeholder group through formal and informal communication. Prior to the change being discussed at a formal meeting, much of the commitment was elucidated informally over coffee.

A formal presentation of the proposed change was made as part of an educational talk on Legionnaires’ disease to the laboratory scientists. At this stage, the findings of the pre-change audit were presented to the department formally, demonstrating that 62.2% of tests were not indicated, the need for change was galvanised. This was reflected in many of the laboratory scientists approaching the change agent to begin implementation earlier than scheduled. Feedback on the proposed changes to the Standard Operating Procedure (SOP) was requested at this time. By requesting input from these stakeholders, it was hoped that ownership of the change would ensue and followership would be strengthened. As any change has a period of transition, and processing time will temporarily be increased, some level of resistance can be anticipated. This was acknowledged openly in the presentation to the
laboratory scientists but highlighted that this period of flux was predicted to be short.

The key activity to build commitment from clinicians was a “Grand Rounds” presentation, a weekly lunchtime educational meeting well attended by NCHDs and Consultants. This Grand Rounds occurred in H1, where the change agent is based. Clinicians are a diverse group, made up of both NCHDs working in the region for a finite period of time, and Consultants, in permanent posts. The clinicians have low interest but high power as they request the tests. The leadership challenge then is to engage this group, as their support of the project will impact its success. Transformational leaders engage followers by using the values of followers.

During Grand Rounds the change agent discussed Legionnaires’, the BTS Guidelines for use of a LUA test as well as the impending change. The benefits of rationalisation were highlighted such as avoidance of false-positive results and improved turn-around time on other tests due to increased and/or redistributed resources. To the NCHDs, who rotate through jobs frequently, improving turnaround time on specimens is appealing (Wu, 1998). Discussing information on organisational cost-saving will appeal to Consultants in permanent positions. Clinicians also believe in “Primum non nocere”\(^2\) therefore avoidance of false-positive results is an important value. As will be discussed in chapter 5, “framing” of the benefits for change is an important method of earning followers (Conger, 1999). The proposed change was framed in this way to gain commitment from both parties. Following the presentation there was verbal positive feedback, which indicated both engagement and a readiness for change.

Initially the respiratory physicians were considered within the same stakeholder group as the other physicians, Appendix 9. However, given their knowledge of Legionnaires’, they are recognised by all clinicians to have expertise, making them opinion leaders and an influential stakeholder group in

\(^2\) *Primum non nocere* – First do no harm, Hippocratic Oath
their own right. This increases their value as supporters of the change (Kotter, 1995). The use of guidelines developed by respiratory physicians within the BTS as the gold standard for LUA testing gives credence to the project with respiratory physicians fostering the adoption of a shared vision. In an effort to build commitment with this stakeholder group, the respiratory consultant was contacted via email six weeks prior to the implementation of the change to inform regarding the change and offer an opportunity to meet to discuss the change proposal.

Initially it had been planned that the change agent would undertake a face-to-face intervention in half of the hospitals (i.e. 2) but this was not undertaken due to work constraints and unforeseen circumstances. Therefore in Hospital 3 (H3), a member of the clinical microbiology team, as a change champion, gave an educational talk that included a discussion regarding the appropriate use of the LUA test.

The change agent, with one clinical microbiology colleague, further attempted to build commitment amongst NCHDs in all four hospitals using opportunistic discussion on the appropriate use of the LUA test when consulted as part of routine clinical work. However the value of this is difficult to quantify, and as an intervention was largely dictated by time constraints. This means of communication and leadership is becoming more topical as remote leadership is increasingly more called upon with the formation of hospital groups.

A memo was written by the change agent and co-signed by the laboratory management team. The intention was that this email would be cascaded to all users, via the general manager, in each of the four hospitals. However, as will be discussed, it was recognised following the re-audit that the email was only received by NCHDs in one of four hospitals, Hospital 2 (H2).

Laboratory management supported the proposal as a quality improvement tool and a potential cost-saving means. The change agent met regularly with laboratory management to keep the team updated and obtain authorisation to proceed as demonstrated in the mini-Gantt chart, Appendix 7.
3.4.2 Determining the detail of the change

The SOP was developed by the author using available evidence, clinical practice guidelines (Health Protection Agency, 2012; Lim et al., 2009; Mandell et al., 2009), and information gathered from the initial audit as well as feedback from stakeholder groups, Appendix 3. This proposed SOP was presented to key stakeholders for feedback. Laboratory Management approved the final SOP prior to implementation.

The planned changes to the SOP were presented to the clinicians at Grand Rounds and feedback requested. Two key messages were emphasised to the clinicians at this stage.

- LUA tests should only be requested in accordance with BTS guidelines (Lim et al., 2009) and education was delivered around this point.
- Only forms with relevant clinical information would be processed. Tests with insufficient information would not be processed but that the specimen would be stored for seven days. If required by the clinical team to be processed, the relevant clinical information could be provided on repeat form.

Clinicians present, including representatives from the respiratory department, agreed with this proposal. Support from senior clinicians can lead to changed behaviour in more junior staff (Dawson et al., 1999) This information was in the memo as emailed to H2.

The proposed changes to the SOP were presented to the laboratory scientists at the education and information session. This was an interactive session to gauge both the level of readiness for change by the laboratory staff and also to assess if they were comfortable with the proposed algorithm. It was ascertained that the amount of additional educational material as provided by the new SOP was sufficient. The change agent arranged that queries on LUA test requests could be raised on the daily laboratory round. Empowering the laboratory scientists to make decisions with the option of the support of the Clinical Microbiology team if required should prevent delays in processing from occurring.
In accordance with the Employees (Provision of Information and Consultation) Act 2006 (House of the Oireachtas, 2006), the change agent invited feedback from a number of stakeholder groups, for example at Grand Rounds, at the laboratory scientist education session and from laboratory management as well as in an email to the Respiratory Consultant.

3.4.3 Developing the Implementation Plan

The finalised laboratory SOP was given to the laboratory Quality Officer to allow specific codes be added to the laboratory technology system. A location to store the specimens for seven days following receipt was negotiated by the change agent once the literature on storing specimens was researched.

3.5 The Change Process: Implementation

The 11\textsuperscript{th} of February 2014 was chosen as the start date for implementation. The emailed memo notification of the change had been sent previous to this date, although it later became apparent that three of the four hospitals did not receive it. Early in the implementation phase, the change agent was available for any queries, informally met with the laboratory scientists involved and was on hand to deal with issues. Highlighted in the HSE Change Model is the need to balance stability and change (Fleming et al., 2008) and for this reason the leader felt it was important to be highly visible through this period of transition. During the initial implementation phase, the change agent randomly checked at least one request per day from any hospital to determine if tests were being processed and/or held appropriately. Subsequently a formal post-change audit was undertaken of requests from H1, similar to the audit completed in the initiation stage. The change agent put these mechanisms in place to avoid a negative impact on service users. As the change agent was known to be the key contact for the project, clinicians, laboratory scientists and members of the clinical microbiology team channeled enquiries directly to them.
An issue that arose during the implementation phase, which had not been considered in the planning stage, was the appropriateness of amending reports. The Irish National Accreditation Board (INAB) is the accreditation body for the laboratory of the change agent. Once a report has been authorised and available for viewing by the clinical staff it should not be altered. As part of this change, the result was authorised as “Not Tested”, then if further clinical information was received it was de-authorised and the result inserted for re-authorisation. This is incorrect from an accreditation viewpoint and a solution was presented by the change agent to the laboratory management team. This issue highlights how beneficial auditing of the project is in the early stages, as this issue was addressed in real time. It also highlights that the senior level support is key in order to rectify issues in real-time. When a solution to the aforementioned problem was reached, the change agent redrafted the SOP and held a short intervention with the relevant laboratory staff.

3.6 The Change Process: Mainstreaming

3.6.1 Making it “the way we do business”, Evaluating and Learning

The change agent re-audited four weeks of data following implementation of the change, the results of which are presented and discussed in the chapter entitled “Evaluation”. The concept of auditing and re-auditing is lauded in the literature (Deming, 1982; Fleming et al., 2008; Langley et al., 2009) as a method for continual improvement, Appendix 12. A further benefit is to demonstrate improvements, as if gains are not publicised, resisting forces could brand the initiative as a failure (Fleming et al., 2008).

The audit results demonstrated both the positive improvements attained to date and areas to be targeted for improvements in the future. Presentation of improvements and positive feedback will encourage stakeholders to continue adherence to the change until it becomes routine (Bareford & Hayling, 1990; Dowling, 1988; Nardella et al., 1994). As also highlighted in the literature
review, to encourage continued guideline compliance, feedback is required on an ongoing basis (Jamtvedt et al., 2006; Mandelblatt & Kanetsky, 1995). Improvements to date were presented to the clinicians in H1 via a poster presentation at a regional Quality Conference. The change agent hopes to present at a local audit meeting scheduled in the near future. A meeting was held with the laboratory staff to feedback both the gains as well as potential areas for improvement. Audit results were fed back to the Clinical Microbiology and laboratory management team at a departmental audit meeting.

In future, the indications for requesting a LUA test will be included in the introductory NCHD talk that is scheduled biannually in the four hospitals. This should target one of the main organisational barriers for change, NCHD turnover (Brand et al., 2005). New departmental staff, either to the clinical microbiology or laboratory scientist team, receives laboratory training, including introduction of the SOPs. It is hoped that further audit cycles will be undertaken by a member of the clinical microbiology team in order to maintain improvements.

3.7 Conclusion

In conclusion, the change agent, following a review of three change models, chose the HSE Change Model for implementation. The main reasons for this were its development specifically for use in the HSE, its acknowledgement of the role of culture and stakeholders in an organisation as well as its comprehensive literature and support documentation to steer the more inexperienced change agent.

In the planning stages tools such as a Gannt chart, Stakeholder Analysis and SWOT analyses were undertaken. The audit results became a key leverage point and influential in the success of the project overall. The planning stage involved a significant amount of communication and interaction with stakeholder groups.
The implementation phase was largely successful however did reveal one obstacle but demonstrated the importance of auditing as change is implemented as well as the value of laboratory management support. The final stage of mainstreaming was achieved by distributing audit results to key stakeholder encouraging ongoing support of the change as well as improving on gains already achieved.
4.0 Evaluation

4.1 Introduction

This evaluation chapter looks at tangible outcomes to demonstrate change and improvements. Kaplan and Norton, in the discussion on quality improvement, state that measurements help to “translate complex and frequently nebulous concepts into a more precise form”. Ultimately it is the measurements that demonstrate to the organisation and stakeholders, in a concrete fashion, what has been changed or improved (Kaplan & Norton, 1996). Lloyd (2004) highlights the importance of choosing the correct indicators to quantify the concept that is being captured, then using this data for further interventions as “data without a context for action are useless” (Lloyd, 2004).

This chapter will discuss the results of the pre-change audit undertaken in the Initiation stage. Subsequently the results of the post-change audit will be analysed and discussed. Detailed evaluation will demonstrate if change occurred, and if so which interventions or combination of interventions were successful. Evaluation post the implementation of change with feedback to stakeholders is a key stage in mainstreaming change (Fleming et al., 2008). The financial impact of this change will also be critiqued.

Clinical audit is a recognised quality improvement tool, which compares actual practice with a guideline. The guideline is usually an accepted standard of care or else derived from evidence-based practice. Clinical audit has been shown to improve outcomes (Englert, Davis, & Koch, 2001; Lagerløv, Loeb, Andrew, & Hjortdahl, 2000) when the information is acted on appropriately, Appendix 12.
4.2 Pre-change audit

4.2.1 Purpose of pre-change audit

As part of the Initiation stage an audit was undertaken to serve a number of purposes. It confirmed a scope to improve practice when compared to local and international guidelines. It highlighted areas to be targeted for improvement, namely clinician education on when a test is indicated as well aiding the development of a laboratory intervention to allow screening of LUA test requests. Finally, the audit results highlighted the need for change, created urgency and indicated the potential for false-positives when the test is processed without indication. The audit results were then used as leverage with key stakeholders.

4.2.2 Pre-Change Audit Results

The initial audit was undertaken in H1, where the change agent is based. A retrospective review of medical charts, test request forms and clinical microbiology notes was undertaken of all LUA test requests in February 2013, a 28-day period. 51 tests were requested in 45 patients during the audit period and 47 were processed. In 10 tests data were unavailable.
Figure: 1 Pre-change Audit

*47 tests requested – 10 tests (data not available) = 37 tests
The ordering behaviour of clinicians was analysed. 8 patients did meet the definition of pneumonia\(^3\) (21.6\%). Of note, the two false-positive results were in one patient without pneumonia, therefore the LUA test was not indicated. These were deemed to be falsely positive following review of the clinical presentation and the Reference Laboratory result. Four patients (10.8\%) had a CURB-65 score of 0 or 1, which does not require LUA testing as per guidelines. Seven patients (18.9\%) had a CURB-65 score of 2 without risks for Legionnaires’ therefore the test was not indicated (18.9\%).

A review of the laboratory process demonstrated that of the tests ordered, two duplicated requests were processed for a second time in 48 hours. On another occasion, a pneumococcal urinary antigen test was requested however a LUA test was performed. One patient had a positive Pneumococcal Urinary Antigen therefore it is likely that the cause of their pneumonia was *Streptococcus pneumoniae* and not *Legionella pneumophila*.

Of 37 tests audited, 51.3\% of tests were not indicated from a clinician ordering perspective. 10.8\% of tests could have been rationalised from a laboratory perspective. In conclusion, 23 (62.2\%) of tests processed were not indicated. These audit results were used to guide interventions to achieve the aim of this project.

4.2.2 Pre-Change Audit Finance

This pre-change audit confirmed that 62.2\% of LUA tests that were processed were not indicated. This amounts to €18,065.93 due to the cost of each test (extrapolated from previous year’s data), and 197 hours of laboratory scientist time per annum. This is a conservative estimate that does not include the indirect costs as incurred by the false-positive result.

\(^3\) Pneumonia is defined by either the clinical or radiological features consistent with infection of the respiratory tract.
4.3 Interventions

The process of change is discussed in greater detail in Chapter 3 and 5. The first objective was to change the ordering practices of clinicians by education on indications for LUA testing. Educational sessions were held in H1 and H3. A memo, drafted by the change agent and co-signed by the laboratory management team, was distributed in H3. The pre-change audit results were used as part of these interventions to create urgency for change and demonstrate scope for improvement.

The second objective was to develop a SOP that would enable the laboratory scientists to screen requests based on the clinical information provided on the form. The audit results were used to create the SOP and were also used in the educational presentation to the laboratory scientists. The third objective was the rationalisation of LUA testing to reduce costs.

4.4 Post-change Audit

4.4.1 Post-change Audit Results

The writer re-audited in H1 to capture evidence of changes and improvements following the aforementioned interventions. 42 LUA tests were requested in a similar study period, in 36 patients. Of these 42 tests requested, 15 (35%) were processed. In 5 tests data were unavailable; therefore the data from 37 tests are presented in Figure 2.
Figure 2: Post-change Audit: All orders

*42 tests requested – 5 tests (data not available) = 37 tests

Of the 15 tests that were processed, it was found that when auditing against BTS guidelines and the SOP, 9 tests were indicated (60%), Figure 3. Two forms had sufficient clinical information and twelve were processed as identified as Intensive Care, Haematology or Oncology patients, and met the clinical definition of pneumonia. The remaining test was initially not processed, however was subsequently processed following the provision of information by the change agent, as will be discussed later.
Of the 6 tests that were felt to be not indicated from the audit, 2 tests (13.3% of those processed) were performed in patients who did not have pneumonia but were processed, as the patients were in the Intensive Care Unit, as per the SOP, Appendix 3. Two were duplications and 1 had a positive pneumococcal urinary antigen test. One test was misidentified as a haematology patient by ward, but the admitting consultant was a general physician. In conclusion, of the 15 tests processed, 4 tests did not meet the criteria for processing at a laboratory level, and 2 did not fit the clinical criteria for requesting the test.

Figure 3: Post-Change Audit – Analysis of tests processed

This audit included a review of the tests that were not processed, Figure 4. This is to determine firstly, if there is an impact on patient care and secondly,
that the laboratory SOP is being adhered to and tests not meeting the criteria for processing are being held appropriately.

Twenty-three tests were initially not processed. As will be discussed, 1 of these tests was subsequently processed and found to be negative when clinical details on the patient were provided by the change agent. Of the 22 that were not processed, none of these were indicated as per BTS guidelines or the SOP. Fourteen (60.8%) were in patients who did not meet the definition of pneumonia, 4 patients had a CURB-65 score of 0 or 1 (17.4%) and in 2 (8.7%) patients the CURB-65 score was calculated at 2 with no identifiable risk of Legionnaires' upon review of the medical notes. To review laboratory practice against the SOP, 2 tests (8.7%) were correctly not tested, as they were duplicated specimens.

Figure 4: Post-change Audit – Analysis of tests NOT processed
*initially not processed, however was subsequently undertaken following receipt of clinical information

---

**Figure 4**

- **Clinical practice**
  - 14 = no pneumonia (60.8%)
  - 4 = CURB65 Score of 0/1 (17.4%)
  - 2 = CURB65 Score of 2 (8.7%)

- **Laboratory practice**
  - 2 = duplications (8.7%)

- **Indicated (4.3%)**
  - 1 = CURB65 Score 2 with features of Legionnaires' (4.3%)

- **Not indicated (95.7%)**
  - 22 = no pneumonia (95.7%)
In conclusion, of the 15 tests processed, if the clinical practice guidelines for ordering were adhered to and the SOP was followed more prescriptively, a further reduction in processing could be made, representing 40% of tests ordered. Furthermore, only one of the 23 tests initially not processed did meet the clinical criteria for testing but these details were not provided on the form as will be discussed.

To look at the data in the context of the objectives, a further analysis of the data from all four hospitals in February 2014 was undertaken. The first objective was the education of clinicians on the appropriate indications for LUA testing. This objective would be measured as reflected in the reduction of requests overall, Figure 5. In H1 there was a reduction in ordering from 51 to 42, representing a 17.6% decrease in ordering. There was a marginal increase in order numbers from 21 to 22 in H2 (7%). H3 showed a decrease in ordering from 26 to 22 (15%) and in H4 there was a large increase of test requests of 60%, from 30 to 48. Overall, unfortunately there was an increase in the total number of tests requested from 128 to 131 (2.3%).
The second objective was the development and introduction of a new laboratory SOP to allow screening of LUA test requests. The data were analysed to demonstrate a reduction in the number of tests processed, Figure 6. In H1, processing decreased by 68.8%. In H2, the decrease was 81%. In H3, the number of tests processed fell by 75% and in H4 it fell by 66.6%. Overall, despite the slight increase overall in test requests, the number of processed tests fell by 71.5%, from 123 to 35.
Figure 6: Changes in LUA tests processed

4.4.2 Post-change Audit Finance

The third objective was to use the rationalisation of LUA testing as a cost improvement process. To translate the above data into cost, 96 tests were held without processing. This is a direct reduction in cost of €2,195.52, for a 28 day period. These tests would have taken one laboratory scientist 24 hours to process. In a year, this would suggest a cost saving of €28,541.76 and 312 laboratory scientist hours.

4.4.3 Survey of NCHDs re Written Intervention

Sixteen randomly selected NCHDs from all four hospitals were surveyed. In H1, H3 and H4, none of the 12 NCHDs (4 NCHDs per hospital) surveyed reported having received the emailed memo. In H2, of the 4 NCHDs...
surveyed, three reported receiving the memo. In conclusion it is likely that only NCHDs in H2 received the emailed notification.

4.5 Critical Analysis

4.5.1 Achieving objectives

The first objective was the education of clinicians on the appropriate ordering of the LUA test to reduce the number of tests requested, Figure 5. In H1, where the change agent undertook a face-to-face intervention, 42 tests were requested compared with 51 tests prior to the change, a reduction of 17.6%. In H3 where a change champion undertook a face-to-face intervention there was a reduction of 15%. Analysis of the data from other hospitals shows varied results. In H2 where no face-to-face intervention occurred, but most clinicians received written notification of the change by email, there was an increase in ordering from 21 to 22 (7%). In H4, where no intervention occurred there was a significant increase of 60%.

As discussed in the literature review, face-to-face education is most likely to increase guideline compliance and moderate ordering behaviours (O’Brien et al., 2007; Soumerai et al., 1993) and this has been demonstrated here. Further literature suggests that written interventions alone can increase guideline compliance (Giguère et al., 2012), and if the results of H4 are a guide, it can be inferred that the memo did have some impact by reducing a large increase in orders. Overall across four hospitals there was an increase of 2.3%. There is a general increase in laboratory testing of all types year on year, however the objective was to reduce LUA test ordering overall which was not achieved.

The second objective was a reduction in the number of tests processed. The data in this area was favourable overall. Across the region, 131 tests were requested, 96 (73.3%) of which were not processed. In two cases, the test was processed following the receipt of further clinical details from either the clinical team or the change agent. No negative feedback was received from
any clinician when a test was held without processing. As seen in Figure 6, this decrease in test processing was across all four hospitals. There was a decrease in processing of 71.5% comparing the pre-change to post-change data. This demonstrates this objective was achieved.

The third objective was to reduce costs through rationalisation of LUA testing. Despite an increase in orders overall, given the 71.5% reduction in tests processed, a significant cost saving of €2,195.52 and 24 laboratory scientist hours was achieved.

The change agent had proposed at the start of the project that a reduction in processing of 20% could be achieved with a combination of educational and administrative interventions. The literature review suggested that this combination of interventions could reduce processing by 50% (Grimshaw & Russell, 1994). The reduction in the processing of tests by 71.5% surpassed expectations. It is worth noting, that the administrative component of this change project was the more successful arm. The use of educational techniques alone would have decreased the tests processed in H1 and H2 by 17.6% and 15% respectively but overall the number of tests processed would have increased.

4.5.2 Comparison of audit data

The pre-change audit was a retrospective audit and the month of February in 2013 was chosen as to coincide with a planned post-change audit in February 2014. Ideally the same time of year should be audited as Legionnaires’ as well as all-cause pneumonia varies by season. There is also a seasonal variation in hospital activity levels in general. The post change audit was a 28-day period from the 11th of February to the 10th of March 2014. Although a slight difference in the audit periods of 11 days exists they are still within the same season.
In the audit period in 2014, there was a seasonal Influenza outbreak locally and nationally (Health Protection Surveillance Centre, 2014), when compared to the same period of time in 2013, Appendix 15. This likely increased admissions of patients with respiratory tract infections with an increase in the number of investigations for pneumonia. This may partially explain the large increase in test requests in H4.

4.5.3 Retrospective verses real-time audit

The initial audit undertaken was a retrospective audit however the post-change audit data was collected in real time. When the post-change audit commenced, the change agent decided that the collection of data via a chart review would enable the change agent to both closely monitor for issues arising, as well collect the data with speed. On one occasion, the change agent felt, on balance following review of the clinical notes, that a LUA test was indicated however was not processed due to insufficient clinical details as per the SOP. In the interest of patient safety, the change agent supplied the clinical details to the laboratory and the test was processed and was negative. The change agent contacted the clinical team and explained what had occurred. This opportunity was taken to educate the clinician on the importance of provision of the clinical details to avoid a delay to diagnosis or compromise of patient care.

4.5.4 Maintaining and Improving on Gains Achieved

Repeated audit cycles with feedback maintains the gains made (Dowling, 1988). The post-change audit results demonstrate that further improvements can be made. Going forward, the value of face-to-face will be utilised by discussing LUA testing at NCHD introductory meetings. Feedback of audit results to laboratory staff with clarification of some points on the SOP, can improve laboratory practices, e.g. ensuring duplicated specimens are not processed.
4.5.5 False-positive results

One of the key leverage points for this change project was the occurrence of false-positive tests. In the initial audit, one false positive occurred, which was deemed falsely positive following clinical review of the patient and Reference Laboratory result. Due to the lack of clinical information on the request form, if it had been received after the implementation of the change it would not have met the criteria for processing.

4.6 Conclusion

This chapter has presented the results from two audits, one prior to the implementation of a change and one post. The outcomes, as measured in the post-implementation audit were designed to evaluate if the stated objectives of the change project were met.

The first objective was to educate clinicians on the indications for LUA testing. Education varied across the four hospitals in the region, either a face-to-face intervention on indications for LUA testing by a change agent or by a change champion, an emailed memo, or no intervention. The data suggested that face-to-face intervention changes clinician behaviour on laboratory ordering. Written information alone is less effective however may have had a moderating effect when compared to the data from the hospital where no intervention occurred.

The second objective was to reduce the number of tests processed by introducing a new SOP enabling laboratory scientists to hold test with insufficient clinical details. This was an effective intervention and resulted in a 71.5% decrease in tests processed. Only 2 of tests of the 131 tests requested over the 28-day period where were processed following the receipt of further clinical information.

This project successfully achieved the second objective and was partially successful in achieving the first. A number of learning points have arisen from
this evaluation and will be debated in the next chapter. The third objective was to rationalise cost through this undertaking. The reduction in cost of €2,195.52 in four weeks as well as 24 laboratory scientist hours is proof of this objective being achieved.
5.0 Discussion and Conclusion

5.1 Introduction

In the previous chapter, the results of the change process were presented. This project has used the HSE Change Model to initiate, plan, implement and mainstream the change process while using clinical audit as a means of evaluation. In this final chapter, some of the finer details of the change process will be discussed. Success factors will be highlighted. The author will discuss threats and areas for potential improvement. There will be an in-depth discussion on the evaluation of the change and the impact of the change upon the organisation. Finally, the author will make some recommendations for others undertaking similar changes in their organisation.

5.2 Success factors

The change agent can identify three strengths of this project, namely

i. High level management support

For successful change, powerful followers are valuable (Kotter, 1995). Often identified as a critical success factor in literature, necessity of support from those in authority is inarguable (Kotter, 1996). This is relevant not only to change in general but is also in the literature pertaining particularly to changing clinicians practice when ordering laboratory investigations (Bareford & Hayling, 1990; Dowling, 1988; Yeh, 2014). The laboratory management team from its conception supported this change project, giving it credibility with other stakeholders. As the author does not have authoritative power this management support gave legitimacy throughout. The laboratory management team have a vested interest in the success of this project as a cost rationalisation initiative.

Support from senior clinicians has an important role in changing behaviour of more junior staff (Dawson et al., 1999). The verbal support from medical consultants at the end of the Grand Rounds educational session was likely
critical to the overall successful implementation of the change. This could also be extrapolated into the laboratory setting where the senior scientist was openly supportive of the change.

ii. Persuasive leverage points
Any change must be assessed on both merits and place within the organisational context (Higgs & Rowland, 2010). The current economical climate is accommodating to a cost-rationalisation project. The initial audit results were convincing and established a sense of urgency by demonstrating a potential saving of €18,065.93 and 197 hours of laboratory scientist time per annum. This information was used as a key leverage point when negotiating with stakeholders.

The mission statement of the hospital group within which this change is undertaken is “Together we will provide quality patient care, delivered by skilled and valued staff, through the best use of available resources”. This statement is similar to the HSE National Service Plan 2014, where the employees are encouraged to maximise efficiencies and maintain quality patient services (Health Service Executive, 2014). These ideals are reflected in the aim of this change project, which is to improve patient care by rationalising use of an unnecessary test, reducing costs at the same time.

A successful leader believes in the change they are striving for and develops it into a shared vision (Gill, 2011). Transformational leaders motivate people and give them a sense of purpose (Gill, 2011) using leverage points such as the aforementioned which in turn encourages them to engage with the vision of the leader.

A key activity for change in the HSE Model is to “establish a sense of urgency and pace the change” (Fleming et al., 2008). The urgency for change is when 75% of those in positions of power feel that the status quo is not long acceptable (Kotter, 1995). The pre-change audit results highlighted false-positives and the impact they have on patient care, thus creating dissatisfaction with current practice (National Institute for Health and Clinical
Excellence, 2007) increasing the desire to change (Burnes, 2004b). This unrest is also described in the “Unfreeze” stage of Lewin’s Three Stage Model (Lewin, 1947).

iii. Felt readiness for change

The rationalisation of LUA testing had been on the laboratory management agenda for a period of time. The increase in false-positive results prioritised this as an area for improvement. Given the awareness that this was relatively expensive test, it was identified as an area for cost saving. This combination of factors ensured that there was a felt readiness for change from the laboratory and clinical microbiology viewpoint.

Although formal tools exist to assess an organisations readiness for change (Armenakis & Harris, 2002; Palmer, 2004), it can be informally assessed by the change agent. Indicators such as informally interacting with staff that will be affected by the change and observing employee behaviours in previous changes (Armenakis & Harris, 2002; Smith, 2005) are likely assessed by leaders subconsciously. Following the presentation to both clinicians and laboratory staff, the change agent was informally approached and offered support and positive feedback. From this assessment and lack of overt resistance, the change was scheduled to be implemented at the earliest possible time.

5.3 Areas for improvement

5.3.1 Communication

To “communicate relentlessly” is one of the “Activities for Change” in the HSE Change Model (Fleming et al., 2008), Appendix 16. To create a shared vision amongst a large number of stakeholders with a varying degree of interest, intensive communication is key. The stakeholder analysis, Appendix 9, demonstrates which stakeholder groups require more communication than others. The value of high-intensity communication to all stakeholders at the
start is cited in much of the literature (Fleming et al., 2008; Kotter, 1995; National Institute for Health and Clinical Excellence, 2007) but needs to be ongoing to maintain momentum (Fleming et al., 2008; Kotter, 1995).

Throughout this project, efforts were made to communicate the vision, to varying degrees of success. The main interventions by the change agent were presentations given at Grand Rounds in H1 and to the laboratory scientists including members of the laboratory management team. The change agent used these presentations to portray themselves, as the change leader, as a positive motivated force behind the change process as authenticity is an important concept in leadership (Gill, 2011).

As the literature review demonstrated that a combination of interventions is more likely to be successful (Marton, 1985; Smellie, 2012; Solomon, 1998), it was hoped that the face-to-face intervention followed by written material coupled with the administrative intervention would have the largest impact on outcomes. As mentioned in Chapter 3, it was planned that a face-to-face intervention would occur in two hospitals, with the memo providing supplementary information. In the remaining two hospitals, written information would be used alone. It transpired that the memo was only circulated in one hospital. The change agent should have followed this up at an early time. This oversight resulted in a significant increase in requests from H4 where no education had been received. It could also be hypothesized, based on the literature review, that a combination of face-to-face and written educational material in H1 and H3 could have further reduced requests.

In this thesis, the change, although been undertaken in one laboratory, affected four regional hospitals and the clinicians and patients within. For that reason, the interventions and communications to various clinicians were dictated by feasibility. It was this issue, the difficulty in being able to communicate effectively with all users, which became the biggest threat to the success of the project. Use of an opinion leader in H3, did have a positive impact on clinician test requests, as would be predicted by the literature (Flodgren et al., 2011).
A successful change agent will adjust communication styles for the target audience (Fleming et al., 2008). Informal communication and discussions can be as valuable as formal scheduled meetings (National Institute for Health and Clinical Excellence, 2007). Much of the interest amongst the laboratory scientists was generated over coffee and the felt readiness for change was apparent in these conversations (Armenakis & Harris, 2002; R. Smith, 2003). One of the easiest ways of capturing the NCHD group was one to one when discussing consults however this is often dictated by time constraints and difficult to capture in terms of quantitative data.

The key intervention with the clinicians was at the Grand Rounds presentation. The concept of “framing” was considered in the development of the presentation. Framing aims to achieve support for an idea from the audience by demonstrating that the intended outcomes are mutually beneficial (Conger, 1999). Clinicians are a homogenous stakeholder group, made up of NCHDs working short-term contracts, as well as Consultants who are generally on permanent contracts. Tangible benefits that would appeal to both groups of clinicians were discussed – increased turn-around-time on other specimens, cost saving and avoiding false-positives. Gill (2011) notes that often lack of commitment to change can result from a lack of compelling evidence to change (Gill, 2011). The presenter incorporated shared beliefs by referencing the Mission Statement of the hospital – the delivery of quality patient care through the best use of resources. Finally, authenticity has become a word much used in reference to leadership (Gill, 2011) and is crucial when framing a change proposal to future followers.

5.3.2 Gap in Stakeholder Analysis

A stakeholder analysis was undertaken in the Initiation stage, Appendix 9, to recognise areas where amplified communication was required as well as potential threats. Identifying the shareholder groups in a focused analysis can
concentrate the efforts of the change agent into where the creation of followership is best directed (Egan, 1994).

It was at the “building commitment” stage when the change agent realised that the respiratory physicians had not been considered as a key stakeholder group. Although considered as part of the general clinicians they are experts in the area of Legionnaires’, increasing their value as supporters of the change (Kotter, 1995). This neglect of this group in the Initiation stage resulted in the change agent approaching a high impact group with an unknown level of interest in the planning stages. An earlier approach would have allowed the change agent to request their support and determine what level of input they wished to take on. Changes or improvements are dependent on having the key people involved from the beginning (Joss, 1994; Kotter, 1995). Although approached at a later date and no overt resistance was met, an earlier approach would have been more appropriate.

In the literature it was discussed that collaboration between laboratory medicine and clinicians would be necessary to reduce ordering (Baron et al., 2013; Wu, 1998) further stressing the fact that the respiratory physicians should have been approached earlier for an opinion. Young’s Meta-Model For Change was not used in this project as the change agent felt that in laboratory medicine in the department in question there is no “pre-change paradigm” as feedback is not requested from service users outside the laboratory (Young, 2009). As a means of both quality improvement and planning for service provision, general clinicians should be collaborated with going forward.

5.3.3 Delayed recognition of Organisational Culture

For quality improvement initiatives to be successful organisational culture needs to be addressed early in the change process (Joss, 1994). Organisational culture has been defined as “shared cognitions, standard operating procedures, and unexamined assumptions” (Triandis, 1996). The change agent was a new member of staff in the organisation therefore many
aspects of the culture were not initially evident. Although the change agent from the outset acknowledged this gap, it could have presented a greater challenge.

Organisational culture can determine if a change is successful or not (Gill, 2011; Lakomski, 2001; Sarros et al., 2011). Whereas tools exist to “diagnose” or assess a culture (Konteh et al., 2008), often it is experience and astute leadership skills that enable someone to recognise hidden values or belief systems. In Gill’s leadership model, he refers to this “cultural intelligence” as one of the seven multiple intelligences of leadership (Gill, 2011).

Various professionals were involved in this undertaking, from a multitude of disciplines with competing priorities. The main disciplines were clinical microbiology, regarded as a laboratory speciality, general and laboratory scientists. Some of the organisational politics at play are generic across all organisations, such as the dissonance in priorities of clinical verses laboratory medical specialities, a recognised phenomenon (Baron et al., 2013; Wu, 1998). It was important to the change agent that they were seen as open to feedback from physicians challenging the paradigm that the laboratory was enforcing this change and increasing the perceived workload of clinicians.

5.4 Relevance of the Literature Review in this Change

As stated in the introductory chapter, the overarching aim was the rationalisation of LUA testing. The primary objectives were to inform and educate clinicians on Legionnaires’ disease and appropriate investigations, to develop a new SOP to allow laboratory scientists to screen test requests, and finally to reduce costs by rationalising testing.

The information gleaned from the literature review guided the change process overall. Means to increase guideline compliance by clinicians to change ordering behaviours were discussed. The BTS guideline (Lim et al., 2009) was chosen as it is internationally recognised and locally advocated (Dawson
et al., 1999) as recommended by the literature review. Face-to-face educational sessions were likely going to have the greatest impact on change (O’Brien et al., 2007; Soumerai et al., 1993), however, due to logistics of travel to the other locations it became apparent that the change agent would be only able to undertake an educational session in H1. Flodgren et al, advocate the use of opinion leaders in increasing guideline compliance and this was utilised in H3 (Flodgren et al., 2011) where a change champion gave face-to-face education on BTS guideline compliance. This change champion has a high level of power in that organisation, and is perceived as knowledgeable in the subject matter making them an influential opinion leader (Doherty, 2006; National Institute for Health and Clinical Excellence, 2007). High level support is critical to any change (Kotter, 1996) and their demonstration of support likely contributed to the reduced ordering of LUA tests in that hospital.

As can be seen from the evaluation of the change, there was a reduction in ordering in the two centres where the face-to-face interventions occurred, with a reduction of 17.6% and 15% in H1 and H3 respectively. As predicted by the literature review (O’Brien et al., 2007; Soumerai et al., 1993) and now evident from practice, face-to-face education increased support for the change more than if education was via written information alone (Giguère et al., 2012) or no intervention. There are likely to be many contributing factors to these results. Direct interaction with a transformational leader is more likely to engage followers and enhance compliance to whatever behaviour is being encouraged (Hur, van den Berg, & Wilderom, 2011; Kelley, 1997; Menges, Walter, Vogel, & Bruch, 2011) evidence for which pertains often to the direct personal interaction between leaders and followers (Gibson & Manuel, 2003). It is therefore likely that the face-to-face interaction with the change agent and/or the change champion contributed to the increase in compliance to the guidelines.

However challenges to leadership are ever changing and as discussed in the Introductory chapter, leaders of the future, with increasing globalisation, will have to be able to lead from a distance, often over teams who they may not
have direct authority over (Hay Group, 2011). Transformational leadership can still occur from virtual leaders (Gibson & Manuel, 2003; Holtbrügge et al., 2011), even through the media of email, which as a mode of communication is not ideal as it lacks the non-verbal cues of face-to-face interactions (Gibson & Manuel, 2003; Kayworth & Leidner, 2000). Overall, it must be stated, that although face-to-face interventions are likely increase compliance to change and motivate employees, in situations where this is not a possibility, other means to engage with change will have to be improved. To challenge the organisational barrier to change of NCHD change-over, the NCHD introductory meeting will include education on use of the LUA test (Brand et al., 2005).

A further aspect of the literature review was investigating available evidence on how to rationalise use of a laboratory test. The importance of not negatively impacting on patient care as well as not delaying important diagnoses when rationalising laboratory testing was highlighted (Cherry, 2005; Friedman & Katt, 1991). To ensure, as much as possible, that this was not the case, the change agent audited in H1 to capture if unprocessed tests were indicated or not. It was demonstrated of the 23 tests initially not processed one was indicated. As was discussed, this was processed by the request of the change agent and was negative.

A key objective of this project was the rationalisation of the LUA test through development of a SOP to screen requests. Education combined with audit was demonstrated in the literature review to increase clinician guideline compliance (Jamtvedt et al., 2006; Mandelblatt & Kanetsky, 1995; Soumerai et al., 1993) but also pertinent to rationalising tests (Bareford & Hayling, 1990; Nardella et al., 1994; Yeh, 2014). As evidenced by the literature review, administrative, educational or a combination of both interventions could be used to reduce inappropriate testing (Calderon-Margalit et al., 2005; Marton, 1985; Smellie, 2012; Solomon, 1998) as utilised in this project. To rationalise laboratory testing, senior management support is crucial and was available to the change agent from the laboratory management team as evidenced by encouragement of the undertaking from the beginning as well as co-signing.
the memo, and swiftly allowing rectification of the SOP when an issue arose (Bareford & Hayling, 1990; Dowling, 1988; Kotter, 1996; Yeh, 2014). As the change agent has little power and influence, this public support was a critical success factor.

Finally, to rationalise testing, collaboration between laboratory clinicians and physicians is advocated (Baron et al., 2013; Wu, 1998). As previously discussed in relation to communication, the respiratory physicians should have been approached early in the change project to determine if they supported the change. Feedback was welcomed from physicians at the educational session.

5.5 Potential Threats and Learning Points

5.5.1 Power and Influence

As a Non-Consultant Hospital Doctor, albeit as an SpR, the change agent has little power. As a previously unknown character, their influence was low, and they carried minimal authority. According to Gill, there are two types of change, one imposed from a position of authority, the other participative (Gill, 2011). The power of the change agent was their authorisation to change the laboratory SOP; however had no authority over the laboratory scientists to accept the new procedure. The change agent has no power over the clinicians ordering the tests, and can then only cause change by generating commitment through leadership skills (Grimshaw & Russell, 1994). The NHS Leadership Academy, embraces leaders outside formal positions of power (NHS Leadership Academy, 2011; The King’s Fund, 2011), recognising that positive changes in healthcare often come from front-line staff.

5.5.2 NCHD turnover

Until the new way-of-doing-business becomes engrained in the organisation, it is still at risk of failing, which can take a significant period of time, often
years (Kotter, 1995). The high turnover of NCHDs is an example of an organisational barrier to change (Bareford & Hayling, 1990; Dowling, 1988). That risk in reference to this change initiative is two-fold. Both the change agent and many of the clinicians ordering the tests, rotate through posts regularly. It is then vital that the change agent ensures high-level stakeholder commitment is obtained from permanent staff to ensure the longevity of the project. Audit and feedback on both clinician compliance to BTS guidelines in ordering tests as well as laboratory scientist compliance with the SOP are required on an ongoing basis to maintain improvements (Dowling, 1988). New NCHDs as well as new laboratory scientists will receive education on LUA testing and the local SOP when commencing in a post. It will be dependent on encouragement from the senior clinical microbiology team, that re-auditing will be undertaken by subsequent clinical microbiology SpRs.

5.5.3 Collaborative team engagement

With regards to the laboratory scientists in particular, creating an atmosphere where a frank discussion on the proposed change can occur is important. Clinical microbiology and the laboratory Scientists work together as a team, and a team that values contributions from all member is more likely to be engaged thus more effective (Borrill et al., 1999; Tanco et al., 2011). Collaboration between laboratory clinicians and physicians is also an important example of collaborative team approaches to service improvement (Baron et al., 2013).

5.5.5 Resistance

Resistance to change is inevitable (Coghlan, 1993; Scott & Jaffe, 1988) and can come in many forms, passive or covert, verses open or hostile (Bovey & Hede, 2001). The largest source of resistance met was likely from the clinicians ordering the LUA tests. Although no open resistance was encountered, the ongoing request for LUA tests without indication could demonstrate covert resistance. There were some improvements made
however there is still considerable room for improvement as 59.5% of the tests ordered were not compliant with guidelines. To refer back to the literature review, clinicians may not be compliant with guidelines due to lack of awareness of the guidelines existence or their lack of agreement with it (Cabana et al., 1999). These areas can be targeted in the future, by collaboration with clinicians and increasing education prior to re-auditing.

Kotter and Schlesinger describe six different management or leadership techniques to address resistance and lead people through the change process (Kotter & Schlesinger, 2008) ranging from education to coercion. Education is effective, yet often time intensive, but an important tool in any change undertaking (Fleming et al., 2008) and used throughout here. Another tool, manipulation, can take a varying number of forms, one example of which would be the use of a incident to create an urgency or impetus for change (Tiernan, Morley, & Foley, 2006), which was what was done when highlighting to clinicians that unnecessary testing increases the likelihood of false-positive results.

5.6 Impact of the project

5.6.1 Impact on the patient

Although not demonstrable, it is hoped this project improves patient care through improved use of resources. No false-positive results occurred during the audit period, and it is proposed that if fewer tests are processed unnecessarily then rates of false-positive results fall. As no cases of Legionnaires’ were diagnosed in the audit period it cannot be assessed if any delay to diagnosis occurred.

5.6.2 Impact on clinicians

Clinician’s benefit from improved use of resources by improved turn-around-time on other samples. Only 2% of tests were processed after initially being
held, both of which were negative for Legionnaires’. No negative feedback was received on tests not being processed. No false-positive results occurred.

5.6.3 Impact on laboratory staff

In a service with increasing workloads without an increase in staffing numbers (Health Service Executive, 2014), a safe and evidence based reduction of unnecessary testing is welcomed. The estimated potential saving of 312 laboratory scientist hours is a positive outcome.

5.6.4 Impact on the change agent

This is the first large scale change undertaking by the author. The change agent put the academic learning from the first year of this Masters Programme into practice, with guidance from the action learning skill sets. Implementation of a change tests leadership skills. It is informative from a self-development viewpoint. The skills and experience gained from this project will be beneficial in undertakings in the future, such as the value of really knowing one’s stakeholders and the ability to manage resistors. As leaders have recognised before, it is not the specific skills or tools learnt that improves one as a leader, more it is the recognition that a mind open to learning allowed them to be successful the first time around (Quinn, 2011). Improvements were seen following this project giving the change agent confidence in future undertakings.

5.6.5 Impact of the project on the organisation and beyond

This project is in accordance to the mission statement of the hospital as well the HSE National Service Plan (Health Service Executive, 2014) and resulted in considerable savings. This project was presented at the local Quality Conference to encourage other members of staff to undertake quality improvement projects. The initial audit findings were presented at the Irish Society for Clinical Microbiology, and it is hoped that the post-change data will
be presented at the next meeting, to encourage other laboratories to rationalise testing leading to further improvements nationwide.

5.7 Recommendations for future improvements

5.7.1 Face-to-face interventions are key

This project has clearly demonstrated the value of face-to-face engagement with followers in both increasing guideline compliance and rationalising laboratory testing. The use of an opinion leader in H3 was clearly demonstrated and in retrospect, opinion leaders in H2 and H4 may have drastically changed results. Where “social-marketing” is not possible and outcomes still need to be achieved, the leader needs to be able to engage stakeholders through other methods. The distribution of the emailed memo in H2 prevented a dramatic increase in ordering but did not rationalise requests. In the era of distance management, this mode of communication is an important tool and will likely need to be perfected for the future.

5.7.2 Acknowledge key stakeholders from the beginning

Failure to acknowledge the respiratory clinicians as a key stakeholder group in their own right was an oversight on behalf of the change agent. Although there was no apparent negative impact, involvement of key players from the beginning of any change is crucial to sustained success (Fleming et al., 2008; Kotter, 1995).

5.7.3 Obtain high-level support

From the initiation stage, the change agent had the support of the laboratory management team. As the change process evolved and different stakeholder groups were approached, more high-level support was won and vocalised at the Grand Rounds and the laboratory scientist meeting. When issues arose in the implementation phase, it was through the swift response of the
management team that the change agent was able to resolve the problem and continue with the change.

5.7.4 Use leverage points where available

The value of convincing rationale for change cannot be underestimated. Stakeholder groups were won over by the dramatic results of the pre-change audit. Many benefits to change were demonstrable and persuasive, and frequently referenced in any interactions with stakeholders.

5.8 Conclusion

Each organisation and context is different therefore obstacles that arose during this implementation may not be the same as those that occur elsewhere. What is valuable from this change experience is the development of core skills, such as communication. Going forward, the change agent has learnt the ability to learn and adapt to challenges, seeking out the information to guide the route forward, which is the most important learning (Quinn, 2011).

Change is a constant reality, particularly in healthcare. The introduction of change to improve the quality of patient care delivered is often not easy, however as frequently stated; small changes can have a significant positive effect (National Institute for Health and Clinical Excellence, 2007). In the words of Tony Robbins, “for changes to be of any true value, they’ve got to be lasting and consistent” therefore this change has not ended, but can be built upon in this organisation, as well as demonstrating to other organisations the gains that are possible.
Bibliography


67


Smith, R. (2003). From publication to change. *BMJ*, 327(7405), 0–h. doi:10.1136/bmj.327.7405.0-h


# Appendix

## Appendix 1

<table>
<thead>
<tr>
<th>Pneumonia severity (based on clinical judgement supported by severity scoring tool)</th>
<th>Treatment site</th>
<th>Pretreatment microbiological tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low severity (e.g., CURB65=0-1 or OBH score = 0, &lt;5% mortality)</td>
<td>Home</td>
<td>None routinely, PCR, urine antigen or serological investigations may be considered during outbreaks (e.g., Legionnaires’ disease) or epidemic mycoplasma years, or when there is a particular clinical or epidemiological reason.</td>
</tr>
<tr>
<td>Low severity (e.g., CURB65=0-1, &lt;5% mortality) but admission indicated for reasons other than pneumonia severity (e.g., social reasons)</td>
<td>Hospital</td>
<td>None routinely, PCR, urine antigen or serological investigations may be considered during outbreaks (e.g., Legionnaires’ disease) or epidemic mycoplasma years, or when there is a particular clinical or epidemiological reason.</td>
</tr>
<tr>
<td>Moderate severity (e.g., CURB65=2, 5-15% mortality)</td>
<td>Hospital</td>
<td>Blood cultures (minimum 20 ml)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sputum for routine culture and sensitivity tests for those who have not received prior antibiotics (5Gram stain)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pneumococcal urine antigen test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pleural fluid, if present, for microscopy, culture and pneumococcal antigen detection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCR or serological investigations may be considered during mycoplasma years and/or periods of increased respiratory virus activity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Where legionella is suspected, investigations for legionella pneumonia:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(a) Urine for legionella antigen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Sputum or other respiratory sample for legionella culture and direct immunofluorescence (if available). If urine antigen positive, ensure respiratory samples for legionella culture</td>
</tr>
<tr>
<td>High severity (e.g., CURB65=2-3, &gt;15-40% mortality)</td>
<td>Hospital</td>
<td>Blood cultures (minimum 20 ml)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sputum or other respiratory sample for routine culture and sensitivity tests (5Gram stain)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pleural fluid, if present, for microscopy, culture and pneumococcal antigen detection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pneumococcal urine antigen test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigations for legionella pneumonia:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(a) Urine for legionella antigen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Sputum or other respiratory sample for legionella culture and direct immunofluorescence (if available).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigations for atypical and viral pathogens:**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(a) If available, sputum or other respiratory sample for PCR or direct immunofluorescence (or other antigen detection test) for Mycoplasma pneumoniae, Chlamydia trachomatis, influenza A and B, parainfluenza 1-3, adenoviruses, respiratory syncytial virus, Pneumocystis jirovecii (if at risk)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Consider initial and follow-up viral and “atypical pathogen” serology</td>
</tr>
</tbody>
</table>

(Lim et al., 2009)
## Appendix 2

<table>
<thead>
<tr>
<th>Condition</th>
<th>Antibiotic</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community Acquired</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>Amoxicillin 500mg tds PO. (IV if PO administration not possible.) Penicillin allergy; clarithromycin 500mg BD or doxycycline 200mg DD PO loading dose then 100mg DD PO.</td>
<td>No microbiological tests required. 7 days appropriate antibiotic therapy is recommended.</td>
</tr>
<tr>
<td>Low severity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(&lt;1R55 = 0.1) &lt;3% mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate severity</td>
<td>Amoxicillin 500mg-1.0g tds PO plus clarithromycin 500mg bd PO. (IV if PO administration not possible.) Penicillin allergy; PO doxycycline</td>
<td>Microbiology: Send blood culture, sputum, urine for pneumococcal antigen. 7 days appropriate antibiotic therapy is recommended.</td>
</tr>
<tr>
<td>(1R55 = 0.1) 9% mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High severity</td>
<td>Co-amoxiclav 1.2g tds IV plus clarithromycin 5000mg bd IV. (If legionella strongly suspected consider adding levofloxacin) Penicillin allergy (Not IgE mediated reaction /anaphylaxis): cefuroxime 750mg 1.5g tds IV plus clarithromycin 500mg bd IV severe IgE mediated reaction/anaphylaxis to penicillin: levofloxacin 500mg PO/IV OD (12 hourly if severe).</td>
<td>Microbiology: Send blood culture, sputum (excluding legionella culture), urine for pneumococcal antigen and legionella antigen, CRP. Consider switch to PO antibiotics as soon as clinical improvement occurs and patient is afebrile for 24 hours. 7-10 days appropriate antibiotics is proposed. This may need to be extended to 14-21 days according to clinical judgement.</td>
</tr>
<tr>
<td>(1R55 = 3.1) 15 - 40% mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legionellosis</td>
<td>Levofoxacin 500mg PO/IV OD (12 hourly if severe) Discuss with Microbiologist.</td>
<td>IV route to be used if oral absorption unreliable, early oral switch where possible.</td>
</tr>
</tbody>
</table>

Guidelines for the empirical use of antibiotics in adults in NHS FEH Hospitals June 2018

Index to AUG 001 Dated Approval June 2013 Revision Date June 2014 Revision no 7

Local antibiotic guidelines adapted from BTS Guidelines
Appendix 3

New laboratory Standard Operating Procedure Algorithm

When LBUA is requested:

- If PUA requested and positive: Do not process LBUA and authorise with appropriate comment
- Automatically process LBUA if requested on patients from ICU/HDU/MENT/WRH) OR if aged 17 or under
- If LBUA is requested and other criteria do not fit, it should NOT be processed and should be authorised at bench level with the appropriate comment

- If processed within previous 48hrs: Do not process and authorise with appropriate comment
- Process LBUA if requested and a CURB65 score of 3 or more is written on form

Clinical criteria explaining risk factors for Legionnaires' deemed to be appropriate

Any form labelled "Hospital Acquired Pneumonia – Query Legionnaires’” OR during an outbreak of Legionnaires’
Appendix 4

(Young, 2009)

Appendix 5

(Kotter, 1996)
Appendix 6

(Fleming et al., 2008)
### Appendix 7

#### Mini- Gantt Chart

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting with Project Sponsor as representative of laboratory management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assembling data, collecting charts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compilation of Proposal For Change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentation of audit findings to Laboratory Management Team with suggested SOP for LUA test requests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation of final SOP for LUA test requests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meet Stakeholder Groups; Lab Management, Clinical Microbiology, Laboratory Scientists</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meet Stakeholders: Clinicians (in 111 +/- other regional hospitals)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notification of Stakeholders via Memo to general email, Poster reminder in the NCHO Common Room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation of new algorithm for ordering LUA test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reaudit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compilation of results and data from reaudit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentation of audit results to laboratory management for feedback and reevaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment of SOP as required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write up study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submit Thesis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24th May</td>
</tr>
</tbody>
</table>
Appendix 8

Initiation – Identify the Need and Urgency

Easy Access, Public Confidence and Staff Pride is the guiding context for change at organisational, service, team and individual levels. It provides a unifying, consistent direction for change across the system. This vision has to be translated into a meaningful description of what the change will look like at area and local levels, and what it will mean for service delivery. It will also provide clarity regarding the purpose of the change.

Project Name:
Rationalisation of Legionella Urinary Antigen (LUA) Testing

Created by:

Clarify what is being changed:

Change 1
Change to the Laboratory Standard Operating Procedure (SOP) where LUA test requests that do not have sufficient clinical information will not be processed. For patient safety, certain at risk populations will be processed automatically.

Change 2
Education of clinicians requesting tests: when tests are indicated (as per local and international guidelines) and what the changes in the laboratory SOP are going forward
List of activities that need to be ended, changed or redesigned to support this change:
- Change to the SOP to allow laboratory staff not to process tests that are not correctly requested.
- Education of clinicians to reduce number of requests that are not indicated.

List the drivers for change:
- Increase number of false-positives:
  - Cost to patient with false diagnosis, risk of exposure to unnecessary antibiotics.
  - Direct cost of false-positive—repeated tests for confirmation, referral to Reference Laboratory in United Kingdom for further investigation.
  - Indirect cost of false-positives—Clinical team review and management, Clinical Microbiology team review and management, Respiratory Clinician consult, Infection Prevention and Control team review if potentially hospital acquired, Public Health investigation if community acquired.
- Cost of processing tests which are not indicated:
  - Direct cost of each test.
  - Indirect cost of laboratory scientist time.

Adapted from HSEland
Appendix 9

Stakeholder Analysis

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Project Role</th>
<th>Interest*</th>
<th>Why?**</th>
<th>Impact *</th>
<th>Responsibilit y*</th>
<th>Readiness</th>
<th>Capacity*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Manager</td>
<td>Project Sponsor</td>
<td>H</td>
<td>Project credibility</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>M/H</td>
</tr>
<tr>
<td>Chief Laboratory Scientist</td>
<td>Vision, Authority</td>
<td>H</td>
<td>Project credibility</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Clinicians</td>
<td>Order tests</td>
<td>L</td>
<td>Lack of awareness or understanding</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Lab scientists</td>
<td>Process tests</td>
<td>M</td>
<td>Ideology versus Personal Impact</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Microbiology Clinical team</td>
<td>Affected by change</td>
<td>M</td>
<td>Project credibility</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Respiratory Physicians</td>
<td>Specialists in Legionnaires' disease</td>
<td>U</td>
<td>Competing priorities, Ideology</td>
<td>H</td>
<td>L</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Patients</td>
<td>Potentially affected by change – delay in diagnosis if test not processed, subject to misdiagnosis in false-positive</td>
<td>L</td>
<td>Awareness</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>
Adapted from HSEland

Appendix 10

SWOT tool

**Notes:**
* For these fields, please select High, Medium or Low. Or Unknown

** For this field, please select and write one of the following:
  - Awareness
  - Understanding
  - Competing priorities
  - Ideology
  - Personal impact

Red text highlights Key Stakeholders and subsequent analysis that were not considered until the Planning/Building Commitment stage

This key stakeholder group was not considered in the initial stakeholder analysis as a separate entity to “Clinicians” and were therefore added retrospectively

---

**Strengths:**
- Support from Laboratory lead/Project sponsor and Chief Laboratory Scientist (Laboratory Management Team)
- Laboratory scientist support from Senior scientist (Opinion leader)
- Supportive Clinical Microbiology team
- Audit results demonstrate scope for improvement
- False positive results increased urgency for change

**Weaknesses:**
- Lack of interest/ Perceived lack of interest of clinicians ordering tests
- Laboratory serves large population (500,000 people) and four acute hospitals (4,160 hospital beds) therefore broad range of service users

**Opportunities:**
- Grand Round presentation at WRH
- Irish Society of Clinical Microbiology oral presentation of initial audit results and proposed change gaining feedback from other laboratories on current practice
- NCHD changeover as can be educated on laboratory protocol on introduction

**Threats:**
- Difficulty in engaging with service users in other sites, no face-to-face contact
- Change agent will be working in area for 18 months following change implementation, however recognised that often takes 5-10 years for changes to be engrained in psyche
- Culture of organisation – unknown to change agent as newly appointed
Reflection Box:
How might the 'Strengths' and 'Opportunities' you have identified help you enable change?

- Audit results provide an excellent platform from which to gain support and establish urgency. The audit results appeal to the ideology of Microbiology (clinicians and scientists alike) of undertaking the right test in the right patient for the right indications.
- Support from key figures in laboratory: those in laboratory management (authority figures) as well as potential change agent in laboratory (opinion leader)
- Grand rounds presentation opportunity to present findings in positive light and gain interest and support from those with probable low interest

Reflection Box:
How might the 'Weaknesses' and 'Threats' you have identified hinder the change you are working on?

- Clinician support from those with low interest, in those whom cannot be approached in a face-to-face manner (external sites) and in those who are directly affected by the changes (Respiratory physicians) is difficult to predict and receive

Adapted from HSEland
Appendix 11

Memo for distribution to all laboratory users via email

Dear colleagues,

From the 10th of February 2014, the Regional Microbiology Laboratory in [Redacted] Hospital, which provides a service to the hospitals and community in the [Redacted], will be rationalising the use of the Legionella Urinary Antigen.

A recent audit on the use of the Legionella Urinary Antigen would suggest that up to 62.2% of the tests that are performed are not indicated*. This incurs significant large direct and indirect costs, as well as subjecting patients to the risk of treatment following a false-positive result.

Going forward, the following Legionella Urinary Antigen tests requests (as identified on the request form) will be processed automatically:
- ICU/HDU requests
- Haematology/Oncology
- CURB 65 score 3 or more (As per British Thoracic Society Guidelines 2009)**
- Paediatrics
- Any form giving sufficient clinical information specific to Legionnaires’s disease

In cases where both a Pneumococcal and Legionella Urinary Antigen have been requested, if the Pneumococcal Urinary Antigen is positive, the Legionella Urinary Antigen will not be processed unless there is a significant indication to do so.

Any other requests will not be processed but held for seven days. This will allow clinicians to contact Microbiology or re-submit the form with appropriate clinical details, to request that the Legionella Urinary Antigen is processed.

Thank you very much for your support and engagement with these changes.

Yours Sincerely,

Appendix 12

(Clinical Audit Criteria and Guidance Working Group, 2009)
Appendix 13

Changes in LUA tests requested
Red 2013 Green 2014

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>51</td>
</tr>
<tr>
<td>H2</td>
<td>21</td>
</tr>
<tr>
<td>H3</td>
<td>22</td>
</tr>
<tr>
<td>H4</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>
Appendix 15

Map demonstrating Provisional Influenza-like activity in Week 9 2013

Map demonstrating Provisional Influenza-like activity in Week 9 2014 (Health Protection Surveillance Centre, 2014)
Appendix 16

(Fleming et al, 2008)