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Innovation in the time of SARS: the Kiribati infection and control programme

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INNOVATION IN THE TIME OF SARS:
THE KIRIBATI
INFECTION PREVENTION AND CONTROL
PROGRAMME.

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Certification

I, Peta-Anne Patricia Zimmerman, declare that this thesis, submitted in partial fulfilment of the requirements for the award Doctor of Public Health, in the School of Health Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualification at any other academic institution.

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27 January 2012

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List of Abbreviations

AFRO	**African Regional Office of WHO**
AusAID	**Australian Agency for International Development**
BSI	**Blood Stream Infection**
CDC	**Centers for Disease Control and Prevention**
EU	**European Union**
GNI	**Gross National Income**
HAI	**Healthcare Associated Infection**
HIV	**Human Immunodeficiency Virus**
ICP	**Infection Control Professional**
ICU	**Intensive Care Unit**
IFIC	**International Federation of Infection Control**
IPCP	**Infection Prevention and Control Programme**
IPCPE	**Infection Prevention and Control Programme Evaluation**
IVD	**Intravenous Device**
LMI	**Low- and Middle Income**
NHS	**National Health Service**
NNIS	**National Nosocomial Infections Surveillance**
NZAID	**New Zealand Agency for International Development**
PPE	**Personal Protective Equipment**
SARS	**Severe Acute Respiratory Syndrome**
SENIC	**Study on the Efficacy of Nosocomial Infection Control**
SHEA	**Society of Healthcare Epidemiology of America**
SPC	**Secretariat of the Pacific Communities**
UNFPA	**United Nations Population Fund**
UNICEF	**United Nations Children's Fund**
USD	**United States Dollar**
WHO	**World Health Organization**
WPRO	**Western Pacific Regional Office of WHO**

List of publications from the research programme (at time of submission)

Publications

Zimmerman, P. 2007, Help or hindrance? Is current infection control advice applicable in low- and middle-income countries? A review of the literature, *American Journal of Infection Control* 35(8), pp. 494-500.

Zimmerman, P. 2008, Letter to Editor in response to Storr and Pittet, *American Journal of Infection Control* 36(7), p. 501.

Zimmerman, P., Yeatman, H., Jones, M. and Murdoch, H. 2011, Adoption of an infection prevention and control programme (IPCP) in the Republic of Kiribati: a case study in Diffusion of Innovations theory, *BioMed Central Proceedings* 5(Suppl6), O20.

Zimmerman, P-A., Yeatman, H. and Jones, M. 2011, Frameworks to assist adoption of infection prevention and control programmes. Does the literature exist? *Healthcare Infection* 16(4), pp. 129-134.

Zimmerman, P., Yeatman, H., Jones, M. and Murdoch, H. 2012, SARS and Kiribati: Eyes wide open, *International Journal of Infection Control* 8(1), pp.27-34.

Conference presentations

Zimmerman, P., Yeatman, H., Jones, M. and Murdoch, H. 'Adoption of an infection prevention and control programme (IPCP) in the Republic of Kiribati: a case study in Diffusion of Innovations theory.' International Conference on Prevention and Infection Control, 29 June-2 July 2011, Geneva, Switzerland.

ABSTRACT

Background

A locally adapted comprehensive infection prevention and control programme (IPCP) is imperative to the management of healthcare associated infections. An IPCP is a technology cluster made up of a number of elements which are closely inter-related. IPCPs in high-income countries have demonstrated effective control of infection transmission in healthcare settings. Relative to the experience of high-income countries, low- and middle-income (LMI) countries have adopted IPCPs, or parts thereof, with varying degrees of success.

The country of Kiribati has been most successful in adopting IPCP principles and practices. The 'atypical' case of Kiribati raises many questions, primarily 'How and why did it change?', 'What has been the process of the change?' and 'Could other countries in the region benefit from the Kiribati experience?'

This study addresses the research questions: How can the success of IPCPs be enhanced in LMI country healthcare settings? Can the classic Diffusion of Innovations model be used to explain the level of success?'

Methods

The adoption process of an IPCP in the Republic of Kiribati was investigated with the findings analysed within the framework of Diffusion of Innovations theory. The case study investigation involved:

1. Review and analysis of IPCP adoption literature to identify those studies that have both consciously and unconsciously followed classical Diffusion of Innovations theory processes. This was to find evidence to support the suggestion that the theoretical process of Diffusion of Innovations is a key framework within which to explore and understand the adoption of IPCP in LMI countries.
2. Evaluation of current IPCP status in Kiribati using adapted National Health Service (NHS) and World Health Organization (WHO) IPCP audit tools.
3. Survey of healthcare worker knowledge, application and confidence with infection prevention and control principles and practice using a previously validated tool.

4. Chronological and thematic analysis of Republic of Kiribati IPCP documentation (for example: infection control manuals, infection control committee minutes) and findings and recommendations of IPCP assessments performed by Republic of Kiribati staff and external agencies/consultants.
5. Semi-structured interviews with key informants in the Republic of Kiribati and external agencies (using snow-ball sampling) to explore the key elements that contributed to the adoption of IPCP.

Findings

The literature review revealed a scarcity of relevant literature examining the adoption of comprehensive IPCP or associated conceptual frameworks. Only one study was published which demonstrated the Diffusion of Innovations framework, and it is discussed in more detail.

The healthcare worker survey and evaluation of the Kiribati IPCP indicated that the programme had been integrated into healthcare service delivery. The IPCP reached a level of 75% compliance in accordance with the scoring method of the tool.

Two key activities of the organisational innovation process were identified from the interviews and the chronological and thematic analysis of the IPCP documentation. These were: initiation and implementation. The initiation activity included: 1) *agenda-setting:* preparations for severe acute respiratory syndrome (SARS) in 2003 stimulated the identification of organisational IPCP deficits, and 2) *matching:* deficits were identified and the decision to adopt an IPCP innovation package was made. Implementation included: a) *redefining/restructuring:* identification of the components of an IPCP and how they best fit within the local health structure, b) *clarifying*: integration of IPCP into the health services and defining an infection control role within the nursing division and, c) *routinising:* the IPCP became an ongoing element in health service delivery.

Conclusions

Exploration of the adoption of the Kiribati IPCP provided an important case study for other low- and middle-income countries in how they may overcome barriers to the establishment and integration of a programme into a health service.

The outcome of the literature review identified a clear need for more research into IPCP adoption. The availability of relevant literature would be especially important to low resourced healthcare settings to assist their adoption of comprehensive IPCPs. Opportunities were identified for future expansion of the Kiribati IPCP through the healthcare worker survey and IPCP evaluation.

The adoption of the Kiribati IPCP followed the classic Diffusion of Innovations process for Organisations. The Kiribati case study provides a relevant and useful example of an IPCP adoption model in low- and middle-income healthcare settings and suggests ways other LMI countries may utilise opportunities as they occur during an innovation.

It is recommended that other LMI countries should enhance their adoption of IPCP through applying key components of the Diffusion of Innovations framework to their endeavours.

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This dissertation is dedicated to my Grandfather Neil Zimmerman who remains a constant source of inspiration throughout my life. ‘Poppy’ lost his battle with cancer whilst I was collecting data in Kiribati. He was very worried I would not complete this when he was diagnosed. Here it is Poppy! I am just as stubborn as you and I submit this in your honour and memory.

Chapter One

Introduction

This introductory chapter provides a background to the study presented in this dissertation. It details the location of the study and the history behind the study's inception. A brief outline of each chapter of the document is provided, together with a short commentary on the role of the chapter in addressing the research questions. The chapter concludes with a summary of the study and its significance.

1.1 Background

Prevention and control of healthcare associated infection (HAI) is an increasingly important element in the provision of health services globally. It relates to not only protecting those accessing health services from the spread of infectious or pathogenic disease but also protecting healthcare workers, their families, and other persons associated with health services.

At present, resources and expertise in the prevention and control of HAI in low- and middle-income (LMI) countries is minimal (World Health Organization 2008). LMI countries are those with a gross national income (GNI) of between ≤$975 USD and ≤$11 905USD per capita, and high income countries are those with a GNI of ≥$11 906 USD, as classified by the World Bank (World Bank 2009).

Most LMI countries are struggling with this issue, having no infection control guidelines, organisational framework, policy directives or persons responsible for establishing, implementing and monitoring infection control programmes. These issues were identified during the rapid preparedness assessments conducted by World Health Organization (WHO) Infection Control Short Term Consultants, including the researcher, in 2003 in response to the outbreak of severe acute respiratory syndrome (SARS).

An infection prevention and control programme (IPCP) is a collection of activities, resources, policies and procedures designed to control and prevent the transmission of infectious diseases within the healthcare environment and the community (Farr 2000).

Core components of an IPCP have been categorised by the WHO (Informal Network on Infection Prevention and Control in Health Care 2009) as:

- Organization of IPCP
- Technical guidelines
- Human resources
- Surveillance of infections and assessment of compliance with infection prevention and control practices
- Microbiology laboratory support
- Environmental minimum requirements
- Monitoring and evaluation of programmes
- Links with public health or other relevant services.

Together these core components create a cluster of technologies that can be described as an innovation, though they are not generally considered to be a new innovation to the healthcare environment.

The Study on the Efficacy of Nosocomial Infection Control (SENIC) Project, conducted in the mid-1970s, was the first comprehensive and most influential study of the impact of IPCPs on HAI incidence in the United States. This study established an association between intensive IPCPs and reduced rates of HAI and associated healthcare costs. This was achieved by comparing the incidence of HAI in facilities with IPCPs and those without (Haley et al. 1985). The findings from SENIC established the essential requirements of infection prevention and control programmes in the United States to reduce infection rates. These essential requirements included: 1) an emphasis on surveillance and control activities; 2) a minimum of one full-time infection control professional per 250 beds; 3) a trained hospital epidemiologist; and 4) the provision of feedback on surgical site infection rates to surgeons (Haley et al. 1985). It was found that hospitals with these programmes in place reduced the incidence of HAI by 32%, and those without the programmes had an increase in HAI of 18% (Haley et al. 1985). Infection prevention and control programmes which did not include these requirements were found to be less effective in reducing HAI (Hospital Infections Program 1992). Since the SENIC Project, a number of other studies have reinforced the efficacy of

infection prevention and control programmes in reducing HAI and associated costs, though not with the thoroughness of the SENIC project.

Understanding the process of adoption of IPCPs is important to assist other countries to adopt such programmes, particularly those with limited resources. The publication of the findings of the SENIC Project facilitated the adoption of IPCPs in healthcare settings in the United States, and subsequently internationally. The core components of an IPCP have evolved since the 1970s, through to those suggested by the WHO in 2009.

To gain a greater understanding of the process of adoption of IPCPs requires exploration of the process itself, not just whether selected key components are in place. The Diffusion of Innovations theory provides a framework through which the adoption of IPCPs can be examined.

1.2 Diffusion of Innovations and infection prevention and control

Classic Diffusion of Innovations theory describes '…the process by which an innovation is communicated through certain channels over time among the members of a social system' (Rogers 2003, p.5). In every diffusion research study, programme or campaign, four key elements are always present: 1) an innovation; 2) communication channels; 3) time; and 4) a social system (Rogers 1962, 1983, 2003).

When examining the diffusion of an IPCP in a healthcare environment the innovation 1) would be the programme, the communication channels 2) are the means by which information and messages about IPCPs are shared, time 3) includes the rate of adoption, the innovation-decision process and the innovativeness of the individual or organisation and the social system 4) is the healthcare environment and infrastructure where the adoption is to take place.

Rogers also identified a technology cluster as a group of individual components that are closely inter-related and that can be adopted as a package of technology or an innovation package (Rogers 2003). The core components of an IPCP are individual but inter-related, thus they can be considered collectively comprising a specific innovation package.

1.3 The research problem

The efficacy of infection control programmes in reducing the incidence of HAI has been well established in the literature, particularly in developed or high-income countries (Haley et al. 1985; Hospital Infections Program 1992). These infection control programmes are informed by evidence based guidelines and advice developed by internationally recognised health authorities such as the United States Centers for Disease Control and Prevention (CDC) and the WHO. Based on such advice many countries, including LMI countries, have attempted to establish infection control programmes, with varying degrees of success (Nettleman 1993; Leu 1995; Huskins et al. 1998).

From the experience of the researcher it appeared that the standards set by these guidelines and advice were unachievable by LMI countries due to resource limitations, lack of engagement of healthcare workers and health authorities, lack of expertise and institutional and priority competition.

The Republic of Kiribati appeared to be an exception to these general findings. In 2003, the investigator visited Kiribati during a SARS rapid preparedness assessment of infection prevention and control capacity. The assessment found limited infection prevention and control programming and activities. The investigator again visited Kiribati in 2005 during a consultancy with the Secretariat of the Pacific Communities (SPC) to review infection prevention and control capacity. This 2005 review found evidence of significant improvements in the overall programme, increased activities and what appeared to be genuine enthusiasm for infection prevention and control (Zimmerman 2006). It appeared that there had been a progressive adoption of infection prevention and control activities that would result in a comprehensive programme. The extent of these changes was not typical of other LMI countries in the region.

There may have been no *intention* to adopt individual infection prevention and control activities, or innovations, and label it an IPCP, but to an experienced Infection Control Professional (ICP) it was nevertheless evident that the group of activities or innovation package in Kiribati was developing into an IPCP. What was also interesting in the Kiribati case was that they appeared to have been able to address issues that often

prevented the adoption of IPCP in other LMI countries. It was because of these reasons that Kiribati was selected as a case study to explore issues of IPCP adoption.

The 'atypical' case of Kiribati raised many questions, primarily 'How and why did it change?', 'What has been the process of the change?' and 'Could other countries in the region benefit from the Kiribati experience?' These, and many other questions, warranted further exploration.

1.4 The research aim and purpose

The aim of this research study was to explore and understand a successful implementation of an IPCP through the analysis of the experience of health professionals in Kiribati using the classic Diffusion of Innovations model as a frame of analysis.

The purpose of the study was to provide a holistic understanding of the innovation process Kiribati experienced in adopting the IPCP innovation package. In line with this and the research questions, quantitative and qualitative data sources were utilised within the context of the case study method.

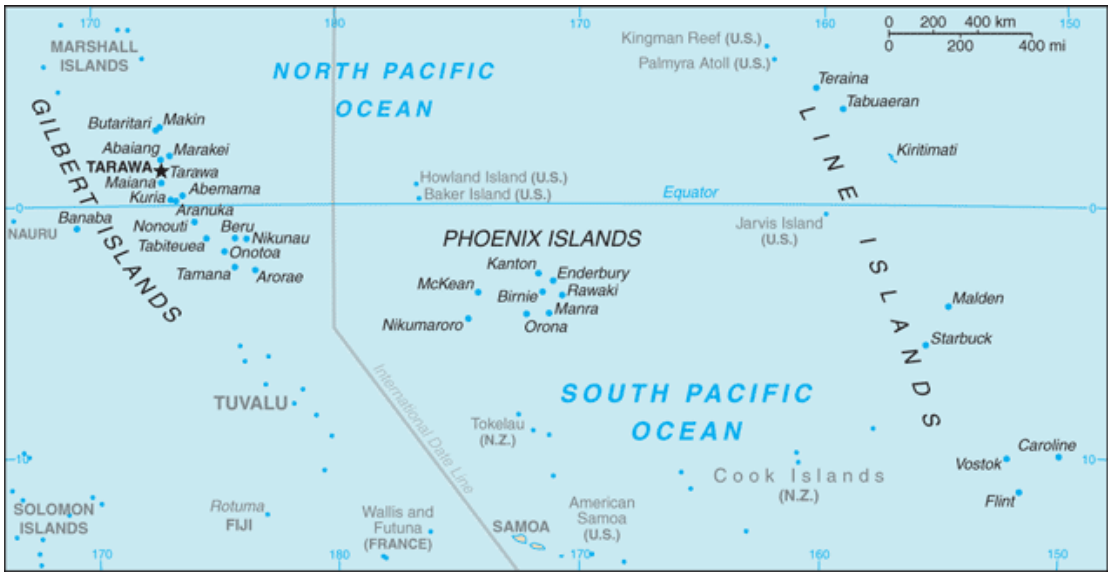
1.5 The researcher

The investigator of this project, an Infection Control Professional (ICP) with 12 years experience, has acquired experience in a variety of healthcare settings in Australia and has also had the privilege of working with health authorities in a significant number of LMI member states of the WHO Western Pacific Region Office. It was through this experience that interest in the difficulties LMI countries' experience in relation to implementation of infection prevention and control activities was first developed.

1.6 The Republic of Kiribati

The Republic of Kiribati is a central western Pacific country of 33 atolls and reef islands in three main island groups, the Gilbert, Phoenix and Line Islands, as illustrated in Figure 1. Kiribati has a total land mass of 811 square kilometres spread over 3.5 million kilometres of ocean. With a GNI of $1 200 USD per capita, Kiribati is considered a lower middle income country (World Bank 2009).

Figure 1: Map of the Republic of Kiribati (Central Intelligence Agency 2011)



Kiribati has a population of approximately 98 989 and an annual population growth rate of 1.7%. The most populated islands are South Tarawa, North Tarawa and Kiritimati Island with urban growth rates of 5.2%, 4.8% and 8% respectively (World Health Organization 2010). Compared to most other Pacific islanders, I-Kiribati have a short life expectancy with 65 years for males and 70 years for females (World Health Organization 2010).

The health system of Kiribati is publicly funded with government spending $13.45 million USD in 2008, primarily on curative services, pharmaceuticals and staffing (World Health Organization 2010). Significant technical and financial assistance is provided to the Ministry of Health by development partners such as WHO, AusAID, NZAID, UNICEF, UNFPA, SPC, EU and the governments of Cuba and Taiwan (China) (World Health Organization 2008). The formal health system is administered by the central Ministry of Health. Traditional healers provide a parallel service offering local medicines, massage, antenatal, childbirth and postnatal care. Most people use aspects of both services though there is no coordination between them. Primary health care is provided through a network of 92 health centres and dispensaries. Basic hospital services are available at South Tarawa (Betio), Kiritimati Island and North Tabiteuea. Secondary care is provided by the national referral hospital in South Tarawa. Patients requiring tertiary care services may be referred overseas for treatment if they meet the criteria defined by the Ministry of Health.

Environmental factors such as overcrowding of urban areas, particularly in South Tarawa, are increasing the risk of transmission of infectious disease. Other factors such as poor water quality, inadequate water supply, inconsistent personal hygiene practices and poor sanitation, food handling and storage practices contribute to communicable disease transmission. The incidence of tuberculosis per 100 000 population in Kiribati is now the second highest in the Pacific (World Health Organization 2009b). The Western Pacific Regional Office of WHO reports 365/100 000 population in Kiribati compared with 108/100 000 population in the region (World Health Organization 2009b). In Kiribati, 70% of reported TB cases are found in Betio, South Tarawa (World Health Organization 2010). In 2005, diarrhoeal disease and respiratory infections were the leading causes of morbidity amongst adults and mortality amongst children (World Health Organization 2008). The WHO has found that non-communicable disease incidence is increasing, making the severity of communicable diseases potentially worse for individuals with chronic disease processes. In addition, poor community knowledge regarding infection prevention practices is likely to be reflected in poor staff practices within healthcare settings.

1.7 Thesis outline

This thesis is presented as a combination of chapters (introduction, methods, literature review, and conclusion and recommendations) and manuscripts published/submitted to peer-reviewed journals, in lieu of results and discussion chapters. The literature review and methodology chapters are reduced as each manuscript contains a review of the literature relevant to the research reported and a method section describing the study undertaken and the research process.

An overview of the methodological approach and design of the research project is presented in Chapter Two and a detailed description of each method is presented in the published and submitted manuscripts. Chapter Two outlines the case study methodology, units of analysis and data sources of the overall project. These include details of the healthcare worker survey, interviews and IPCP evaluation.

Chapter Three provides a brief literature review of the adoption of IPCP in LMI countries. This chapter is somewhat shorter than the traditional monograph thesis format

due to the literature review being fully explored in two of the published and submitted manuscripts. The literature review in Chapter Three informs and provides further background to the issues LMI countries have in the adoption of comprehensive IPCP. In particular, it highlights the need for more research and reporting of the situation of IPCP in LMI countries.

Chapter Four, *"Help or hindrance? Is current infection control advice applicable in low- and middle-income countries? A review of the literature"*, comprises a paper published in the American Journal of Infection Control. This paper presents a review of how current infection control guidelines designed for high-income country settings are utilised by LMI countries and what barriers prevent the adoption of comprehensive IPCP. The chapter provides the basis for a further review of the literature to explore how LMI countries adopt comprehensive IPCP. The issues that LMI countries confront in adopting comprehensive IPCP or their components are identified.

Literature reporting on frameworks that explained the adoption of IPCP, are reviewed in Chapter Five. *"Frameworks that assist adoption of infection prevention and control programmes. Does the literature exist?"* is a paper that has been published in Healthcare Infection. This literature review identified a paucity of published studies that report the adoption of comprehensive IPCP and which follow a distinct framework or model. It is proposed that having a model for adoption of comprehensive IPCP can assist in mirroring such a process in similar healthcare settings.

Chapter Six, *"SARS and Kiribati: Eyes wide open"*, is a paper that has been published in the International Journal of Infection Control. It documents and explores the adoption stages of an IPCP in a specific case situation, in Kiribati. Rogers' (2003) Diffusion of Innovations for Organisations framework has been used to document the process and this was informed by two sets of data. The first set of data comprised chronological and thematic analysis of IPCP documentation and assessments performed by local staff and external agencies/consultants. The second set of data comprised semi-structured interviews with local key informants and external agencies (using snow-ball sampling). Thematic analysis of these data identified the process and key events that facilitated the adoption of the IPCP in the Kiribati case.

Validation of the presence of the Kiribati IPCP was reported in Chapter Seven, *"Evaluating infection control in the Republic of Kiribati"*, a paper currently under review by the American Journal of Infection Control. This paper describes the programme's achievements and areas in need of improvement in relation to infection control in the Republic of Kiribati. This information will be of particular interest to other LMI countries who continue to struggle to overcome barriers which prevent effective infection control.

The findings of Chapters Six and Seven culminate in a further discussion of the research in Chapter Eight, *"Diffusion of Innovations in organisations: A case study of infection prevention and control programme (IPCP) adoption"*, a paper submitted for review to the International Journal for Quality in Health Care. This chapter provides an illustration of how a comprehensive IPCP can be adopted in a LMI country setting with little involvement from external agencies. In examining the Kiribati case, key stimuli, opportunities and activities were identified that could be similarly adopted and implemented by other LMI countries that are facing the challenge of developing an IPCP.

Chapter Nine summarises the conclusions made from the investigation of the research questions and provides recommendations based upon the findings. The recommendations made focus primarily on the use of theoretical frameworks, particularly the Diffusion of Innovations model, to assist in the adoption of IPCP. The chapter goes further to present specific recommendations based upon the documentation of the Kiribati IPCP and the importance of reporting the LMI country situation in the literature.

1.8 Conclusion

This study contributes to an understanding of the elements for successful adoption of IPCP in LMI countries, and hence to improvements in health care and health outcomes in these less advantaged regions in the world. Surveying the knowledge, application and confidence of healthcare workers in relation to infection prevention and control principles and practice, accompanied by a review of the current status of the IPCP, served to assess the success of the adoption of the IPCP in Kiribati. Exploring the chronology of IPCP adoption in a LMI country such as the Republic of Kiribati and

mapping this process within the diffusion of innovation framework provides valuable insights that can be shared with potential adopters from similar countries who may be seeking resolutions to their own infection prevention and control issues.

This introductory chapter has described the background to the research detailed in this thesis and the importance of a comprehensive IPCP in all healthcare provision, regardless of the economic wealth of a country. It described the unique case of the Republic of Kiribati and provided the context for the exploration of how a relatively small Pacific Island country can adopt a comprehensive IPCP in spite of the barriers similar LMI countries face in this endeavour. The next chapter outlines the methodology for exploring the Kiribati case.

Chapter Two

Methodology

This chapter provides a description of the methodology of the overall study, providing an outline of the case study method, units of analysis and data collection methods. Full details of each data collection method are separately included in Chapters Four to Eight as they are presented in article format.

2.1 Introduction

Infection prevention and control research to date has been largely quantitative, focusing on the surveillance of health care associated infections, the measurement of the use of infection prevention practices, and clinical trials (Forman et al. 2008). The use of qualitative data in infection prevention and control has generally been absent, and because of this, explanations as to why certain infection prevention and control practices or activities are or are not adopted have not been identified. It has been suggested that research in the field of infection prevention and control should be a combination of both quantitative and qualitative data to understand phenomena as well as measure it (Forman et al. 2008).

Investigating the adoption of an innovation in an organisation similarly involves the use of quantitative and qualitative data sources. When using the staged model to explore the adoption of an innovation, described previously, data collection methods have been generally cross-sectional retrospective surveys, which Wolfe suggested was too limited to fully explain adoption phenomena (1994). Investigation of the innovation process, however, has included methods which provided in-depth field studies such as field observations, interviews, questionnaires and analysis of historical documents such as reports and archival data, resulting in a combination of quantitative and qualitative data sources (Wolfe 1994). The use of both sources has assisted to fully explore and understand the complexity of the innovation process and has not reduced it to "…a few discrete variables and linear cause-and-effect relationships" (Forman et al., 2008 p.765).

2.2 Case study design

Case study research is considered one of many ways to explore and study contemporary phenomena within its real-life context particularly when '…the boundaries between phenomenon and context are not clearly evident' (Yin 2003, p.13). This research strategy has been commonly used in education, health care, the military, business and industry by numerous disciplines such as psychology, sociology, medicine, psychiatry, law, nursing and education (Mariano 1999).

Case studies have been conducted at various levels of complexity and have used different levels of analysis: factual, interpretive and evaluative (Lincoln and Guba 1985). Case studies can be exploratory, descriptive, interpretive or explanatory (Stake 1995). Four elements typify case studies: context, boundaries, time and intensity (Mariano 1999). In case study research the researcher defines the boundaries of the inquiry, issues and reference points, thus employing an intensive orientation to the phenomenon under study (Woods and Catanzaro 1988; Mariano 1999; Yin 2003).

The unit of analysis can be a person, family, group, organisation, culture, event, program or process (Woods and Catanzaro 1988). Case studies can focus on a single case as the unit of analysis or on multiple cases, which are then compared (Mariano 1999). Single-case design is used when the case represents a typical case, a critical case, an extreme or unique case or a revelatory case (Yin 2003). It is used to document and analyse the precise nature of the phenomenon under investigation and to raise questions for further exploration (Mariano 1999). In multiple-case design, inferences and interpretations are drawn from a group of cases. This design is appropriate when the researcher is interested in exploring the same phenomenon across diverse situations or with a number of individuals. Alternatively, it is used when the researcher wishes to establish whether a proposed explanation is confirmed across a number of cases (Mariano 1999).

Particularities and complexities of the case are examined to understand its activity within important situations. Case study does not generalise, instead it emphasises uniqueness. That implies knowledge of others that the case is different from, but the

first emphasis is on understanding the case itself (Yin 2003). Yin further explains that case study inquiry,

- Copes with the technically distinctive situation in which there will be many more variables of interest than data points, …
- Relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, …
- Benefits from the prior development of theoretical propositions to guide data collection and analysis (2003, p.13-14).

The benefit of the development of theoretical propositions is not required of exploratory studies, such as the study proposed here, yet a clear purpose is necessary (Yin 2003).

Both Yin (2003) and Stake (1995) argue that case study methodology is well matched to conducting social science research where people and programs are the areas of interest. Case studies are generalisable to theoretical propositions rather than populations or universes (Yin 2003). This research method calls on both qualitative and quantitative sources of evidence to explore the research questions.

A single case study approach was chosen for this project as it facilitated the exploration, within a specific context, of the adoption of an IPCP. This study sought to explore contemporary phenomenon within its real-life context (Yin 2003). This is achieved by using multiple sources of evidence to enhance rigour (Stake 1995; Yin 2003). Case study method calls for a triangulating process using multiple sources of evidence, both qualitative and quantitative to explore the research questions. Triangulation in this study was achieved through the analysis of multiple sources of data which were each causally separate.

2.3 Research process

2.3.1 Study aim

To explore and understand the implementation of an IPCP through the analysis of the experiences of health professionals in Kiribati using the classic Diffusion of Innovations model as a frame of analysis.

2.3.2 Purpose

The purpose of the proposed study was to provide a holistic understanding of the innovation process that Kiribati experienced in adopting the IPCP innovation package, with a view to enhancing the adoption of IPCP in other LMI country healthcare settings.

2.4 Methods

The methods of inquiry in exploring the research questions included:

Review of the literature

1. Review of the current state of infection prevention and control advice and barriers to adoption of comprehensive programmes in LMI countries. Full details of this component of the study are presented in Chapter Four, *"Help or hindrance? Is current infection control advice applicable in low- and middle-income countries? A review of the literature"*
2. Review and analysis of IPCP adoption literature to identify those studies that have followed a theoretical framework during the process. This is to clarify the proposition that the Diffusion of Innovations model can assist our understanding of the adoption of IPCP in LMI countries. Full details of this component of the study are presented in Chapter Five, *"Frameworks that assist adoption of infection prevention and control programmes. Does the literature exist?"*

Documenting the adoption of IPCP in Kiribati

1. Chronological and thematic analysis of Republic of Kiribati IPCP documentation (for example: infection control manuals, infection control committee minutes) and findings and recommendations of IPCP assessments performed by Republic of Kiribati staff and external agencies/consultants explored the key elements of the diffusion of innovation process.
2. Semi-structured interviews with key informants in the Republic of Kiribati and external agencies (using snow-ball sampling) explored the key elements of the diffusion of innovation process. Full details of this and the above component of the study are presented in Chapter Six, *"SARS and Kiribati: Eyes wide open"*
3. Evaluation of current IPCP status in Kiribati using adapted NHS and WHO IPCP audit tools with thematic analysis of findings and recommendations –

identified the current infection prevention and control activities and how they corresponded with the core components of a comprehensive programme.

4. Survey of healthcare worker knowledge, application and confidence with infection prevention and control principles and practice using a previously validated self-administered tool – identified strengths or deficits in the education component of the programme. Full details of this and the above component of the study are presented in Chapter Seven *"Evaluating infection control in the Republic of Kiribati"*.

2.5 Units of analysis

2.5.1 Review of IPCP adoption literature

A review of the literature was undertaken to illustrate and research gaps in the current situation of IPCP adoption in LMI countries in relation to the available expertise and the barriers faced in programme adoption.

Chapter Three provides a literature review of Diffusion of Innovations and IPCP adoption which identified an apparent absence of studies which acknowledged the role of the innovation process in programme adoption. A further review of all available IPCP adoption studies was undertaken to identify those programmes which were adopted and unknowingly followed a theoretical framework. The purpose of this review was to determine support for the suggestion that Diffusion of Innovations was a key framework within which to explore the adoption of IPCP, particularly in LMI countries.

2.5.2 IPCP documentation analysis

A chronological and thematic analysis was undertaken within the framework of the key elements and stages of the innovation process. Key data sources were Republic of Kiribati IPCP documentation (for example: infection control manuals, infection control committee minutes) and reports on the findings and recommendations of IPCP assessments performed by Republic of Kiribati staff and external agencies/consultants Review of the IPCP documentation was conducted by the investigator in country. Access to these documents required the permission and cooperation of the Ministry of

Health. This was achieved by following the relevant ethics and study requirements of the Kiribati Ministry of Health.

Analysis of these documents was performed to provide an illustrative timeline of the process of IPCP adoption in Kiribati. This served to identify the stages of the innovation process in the organisation. Text data were subjected to thematic analysis "…as a means of re-organising the data according to conceptual themes recognised by the researcher" (Minichello et al. 2000, p.255).

2.5.3 Interviews

Face-to-face interviews were conducted with key stake-holders in the Ministry of Health, infection prevention and control personnel, and clinicians. Following consultation with these interviewees, a snow-balling technique was used to identify other relevant key stakeholders in Kiribati, and additional interviews were sought with these individuals (Minichello et al. 2000).

The interviews were semi-structured following an interview schedule which explored the chronology and the aspects of the adoption process of the IPCP (Appendix 1). Interviews were audio-recorded and transcribed. Data were subjected to thematic analysis, as detailed in 2.6 below.

Pilot testing of the interview schedule was conducted with infection prevention and control professionals and clinicians in Queensland, each of whom had work experience in LMI countries. This step was undertaken to ensure comprehension and language suitability for the target population in Kiribati. These interviews were held face-to-face, except one which was conducted over the telephone.

2.5.4 Infection Prevention and Control Programme evaluation

The role of the evaluation of the IPCP in Kiribati was to describe the current infection prevention and control activities and how they corresponded with the core components of a comprehensive programme.

Audit and evaluation of IPCPs and their associated activities has been a well recognised data collection method in the field of Infection Prevention and Control (Bryce et al.

2007). As part of an IPCP, audits are used to determine the appropriateness of infection prevention and control policies and the reliability of infection management practices (Hay 2006).

Audit or evaluation tools reported in the literature to be rigorous and validated through various research methods have been found to focus on certain infection prevention and control activities such as hand hygiene (Pittet et al. 2000) and antibiotic stewardship (Saizy-Callaert et al. 2003). Less available are holistic tools for the evaluation of IPCPs.

In searching the literature for available and validated IPCP audit or evaluation tools only two documents were considered appropriate to the task, though with some limitations. The first was the Infection Control Nurses Association *Audit tools for monitoring infection control standards* (Infection Control Nurses Association 2004). This comprised a set of tools that had been validated (Millward et al. 1993, 1995) and used extensively by the National Health System (NHS) of the United Kingdom for the standardised monitoring of clinical practice and the healthcare environment. These tools were not designed to assess the comprehensiveness of an IPCP. Rather they were used to assess infection prevention and control practice in the clinical healthcare environment. These tools were also not designed for the LMI country healthcare setting.

The second research tool was the *Nosocomial Infection Program Rapid Evaluation Guide* produced by the Pan American Health Organization/Regional Office of the World Health Organization (Pan American Health Organization 2005). Validation of this evaluation tool has not been reported in the literature, though Chelenyane and Endacott (2006, 2008) and Wu et al. (2008) argued that tools created from, and based upon, the recommendations from systematically and legally established agencies such as the World Health Organization should be considered as having inherent face and content validity. This tool was designed to evaluate programmes based on the presence of indicators of core components of an IPCP, with the LMI country healthcare settings of the Latin Americas in mind. It was designed to provide a general overview rather than specifics of the status of IPCPs and it was not intended to provide an evaluation of the clinical healthcare environment.

These two tools were combined in this research project to create an evaluation document, the IPCP evaluation (IPCPE), that was used in this study to assess the status of the current IPCP and clinical healthcare environment in Kiribati. Assessing the current status of the IPCP acted to verify the adoption of the activities of the IPCP. The findings of the assessment were compared to other IPCP documentation and assessments sourced through the IPCP documentation analysis, and contributed to the development and understanding of a timeline of the adoption process.

The validity of the IPCPE instrument (Supplement 1) was confirmed by experts in infection prevention and control with experience in LMI country healthcare settings. These experts were asked to assess whether the questions and items were valid, readable and practical. Once the review and adaptation process was complete, the IPCPE was piloted in healthcare facilities in Fiji by an experienced infection prevention and control professional. After piloting and making relevant changes, the IPCPE was then used in the study to assess the IPCP in Kiribati. The IPCPE was conducted in person by the investigator on visits to Kiribati.

2.5.5 Healthcare worker survey

As part of any evaluation of IPCP adoption it is essential to evaluate the knowledge and delivery of safe infection prevention and control practices of the healthcare workers (Bryce et al. 2007). This evaluation assists to identify deficits in the education component of the programme and serves to provide data on the adoption of the IPCP innovation in the clinical setting, particularly how successfully it is being implemented. The results of these self-administered surveys assisted in verifying the adoption of the IPCP.

Four appropriate survey tools were identified in the published literature. Three of these referred to the knowledge and practice of universal precautions (Chan et al. 2002; Stein et al. 2003; Chelenyane and Endacott 2006). Universal precautions are a system of practices designed to prevent the transmission of infectious diseases from blood and body fluids (Centers for Disease Control and Prevention 1987). The term, and some practices of, universal precautions were superseded in 1996 when the CDC produced new recommendations on the prevention of infection, creating a two-tiered approach termed standard and additional precautions (Garner 1996). Though these tools were

designed after 1996, there was no reference to these changes and therefore they were considered not to reflect current infection control practices.

The fourth relevant instrument had been used to determined Taiwanese nursing students' knowledge, application and confidence with standard and additional precautions (Wu et al. 2008). A content validity index strategy was used to examine the validity of the tool (Wu et al. 2008). Internal consistency was also established for the knowledge and confidence scales of the tool. The application scale was not able to be tested, though the authors maintained, as previously mentioned, that items based upon recommendations of organisations such as WHO have inherent validity.

The Wu et al self-administered questionnaire was adapted to the culture and environment of Kiribati (Appendix 2). It was used to assess the knowledge, application and confidence with infection prevention and control practices of clinicians in the Kiribati healthcare environment. The target population was clinicians in the hospital of Betio and the national referral hospital in South Tarawa. The number of surveys administered was 186. Prior to use in Kiribati, the questionnaire was piloted and tested for internal consistency with a sample group of clinicians in Fiji. The healthcare worker survey was conducted in person by the investigator on visits to Kiribati.

Survey data were coded for ease of data entry then collated and entered into SPSS (Statistical Package for the Social Sciences) *Student Version 18* (Pearson Education 2009). The data were then subjected to analysis using descriptive and inferential statistics.

2.6 Thematic analysis

Thematic analysis involves the search for and identification of common themes throughout the document reviews and interviews (Morse and Field 1996). This "…involves reading, overviewing, and annotating the text prior to systematic coding" (O'Leary 2005, p.196). Data were explored for words used, concepts discussed, linguistic devices utilised and non-verbal cues identified by the researcher, during the interview process (O'Leary 2005). To explore word-related themes the text was systematically searched to find all instances of relevant words and phrases, making note

of their context and meaning (O'Leary 2005). Livescribe hardware and NVivo9 software were used in the collection and organisation of data for analysis.

Concepts primarily explored were the four components of the Diffusion of Innovations theory previously described: the innovation, communication channels, time and the social system (Rogers 2003). Other concepts and themes emerged from the data in addition to these components, and were analysed in a similar manner.

By investigating and analysing the phenomena in this way, information was gathered to explore the five stages of the innovation decision process as well as the sequences, divergent and parallel paths, feedback and feed forward cycles in the process (Wolfe 1994; Rogers 2003). This data collection and analysis also assisted with verification of the information gathered from the IPCP evaluation and healthcare worker surveys.

2.7 Study issues

2.7.1 Access to the field

The investigator works as an independent consultant. The investigator had previous work experience with the WHO and the SPC as an Infection Control Technical Consultant in Kiribati. She also had exposure to, and experience with, a significant number of health authorities in the LMI countries of the Western Pacific. These prior experiences assisted in gaining access to the field of investigation. Permission and assistance was sought from the Ministry of Health of Kiribati in accordance with the relevant institutional ethics committees (Appendix 3).

2.7.2 Recruitment

Participation was voluntary throughout the study. Participation in the study was sought and obtained whilst the research was being conducted in Kiribati. This was achieved with the assistance of Senior Nursing and Medical staff.

2.8 Ethical issues

This study received approval from the University of Wollongong Human Ethics Committee (Approval number: HE09/386, Appendix 4) and the Ministry of Health of the Republic of Kiribati (Appendix 3). Particular ethical considerations had been identified in relation to the design of this study. Each of these is detailed below.

2.8.1 Security

During data collection and analysis, all information collected, including digital storage of audio recordings and transcripts of the interviews (master file) were stored in a locked filing cabinet in the residence of the investigator. A working file, including all copies of the master file, that were required for the day-to-day work of the study remained with the investigator or was stored in a locked filing cabinet, separate from the master file, when not in use. Computer files were password protected. Access to the data was confined only to the investigator. All data will be kept for the duration required by the relevant ethics committees, stored in locked filing cabinets at the School of Health Sciences, University of Wollongong.

2.8.2 Confidentiality

Written information was provided and informed consent obtained from interview participants by the investigator, before each interview was conducted. Identities of the interviewees were reported as positions rather than names to help protect identities. However, this may still pose a potential social risk to the interview participants. This issue was outlined on the consent form and discussed with participants during their recruitment to the study and prior to their interview. Interview participants were offered the opportunity to withdraw consent at any point during the study. Copies of the consent forms and participant information forms are in Appendix 1 and 2.

2.9 Conclusion

This chapter has provided an overview of the methodology and research process used throughout the project. It was designed to assist the reader in linking the information and more detailed methodologies presented in the manuscripts/published papers in Chapters Four, Five, Six, Seven and Eight, in terms of how they fit together to provide a comprehensive investigation of the adoption process of a comprehensive IPCP. It also discussed the traditional research approaches to IPC and the rationale for taking a case study approach to explore the relevance of the Diffusion of Innovations framework.

The next chapter details a brief literature review of the background to the use of IPCPs and how the Diffusion of Innovations process in organisations can be used as a framework for the modelling of the adoption of a comprehensive IPCP. Subsequent

chapters provide further details of relevant sections of the literature pertinent to the components of the study reported in published articles of which they are comprised.

Chapter Three

Literature review

This chapter comprises a brief literature review on the background of IPC in LMI countries and an introduction to the Diffusion of Innovations process in organisations. Discussion of the literature identifies the need to further investigate the literature for reports of comprehensive IPCP adoption and the frameworks that informed them. The findings presented in this chapter provide the basis of the literature reviews presented in Chapter Four and Chapter Five.

3.1 Background

It is important to understand the importance of infection and infection control in LMI countries so as to situate this study's focus on how a LMI country was able to introduce an IPCP. This section outlines the current knowledge of IPCP reported in the literature.

The lower the economic status of a given population or nation, the greater is the impact of infectious diseases and HAI on mortality, and the larger the decrease in quality of life (Isturiz and Carbon 2000; Starling 2001; World Health Organization 2002; Rosenthal et al. 2003a; Yalcin 2003). Healthcare facilities in most LMI countries utilise the majority of public health expenditure and as such are the focus of cost cutting to provide care to the greater population (Huskins et al. 1998). The quality of health care, including infection control and prevention, varies across socioeconomic situation. It is commonly influenced by infrastructure, training of health care workers, patient knowledge and purchasing power of individuals in each country (Isturiz and Carbon 2000).

The available literature which examines infection prevention and control programmes in LMI countries consists predominantly of review papers or case study reports, focusing on the adoption or modelling of individual IPCP components rather than the adoption of a comprehensive programme. In a series of studies conducted between 2003 and 2005 Rosenthal and colleagues examined the incidence of HAI in specific intensive care units (ICU) of Argentine hospitals before and after the adoption of globally accepted infection control and prevention interventions that included staff education, performance feedback and enhancement of compliance with hand hygiene. The studies

demonstrated improvement in HAI rates after the adoption of these interventions. Through conducting these studies however, barriers to implementation of available guidelines were identified, such as lack of resources, lack of organised IPCP, healthcare staff unaware of infection prevention methods and lack of institutional support (Rosenthal et al. 2003a; Rosenthal et al. 2003b; Rosenthal et al. 2004; Rosenthal et al. 2005).

3.2 Barriers to adoption of IPCP in LMI countries

The principles of infection prevention and control remain the same regardless of the healthcare environment, but how they are implemented depends on a number of factors. Raza et al. indicated that the United States' or high income countries' experience of infection prevention and control was not applicable to LMI countries due to, '…the high costs involved and local factors such as climate, socioeconomic and demographic conditions, antibiotic prescription habits and bacterial resistance patterns' (Raza et al. 2004, p.295). Experiences of LMI countries in their attempts to adopt IPCP were thus reviewed to identify key factors that impact on successful implementation.

The report of a Project Hope programme that endeavoured to implement an infection prevention and control programme based upon CDC infection control guidelines in Indonesia described a number of barriers that were experienced (Rhinehart et al. 1991). Rhinehart and colleagues reviewed an 11 bed paediatric ICU in a 1200 bed tertiary facility in Jakarta. They found that literal adoption of CDC guidelines, as would occur in a high income country, was impossible due to the poor physical environment, budgetary constraints, unreliable and inappropriate supply of equipment and supplies, limited microbiological diagnostic facilities, lack of healthcare worker knowledge, local customs and culture, lack of institutional support and infection control infrastructure and poor sterilisation capabilities (Rhinehart et al. 1991). Given this situation the project team reviewed CDC guidelines to adapt them to the local circumstances. This was performed in collaboration with hospital counterparts. The results of the facility and CDC guideline review resulted in adapted guidelines for core infection prevention and control programme components. Though this older study focussed on a very specific clinical unit, it has provided an important contribution through identification of the barriers to the successful adoption of IPCP in a LMI healthcare setting.

A number of review papers echoed the Rhinehart et al. (1991) findings; adoption of infection control and prevention practices in LMI countries was reported to be often hindered by a lack of awareness of risk of infection, lack of knowledge, inadequate supplies of personal protective equipment (PPE) and other equipment, staffing and time, inconvenience to staff and poor health care system support for safe practice (Sagoe-Moses et al. 2001; Kermode et al. 2005).

In a cross-sectional survey of health care workers in rural north India, Kermode et al. (2005) also reported on factors that affected the adoption of infection prevention and control practices. The principal factors they identified included: length of time in the job, knowledge of blood borne pathogen transmission, perception of safety climate and perception of barriers to safe practice. They went on to suggest that promotion of safety climate factors might be an effective way to assist in implementation of infection prevention and control advice. However, it was predicted that this cannot be achieved without structural supports such as a comprehensive IPCP that included those core components previously mentioned (Informal Network on Infection Prevention and Control in Health Care 2009), provision of appropriate safety equipment and commitment from health care leaders (Kermode et al. 2005).

Other studies have identified methods to overcome these barriers, including ensuring that IPCP was adapted to the local environment and context, making use of available resources and targeting interventions to those infectious diseases of local importance (Ponce-de-Leon 1991; Rhinehart et al. 1991; Raza et al. 2004).

Studies of the adoption of IPCP in LMI countries were generally unavailable in the literature. One reason suggested for this was that such reports were rarely published in English, particularly studies from Asian countries (Leu 1995). What were available though, as previously described, were reviews of the general issues related to adopting IPCP in LMI countries or reviews of individual component adoption, such as surveillance. Of these reviews the major problems identified were:

- Most LMI countries have weak or absent IPCP,
- IPCP are often unidirectional, focusing only on one or a few interventions such as antibiotic usage,
- Local studies and local expertise are not utilised in developing an IPCP,

- Appropriate resource allocation to the health sector and delivery system is not addressed,
- Human resources are not adequately developed to support IPCP adoption, and
- Equipment and consumable items such as sharps containers, sterilisers, disinfectants, PPE, running water and electricity have limited availability (Mortensen 1991; Sobayo 1991; Nettleman 1993; Huskins et al. 1998; Starling 2001; Nyamogoba and Obala 2002).

Given these barriers identified for other LMI countries, Kiribati appeared to have demonstrated a concentrated effort to adopt infection prevention and control activities which together created a comprehensive IPCP. Exploring the research questions: 'How can the success of IPCP be enhanced in LMI country healthcare settings?' and 'Can the classic Diffusion of Innovations model be used to explain variations in success?' would assist in illuminating the adoption process that Kiribati had undertaken to achieve its current level of IPCP development. In undertaking this discovery, it was first necessary to further understand classical Diffusion of Innovations theory and its potential role in understanding IPCP adoption reported in the literature.

3.3 Diffusion of Innovations

Diffusion of Innovations theory has its roots firmly embedded in agriculture and geography. The concepts central to the classical theory were first described in the 1930s by researchers studying the adoption of hybrid corn in farming. Whilst observing the process they noticed patterns of communication and influence amongst the farmers (Lennarson Greer 1977). Since then, Everett Rogers has been primarily responsible for the scholarly development of Diffusion of Innovations theory (Rogers 1962; Rogers and Shoemaker 1971; Rogers and Agarwala-Rogers 1976; Rogers 1983, 2003). Other scholars who have contributed to the development of the theory include Downs and Mohr (1976), Brown (1981) and Tornatzky and Fleischer (1990).

Diffusion of Innovations research has produced a substantial body of literature and publications covering a range of academic disciplines including geography, education, economics and sociology (Mahajan and Peterson 1985). However, as literature were not discovered which directly related to the combination of *diffusion theory* and *IPCP*, this

preliminary literature review focuses on Diffusion of Innovations theory as it relates to the organisation and delivery of health services and IPCP.

3.3.1 Diffusion of Innovations in an Organisation

It has been argued in the literature that classical Diffusion of Innovations theory was limited in its application to organisational adoption of innovations (Lennarson Greer 1977). It was generally accepted that the classical theory was limited to explaining adoption of innovations by single individuals. After the first edition of "Diffusion of Innovations" was published (Rogers 1962), Everett Rogers began exploring innovation in organisations, resulting in the development of a clear description of how the classic theory applied to organisations (Rogers and Agarwala-Rogers 1976; Rogers 2003). Rogers (2003) suggested that the focus of research into innovation in organisations was on the innovation process itself. This was achieved by using a staged model. The process specific to organisations was a sequence of five stages, which were divided into two sub-processes, initiation and implementation.

Initiation involved the information gathering, conceptualising, and the planning of adoption of the innovation leading up to the point where the decision was made to adopt the innovation. The implementation was all the events, actions and decisions which were involved in putting the innovation into use. The decision to adopt was the event that divided initiation from implementation (Rogers 2003). Other researchers added to this model, examining sequences in the innovation process, divergent and parallel paths, and feedback and feed forward cycles (Wolfe 1994). Wolfe suggested investigating the innovation process in a more meaningful manner by not only examining stages but also sequences, divergent and parallel paths, feedback and feed forward cycles in the process (1994).

3.3.2 Diffusion of Innovations theory in IPCP adoption

The adoption of infection prevention and control programmes in healthcare settings has not figured prominently in Diffusion of Innovations research. To explore the study's aim, through the frame of the classic Diffusion of Innovations model, an extensive search of the literature was performed. The review concentrated on Diffusion of Innovations theory in relation to infection prevention and control, and searched for evidence specifically related to the adoption of IPCPs. It was anticipated that the review

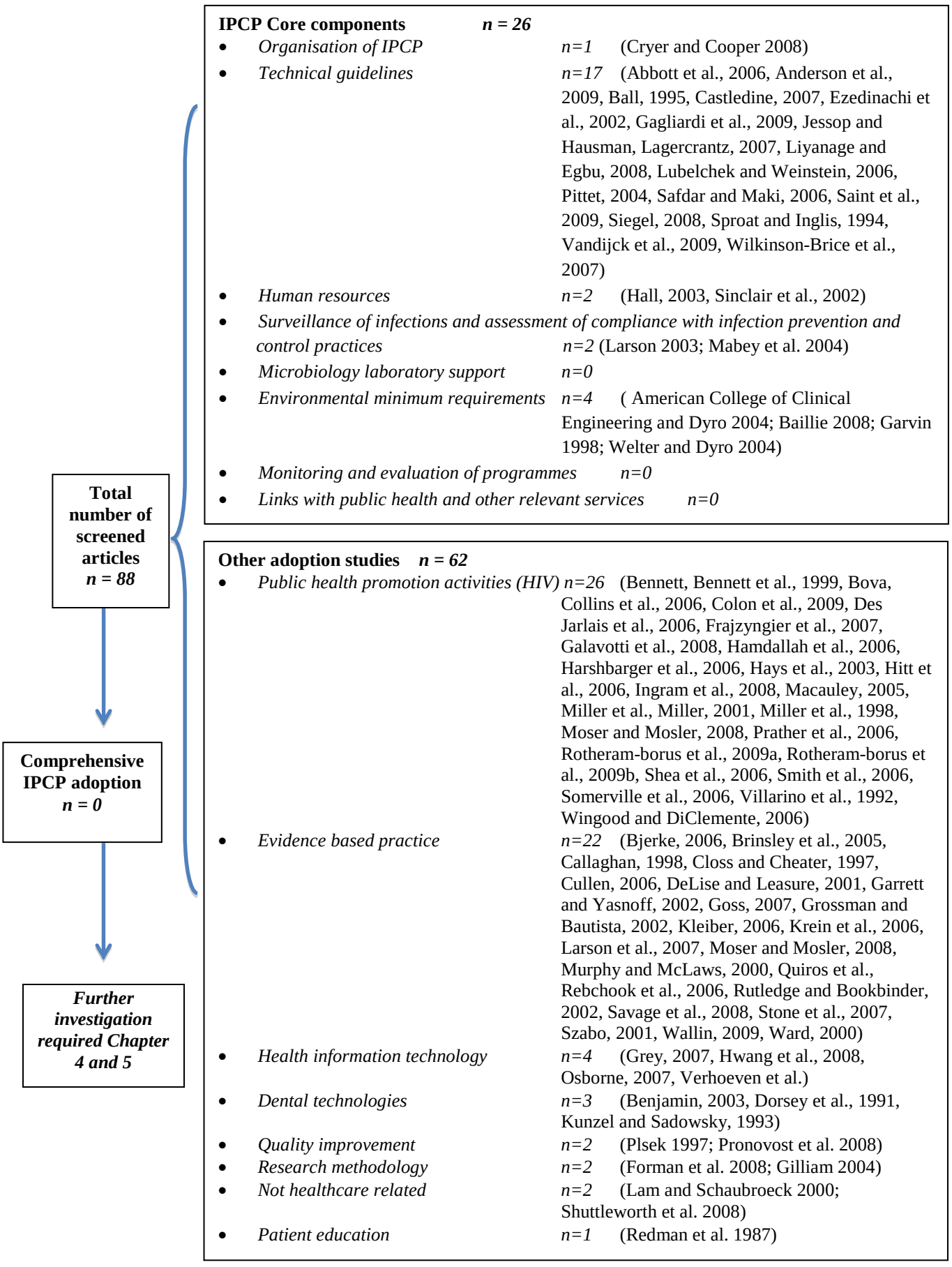
would provide evidence that the classic Diffusion of Innovations model could be used to explain the success or failure of the adoption of an IPCP.

The search terms used were: infection control, infection prevention, nosocomial infection control, infection control programme, infection prevention and control programme, healthcare associated infection and Diffusion of Innovations. The databases used for the search were Medline, CINAHL, Proquest Central, Academic Onefile, Academic Research Library, Science Direct, Cochrane, PsycArticles and ERIC. There were no time parameters included in the search, and results were only sought if they were written in English. In total, 88 abstracts were found using these search criteria (Figure 2). Of these 88, most reported or described the adoption of individual IPCP components not the comprehensive technology cluster. Of the IPCP core components reported, the majority of the articles focused on the adoption of technical guidelines (n=17). The other more numerous articles related to the adoption of public health promotion activities which had a large HIV focus (n=26) and the adoption of evidence based practice (n=22). Two of the articles had no healthcare delivery relevance at all.

What was absent from the results of this search was literature that addressed the adoption of a comprehensive IPCP. This absence of literature regarding the adoption of an IPCP, particularly as it pertained to Diffusion of Innovations theory, suggested three possible situations:

1. There had been no studies that examined the adoption of an IPCP using Diffusion of Innovations theory
2. IPCP had been adopted unknowingly following a Diffusion of Innovations process
3. Studies of IPCP adoption may have been reported in a language other than English

Figure 2: Flow chart of preliminary literature search



3.4 Conclusion

This chapter provided an overview of the current knowledge of IPCPs in LMI countries. In particular it highlighted an absence of reports of the adoption of IPCPs and/or the process that this may follow. The findings from this brief review are further explored in Chapter Four and Chapter Five.

The next two chapters comprise published articles. Chapter Four further examines the literature regarding IPC in LMI countries. Chapter Five explores the two situations suggested above, in essence, whether there are conceptual frameworks reported that have informed the adoption of comprehensive IPCP. Chapter Five reports and discusses the discovery of a relevant study that had unknowingly followed a Diffusion of Innovations process, as previously suggested.

Chapter Four

Publication I: Help or hindrance? Is current infection control advice applicable in low- and middle-income countries? A review of the literature

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Introduction

This chapter consists of a manuscript accepted for publication. It is presented in a form unaltered from the version accepted for publication, apart from the numbered structure imposed as a result of this dissertation style of presentation.

The article follows on from the general overview of the literature presented in chapter 3. In particular it explores the literature that report on those areas identified as research gaps in studies of the adoption of comprehensive infection control programmes in low- and middle-income (LMI) countries and how advice from high-income countries needs to be adapted to suit the LMI setting.

Contribution of authors

This manuscript presents the results of the literature review conducted by P. Zimmerman. The sole author is P. Zimmerman.

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ABSTRACT

Background

High income countries with established infection control programmes have demonstrated effective control of infection transmission in healthcare settings. The guidelines and advice underlying these effective control programmes have been produced by high income countries for their own social, economic and health environments. These have also been adopted by low- and middle- income (LMI) countries but these countries appear to have a limited ability to apply these principles using the same methods.

Methods

A systematic search for literature published in English was conducted exploring the relationship between the available infection prevention and control advice and the capacity of LMI countries to apply this guidance in their healthcare settings. Articles relevant to this exploration were identified and subsequently informed further search terms and identified other significant documents.

Results

Infection control guidelines designed for high income countries are being utilised by LMI countries, with varying degrees of success mainly due to physical, environmental and socioeconomic factors. There is a lack of published studies exploring the implementation of comprehensive infection control advice and programmes, including the minimal advice which is designed specifically for resource limited settings.

Conclusion

What is evident from the literature is that there is a need for the development of infection control and prevention guidelines based on evidence but adapted to the specific needs of healthcare workers in LMI countries. This must be done in collaboration with those same LMI country healthcare workers. Equally due to finance and health priorities healthcare facilities should choose those interventions most relevant to the needs of their population and workers to prevent infection transmission. Opportunities for further research into application of available infection control advice in LMI countries are identified. Through such research more appropriate advice may be

devised to assist with the development of infection control programmes in these settings.

4.1 Introduction

The efficacy of infection control programmes in reducing the incidence of healthcare associated infection (HAI) has been well established in the literature, particularly in high-income countries. These infection control programmes are informed by evidence based guidelines and advice developed by internationally recognised health authorities such as the United States Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO). Based on such advice many countries, including resource limited or low- and middle income (LMI) countries attempt to establish infection control programmes, with varying degrees of success. This literature review aims to explore the relationship between the available infection prevention and control advice and the capacity of LMI countries to apply this guidance in their healthcare settings.

4.2 Method

The categorisation of LMI countries include those in seven regions, with a few exceptions, sub-Saharan Africa, India, China, other Asian countries, Latin America and the Caribbean, the Middle Eastern crescent, and countries that comprise territories included in the former socialist economies of Europe (Huskins et al. 1998). For the purpose of the discussion of this paper, LMI countries are those with a gross national income (GNI) per capita of between $825 USD, or less and $10 065 USD, and high income countries are those with a GNI of $10 066 USD or more, as classified by the World Bank (World Bank 2004).

In reviewing the literature a systematic search for literature published in English available via MEDLINE for the years 1996 through to April 2006 was conducted. The MEDLINE search was supplemented by a Cumulative Index to Nursing, Allied Health Literature (CINAHL) search for the years 1982 through 2006. The search terms included infection control and developing countries, infection control and developing nations, infection control and limited resources, infection control guidelines, infection control compliance, infection control efficacy, and infection control implementation. Identified articles were used to select additional key terms for further searches. Other relevant articles were identified from the bibliographies of these papers. A search was

also conducted of the CDC and WHO published documents which focused on infection control and prevention in healthcare settings.

Articles and documents sought in the review were those that examined the implementation of comprehensive infection control programmes in LMI countries. More specifically the search was for examination of programmes which had been based upon advice and guidelines designed for high income countries, their evaluation and identification of key elements of success or failure and lessons learnt from the experience.

4.3 Results

4.3.1 Effectiveness of infection control programmes

Prevention and control of HAI is one of the greatest challenges confronting healthcare providers around the world. Thorough studies of the impact of HAI in LMI countries have not been performed but estimates indicate that they pose a substantial public health problem, with HAI one of the most common adverse outcomes of healthcare (Huskins et al. 1998). Studies of the United States experience estimate the cost of HAI to annually exceed $6.5 billion in 2004 dollars (Stone et al. 2005). In dealing with the potential human and financial costs caused by HAI it is generally recognised that an effective infection control and prevention programme is the best way to minimise these costs (Haley et al. 1985; Garner 1996; Herrick and Loos 1996; Huskins et al. 1998; Scheckler et al. 1998; Farr 2000; Dembrey and Hierholzer 2001; Gulland 2001; Starling 2001; Health Canada 2004).

The Study on the Efficacy of Nosocomial Infection Control (SENIC), conducted in the mid-1970s, was the first comprehensive, and considered seminal, study of the burden of HAI in the United States which also established an association between intensive infection control and surveillance programmes with reduced rates of HAI by 32% and subsequent healthcare costs (Haley et al. 1985). If an average HAI rate of 8% was present in the LMI countries of Asia and Africa, with the cost of an infection being between $50 USD and $500 USD, it is estimated that a 32% reduction in HAI could result in a saving of $230 million USD to $2.3 trillion USD annually (Nyamogoba and Obala 2002).

Since SENIC a number of other studies have reinforced the efficacy of infection control programmes in reducing HAI and associated costs. This has resulted in health authorities such as CDC, WHO and professional organizations such as the Society of Healthcare Epidemiology of America (SHEA), as aforementioned, to continually refer to infection control and prevention programmes and their activities as essential in the provision of safe healthcare (Garner 1996; Centers for Disease Control and Prevention 1998; Centers for Disease Control and Prevention and World Health Organization 1998; Scheckler et al. 1998; Mangram et al. 1999; Centers for Disease Control and Prevention 2001; Dembrey and Hierholzer 2001; Centers for Disease Control and Prevention 2002a, 2002b; World Health Organization 2002; Centers for Disease Control and Prevention 2003, 2004; Jackson et al. 2004; World Health Organization 2004). This has consequently encouraged health authorities worldwide to adopt and implement comparable programmes (Nettleman 1993; Leu 1995; Huskins et al. 1998).

4.3.2 Available infection control advice

The most prolific publisher of evidence based infection control guidelines has been the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the CDC (Dembrey and Hierholzer 2001). The guidelines produced by the CDC include topics such as isolation precautions (Garner 1996), hand hygiene (Centers for Disease Control and Prevention 2002a), oral health (Centers for Disease Control and Prevention 2003), protection of healthcare workers (Centers for Disease Control and Prevention and World Health Organization 1998; Centers for Disease Control and Prevention 2001), environmental hygiene (Sehulster et al. 2003) and prevention of various types of HAI (Mangram et al. 1999; Centers for Disease Control and Prevention 2002b, 2004). It is generally accepted that the guidelines produced by the CDC are designed for healthcare environments of the United States, to meet regulatory requirements (Simmons and Gross 2001). Though this may be the case, many other countries, rich and poor, as well as international health bodies such as the WHO, look to these guidelines and advice to develop their own programmes and guidelines. This has mainly been due to the evidence generated from the seminal SENIC study, as described earlier.

The WHO has produced a number of comprehensive infection prevention and control guidelines not only for healthcare settings but also for community health and specific infectious diseases (World Health Organization 2002, 2004). These guidelines are again

based on those produced by the CDC and evidence from high income countries. These guidelines address the needs for countries with limited resources to some extent but do not provide assistance on how to adapt them to the local environment. One document significantly different from these guidelines is the joint WHO and CDC Infection Control for Viral Haemorrhagic Fevers in the African Health Care Setting which has been specifically designed as emergency guidelines for resource limited healthcare settings in African countries during outbreaks of disease such as Ebola haemorrhagic fever (Centers for Disease Control and Prevention and World Health Organization 1998).

The International Federation of Infection Control (IFIC) has sought to assist LMI countries in particular by producing an infection control guideline to be used as a foundation for the development of local policies and procedures, focusing on the very basic evidence based principles of infection control and prevention. The document is used extensively in training workshops conducted by IFIC member societies and is considered a global guideline as it is free from social and cultural restraints of individual countries (International Federation of Infection Control 2003). However, there have been no studies that have examined how successful this advice is in the LMI country setting.

The WHO has also recognised the importance of contextually appropriate infection control guidelines, particularly for LMI countries. One example of this was the development of the WHO Regional Office for Africa (AFRO) Infection Control Toolkit which aims to provide evidence based infection control advice whilst recognising the resource, infrastructure and educational limitations present in African healthcare settings (Reid 2001). This toolkit recognises that the principles of infection control and prevention always remain the same; it is how they are implemented within the context of a particular healthcare environment which may differ. As with the IFIC guideline, there have been no studies that have examined how successful this advice is in the LMI country setting.

4.3.3 Implementation of advice and infection control programmes in low- and middle income countries

For those countries who have equivalent or similar resources to the United States implementing guidelines similar to that of the CDC or WHO does not appear to be a problem, however it has been reported in the literature that resource limited countries appear to have some difficulty implementing these guidelines in their settings (Nettleman 1993; Huskins et al. 1998; Lim 2001; Starling 2001; Raza et al. 2004).

It is generally recognised that the lower the economic status of a given population or nation, the greater the significance and impact of infectious diseases and HAI in mortality and decreased quality of life (Isturiz and Carbon 2000; Starling 2001; World Health Organization 2002; Rosenthal et al. 2003a; Yalcin 2003). Hence the importance of infection prevention and control programmes in LMI countries is evident. The available literature which examines infection control programmes in LMI countries consists predominantly of review papers or case study reports, focusing on the adoption or modelling of individual components of an infection control programme rather than the implementation of a comprehensive plan.

A number of successful model infection control programmes in LMI countries have been reported in the literature, but these programmes have been located at primarily academic or well funded urban facilities (Huskins et al. 1998). When reviewing the literature it is difficult to ascertain the economic situation of those facilities reporting their findings. Of the literature relevant to this review most papers were from four main regions: 1) South America (Ponce-de-Leon 1991; Lima et al. 1993; Berg et al. 1995; Orrett et al. 1998; Rosenthal et al. 2003a; Rosenthal et al. 2003b; Macias et al. 2004; Rosenthal et al. 2004; Lobo et al. 2005; Rosenthal et al. 2005); 2) Asia (Rhinehart et al. 1991; Leu 1995; Merchant et al. 1998; Lim 2001; Marjadi 2001; Kermode et al. 2005); 3) Africa (Bowen-Jones et al. 1990; Cronin et al. 1991; Foorder 1993; Jepsen et al. 1993; Foorder 1995; Issack 1999; McCarthy et al. 2000; Ansa et al. 2002; Eriksen et al. 2003); and 4) the Middle East (Khuri-Bulos et al. 1999; Askarian et al. 2005a; Askarian et al. 2005b; Memish et al. 2005). Arguably the most prolific publishing countries from this selection would generally be considered on the upper end of the LMI scale or even considered high income in some situations (World Bank 2004).

Most papers reported on the implementation of individual infection control programme components, not implementation of comprehensive advice. Approximately half of the above mentioned articles were reports of surveillance studies to measure the incidence, causes and consequences of HAI and potential prevention methods (Bowen-Jones et al. 1990; Jepsen et al. 1993; Lima et al. 1993; Berg et al. 1995; Merchant et al. 1998; Orrett et al. 1998; Khuri-Bulos et al. 1999; Eriksen et al. 2003; Rosenthal et al. 2003a; Rosenthal et al. 2003b; Macias et al. 2004; Rosenthal et al. 2004; Lobo et al. 2005; Rosenthal et al. 2005). A number of these utilised CDC guidelines (Garner et al. 1988; Mangram et al. 1999; Centers for Disease Control and Prevention 2002b; 2004) for case definitions and surveillance methodology without any alteration, for validity and ease of comparability with the United States National Nosocomial Infections Surveillance (NNIS) (Lima et al. 1993; Berg et al. 1995; Khuri-Bulos et al. 1999; Eriksen et al. 2003; Rosenthal et al. 2003a; Rosenthal et al. 2003b; Rosenthal et al. 2004; Rosenthal et al. 2005). In each of these studies there were no problems reported in applying the CDC advice on surveillance to the respective healthcare settings, though in comparison with the NNIS data, generally the LMI countries demonstrated higher rates of HAI (Berg et al. 1995; Khuri-Bulos et al. 1999; Rosenthal et al. 2003a; Rosenthal et al. 2004; Lobo et al. 2005). These studies did not provide substantive information as to: 1) what other infection control programme components were in place; 2) whether there were policies or practices in place for basic infection prevention; 3) the financial cost of implementing individual programme components; or 4) what available infection control advice they may have been based upon.

Perhaps one of the best reviews of infection control programme implementation and interventions, from available advice and guidelines, found through this literature review is a series conducted in Argentina (Rosenthal et al. 2003a; Rosenthal et al. 2003b; Rosenthal et al. 2004; Rosenthal et al. 2005). These studies examined the incidence of HAI in specific intensive care units (ICU) of Argentine hospitals before and after the implementation of globally accepted infection control and prevention interventions such as staff education, performance feedback and enhancement of compliance with hand hygiene, all key components of an infection control programme, but not indicative of a comprehensive programme. The studies demonstrated improvement in HAI rates post interventions in study facility ICUs, resulting in a decrease from 45.94 bloodstream infections (BSI)/1000 intravascular device (IVD) days to 11.10 BSI/1000 IVD days and

47.55 HAI/1000 bed days to 27.93 HAI/1000 bed days. It is important to note that the sites involved with the Argentine studies had infection control teams in place. These teams had received formal training in infectious disease control and prevention, were located in Buenos Aires with the ICUs operating at a tertiary care teaching level. This reflects the previous finding that most programmes and studies have been located at primarily academic or well funded urban facilities. Even so, through conducting these studies barriers to implementation of available advice were identified such as lack of resources, lack of organised infection control programmes, healthcare staff unaware of infection prevention methods and lack of institutional support (Rosenthal et al. 2003b; Rosenthal et al. 2005). Similar barriers to implementation of available infection control advice in LMI countries have been reported in the literature, as shall be described further.

4.3.4 Barriers to implementation of infection control advice in low- and middle income countries

It is well recognised that the principles of infection control remain the same regardless of the healthcare environment, yet how they are implemented depends on a number of factors (Nettleman 1993; Huskins et al. 1998; Raza et al. 2004). It has been indicated in a number of papers that the United States or high income experience of infection control is not applicable to resource limited countries (Nyamogoba and Obala 2002; Raza et al. 2004; Kermode et al. 2005).

> Unfortunately much of the Western experience is not applicable to developing countries owing to the high costs involved and local factors such as climate, socioeconomic and demographic conditions, antibiotic prescription habits and bacterial resistance patterns (Raza et al. 2004, p.295).

The report of an endeavour to implement an infection control programme based upon CDC infection control guidelines in an Indonesian paediatric ICU has also described a number of barriers in the attempt (Rhinehart et al. 1991), similar to those in the Argentine setting mentioned previously. It was found that literal adoption of CDC guidelines, as would occur in a high income country was impossible due to: 1) the poor physical environment such as absence of hand washing basins and presence of contaminated tap water; 2) budgetary constraints; 3) unreliable and inappropriate supply of equipment and supplies including reuse of single use items, poor storage of

reprocessed items and overuse of expensive disinfection agents; 4) limited microbiological diagnostic facilities; 5) lack of healthcare worker knowledge particularly regarding transmission risks associated with poor practice; 6) local customs and culture including the hierarchical relationship between physicians and nurses; 7) lack of institutional support from the hospital administration and infection control infrastructure; and 8) poor sterilisation capabilities (Rhinehart et al. 1991). Given this situation each CDC guideline was reviewed and adapted to the local circumstances in collaboration with hospital counterparts.

One of the very important lessons learnt from the Indonesian study was that LMI countries look to the United States and other high income countries for infection control advice, but this advice may not be directly applicable in the presence of resource limitations (Rhinehart et al. 1991). It was found and reported that the CDC guidelines were not suitable for resource limited settings, their populations, environments or cultures and that this needs to be taken into consideration in the future, going on to suggest that additional research must be made into exploring flexible assessment and delivery methods in LMI countries for infection control (Rhinehart et al. 1991). Methods to overcome the barriers identified from the review include ensuring that the available infection control advice is adapted to the local environment and context, making use of available resources and targeting interventions to those infectious diseases of local importance (Ponce-de-Leon 1991; Rhinehart et al. 1991; Raza et al. 2004). In achieving this local expertise must be utilised (Rhinehart et al. 1991; Raza et al. 2004).

> Only policies adapted to local conditions, ‘owned’ and practised by local experts and workers are likely to be sustainable (Raza et al. 2004, p.298).

The published literature indicates the barriers to using unadapted infection control advice are: most LMI countries do not have or have weak infection control programmes; infection control programmes are often unidirectional focusing only one or a few interventions such as surveillance or antibiotic usage; local studies and local expertise are not utilised in developing infection control programmes; resource allocation to the health sector and delivery system must be addressed; and human resources must also be developed (Mortensen 1991; Sobayo 1991; Nettleman 1993; Huskins et al. 1998; Starling 2001; Nyamogoba and Obala 2002). Other more physical

limitations to infection control include a lack of equipment and consumable items such as sharps containers, sterilisers, disinfectants, personal protective equipment (PPE), running water and electricity (Sobayo 1991; Nettleman 1993; Starling 2001). In addition to this other health priorities for LMI countries such as nutrition, high mother and infant mortality rates and community infectious disease outbreaks take precedence over HAI and their control (Meers 1988).

4.4 Discussion

An infection control programme is a collection of activities, policies and procedures designed to control and prevent the transmission of infectious diseases within the healthcare environment and the community (Farr 2000). This is achieved through monitoring infections and implementing control measures through education of patients, employees and visitors in the principles and practices of infection control and prevention. Essential components of an infection control programme include infection control policy and procedure development, surveillance, outbreak management, education, employee health, programme oversight, programme documentation (Herrick and Loos 1996; Health Canada 2004).

> The success or failure of the infection control program is defined by its effectiveness in achieving its goals (Scheckler et al. 1998, p.48).

An effective infection control programme can only be achieved when all essential elements are implemented in the context of a specific healthcare environment. Introducing and conducting individual components such as surveillance of HAI in an environment where basic infection control policies and practices are absent for patient and healthcare worker safety is inappropriate.

Quality studies of the comprehensive implementation of high income country-style infection control programmes are generally unavailable in the literature. One reason for this is that such reports are rarely published in English, particularly from Asian countries (Leu 1995; Starling 2001).

> The number of papers published in the international literature certainly does not reflect the level of infection control activities in developing countries. Language barriers and sometimes other simple obstacles may discourage infection control professionals from publishing their personal experiences (Starling 2001, p.465).

What are available though are reviews of the general issues related to implementing infection control programmes in LMI countries or reviews of individual component implementation, such as surveillance.

The study from Indonesia is perhaps the most comprehensive published review of the implementation of an all-inclusive infection control programme, based on original CDC guidelines which have now been updated, in a LMI country (Rhinehart et al. 1991). This project identified the key issues which prevent the unadapted adoption of high income country guidelines in the LMI setting, while establishing a strategy to transform them into contextually appropriate useful policies and procedures, as outlined in Table 1 (Rhinehart et al. 1991). This strategy could arguably be replicated in other settings.

Table 1: Strategy to adapt available guidelines to the LMI country context

1. Assess the existing situation through interviews, site visits and practice observation
2. Adopt a flexible approach to implement or reinvigorate infection control programmes
3. Institute a broadly representative infection control committee with strong leadership support
4. Appoint and train dedicated health care workers to become infection control professionals
5. Establish simple surveillance mechanisms where indicated, focusing on high risk areas
6. In collaboration with local health care workers, review and modify available guidance, such as that from CDC, to suit local conditions, practice and resources, using a low technology, low cost approach

Healthcare facilities in LMI countries which experience the previously mentioned barriers and capacity limitations are in no position to be able to implement the available infection control advice from the CDC, WHO or IFIC. From this it is evident that there does appear to be limitations for LMI countries to implement this advice. What is also evident is there is an opportunity for further research into this area, particularly in the form of studies of implementation of the available advice in the LMI country setting.

> Infection control in developing countries differs markedly from that in developed countries. It is important that both local and international authorities take these differences into account when formulating policies for use in developing countries (Raza et al. 2004, p.294).

4.5 Conclusion

Is the current infection control advice applicable in LMI countries? Does this advice help or hinder? What is evident from the literature is that there is a need for the development of infection control and prevention guidelines based on evidence but adapted to the specific needs of healthcare workers in LMI countries. This must be done in collaboration with those same LMI country healthcare workers. Equally due to finance and health priorities healthcare facilities should choose those interventions most relevant to the needs of their population and workers to prevent infection transmission.

Evidence based infection control and prevention guidelines and advice is readily available and their efficacy is well established through the successful implementation and monitoring of infection control programmes. The advice provided is however designed for healthcare environments the same as or similar to those in the United States and other high income countries.

This literature review has highlighted some of the capacity issues that LMI countries experience when implementing the available advice. The literature identifies resource limitations in LMI countries which make comprehensive implementation of available advice either difficult or near impossible. The resource limitations include not only those of a physical or monetary nature but are also in the form of health priorities and human resources.

> Additional research is needed to refine flexible methods for rapidly assessing the specific infection control needs of institutions with widely disparate resources, patient populations, environments and cultures (Rhinehart et al. 1991, p.S213).

This review has also highlighted the opportunity for further research on this topic. Available studies focus mainly upon the implementation of individual infection control programme components, such as surveillance rather than the comprehensive adoption of the available advice, whether designed for high income or LMI settings, and

measurement of the success of such endeavours. By examining such situations, lessons may be learnt on how to best adapt the advice to specific healthcare environments or create resource specific advice, assisting with ease of use in the LMI context**.**

Chapter Five

Publication II: Frameworks that assist adoption of infection prevention and control programmes. Does the literature exist?

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Introduction

This chapter consists of a manuscript accepted for publication. It is presented in a form unaltered from the version accepted for publication, apart from the numbered structure imposed as a result of this dissertation style of presentation. This chapter builds on the investigation and findings of Chapter Three and Chapter Four. The presentation of the chapter as a stand-alone article, and thus providing a more complete picture of the available body of knowledge, has resulted in some duplication of the presentation of information.

The article reports on the component of the overall study that reviewed literature to identify frameworks used to explain the adoption process of comprehensive infection prevention and control programmes (IPCP). In the article it has been identified there was an absence of reports in the literature which examined the adoption of a comprehensive IPCP whilst using a theoretical framework. The literature reviewed in this chapter provides evidence to support the case that the diffusion of innovation process in an organisation is relevant as a framework to examine the adoption of comprehensive IPCP in healthcare organisations.

Contribution of authors

This manuscript presents the results of a literature review conducted by P. Zimmerman under the supervision of H. Yeatman and M. Jones. The manuscript was written by P. Zimmerman, H. Yeatman and M. Jones.

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ABSTRACT

The importance of comprehensive infection prevention and control programmes (IPCP) to prevent healthcare associated infection is well reported in the literature. What is not as well reported are the conceptual frameworks that guide the adoption of these comprehensive programmes. By reporting the catalysts and processes associated with the successful adoption of IPCPs a template for successful programme implementation may be developed that will assist others in recognising such opportunities, thus allowing replication. This paper provides stimulus for such adoption and implementation.

A systematic review of the literature was undertaken to identify reports of comprehensive IPCP adoption and the conceptual frameworks used in the process. The review activity revealed an absence of relevant literature examining the adoption of comprehensive IPCP or associated conceptual frameworks. Only one study was published which demonstrated the Diffusion of Innovations framework, and it is discussed in more detail. The outcome of this literature review points to a clear need for more research into IPCP adoption. This is especially important as relevant literature would assist low resourced healthcare settings in their adoption of comprehensive IPCPs.

5.1 Background

Prevention and control of healthcare associated infections is an increasingly important element in the provision of health services globally (Informal Network on Infection Prevention and Control in Health Care 2009). It relates to not only protecting those accessing health services from the spread of infectious or pathogenic disease but also to protecting healthcare workers, their families, and other persons associated with health services. A locally adapted comprehensive infection prevention and control programme (IPCP) is imperative to the management of healthcare associated infections (Informal Network on Infection Prevention and Control in Health Care 2009).

An IPCP is a collection of activities, resources, policies and procedures designed to control and prevent the transmission of infectious diseases within the healthcare environment and the community (Farr 2000). Core components of an IPCP have been categorised by the World Health Organization (WHO) as:

- Organization of IPCP
- Technical guidelines
- Human resources
- Surveillance of infections and assessment of compliance with infection prevention and control practices
- Microbiology laboratory support
- Environmental minimum requirements
- Monitoring and evaluation of programmes
- Links with public health or other relevant services (Informal Network on Infection Prevention and Control in Health Care 2009).

IPCPs are a cluster of individual components which are closely inter-related. IPCPs in high-income countries have demonstrated effective control of infection transmission in healthcare settings (Haley et al. 1985; Informal Network on Infection Prevention and Control in Health Care 2009). Relative to the experience of high-income countries, low- and middle-income (LMI) countries have adopted IPCPs, or parts thereof, with varying degrees of success (Leu 1995; Huskins et al. 1998). Studies of the adoption of IPCP in LMI countries are generally unavailable in the literature. What are available are

reviews of the general issues related to adopting IPCP in LMI countries or reviews of individual components of adoption, such as surveillance. Of these reviews (Mortensen 1991; Sobayo 1991; Nettleman 1993; Huskins et al. 1998; Starling 2001; Nyamogoba and Obala 2002) the major problems identified are:

- most LMI countries have weak or absent IPCP,
- IPCP are often unidirectional focusing on only one or a few interventions such as antibiotic usage,
- local studies and local expertise are not utilised in developing an IPCP,
- appropriate and sufficient resource allocation to the health sector and delivery system is not addressed,
- human resources are not adequately developed to support IPCP adoption,
- there is a lack of equipment and consumable items such as sharps containers, sterilisers, disinfectants, PPE, running water and electricity.

To gain a greater understanding of the process of adoption of IPCPs requires exploration of the process itself, not just whether selected key components are in place. By reporting the catalysts and processes associated with the successful adoption of IPCPs, it may be possible to develop a template for successful programme implementation. This may assist others to recognise such opportunities, thus allowing replication.

The adoption of knowledge and technological innovations into clinical practice and the delivery of health services involve appropriate facilitation, such as the insight gained through the use of conceptual frameworks. A conceptual framework is a group of concepts or ideas that are broadly described and systematically organized to provide a focus, a rationale, and a tool for the integration and interpretation of information (Mosby 2009). It provides a frame within which to understand the process of transfer, transformation and adoption of policies and practices, such as those in an IPCP (Donaldson et al. 2004). The reporting of the conceptual frameworks utilised in adoption processes also assists translation into other clinical contexts (Donaldson et al. 2004).

The following review seeks to detect the conceptual frameworks that have been utilised in the adoption of comprehensive IPCPs, regardless of economic well-being, reported in the literature. The aim of this is to identify how adoption of comprehensive IPCPs can be facilitated in LMI country settings.

5.2 Methods: A systematic review of the literature

Literature was sought based on three parameters: 1) literature must be published in English; 2) available on MEDLINE, ERIC, CINAHL or Web of Science, and 3) no time limits were defined. The initial search terms were: infection control and adoption, infection control and implementation. The search was then extended to include additional search terms based on analysis of the first search yield. These search terms included: infection control/mt (methods), program implementation and program adoption. The search was not limited to studies from LMI countries. Other relevant articles were identified from the bibliographies of these papers. Articles which demonstrated a conceptual framework in the adoption or implementation of a comprehensive IPCP were then selected from this extended sample.

5.3 Results

5.3.1 Theoretical frameworks for IPCP adoption

The initial literature search found 101 articles that described the adoption or implementation of a comprehensive IPCP. Analysis of these found that 75 made no reference to any conceptual adoption framework. A further 15 did not have any relevance to hospital based IPCP though they demonstrated the use of an adoption framework. The remaining 11 articles demonstrated the application of a conceptual framework and relevance to aspects of a hospital based IPCP (Leu 1995; Pittet et al. 2000; Misset et al. 2004; Abbott et al. 2006; Vollman 2006; Hall et al. 2007; Harnage 2007; Larson et al. 2007; Muder et al. 2008; Farrell and Petrik 2009; Scales et al. 2011). However, only one paper reported a study that demonstrated a conceptual framework in the adoption of a comprehensive IPCP (Leu 1995). The absence of such studies therefore forced an examination of those studies that identified core IPCP components and their associated adoption frameworks, each with varying levels of success. Hence, all 11 articles were included for analysis in this study. Classification of these articles as

to the programme component and the framework identified within the article is presented in Table 1.

Table 1: Adoption studies of individual IPCP core components which demonstrate a theoretical framework.

Article	IPCP component	Framework
1. Introduction of an isolation policy in paediatric wards (Hall et al. 2007)	• Technical guidelines • Surveillance of infections and assessment of compliance with IPC practices	Change leadership (Kotter 1996)
2. Achieving zero catheter related blood stream infections: 15 months success in a community based medical center (Harnage 2007)	• Technical guidelines • Surveillance of infections and assessment of compliance with IPC practices • Monitoring and evaluation of programmes	The Model for Improvement (Langley 2009)
3. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene (Pittet et al. 2000)	• Technical guidelines • Surveillance of infections and assessment of compliance with IPC practices • Monitoring and evaluation of programmes	Behavioural theory (Kretzer and Larson 1998)
4. Implementation of an industrial systems-engineering approach to reduce the incidence of methicillin-resistant Staphylococcus aureus infection (Muder et al. 2008).	• Technical guidelines • Surveillance of infections and assessment of compliance with IPC practices • Monitoring and evaluation of programmes	Toyota Production System (Spear and Bowen 1999)
5. A Multifaceted Intervention for Quality Improvement in a Network of Intensive Care Units A Cluster Randomized Trial (Scales et al. 2011)	• Technical guidelines • Surveillance of infections and assessment of compliance with IPC practices	Continuous quality improvement

Article	IPCP component	Framework
	• Monitoring and evaluation of programmes	
6. A continuous quality-improvement program reduces nosocomial infection rates in the ICU (Misset et al. 2004)	• Technical guidelines • Surveillance of infections and assessment of compliance with IPC practices • Monitoring and evaluation of programmes	Continuous quality improvement
7. Ventilator-associated pneumonia and pressure ulcer prevention as targets for quality improvement in the ICU (Vollman 2006)	• Technical guidelines	Continuous quality improvement
8. Dissemination of the CDC's hand hygiene guideline and impact on infection rates (Larson et al. 2007)	• Monitoring and evaluation of programmes	Diffusion of Innovations
9. Infection control. The impact of US-style infection control programs in an Asian country (Leu 1995)	• All IPCP core components	Diffusion of Innovations
10. Adoption of a ventilator-associated pneumonia clinical practice guideline (Abbott et al. 2006)	• Technical guidelines • Surveillance of infections and assessment of compliance with IPC practices • Monitoring and evaluation of programmes	Diffusion of Innovations (Rogers 1995)
11. Hydration and nosocomial pneumonia: killing two birds with one stone (a toothbrush) (Farrell and Petrik 2009)	• Technical guidelines	Diffusion of Innovations – Champions (Higgins and Howell 1990)

A total of six frameworks were identified through the review of the literature: change leadership (Hall et al. 2007), the model for improvement (Harnage 2007), behavioural theory (Pittet et al. 2000), the Toyota production system (Muder et al. 2008) continuous

quality improvement (Misset et al. 2004; Vollman 2006; Scales et al. 2011) and Diffusion of Innovations (Leu 1995; Abbott et al. 2006; Larson et al. 2007; Farrell and Petrik 2009). Continuous quality improvement (n=3) and Diffusion of Innovations (n=4) were the frameworks more frequently identified.

In relation to the IPCP component that was the focus of the 11 reported interventions, the adoption of technical guidelines (n=9) was most frequently reported. This was followed by the adoption of surveillance of infections and assessment of compliance with IPC practices (n=7) and monitoring and evaluation of programmes (n=7) equally. In approximately half of the studies, the adoption of technical guidelines occurred with associated surveillance and monitoring and evaluation components (n=6).

Only one of the 11 studies examined the adoption of all the components of the WHO defined comprehensive IPCP (Leu 1995). This Taiwanese case described the gradual adoption of IPCP core components beginning in 1976 and continuing through to 1994; the paper was subsequently published in 1995. The author identified catalytic incidents, such as the local staff visiting healthcare facilities in the United States and an outbreak of salmonellosis, which identified the need for an IPCP, as well as a resolution to a gap in the provision of care. This was then addressed by seeking assistance from external sources, training of local staff and the establishment of multi-disciplinary infection control committees, targeted surveillance programmes and local infection control manuals suited to the needs of their healthcare environment. Eventually the programme was accepted by the Department of Health and became part of the routine administration and accreditation processes of health facilities in Taiwan (Leu 1995).

This one case report, in Taiwan, did not make direct reference to any conceptual framework, though it clearly followed the initiation and implementation stages of the Diffusion of Innovations process in organisations, as shall be discussed (Rogers 2003).

5.4 Discussion

From the results it is evident that there is an absence of literature that reports studies that have applied conceptual frameworks to describe and analyse the adoption of comprehensive IPCPs within healthcare settings. The frameworks which dominated the literature focused on continuous quality improvement and Diffusion of Innovations.

The only study which examined adoption of a comprehensive IPCP clearly demonstrated the Diffusion of Innovations stages, even though it did not overtly position the activities within this framework. As the aim of this review was to identify those studies in the literature which identified frameworks for the adoption of comprehensive IPCPs, the role of conceptual frameworks with particular reference to Diffusion of Innovations will be discussed further below. It is from this discussion that the stages of the Diffusion of Innovations framework can be recognised in the Taiwanese experience of comprehensive IPCP adoption.

5.4.1 Conceptual frameworks and IPCP

The successful use of conceptual frameworks to translate evidence into practice in various healthcare disciplines is well recognised in the literature (Donaldson et al. 2004; Sudsawad 2005; Biron et al. 2007; Danjoux et al. 2007; Gagnon et al. 2007; Kolok et al. 2009; Atun et al. 2010; Drolet and Lorenzi 2011). Unfortunately, this does not appear to be the case for the adoption of comprehensive IPCP, as it appears there has been essentially no method for capturing and sharing lessons learned from the process of adopting IPCPs. Consequently, the adoption of an IPCP may be an unplanned decision in healthcare organisations, occurring under independent circumstances. This has been similarly recognised in the adoption of surgical innovation (Martin et al. 2003; Danjoux et al. 2007).

The reporting of the experiences of IPCP adopters, particularly in LMI countries, could provide significant guidance to clinicians and administrators who aim to achieve such a programme (Donaldson et al. 2004; Danjoux et al. 2007). The importance of identifying the events and stimuli that influence the adoption of such an innovation is critical to other healthcare organisations' abilities to mirror the process (Donaldson et al. 2004).

5.4.2 Diffusion of Innovations and IPCP

Diffusion of Innovations research has produced a substantial body of literature with publications covering a range of academic disciplines including geography, education, economics and sociology (Mahajan and Peterson 1985). The concepts central to classical theory were first described in the 1930s by researchers studying the adoption of hybrid corn in farming. Whilst observing the process they noticed patterns of

communication and influence amongst the farmers (Lennarson Greer 1977). Since then Rogers has been responsible for most of the scholarly development of Diffusion of Innovations theory (Rogers 1962; Rogers and Shoemaker 1971; Rogers and Agarwala-Rogers 1976; Rogers 1983, 1995, 2003). Other scholars who have contributed to the development of the theory include Brown (1981), Downs and Mohr (1976) and Tornatzky and Fleischer (1990).

More recently a major review conducted by the United Kingdom Department of Health to explore the use of the Diffusion of Innovations framework in health service organisations has been reported (Greenhalgh et al. 2005).

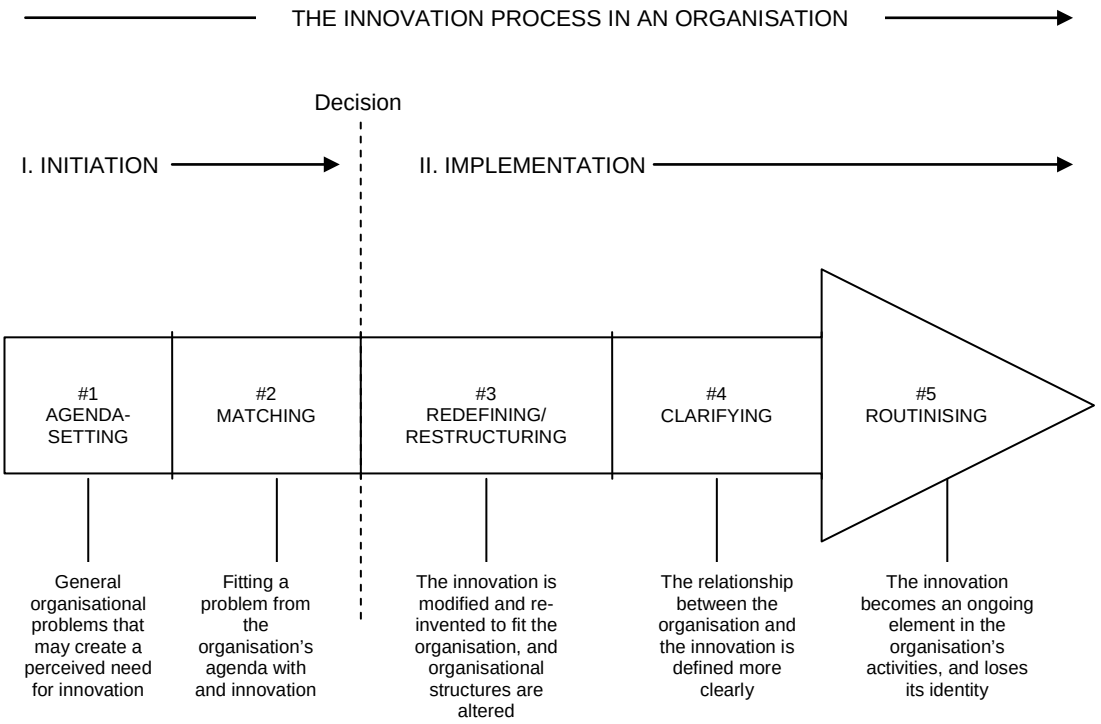
Classic Diffusion of Innovations theory describes "…the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 1983, p.5). In diffusion research studies, programmes or campaigns four key elements are consistently present: 1) an innovation; 2) communication channels; 3) time; and 4) a social system (Rogers 1962, 1983, 2003).

When examining the diffusion of an IPCP in a healthcare environment the innovation 1) would be the programme, the communication channels 2) are the means by which information and messages about IPCPs are shared, time 3) includes the rate of adoption, the innovation-decision process and the innovativeness of the individual or organisation and the social system 4) is the healthcare environment and infrastructure where the adoption is to take place.

It has been argued in the literature that classical Diffusion of Innovations theory is limited in its application to organisational adoption of innovations such as in the healthcare setting (Lennarson Greer 1977). It was generally accepted that classical theory was limited to explaining adoption of innovations by single individuals. After the first edition of "Diffusion of Innovations" was published, Rogers began exploring innovation in organisations, resulting in the development of a clear description of how the classic theory is applied to organisations (Rogers 1962; Rogers and Agarwala-Rogers 1976; Rogers 2003). Rogers suggests that the focus of research into innovation in organisations is upon the innovation process (Rogers 2003). This is achieved by investigation of the implementation process in an organisation using a staged model.

The process is a sequence of five stages, which are divided into two sub-processes. The length of time taken to move through these five stages can be significant (Rogers 2003). The model is illustrated in Figure 1.

Figure 1: Five stages in the innovation process in organisations



Initiation involves the information gathering, conceptualising, and the planning of adoption of the innovation leading up to the point where the decision is made to adopt the innovation. As described in the Taiwanese case, this can be through identifying gaps in the IPCP and then sourcing and developing resolutions to the problems (Leu 1995). The implementation is all the events, actions and decisions which are involved to put the innovation to use. What is important in this sub-process is involvement of local staff and the adaption of the innovation to fit the needs of the local healthcare environment, through consultation and the use of key staff, as described by (Leu 1995). The decision to adopt (the dotted line in Figure 1) is the event that divides initiation from implementation. This contextual nature and dependence on local information and involvement is also recognised in other studies of the innovation adoption process in healthcare organisations (Greenhalgh et al. 2005).

There is an argument that using the staged model of research is limiting, as many innovations are complex and may originate from within the organisation and the process may not conveniently fit into stages (Wolfe 1994). It has therefore been suggested that investigating the innovation process in a more meaningful manner would include not only examining stages but also sequences, divergent and parallel paths, feedback and feed-forward cycles in the process (Wolfe 1994; Greenhalgh et al. 2005). The literature as it stands, specific to the adoption of comprehensive IPCPs, is unable to illuminate this further, though the successful utilisation of the Diffusion of Innovations framework in other health service disciplines is well recognised (Greenhalgh et al. 2005).

The use of a conceptual framework, such as Diffusion of Innovations provides a valuable template for healthcare providers to adopt comprehensive IPCPs. Case reports of the experience of the adoption of IPCPs particularly in LMI countries would help managers in other like settings to be able to identify the stages in the innovation process in an organisation. Such reports would give clear examples as to what type of events or performance gaps could be exploited to stimulate agenda-setting and matching. Case reports could assist to identify potential barriers that may prevent the decision to adopt from occurring and also how to circumvent these hurdles. Examples of how an IPCP can be redefined to suit the needs of the clinicians and the organisation, and how best to involve them to routinise practice in health service delivery would be invaluable. Learning from the experience of others paves the way for ease in the adoption of any innovation including comprehensive IPCPs. What is needed is the opportunity to learn from more published case reports.

5.5 Conclusion

There is a lack of literature which examines the conceptual frameworks of comprehensive IPCP adoption regardless of the economic wealth of a healthcare setting. Guidance as to how to identify and take advantage of opportunities to adopt and successfully sustain a programme is important, particularly for low- and middle-income countries. The Diffusion of Innovations theory provides an example of a useful framework to assist LMI countries to match their programme deficits to the IPCP innovation, make it their own and integrate it into their routine healthcare delivery and administration. Further research is needed to explore and report the experience of the

adoption of comprehensive IPCP in low- and middle-income countries and other frameworks which may assist with understanding these processes.

Conflicts of interest

There are no conflicts of interest arising from any financial or personal relationships with other people or organisations that could bias this work. There is no relevant commercial interest, funding or sponsorship.

Chapter Six

Publication III: SARS and Kiribati: Eyes wide open.

Publication status: Accepted for publication (Appendix 5)

International Journal of Infection Control

Permission granted for reproduction (Appendix 6)

Publication details:

Zimmerman, P., Yeatman, H., Jones, M. and Murdoch, H. 2012, SARS and Kiribati: Eyes wide open, *International Journal of Infection Control* 8(1), pp.27-34.

Introduction

This chapter consists of a manuscript accepted for publication. It is presented in a form unaltered from the version accepted for publication, apart from the numbered structure imposed as a result of this dissertation style of presentation.

The article explores the adoption process of the infection prevention and control programme (IPCP) in the Republic of Kiribati. It reports on, and discusses, the findings of the IPCP document analysis and interviews with key informants to the adoption process.

This article provides evidence that the Diffusion of Innovation process in an organisation is a relevant framework within which to explore and understand the adoption of the IPCP in the Republic of Kiribati.

Contribution of authors

This manuscript presents the results of documentation analysis and interviews conducted by P. Zimmerman under the supervision of H. Yeatman and M. Jones. The manuscript was written by P. Zimmerman, H. Yeatman, M. Jones and H. Murdoch.

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SUMMARY

A comprehensive infection prevention and control programme (IPCP) is designed to control and prevent the transmission of infectious diseases within the healthcare environment and the community. Understanding how an IPCP is introduced within a health system can inform actions to encourage their adoption in other locations. This paper explores the adoption stages of an IPCP in a specific case situation of SARS.

Data sources and analysis included: 1) Chronological and thematic analysis of IPCP documentation and assessments performed by local staff and external agencies/consultants; and 2) semi-structured interviews with local key informants and external agencies (using snow-ball sampling) with thematic analysis. Analysis was informed by Everett Rogers' (2003) Diffusion of Innovations for Organisations framework.

The two key activities of the organisational innovation process were identified. These were: initiation and implementation. The initiation activity included: 1) *agenda-setting:* preparations for severe acute respiratory syndrome (SARS) in 2003 stimulated the identification of organisational IPCP deficits; and 2) *matching:* deficits were identified and the decision to adopt an IPCP innovation package was made. Implementation included: a) *redefining/restructuring:* identification of the components of an IPCP and how they best fit within the local health structure; b) *clarifying*: integration of IPCP into the health services and defining an infection control role within the nursing division and; c) *routinising:* the IPCP became an ongoing element in health service delivery.

The adoption of the IPCP followed the classic Diffusion of Innovations Process for Organisations. The case study described serves as an example of IPCP adoption model in other low- and middle-income healthcare settings and suggests ways to utilise opportunities as they present.

Keywords

Infection control, Diffusion of Innovations, adoption framework, low- and middle-income countries

6.1 Background

An IPCP is a collection of activities, resources, policies and procedures designed to control and prevent the transmission of infectious diseases within the healthcare environment and the community (Farr 2000).

6.1.1 The Republic of Kiribati

The Republic of Kiribati is a central western Pacific country of 33 atolls and reef islands in three main island groups, the Gilbert, Phoenix and Line Islands. Kiribati has a total land mass of 811 square kilometres spread over 3.5 million kilometres of ocean. It has a population of approximately 100 000 and an annual population growth rate of 1.7%. The most populated islands are South Tarawa, North Tarawa and Kiritimati Island with urban growth rates of 5.2%, 4.8% and 8% respectively (World Health Organization 2010). Compared to most other Pacific islanders, I-Kiribati have a short life expectancy with 65 years for males and 70 years for females (World Health Organization 2010).

The health system of Kiribati is publicly funded with government spending $13.45 million USD in 2008, primarily on curative services, pharmaceuticals and staffing (World Health Organization 2010). Significant technical and financial assistance is provided to the Ministry of Health by development partners (World Health Organization 2008). The formal health system is administered by the central Ministry of Health. Traditional healers provide a parallel service offering local medicines, massage, antenatal, childbirth and postnatal care. Most people use both services though there is no coordination between them. Primary health care is provided through a network of 92 health centres and dispensaries. Basic hospital services are available at South Tarawa (Betio), Kiritimati Island and North Tabiteuea. Secondary care is provided by the national referral hospital in South Tarawa. Patients requiring tertiary care services may be referred overseas for treatment if they meet the criteria defined by the Ministry of Health.

Environmental factors such as overcrowding of urban areas, particularly in South Tarawa, are increasing the risk of transmission of infectious disease. Other factors such as poor water quality, inadequate water supply, inconsistent personal hygiene practices, poor sanitation, food handling and storage practices contribute to communicable disease

transmission. The incidence of tuberculosis per 100 000 population in Kiribati is now the second highest in the Pacific (World Health Organization 2009b). The Western Pacific Regional Office of WHO reports 365/100 000 population in Kiribati compared with 108/100 000 population in the region (World Health Organization 2009b). In Kiribati, 70% of reported TB cases are found in Betio, South Tarawa (World Health Organization 2010). In 2005, diarrhoeal disease and respiratory infections were the leading causes of morbidity amongst adults and mortality amongst children (World Health Organization 2008). The WHO has found that data suggest non-communicable disease incidence is increasing, making the severity of communicable diseases potentially worse for individuals with chronic disease processes. In addition, poor community knowledge regarding infection prevention practices is likely to be reflected in poor staff practices within healthcare settings.

6.2 Methods

To gain an understanding of the process of adoption of IPCPs requires exploration of the process itself, not just whether programme components are in place. To assist in understanding this process, an examination of the evolution of the IPCP in the Republic of Kiribati was conducted. As this was an exploration of how an IPCP, as a group of activities and components, had been adopted over time, it was examined through the Diffusion of Innovations framework (Rogers 2003).

Data which assist in the investigation of the innovation process in an organisation include the recollections of key participants in the process, written documentation of the organisation about the adoption decision and process and other data sources (Rogers 2003).

With the co-operation and permission of the Ministry of Health of the Republic of Kiribati, collaboration was established with the Infection Control Principal Nursing Officer (ICPNO). In consultation with the ICPNO, a review of relevant infection control documentation was performed and a series of seven interviews were conducted with key stakeholders in the IPCP.

6.2.1 IPCP documentation analysis

A chronological and thematic analysis of Republic of Kiribati IPCP documentation (for example: infection control manuals and Infection Control Committee minutes) was undertaken. This analysis was supplemented with further analysis of the findings and recommendations of IPCP assessments as performed by Republic of Kiribati staff and external agencies/consultants. The analysis was guided by the key elements and stages of the innovation process in organisations (Rogers 2003). The document review was conducted by the researcher while in Kiribati. Analysis of these documents was performed to provide a descriptive timeline of the process of IPCP adoption in Kiribati. The data were cross referenced against available reports and recommendations of external agencies/consultants to determine whether changes had occurred after the provision of technical guidance. This served to identify the stages of the innovation process.

6.2.2 Interviews

Interviews were conducted with available key stakeholders in the Ministry of Health, infection prevention and control personnel, senior nursing, medical and laboratory staff. There were no refusals to participate from the stakeholders approached. From these interviews a snow-balling technique was used to identify other key stakeholders who had been involved in the development of the Kiribati IPCP and interviews were sought with these individuals (Minichello et al. 2000). Each stakeholder was interviewed individually. The interviews were semi-structured following an interview schedule. Interviews were audio-recorded and transcribed by the researcher. The interviews averaged 40 minutes in length. Data were subjected to thematic analysis.

Piloting of the interview schedule for comprehension and language suitability was conducted with an infection prevention and control professional from a similarly resourced IPCP in the Pacific. Written consent for the interviews was sought and received from all interview participants in accordance with the requirements of the University of Wollongong Human Research Ethics Committee.

6.2.3 Thematic analysis

All data were subjected to thematic analysis "…as a means of re-organising the data according to conceptual themes recognised by the researcher" (Minichello et al. 2000, p.255).

Thematic analysis involved the search for and identification of common themes throughout the document reviews and interviews (Morse and Field 1996). This involved reading, overviewing, and annotating the text prior to systematic coding (O'Leary 2005). The data were explored for words that were used, concepts discussed, linguistic devices utilised and non-verbal cues identified by the researcher during the interview process (O'Leary 2005). To explore word-related themes the text was systematically searched to find all instances of a particular word or phrase, making note of its context or meaning (O'Leary 2005). Livescribe hardware and NVivo9 software were used in the collection and organisation of data for analysis (Livescribe Inc. 2009; QSR International 2010).

Concepts that were primarily used to explore the innovation process were the four components of the Diffusion of Innovations theory: the innovation, communication channels, time and the social system (Rogers 2003). Other concepts and themes that emerged from the data in addition to these components were equally analysed.

By investigating and analysing the phenomena in this way it was expected that information would be gathered to identify the five stages of the innovation decision process as well as the sequences, divergent and parallel paths, feedback and feed forward cycles in the process (Wolfe 1994; Rogers 2003).

6.4 Results

The IPCP documentation provided chronological and thematic information covering the period: 2000 to 2010. Documents analysed during the review process included: reports from external agencies, Infection Control Committee minutes, programme documentation, internal review reports, staff health records, education records, minutes of other communicable disease committees, strategic plans, implementation plans and guidelines. This information provided the chronological framework to identify the significant events which informed the adoption process.

The interviews (n=7) provided further identification of key points in the innovation process and personal insights into the other events and actions of individuals, which were not identifiable from the documentation. Table 1 provides a summary of the key events and results that shaped the current IPCP in Kiribati.

Table 1: Factors contributing to the development of the Kiribati IPCP

Year	Activities/events	Findings/results
Pre 2003	• Persistent organic pollutants (POPS) review	• Absence of Infection Control Committee or personnel
2003	• SARS Rapid Preparedness assessment • SARS taskforce establishment and activities	• Limited infection control awareness and practice • Absence of an infection control programme
2004	• Senior nurse recognises need for an IPCP	• Need for a comprehensive IPCP identified
2005	• Proposal made to donor for assistance to develop IPCP • Short term consultant (STC) visits • Limitations assessment of the health services performed by senior nursing staff • Provision of resources, mentoring to ICC and ICPNO • Further recommendations made by STCs to expand the scope of the IPCP	STC - outcomes of visit: • Train the trainer workshop for senior nursing officers • Nursing based infection control committee established • Infection control manual written by staff • Training of other health care staff • IEC development • Infection Control Principal Nursing Officer (ICPNO) role established • IPCP action plan developed • Internal risk assessment and audit • Occupational exposure management programme established
2006	• Multi-disciplinary ICC directing national practices	• Work plan implemented • Recognition of the IPCP by Hospital

	established • Annual IPCP work plan • Surveillance plan • Hepatitis B vaccination programme proposed	Management Committee
2007	• Annual review of work plan • Expansion of ICPNO role • Education programme reviewed	• Hepatitis B vaccination programme implemented • New education programme developed and implemented
2008	• Annual review of education programme and work plan • Ministry of Health Clinical Service Plan included IPCP activities for first time • Infection control manual reviewed • Occupational exposure surveillance data regularly reported at ICC and senior management meetings	• Hand hygiene initiatives developed • Targeting of education to specific healthcare workers
2009	• H1N1 preparedness activities • Annual review of IPCP • Syndromic surveillance activities • Direct reporting of surveillance activities to the Ministry of Health	• Development and distribution of hand hygiene and occupational exposure IEC to all health facilities • Further targeting of education • H1N1 vaccination completed
2010	• Baseline survey of infection control practices • Waste management and cleaning plans reviewed • Surveillance plan to include	• Action plans developed and implemented based on survey and review findings • Water quality testing implemented based on surveillance findings

	surgical site infections	• HIV specialist medical officer permanently attached to occupational exposure management programme

6.4.1 Pre 2003-2005

The documentation review found no reference to any IPCP activities prior to 2003. In 2003, the world experienced the Severe Acute Respiratory Syndrome (SARS) outbreak, which was focused in the Asia Pacific region. This resulted in a SARS Task force being established in Kiribati, preparedness training for health staff and an assessment of public health and infection control preparedness being conducted, as detailed in Table 1. All interview participants noted SARS as a significant event in the adoption of the IPCP. One interview participant provides a clear example of this.

> *P2: "It especially started with the SARS …there was not even a programme of infection control at that time."*

There was no documentary evidence available for 2004, yet interview participants identified this was the year that a comprehensive IPCP was first conceptualised by a senior nursing officer.

> *P3: "Okay – actually there was one nurse,* [name withheld], *I think she did her Masters in* [overseas country], *and then she came back with the idea of creating this* [IPCP] *programme. … I think that's the first, ... 2004."*

All interview participants identified 2005 as the year the IPCP came into being. This was supported by a number of IPCP documents. After a proposal was made to a donor organisation, assistance was provided in the form of a short term consultant (STC) in May of that year. Six of the seven interviewees identified this as a significant event. A number of activities stemmed from the involvement from the STC as detailed in Table 1. The events of 2005 ultimately resulted in the beginnings of a comprehensive IPCP. This included the establishment of an Infection Control Committee at the facility level.

6.4.2 2006-2009

In 2006 the ICC became multi-disciplinary and took on a national role in guiding practice with the IPCP progressively being implemented in all levels of healthcare. This

included education, occupational exposure management and hand hygiene initiatives. These initiatives consisted of IEC materials, training sessions and the introduction of alcohol based hand hygiene products provided by donor organisations. The hand hygiene initiatives were based on resources provided by the STCs and the WHO.

One of the most significant events between 2006 and 2009 was the establishment of a programme to vaccinate health care workers for hepatitis B as part of the occupational exposure management initiative. In 2006 a proposal for the vaccination of health care workers for hepatitis B was developed in consultation with the WHO and UNICEF.

> *P3: "The end of 2006 they proposed for the more vaccines for hepatitis for health care workers, and then early May 2007 we started off."*

In 2007 the hepatitis B vaccination programme for health care workers was introduced. This incorporated immune status testing of staff prior to vaccination for hepatitis B which was able to be performed in country**.** This programme was administered and operationalised by the ICPNO who assumed the role of the occupational exposure co-ordinator.

6.4.3 2009-present

During this period it was recognised there was a need to identify separate funding for alcohol based hand rubs and not to rely on donor organisations. Syndromic surveillance of communicable disease and water availability was added to the IPCP and direct reporting was established with the Ministry of Health.

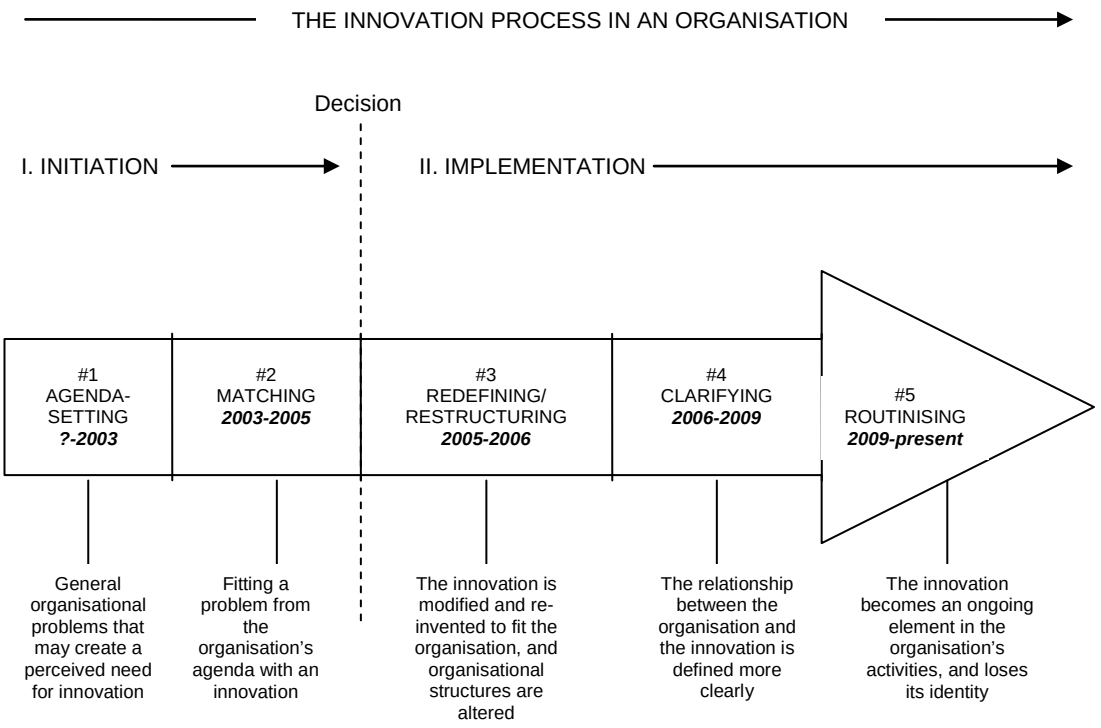
6.5 Discussion

The value of reporting the evolution of an IPCP in a low- and middle income country (LMI) is to identify a model that can explain how it came to be. By identifying such a model this can then serve to assist similar health environments to exploit opportunities which may present themselves. In the case of Kiribati this opportunity was created by SARS.

Based on the outcomes of the interviews and documentation analysis it is clear there was a staged progression of the IPCP. The Diffusion of Innovations framework is thus relevant to how the IPCP was adopted in the Republic of Kiribati, as shall be discussed.

The IPCP adoption in Kiribati included sequences and response to stimulus from external and internal sources, consistent with Rogers' staged process of initiation and implementation, as shall be discussed and illustrated in Figure 1 (Tornatzky and Fleischer 1990; Wolfe 1994; Rogers 2003).

Figure 1: Five stages in the innovation process in the Kiribati healthcare organisation.



Initiation of the IPCP involved both agenda-setting and matching. In Kiribati this agenda-setting stage appears to have occurred in the years up to and including 2003. It is in this stage that the identification and prioritisation of needs and problems occurs resulting in the search within the organisation for innovativeness to meet these problems (Rogers 2003). Innovations result not from a single incident, though a shock, such as SARS, can provide the opportunity to address an already known performance gap and initiate the innovation process. Normally this would occur through a sequence of events which culminate in a force for change (Schroeder 1986).

The matching stage within the Kiribati case study emerges in a sequence of events after the shock of SARS in 2003 and up to and including 2005. This resulted in a decision to rectify the infection control performance gap with the IPCP innovation. Successfully matching the problem to the innovation is essential to its success and sustainability, particularly within healthcare organisations (Goodman and Steckler 1989). It is at the point, after the matching has occurred, that the decision to proceed with the innovation occurs and the implementation sub-process can begin.

Implementation of an innovation is considered by Rogers to involve three stages: redefining/restructuring, clarifying and routinising. The year 2005 was when the implementation sub-process began in Kiribati. Through the facilitation of a STC the IPCP was adapted and changed to suit the needs of the organisation. Structural changes were also made to the organisation through the introduction of an Infection Control Committee and an ICPNO. This demonstrated a feedback and feed-forward cycle that encouraged active participation of individuals in the organisation. Through the remainder of 2005 and 2006, redefining/restructuring continued. One example was the change in membership of the Infection Control Committee to be more representative of the key stakeholders in the IPCP and to adopt a more nationally directed role.

Between 2006 and 2009 the Kiribati healthcare organisation utilised the IPCP to review and establish education programmes, develop quality indicators to assess compliance with the programme and provide specialist consultation and advice. The information gained from these reviews assisted in clarifying the programme and its direction. In addition, the Infection Control Committee was expanded during this stage. Its membership, from the various healthcare disciplines, became champions of the IPCP and they played a significant role in achieving acceptance of the programme.

In this Kiribati case study, participation of health care workers in the innovation process was evident and acted to routinise and thus sustain the innovation in the Kiribati health care environment. Regular IPCP activities included the assessment of compliance amongst healthcare workers through the quality indicators and continual review process. The feedback from these assessments continued to inform the programme and assisted in its routinisation in the organisation. From 2009 until the present, the activities of the IPCP continue and are accepted as part of the delivery of healthcare in Kiribati. It has

now become part of the continuous quality improvement process, a fixture of the education programme, and a source of advice and information.

6.6 Limitations of the study

The information to support the premise that the Kiribati IPCP followed a Diffusion of Innovations framework was limited by the availability of documentation and interview participants. Prior to 2005 there is no documentary evidence of the absence or presence of an IPCP and thus information is purely dependant on the recollections of the interview participants. The researcher, though known by the organisation, is not I-Kiribati which may have had an effect on the desire to disclose by the interviewees.

6.7 Conclusion

The sequence of events and activities in the Kiribati case study clearly follows the stages of the Innovation Process in Organisations model and provides an opportunity for lessons to be learnt (Rogers 2003). *Set the agenda*: Healthcare workers and administrators should exploit the opportunities that external stimuli such as shocks to the health care system can provide, in order to introduce an IPCP; *Match the solution to the problem*: Use the resources available both within and external to the healthcare system to find a suitable solution and move the innovation ahead. *Make the solution and the environment fit each other*: Involve key people and healthcare workers themselves to make the IPCP applicable and unique to their healthcare environment. *Let the relationship evolve*: Seek input and feedback through open communication, audits and marketing of the innovation to administrators and healthcare workers. Identify champions within the health system who can assist in its integration. Provide practical ways to demonstrate how the innovation benefits the healthcare worker and the patient. *Let it become routine*: Incorporate the IPCP into the day to day work of the healthcare worker so that it becomes an integral part of health service delivery.

This case highlights the usefulness of considering the adoption of an IPCP in a healthcare organisation through the lens of a theoretical framework such as the Diffusion of Innovations model. Practical insights were gained that can serve as an IPCP adoption model in similar healthcare settings.

Acknowledgements

The authors acknowledge and thank the Ministry of Health of Kiribati and its staff for their permission and assistance in conducting this research.

Author declaration

We the authors declare that we have seen and agreed to the submitted version of SARS and Kiribati: Eyes wide open and that; all who were included in the acknowledgments section, or as providers of personal communications, have agreed to those inclusions; and that the material is original, unpublished an has not been submitted elsewhere.

There are no conflicts of interest arising from any financial or personal relationships with other people or organisations that could bias this work. There is no relevant commercial interest, funding or sponsorship.

A short synopsis of the results used in this paper was presented at the International Conference on Prevention and Infection Control 29 June to 2nd July 2011 Geneva, Switzerland.

Ethical approval was provided by the Ministry of Health, Republic of Kiribati (Dr Revite Kiriton) and the University of Wollongong Human Research Ethics Committee HE09/386.

Chapter Seven

Publication IV: Evaluating infection control in the Republic of Kiribati

Publication status: Accepted for publication (see Appendix 7)
American Journal of Infection Control

Publication details: Zimmerman, P., Yeatman, H., Jones, M. and Murdoch, H.

Introduction

This chapter consists of a manuscript accepted for publication. It is presented in a form unaltered from the version accepted for publication, apart from the numbered structure imposed as a result of this dissertation style of presentation.

The article reports on the evaluation of the IPCP in the Republic of Kiribati. It reports and discusses the findings of the IPCP evaluation (Supplement 1) and healthcare worker survey (Appendix 2).

This component of the study identifies evidence of the routinisation of the IPCP in the Republic of Kiribati, the final stage of the Diffusion of Innovation process in an organisation.

Contribution of authors

This manuscript presents the results of an IPCP evaluation and healthcare worker survey conducted by P. Zimmerman under the supervision of H. Yeatman and M. Jones. The manuscript was written by P. Zimmerman, H. Yeatman, M. Jones and H. Murdoch.

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ABSTRACT

Background

This study reviews the status of the comprehensive infection prevention and control programme (IPCP) established in the Republic of Kiribati in 2005. It identifies opportunities to continue and expand the integration of the IPCP into health service delivery.

Methods

The review was conducted in 2010 using two empirical tools: 1) A pilot infection prevention and control programme evaluation (IPCPE) tool that evaluated the activities of the programme and its implementation; and 2) a previously validated self-administered survey assessed healthcare worker knowledge, application and confidence in infection control principles and practice. The survey was directed to all 186 clinicians at Tungaru Central Hospital (response rate of 59.7%).

Results

The Kiribati IPCP demonstrated a minimum level of compliance (75%) with the activity standards set out in the IPCPE. The mean scores achieved in the healthcare worker survey were: 1) knowledge 62%; 2) application 63%; and 3) confidence 79%. Significant correlations were found between knowledge, application and confidence.

Conclusions

This evaluation of the Kiribati IPCP provides valuable insight into the status of a recently adopted comprehensive programme and how it has translated into the knowledge, application and confidence of healthcare workers in their clinical practice. The healthcare worker survey provides evidence that the IPCP has translated into confidence and ability in applying infection prevention practices.

7.1 Background

The significance and impact of infectious diseases and healthcare associated infection (HAI) on mortality and quality of life increase as the economic status of a given population or nation decreases (Isturiz and Carbon 2000; Starling 2001; World Health Organization 2002; Rosenthal et al. 2003a; Yalcin 2003). The capacities of healthcare facilities in most low- and middle- income (LMI) countries also are affected by a number of factors. Health services are commonly the focus of cost cutting (Huskins et al. 1998). Socioeconomic situations will impact on the quality of health care, including infection prevention and control. Healthcare capacity is commonly influenced by infrastructure, training of health care workers, patient knowledge and purchasing power of individuals (Isturiz and Carbon 2000).

In 2005, the Ministry of Health of the Republic of Kiribati made inroads into establishing a comprehensive infection prevention and control programme (IPCP) after gaps had been identified during the SARS outbreak of 2003 (Pittman and Zimmerman 2003). Since 2005, the IPCP has been adopted and integrated into standard health service delivery throughout the country. This study explores the status of the current IPCP and verifies its adoption into the Kiribati healthcare services. It develops and tests a set of tools that can be adopted by other researchers and practitioners to ensure IPCP development in LMI settings achieves maximum effectiveness. The tools also guide operators towards optimum remedial design when design flaws are identified.

The Republic of Kiribati

The Republic of Kiribati is a central western pacific country with a population of approximately 100 000 and an annual population growth rate of 1.7%. The health system of Kiribati is publicly funded with government spending $13.45 million USD in 2008 (World Health Organization 2010), and with significant technical and financial assistance from development partners (World Health Organization 2008). Basic hospital services are available together with secondary care provided by a 130 bed national referral hospital. The healthcare workforce is made up of both locally and internationally trained individuals. Infection prevention and control principles and practices are taught during formal training of healthcare workers, pre and post commencement of employment as part of the IPCP.

7.2 Methods

This study explores the status of the current IPCP, based on the World Health Organization (WHO) core components (Informal Network on Infection Prevention and Control in Health Care 2009). A pilot study using an IPCP evaluation tool was conducted, together with a survey of healthcare worker knowledge, application and confidence of infection control principles. Both tools used in this study are available upon request.

With the co-operation and permission of the Ministry of Health of the Republic of Kiribati and in accordance with the requirements of the University of Wollongong Human Research Ethics Committee, the study was conducted in collaboration with the Infection Control Committee in Kiribati.

The study was conducted at the Tungaru Central Hospital. All clinical staff employed in Kiribati rotate through this facility to provide consistency and currency of education and practice and to maintain a level of quality assurance in the country's clinical standards.

7.2.1 IPCP evaluation

Audit and evaluation of IPCPs and their associated activities is a well recognised data collection method in the field of infection prevention and control (Hay 2006; Bryce et al. 2007)

Audit or evaluation tools reported in the literature to be rigorous and validated through various research methods focus on specific infection prevention and control activities, for example hand hygiene and antibiotic stewardship (Pittet et al. 2000; Saizy-Callaert et al. 2003). Two validated IPCP audit or evaluation instruments were considered relevant to the low- and middle-income (LMI) country setting, though each had some limitations. The Infection Control Nurses Association's (ICNA), *Audit tools for monitoring infection control standards* (Infection Control Nurses Association 2004) is a set of validated tools (Millward et al. 1993, 1995) which has been used extensively by the National Health System (NHS) of the United Kingdom for the standardised monitoring of clinical practice and the healthcare environment.

The second instrument, the *Nosocomial Infection Program Rapid Evaluation Guide*, was produced by the Pan American Health Organization/Regional Office of the WHO (PAHO) for use in LMI countries (Pan American Health Organization 2005). Testing of this tool has not been reported, though it was considered suitable as it was created from, and based upon, the recommendations from the WHO and thus should be considered as having a high degree of inherent face and content validity (Chelenyane and Endacott 2006; Wu et al. 2008).

Each of these tools had specific but complementary deficits, so they were combined to create a new evaluation document, the IPCP evaluation (IPCPE), which was suitable for assessment of comprehensive IPCP in LMI countries.

The IPCPE was based primarily on the PAHO tool, which divided the evaluation into seven specific areas for examination: 1) *Organisation*; 2) *Epidemiological surveillance of infections*; 3) *Microbiology*; 4) *Intervention strategies*; 5) *Sterilisation and high-level disinfection*; 6) *Personnel health*; and 7) *Hospital environment and sanitation*. Specific aspects of the ICNA tool were included into the Areas of *Intervention strategies*, *Personnel health* and *Hospital environment and sanitation* to provide details and observational opportunities for clinical infection prevention and control practice.

Experts in infection prevention and control who have experience in LMI country healthcare settings and a regional expert from Fiji (also an LMI country) confirmed the validity of the IPCPE instrument. A pilot of the IPCPE was conducted in person by the authors in Kiribati. The IPCPE was developed to collect information on a number of aspects that the WHO identified should be included as core components in an IPCP (Informal Network on Infection Prevention and Control in Health Care 2009).

The study location, Tungaru Central Hospital (TCH), provides the national population with general surgery, general medicine, obstetrics, special care nursery, paediatrics, and tuberculosis services. The IPCPE took nine hours to conduct over three days.

Evaluation of the raw data collected by the IPCPE created a compliance score in seven areas of IPCP implementation. Scores were derived by aggregating the ‘yes’ answers and dividing by the total number of questions answered (including all yes and no

answers), excluding those that were not applicable. These scores were normalised into percentage scores, which indicated level of compliance with the IPCPE standards. To produce an overall programme score, the scores for each area were aggregated then divided by the number of areas assessed, providing an overall evaluation percentage. The categories of score were: compliant (85% or above); partial (84 to 76%); and minimal 75% or below. The ICPNO assisting with the evaluation provided further insight into the specifics of the setting. These details are included in the results.

7.2.2 Healthcare worker survey

Evaluation of the knowledge and delivery of safe infection prevention and control practices of the healthcare workers (Bryce et al. 2007) assists to identify deficits in the education component of the programme and provides data on the effectiveness of IPCP adoption in the clinical setting.

A previously implemented and validated survey instrument used to determine Taiwanese nursing students' knowledge, application and confidence with standard and additional precautions of IPCP was used (Wu et al. 2008). The validity of the tool and its internal consistency for the knowledge and confidence scales had been established (Wu et al. 2008). The application scale had not been validated, though the authors maintained, that items based upon recommendations of organisations such as WHO have a high degree of inherent validity.

Minor modifications were made to the selected instrument to make it more applicable to the Kiribati environment and population. The knowledge section contained fifteen items, eleven yes or no questions and four multiple choice questions. The application and confidence sections had twelve and eight yes or no questions respectively which were based on three scenarios related to the care of patients with a suspected diagnosis of an infectious disease. Prior to use in Kiribati, the questionnaire was piloted and feedback received for internal consistency with a representative group of clinicians in Fiji.

A total of 186 healthcare worker surveys were issued to nurses, medical officers, medical aides, oral health and laboratory staff. One hundred and eleven completed surveys were returned, a response rate of 59.7%.

Data were analysed using SPSS v18.0 (Pearson Education 2009). Raw scores were collated and presented as percentages. The scores for each question were of an equal weighting. Pearson correlation coefficients were applied to examine the demographics, including clinical experience and infection control training, in relation to each outcome variable such as knowledge, application and confidence with infection control principles and practice, to identify significant relationships. These data were not presumed to be categorical; in the real world they are not precise measurements. Thus correlation analyses were considered to provide insights into indicative relationships. The significance of the tests was set as $p < 0.05$, 2-tailed.

7.3 Results

7.3.1 Infection Prevention and Control Programme Evaluation

The IPCPE was conducted examining seven key areas of an IPCP. The results for each of the seven areas reviewed as part of the IPCPE are shown in Table 1. The area *Organisation* and *Sterilisation and high-level disinfection* achieved the highest levels of compliance. Half of the areas reached a partial level of compliance and two received a minimal compliance level. Details of the compliance results are provided below.

Table 1: Infection prevention and control programme evaluation scores

Area	***Percentage compliance***	***Compliance level***
1. Organisation	100%	Compliant
2. Epidemiological surveillance of infections	35.3%	Minimal
3. Microbiology	83.3%	Partial
4. Intervention strategies	76.3%	Partial
5. Sterilisation and high-level disinfection	87.5%	Compliant
6. Personnel health	78.6%	Partial
7. Hospital environment and sanitation	60.9%	Minimal
Overall score	75.0%	Minimal

Compliant

The area of *Organisation* was compliant as the programme was established in 2005 and since then has been well integrated into health service delivery through leadership involvement and a strong education programme both in undergraduate and post-basic training for healthcare workers. The area of *Sterilisation and high-level disinfection* was also found to be compliant, even in the presence of the resource limitations of the equipment and the environment.

Partial

The area of *Microbiology* achieved partial compliance due to the unavailability of diagnostic tools to identify healthcare associated infection agents and their antimicrobial susceptibility patterns. *Personnel health* was identified as an integral area of the programme with hepatitis B vaccination of staff continuing to be promoted, though it had not reached the 80% target identified in the tool. A rubella vaccination programme for susceptible women was also not in place though a childhood programme was active.

Intervention strategies are important areas of the evaluation. The best performing components of this area were compliance with evidence-based clinical practices and infection control guidelines and evaluation of these practices. The worst performing was hand hygiene compliance.

Minimal

The areas which received a minimal compliance assessment, were *Epidemiological surveillance of infections* and *Hospital environment and sanitation*. Lack of compliance for *Epidemiological surveillance of infections* was directly related to issues identified in the *Microbiology* area, the inability to identify healthcare associated infection agents and their susceptibility patterns.

Hospital environment and sanitation was found to be of minimal compliance primarily due to the physical limitations of the environment and climate in Kiribati. The basic general structural conditions of the facility were found to be difficult to maintain and improvement was dependant upon input of capital and financial assistance from donor organisations. Cleaning of patient care equipment was an area in need of improvement, as was safe waste disposal on removal from the facility. Sharps safety and disposal was

however found to be exceptional in this area and as an independent standard reached full compliance 87.5%.

7.3.2 Healthcare Worker Survey

Demographic data

The ages of participants ranged from 21-69 years, with a mean of 35.43 (SD 10.228). The majority of the participants (75.68%) were female nurses with varying levels of experience. Almost nine in ten participants (88.9%) reported having some clinical experience with infectious diseases. Some participants, 38 (35.2%), reporting they had received some form of post-basic infection control training and the majority of these, 30 (78.95%), spent between one hour and two days undertaking this training. A more comprehensive breakdown of this demographic data is shown in Table 2.

Table 2: Demographic information relating to participants

Demographic	*n*	**%**
Sex		
Male	16	14.4
Female	95	85.6
Designation		
Registered nurse	74	66.7
New graduate registered nurse	15	13.5
Senior nursing officer	6	5.4
Medical officer	4	3.6
Laboratory staff	12	10.8
Years worked since basic training		
0-4 years	34	31.5
4-8 years	17	15.7
8-12 years	20	18.5
12 years and greater	37	34.3
Clinical infectious diseases experience		
No	12	11.1
Yes	96	88.9

Post-basic infection control training		
No	70	64.8
Yes	38	35.2
Time spent on post-basic infection control training		
No training	69	64.5
1-4 hours	11	10.3
4-8 hours	6	5.6
1-2 days	13	12.1
2 days - 1 week	0	0
1-2 weeks	7	6.5
2-4 weeks	1	0.9

Knowledge of infection prevention and control

Of a possible score of 15 in the knowledge section the results ranged from 0-13, with a mean knowledge score of 9.23 (SD 1.896). Over 77% of the participants had a score between 8 and 11. The items that were answered correctly most frequently related to standard precautions such as the safe disposal of sharps (100%), use of personal protective equipment to prevent body fluid exposures (98.2%) and use of barriers to protect non-intact healthcare worker skin (96.1%). The items that were answered most incorrectly related to additional precautions, particularly how droplet pathogens are transmitted (23.5%) and how to prevent transmission of droplet and airborne organisms (31.1%). Overall knowledge of standard precautions was demonstrably better than that of additional precautions. There was no correlation established between knowledge scores and demographic variables (Table 3).

Table 3: Correlations between demographics and outcome variables

Variable	*Knowledge*	*Application*	*Confidence*
Age	0.001	0.087	0.047
Gender	-0.060	0.019	0.204*
Clinical infectious disease experience	0.052	-0.043	-0.356**
Post-basic infection control training	-0.016	0.012	-0.142

* Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

Application of infection control precautions

The application section of the survey tool had a possible score of 12, with the results ranging from 0-11, with a mean application score of 7.54 (SD 2.194). Just over 74% of participants had a score between 7 and 10. For standard precautions the highest scores were for glove use (96.2%) and hand hygiene (85.7%). Additional precautions were also well recognised in caring for a patient with scabies with contact precautions applied (91.5%) and contact and airborne precautions applied for a patient with possible pandemic influenza or SARS (96.2%). The most frequently incorrect item was related to a patient under airborne and contact precaution wearing a duckbill mask all the time, with 59% of participants indicating they would ask the patient to do so. There was no correlation established between application scores and demographic variables (Table 3). Pearson correlation analysis did, however, reveal a significant relationship between knowledge and application abilities as shown in Table 4.

Confidence in infection control precautions

The confidence section of the tool had a possible score of eight, with participants' responses ranging from 0-8. The mean score was 6.34 (SD 1.956) with just over 79% of participants scoring between 6 and 8. The items of least confidence were the participants' ability to educate the radiographer on additional precautions and only 38% felt that the radiographer had an invalid reason to not approach a patient with suspected influenza. High levels of confidence were displayed in educating patients and family members (96.2%) and in their ability to apply infection control practices in the clinical setting (93.3%).

Correlation between participants' gender and clinical infectious disease experience and their confidence to apply infection control in the clinical setting was demonstrated (Table 3). Pearson correlation analysis revealed a significant relationship between knowledge, application and confidence in applying infection control precautions as shown in Table 4.

Table 4: Relationship between variable of knowledge, application and confidence

	Knowledge	*Application*	*Confidence*
Knowledge	-	.241*	.283**
Application	.241*	-	.569**
Confidence	.283**	.569**	-

* Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

7.4 Discussion

The aim of this IPCP review was to evaluate its adoption into the Kiribati healthcare environment through a descriptive assessment of the Kiribati IPCP as it stood in 2010. It provides an assessment of the programme itself and how this has translated into the knowledge, practice and confidence of healthcare workers within the system. Though the relationship between the programme evaluation results and the survey scores cannot be statistically correlated, it is possible to discuss how the presence and performance of components of the IPCP influence health care workers knowledge of, and application and confidence in, incorporating infection control principles in practice.

7.4.1 Barriers to achieving compliance

To achieve a rating of 'compliant' within the IPCPE tool, a score of at least 85% must be reached in any given area. The IPCPE identified the areas of *Organisation* and *Sterilisation and high-level disinfection* as being compliant. Both of these areas have been previously reported in the literature (Mortensen 1991; Sobayo 1991; Nettleman 1993; Huskins et al. 1998; Starling 2001; Nyamogoba and Obala 2002) as being deficient in LMI countries due to a number of factors. The results of both the IPCPE and the survey show that the Kiribati IPCP has overcome such issues to some extent. However, these tools were not designed to explore how this occurred. Other research into the Kiribati IPCP has demonstrated that these impediments have been overcome by: 1) adapting the IPCP to the local environment and context; 2) making use of available resources; 3) involving end users and key stakeholders; 4) identifying and utilising infection control champions or opinion leaders; and 5) targeting interventions to those infectious diseases of local importance (Zimmerman et al. 2012). The Kiribati findings are similarly demonstrated in other LMI country settings (Ponce-de-Leon 1991; Rhinehart et al. 1991; Raza et al. 2004).

The areas of the IPCPE that received a minimal compliance score were those of *Epidemiological surveillance of infections* and *Hospital environment and sanitation*. Neither of these areas could be said to be directly related to any of the survey's results but are more related to the human resource and physical limitations of the environment, which is a well recognised concern in LMI countries (Rhinehart et al. 1991; Huskins et al. 1998; Isturiz and Carbon 2000; Raza et al. 2004).

The results of the evaluation, in conjunction with the findings of the survey, indicate that there has been a measurable integration and adoption of the IPCP into the Kiribati healthcare environment. However, compliance was minimal with a score of 75%. The results of the IPCPE identified there are opportunities to improve the effectiveness of the IPCP in Kiribati and subsequently will be used to improve compliance of the overall IPCP.

7.4.2 Knowledge, application and confidence

Within the area of *Organisation* of the IPCPE is a component for education. The Kiribati IPCP provides training at both the undergraduate and post-basic healthcare worker training level. Healthcare worker training and knowledge, particularly of blood borne pathogen infectious disease risk, transmission routes and prevention methods has been identified in the literature as essential to the success of an IPCP, particularly in translating this knowledge into practice (Rhinehart et al. 1991; Raza et al. 2004; Kermode et al. 2005).

Although their knowledge relating to standard precautions was better than additional precautions, the participants of the survey demonstrated the confidence and ability to apply both. This result begs the question as to why these participants were confident and able to apply these precautions, given the survey's finding that there is a lack of knowledge. This issue could be researched further.

Of the participants, two-thirds (64.5%) reported that they had received no post-basic infection control training. This indicates that there appears to have been adequate training for most participants at an undergraduate level. However, outcome scores could be improved if enhanced post-basic training were provided to clinicians and added to

what is already included in the IPCP (Rhinehart et al. 1991; Sagoe-Moses et al. 2001; Rosenthal et al. 2003b; Kermode et al. 2005).

Statistically significant correlations were demonstrated between knowledge, application and confidence, which imply that the education component of the programme has an impact upon clinicians' abilities to apply their knowledge and be confident in doing so. This has implications for the IPCPE area of *Intervention strategies*, which received a score of partial compliance; there may be a need to improve the post-basic training of clinicians. The other areas that received partial compliance were *Microbiology* and *Personnel health*. This was likely to be largely due to resource availability, both human and financial.

7.5 Limitations

This is a case study of an individual situation. The findings of this study cannot be generalised to other LMI country situations, though lessons learnt may be valuable. While the relationship between the programme evaluation results and the survey scores cannot be statistically correlated, they may be used together to authenticate the educational component of the programme.

Recommendations for future research include the testing of both the IPCPE and the survey tool in other settings and other populations to increase the ability to generalise the findings. It may also be useful to examine the use of written scenarios for evaluation of healthcare worker knowledge and application of infection prevention and control principles, as they do not provide visual cues that a clinician may use in practice.

7.6 Conclusion

This evaluation of the Kiribati IPCP provides valuable insight into the status of a newly adopted comprehensive programme and how it has translated into the knowledge, application and confidence of healthcare workers in their clinical practice. Kiribati appears to have demonstrated a concentrated effort to adopt infection prevention and control activities that together create a comprehensive IPCP with at least minimal compliance achieved. The healthcare worker survey provides evidence that the IPCP has translated into confidence and ability in applying infection prevention practices, though knowledge could be improved. The programme evaluation and healthcare

worker survey together identify opportunities where expansion and improvement can be made.

The areas of *Microbiology*, *Personnel health* and *Hospital environment and sanitation* are largely impacted by barriers such as environmental, financial and human resource limitations and have been identified in the literature for other LMI countries. The strength of the *Organisation* of the IPCP appears to be able to assist this though it may require additional involvement of healthcare leaders and administration to progress.

Intervention strategies and *Epidemiological surveillance of infections* are areas that can be improved through strengthening the education of healthcare workers and adopting surveillance activities such as practice observation, environmental audits and promotion of evidence-based clinical guidelines. In addition to this, the IPCPE that was developed as part of this study and the associated survey provide a baseline measure for the Kiribati IPCP and have identified areas in need of improvement. These tools can be used in the future to track the progress of the adoption of the programme.

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Chapter Eight

Publication V: Diffusion of Innovations: A case study of infection prevention and control programme (IPCP) adoption

Publication status: Under review (see Appendix 8).

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Introduction

This chapter consists of a manuscript submitted for publication. It is presented in a form unaltered from the version accepted for publication, apart from the numbered structure imposed as a result of this dissertation style of presentation.

The article presents a discussion of the role of the Diffusion of Innovations process in organisations using the Republic of Kiribati as a case study to illustrate how it can be used as a model in adopting comprehensive IPCP. It is concluded that the Diffusion of Innovations process in organisations framework can assist in the adoption of comprehensive IPCP, particularly in LMI healthcare organisations.

Contribution of authors

This manuscript presents a discussion of the results of the overall study of the adoption of a comprehensive IPCP in the Republic of Kiribati conducted by P. Zimmerman under the supervision of H. Yeatman and M. Jones. The manuscript was written by P. Zimmerman, H. Yeatman, M. Jones and H. Murdoch.

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ABSTRACT

Objective: To explore the role of the Diffusion of Innovations framework in adopting infection prevention and control programmes (IPCP) in low- and middle income (LMI) countries.

Data Sources/Study Setting: The study was set in the healthcare environment of the Republic of Kiribati.

Study Design: Case study methodology was used to examine and contextualise the analysis of the Republic of Kiribati's adoption of the IPCP from 2003-2010. Multiple sources of data were incorporated in the project.

Data Collection/Extraction Methods: Data were collected from multiple sources including semi-structured interviews, IPCP documentation, programme evaluation and healthcare worker survey. Data were subjected to thematic analysis and descriptive statistics where relevant to the study design.

Principal Findings: The progression of activities and stimuli has resulted in the adoption of a comprehensive IPCP in the Republic of Kiribati. The process follows the staged model of the classic Diffusion of Innovations process in organisations described by Everett Rogers.

Conclusions: This case study provides an illustration of how a comprehensive IPCP can be adopted in a LMI country setting with little involvement from external agencies. In examining the Kiribati case key stimuli, opportunities and activities have been identified which could be similarly adopted and implemented by other LMI countries in adopting or improving an IPCP.

Keywords:
Infection control, Diffusion of Innovations

8.1 Background

Prevention and control of healthcare associated infections (HAI) is an increasingly important element in the provision of health services globally. It relates to not only protecting those accessing health services from the spread of infectious or pathogenic disease but also protecting healthcare workers, their families, and other persons associated with health services.

At present, resources and expertise in the prevention and control of HAI in low- and middle income (LMI) countries is minimal. Most LMI countries are struggling with this issue. Often they lack (or have minimal) infection control guidelines, infrastructure, policy directives or persons responsible for establishing, implementing and monitoring infection control programmes.

An infection prevention and control programme (IPCP) is a collection or cluster of activities, resources, policies and procedures designed to control and prevent the transmission of infectious diseases within the healthcare environment and the community (Farr 2000). The core components of an IPCP are individual but inter-related, collectively comprising a specific innovation package. Core components of an IPCP have been categorised by the World Health Organization (WHO) as:

- Organisation of IPCP
- Technical guidelines
- Human resources
- Surveillance of infections and assessment of compliance with infection prevention and control practices
- Microbiology laboratory support
- Environmental minimum requirements
- Monitoring and evaluation of programmes
- Links with public health or other relevant services (Informal Network on Infection Prevention and Control in Health Care 2009).

The efficacy of infection control programmes in reducing the incidence of HAI has been well established in the literature, particularly in developed or high-income countries

(Haley et al. 1985; Hospital Infections Program 1992). These infection control programmes are informed by evidence based guidelines and advice developed by internationally recognised health authorities such as the United States Centers for Disease Control and Prevention (CDC) and the WHO.

Based on such advice many countries, including resource limited or LMI countries, attempt to establish infection control programmes, with varying degrees of success (Nettleman 1993; Leu 1995; Huskins et al. 1998). From the experience of the first author it appears that the standards set by these guidelines and advice are unachievable due to resource limitations, lack of engagement of healthcare workers and health authorities, lack of expertise, and institutional and priority competition.

The Republic of Kiribati appears to be an exception to these general findings and experience. In 2003, the first author visited Kiribati during a SARS rapid preparedness assessment of infection prevention and control capacity. The assessment found limited infection prevention and control programming and activities. Kiribati was visited again in 2005 to review infection prevention and control capacity. This 2005 review found evidence of significant improvements in the overall programme, increased activities and what appeared to be genuine enthusiasm for infection prevention and control. A progressive adoption of infection prevention and control activities was evident and it appeared that a comprehensive programme would result. The extent of these changes was not typical to other LMI countries in the region.

8.2 The Republic of Kiribati

The Republic of Kiribati is a central western pacific country of 33 atolls and reef islands in three main island groups, the Gilbert, Phoenix and Line Islands. Kiribati has a total land mass of 811 square kilometres spread over 3.5 million kilometres of ocean. It has a population of approximately 100 000 and an annual population growth rate of 1.7%. The most populated islands are South Tarawa, North Tarawa and Kiritimati Island with urban growth rates of 5.2%, 4.8% and 8% respectively (World Health Organization 2010). Compared to most other Pacific islanders, I-Kiribati have a short life expectancy with 65 years for males and 70 years for females (World Health Organization 2010).

The health system of Kiribati is publicly funded with government spending $13.45 million USD in 2008, primarily on curative services, pharmaceuticals and staffing (World Health Organization 2010). Significant technical and financial assistance is provided to the Ministry of Health by development partners (World Health Organization 2008). The formal health system is administered by the central Ministry of Health. Traditional healers provide a parallel service offering local medicines, massage, antenatal, childbirth and postnatal care. Most people use both services though there is no coordination between them. Primary health care is provided through a network of 92 health centres and dispensaries. Basic hospital services are available at South Tarawa (Betio), Kiritimati Island and North Tabiteuea. Secondary care is provided by the 130 bed national referral hospital, Tungaru Central Hospital in South Tarawa. Acute care services include surgery, obstetrics, paediatrics, internal medicine, special care nursery and tuberculosis treatment. Patients requiring tertiary care services may be referred overseas for treatment if they meet the criteria defined by the Ministry of Health.

The healthcare workforce is made up of both locally and internationally trained individuals. The chain of command is hierarchical, with a top down approach to decision making, though evidence of collaboration and co-operation is evident in the structure and activities of various committees, particularly the Infection Control Committee. Senior staff and directors are seen as the decision-makers within the system as they hold positions of influence based upon their skills, experience and expertise.

8.3 The study: Exploration of the Kiribati case

The ‘atypical’ case of Kiribati raises many questions, primarily: ‘How and why did it change?’, ‘What has been the process of change?’ and ‘Could other countries in the region benefit from the Kiribati experience?’ These, and many other questions, warranted further exploration.

Exploring and identifying the process of successful IPCP adoption is important to assist other countries in their adoption and implementation of IPCPs. This is particularly salient where LMI countries are relying on guidance established for use in well resourced settings, which often provides them with a poor practical fit (Zimmerman 2007). To gain a greater understanding of this process of adoption requires exploration

of the key elements and stages of the process itself, not just whether selected key components are in place.

One tool which is appropriate for conducting an exploration of these key elements and stages in the Classic Diffusion of Innovations theory. Classic Diffusion of Innovations theory describes "…the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers 2003, p.5). Diffusion of Innovations theory has its roots firmly embedded in agriculture and geography. The concepts central to classical theory were first described in the 1930s by researchers studying the adoption of hybrid corn in farming. Whilst observing the process they noticed patterns of communication and influence amongst farmers (Lennarson Greer 1977). Since then Everett Rogers has been primarily responsible for the scholarly development of Diffusion of Innovations theory (Rogers 1962; Rogers and Shoemaker 1971; Rogers and Agarwala-Rogers 1976; Rogers 1983, 2003). Other scholars who have contributed significantly to the development of the theory include Brown (1981), Downs and Mohr (1976) and Tornatzky and Fleischer (1990).

The classic Diffusion of Innovations theory as it relates to organisations provides a framework through which the adoption of IPCPs can be examined. In every diffusion research study, programme or campaign, four key elements are always present: 1) an innovation; 2) communication channels; 3) time; and 4) a social system (Rogers 1962, 1983, 2003). These elements inform the process, whether for an individual or for an organisation. It is from this perspective that the Kiribati IPCP adoption process shall be explored.

When examining the diffusion of an IPCP in a healthcare environment the innovation 1) would be the programme. The communication channels 2) are the means by which information and messages about IPCPs are shared. Time 3) includes the rate of adoption, the innovation-decision process and the innovativeness of the individual or organisation. The social system 4) is the healthcare environment and infrastructure where the adoption is to take place. Together, these four elements work to create an environment and context where the new innovation (the IPCP) is established and embedded, and conditions emerge which encourage an organic evolution of the innovation to more directly solve the targeted organisation problems, in this case the

prevention of HAI . This organic evolution follows a staged adoption process in an organisation, such as the Kiribati healthcare organisation. The stages are: 1) agenda-setting; 2) matching; 3) redefining/restructuring; 4) clarifying; and 5) routinising (Rogers 2003). The process is not entirely linear and is responsive to the four key elements previously mentioned.

To discuss the role of Diffusion of Innovations in IPCP adoption, a case study of the Republic of Kiribati was developed, identifying the four key elements of the process, but more importantly exploring and discussing the stages of the innovation process in the Kiribati healthcare organisation. The specific methodology and findings of the Kiribati study have been reported elsewhere (Zimmerman et al. 2011; Zimmerman et al. Accepted 29 Sep 2011; Submitted 14 Dec 2011 American Journal of Infection Control). This paper discusses the Kiribati case specifically in relation to the Diffusion of Innovations process in the healthcare organisation.

8.4 Methods

In order to understand the IPCP adoption process in a LMI country setting, a case study of the Kiribati IPCP was undertaken in 2010. A single case study approach was chosen for this project as it facilitated the exploration, within a specific context, of the adoption of an IPCP. This study seeks to explore the contemporary phenomenon within its real-life context (Yin 2003). The case study method calls for a triangulating process using multiple sources of evidence, both qualitative and quantitative to explore the research questions to enhance rigour (Stake 1995; Yin 2003). Triangulation in this study was achieved through the analysis of multiple sources of data which are each causally separate and have been reported as such elsewhere (Zimmerman et al. 2011; Zimmerman et al. Accepted 29 Sep 2011; Submitted 14 Dec 2011 American Journal of Infection Control).

8.4.1 Documenting the adoption of IPCP in Kiribati

To document the adoption of the IPCP in Kiribati an investigation strategy comprising four components was used: 1) Evaluation of current IPCP status in Kiribati using a pilot evaluation tool with thematic analysis of findings and recommendations – to identify the current infection prevention and control activities and how they correspond with the core components of a comprehensive programme; 2) Survey of healthcare worker

knowledge, application and confidence with infection prevention and control principles and practice using a previously validated self-administered tool – to identify strengths or deficits in the education component of the programme; 3) Chronological and thematic analysis of Republic of Kiribati IPCP documentation (e.g. infection control manuals, infection control committee minutes) and findings and recommendations of IPCP assessments performed by Republic of Kiribati staff and external agencies/consultants to explore the key elements of the diffusion of innovation process; 4) Semi-structured interviews with key informants in the Republic of Kiribati and external agencies (using snow-ball sampling) to explore the key elements of the diffusion of innovation process.

These data sources provide evidence of the four key elements and illustrate the five stages of the adoption process in an organisation. More specifically the interviews and the documentation analysis explore the communication channels, social system, the time it took the innovation to be adopted and the five stages of the adoption process in the organisation. The healthcare worker survey and the evaluation of the IPCP more specifically, provide information on the innovation itself as well as providing evidence of the clarification and routinising stages of the adoption process.

The healthcare worker survey assessed the knowledge, application and confidence of staff with infection prevention and control principles and practice using a previously validated self-administered tool (Wu et al. 2008). This was performed to identify strengths and deficits in the education component of the programme.

Evaluation of the current IPCP status in Kiribati was achieved using a pilot evaluation tool, the Infection Prevention and Control Programme Evaluation (IPCPE). This was performed to identify the current IPCP activities and how they correspond with the core components of a comprehensive programme.

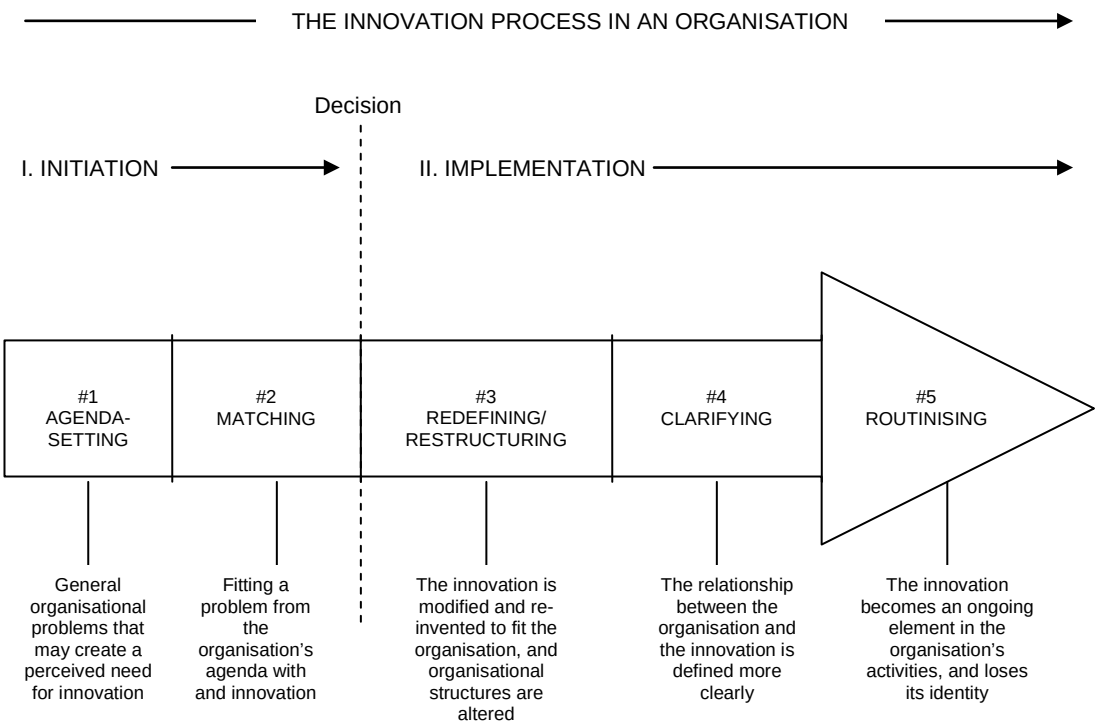
Using the case study method to explore the innovation process in the Kiribati healthcare setting provides an opportunity to analyse and critique the applicability of the diffusion of innovation process for adoption into other healthcare settings. To this end the results of the study are discussed together, highlighting the stages of the process, providing a narrative of the organic evolution of the IPCP in the Republic of Kiribati.

8.5 Discussion of the findings

8.5.1 Diffusion of Innovations in organisations

It has been argued in the literature that classical Diffusion of Innovations theory is limited in its application to organisational adoption of innovations (Lennarson Greer 1977). It was generally accepted that classical theory was limited to explaining adoption of innovations by single individuals. After the first edition of "Diffusion of Innovations" (Rogers 1962) was published, Everett Rogers began exploring innovation in organisations, resulting in the development of a clear description of how the classic theory is applied to organisations (Rogers and Agarwala-Rogers 1976; Rogers 2003). Rogers suggests that the focus of research into innovation in organisations is on the innovation process itself. This is achieved by using a staged model. The process specific to organisations is a sequence of five stages, which are divided into two sub-processes: 1) initiation; and 2) implementation. The model is illustrated in Figure 1.

Figure 1: Five stages in the innovation process in organisations (Rogers 2003)



The initiation sub-process involves the information gathering, conceptualising and the planning of adoption of the innovation leading up to the point where the decision is made to adopt the innovation. The implementation sub-process comprises all the events, actions and decisions which are involved to put the innovation to use. The decision to adopt, the dotted line, is the event that divides initiation from implementation (Rogers 2003).

Other researchers have added to this model, examining sequences in the innovation process, divergent and parallel paths, and feedback and feed forward cycles (Tornatzky and Fleischer 1990; Wolfe 1994). The IPCP adoption in Kiribati appears to have included sequences in response to stimulus from external and internal sources, yet followed Rogers' clearly staged process, as shall be explored further below (Rogers 2003).

8.6 Evolution of the Kiribati programme

The interviews and documentation analysis were essential for the identification of the stages of the IPCP adoption process. The results from these data sources reveal the chronological picture of the process, commencing in 2003 and continuing to the present day. There is no evidence prior to 2003 of any existence of a comprehensive IPCP apart from the occasional individual activity which identified the lack of a programme. These events and stimuli are chronologically summarised in Table 1.

Table 1: Summary of activities in Kiribati IPCP adoption process

Year	Key event/stimuli
2003	• SARS preparation identified lack of infection control awareness and programme • exposure to external infection control consultants
2004	• Senior nursing staff identifies need for IPCP, after completing a Masters of Nursing in New Zealand
2005	• External assistance sought by senior nursing staff and provided to introduce an IPCP in collaboration with local staff • needs assessment performed • local nurse lead infection control committee (ICC) and infection control nurse role established

	• infection control guidelines, resources and training developed and disseminated • occupational exposure management plan developed and implemented
2006	• ICC becomes multi-disciplinary with national role, IPCP annual work plan developed • surveillance plan implemented • staff hepatitis B vaccination proposed
2007	• education programmes reviewed and improved • hepatitis B vaccination programme implemented
2008	• IPCP activities included in quality indicators for health • reporting of occupational exposure data at ICC and senior management forums • hand hygiene initiatives developed and implemented
2009	• H1N1 influenza preparation activities coordinated and actioned by IPCP in collaboration with Public Health • direct reporting of surveillance activities to Ministry of Health
2010	• baseline survey of infection control practices, waste management and environmental hygiene conducted with action plans developed and implemented

From this chronology, identification of the stages of the innovation process in the Kiribati healthcare organisation can be performed and shall be discussed. This serves to illustrate the impetus to begin and persist with the adoption of an IPCP for other LMI country settings.

Initiation:

Agenda-Setting

The agenda-setting stage provides the motivation for initiating the innovation process. This stage may go on for some time, perhaps years. In the case of Kiribati this stage appears to have occurred in the years up to and including 2003. It is in this stage that the identification and prioritisation of needs and problems occurs resulting in the search within the organisation for innovativeness to meet these problems (Rogers 2003).

Innovations result not from a single incident, though a shock, such as SARS, can provide the stimulus to address an already known performance gap and initiate the innovation process, but rather through a sequence of events which culminate in a force for change (Schroeder 1986).

Matching

The second stage of initiation involves the performance gap being matched with an innovation. The responsibility of this matching rests with the organisation's decision makers who must ensure that it fits, through its planning and design, within the needs and capabilities of the organisation (Rogers 2003).

The matching stage within the Kiribati case study emerges in a sequence of events after the shock of SARS in 2003 and up to and including 2005. This resulted in a decision to rectify the infection control performance gap with the IPCP innovation. Successfully matching the problem to the innovation is essential to its success and sustainability, particularly within healthcare organisations (Goodman and Steckler 1989). It is at the point, after the matching has occurred that the decision to proceed with the innovation occurs and the implementation sub-process can begin.

The Decision to Adopt

The decision to adopt appears to have occurred between 2004 and 2005, when the senior nurse returned from New Zealand and external assistance was sought to improve the infection control performance gap.

Rogers describes three types of innovation decisions in organisations (Rogers 2003):

1. Optional innovation-decisions are made by an individual independent of the decisions made by other members of a system
2. Collective innovation-decisions are made by consensus among the members of a system
3. Authority innovation-decisions are made by relatively few individuals in a system where these individuals possess power, high social status or technical expertise.

Given the social system within the Kiribati healthcare organisation and the role of hierarchy, the decision to adopt was not undertaken by one person alone, rather a shared authority of senior staff. The decision to move ahead to reduce the infection control performance gap was an authority innovation-decision (Rogers 2003).

Implementation:

Redefining/Restructuring

The year 2005 was when the implementation sub-process began in Kiribati. The redefining/restructuring stage of the process is the time when the innovation and organisational structure are modified to assist successful adoption (Van de Ven 1986; Rogers 2003). It is at this point that the innovation undergoes re-invention to fit the specific needs and structure of an organisation as it is rare for an innovation to fit an organisation perfectly (Rogers 2003). Through the facilitation of an external consultant the IPCP was adapted and changed to suit the needs of the organisation. Structural changes were also made to the organisation through the introduction of an Infection Control Committee (ICC) and the establishment of the infection control principal nursing officer position. This demonstrated a feedback and feed-forward cycle that encouraged active participation of the individuals in the organisation.

The redefining/restructuring stage continued through the remainder of 2005 and 2006. These years saw further definition of the IPCP and the organisation with action plans developed based upon internal reviews of the needs of the organisation. A further organisational structure change that occurred during this stage was a change in membership of the ICC to be more representative of the key stakeholders in the IPCP and provide guidance and co-ordination at a national level.

Clarifying

The clarification stage of the IPCP innovation occurred between 2006 and 2009. This stage of the process is the beginning of acceptance of the innovation within the organisation. Following its introduction, it becomes more widely used and is further adapted to the environment. During this stage, the Kiribati healthcare organisation utilised the IPCP to establish education programmes, develop quality indicators and provide specialist consultation and advice.

Key individuals within the organisation play a significant role in achieving acceptance. These persons are often referred to as champions (Rogers 2003). Champions are often well respected within an organisation for their position, knowledge, skills and interpersonal style. They can help ease an innovation into the organisational structure because people listen to them (Rogers 2003). The ICC was expanded during this stage, its membership being champions from the various healthcare disciplines.

Routinising

The routinising of an innovation is the final stage of the process. This is the point when the innovation has become a part of the everyday operation within an organisation and it no longer holds a separate identity. For an innovation to become routine it must be sustainable. An indicator for the sustainability of an innovation is the degree to which the individuals within the organisation have been involved in the process including its re-invention to fit the needs of the organisation (Rogers 2003).

A key method for the elimination of barriers in the adoption of an IPCP is the involvement of key stake holders and opinion leaders. In the Kiribati case, participation of health care workers in the innovation process was evident. As previously discussed, broad involvement occurred from the beginning of implementation and was fundamental in the matching stage of the initiation sub-process. Participation allowed the identification and adaptation of appropriate resources and tools for the IPCP. This has assisted in the IPCP being a sustainable innovation in the Kiribati health care environment. The founding of regular IPCP activities applicable and delivered across all health services demonstrated the routinising of the programme in Kiribati. From 2009 until the present, the activities of the IPCP continue and are accepted as part of the delivery of healthcare in Kiribati. It has now become part of the continuous quality improvement process, a fixture of the education programme, a source of advice and information. Kiribati is representative of a case where IPCP adoption has been successful, this however is not always the situation.

Studies of the adoption of IPCP in LMI countries are generally unavailable in the literature (Leu 1995). What are available though are reviews of the general issues related to adopting IPCP in LMI countries or reviews of individual component adoption, such as surveillance. Of these reviews the major problems identified are:

- most LMI countries have weak or absent IPCP,
- IPCP are often unidirectional, focusing only one or a few interventions such as antibiotic usage,
- local studies and local expertise are not utilised in developing an IPCP,
- appropriate resource allocation to the health sector and delivery system is not addressed,
- human resources are not adequately developed to support IPCP adoption,
- limited equipment and consumable items such as sharps containers, sterilisers, disinfectants, PPE, running water and electricity are available (Mortensen 1991; Sobayo 1991; Nettleman 1993; Huskins et al. 1998; Starling 2001; Nyamogoba and Obala 2002).

Given these barriers identified for other LMI countries, Kiribati appears to have demonstrated a concerted effort to adopt infection prevention and control activities which together create a comprehensive IPCP. In the context of the classic Diffusion of Innovations framework, this can also be described as a technology cluster or innovation package. Rogers identifies a technology cluster, as a group of individual components that are closely inter-related and that can be adopted as a package of technology or innovation package (Rogers 2003). In the Kiribati case there is evidence, supported by the IPCPE and healthcare worker survey, of the adoption of infection prevention and control activities or innovation package which has evolved into an IPCP.

8.7 Evidence of routinisation of the innovation

The healthcare worker survey and the infection prevention and control programme evaluation (IPCPE) served to validate the presence and adoption of the IPCP in Kiribati by verifying the activities that had occurred since 2003. They also served to provide evidence that the key components of an IPCP, as previously described by WHO (Informal Network on Infection Prevention and Control in Health Care 2009) were in existence. The IPCPE tool that was developed as part of the study indicated that the programme met a minimal level of compliance of 75%, where a score greater than 76% is required to show at least a partial level of compliance.

The areas which demonstrated the greatest need for improvement were the *Epidemiological surveillance of infections* and *Hospital environment and sanitation*. The results of each area examined as part of the IPCPE are detailed in Table 2.

Table 2: Results of the IPCPE

Area	**%**	**Level of compliance**
Organisation	100	Compliant
Epidemiological surveillance of infections	35.3	Minimal
Microbiology	83.3	Partial
Intervention strategies	76.3	Partial
Sterilisation and high-level disinfection	87.5	Compliant
Personnel health	78.6	Partial
Hospital environment and sanitation	60.9	Minimal
Ineffective practices	77.8	Partial
Overall	**74.56**	**Minimal**

The area *Organisation* achieved complete compliance. Within this area is the educational component of the programme which was verified by the healthcare worker survey. The survey demonstrated that staff had a good knowledge of standard precautions in comparison to additional precautions and they felt confident in their ability to apply infection prevention measures in their clinical practice (Zimmerman et al. Submitted 14 Dec 2011 American Journal of Infection Control).

What is interesting in the Kiribati case is that the healthcare organisation appears to have been able to address issues that often prevent the adoption of IPCP in other LMI countries. Methods to overcome these issues include ensuring that IPCP is adapted to the local environment and context, making use of available resources and targeting interventions to those infectious diseases of local importance (Ponce-de-Leon 1991; Rhinehart et al. 1991; Raza et al. 2004). These methods are integral to the Diffusion of Innovations framework in an organisation.

8.8 Conclusion

The findings demonstrate that the classic Diffusion of Innovations for organisations is a model that can explain the adoption of the IPCP in the Republic of Kiribati. Given this

situation it may be useful as a framework for LMI countries to follow in the adoption of a comprehensive IPCP. The Kiribati case clearly demonstrates the successful and consistent progression of the innovation process in an organisation through initiation and implementation, this is demonstrated through application of the staged model of Diffusion of Innovations for organisations. The routinisation of the programme is confirmed through the evaluation of the current IPCP and the status of healthcare worker infection control knowledge and skill and their confidence in applying this in practice. This case clearly identifies the importance of involving the end users in the innovation process as well as the particular role of champions in supporting implementation.

The Kiribati case illustrates how an IPCP can be adopted with little involvement from external agencies and how important it is to recognise performance gaps to catalyse change in the healthcare environment. The awareness of staff within the health system to identify opportunities is paramount as is their ability to motivate change and seek the resources to enable it. By presenting a story of successful adoption, other LMI countries can feel inspired to venture on a similar journey.

Limitations

This is a case study of an individual situation and hence the findings of this study cannot be generalised to other LMI country situations, though lessons learnt may be valuable. The findings of this study are applicable to the population and organisation represented. Recommendations for future research include the testing of both the IPCPE and the survey tool in other settings and other populations to increase the ability to generalise the findings.

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Chapter Nine

Recommendations and conclusions

This study has provided new knowledge that models how LMI countries can improve their adoption of comprehensive IPCP. Further, the discussion within will assist all countries in their adoption of the complementary programme components of IPCP. The case study demonstrated that applying a theoretical framework such as the Diffusion of Innovations process in an organisation to a comprehensive IPCP, or its componentry, can lead to successful and sustainable integration into healthcare service delivery, to the benefit of patients, staff and visitors to that environment.

The study has shown that there is an absence of reported literature to assist LMI countries to improve the status of IPCP. The need for undertaking in-depth evaluation of health care practices in LMI countries is established and evident, as they are most at risk of healthcare associated infection and have negligible resources to deal with such problems.

Findings from this study provide support for the application of a case study approach to a real life example. Further, it demonstrates the efficacy in leveraging successful experience for emulation in similar health care settings. This establishes a connection between lived experience and remedial action, based on the understanding of IPCP issues and the adoption of solutions.

This chapter commences with a summary of the overall findings of the study. It draws together the insights gained from the varied literature and consolidates answers to each of the research questions. Relevant recommendations to address each of these questions are also discussed in this section. The limitations of the study design and implementation are then acknowledged. The chapter concludes with a summary of the benefits of applying the Diffusion of Innovations process in organisations framework to gain important insights into LMI country and poorly resourced healthcare settings.

9.1 Introduction

It is globally recognised that the prevention of healthcare associated infection is an integral component of the delivery of safe and effective care to patients and clients in any healthcare environment. Included in this safe delivery is the protection of healthcare workers and all who visit and are involved in these environments. The goal of the WHO First Global Patient Safety Challenge is to:

> …ensure that infection control is acknowledged universally as a solid and essential basis towards patient safety and supports the reduction of health care-associated infections and their consequences (World Health Organization 2009a).

It is with this goal in mind that an understanding of how comprehensive infection prevention and control programmes are essential, and how important it is that they are adopted in all economic circumstances.

This study set out to explore and understand the successful implementation of an IPCP through the analysis of the experiences of health professionals in Kiribati, using the classic Diffusion of Innovations model as a frame of analysis. This model provided a holistic understanding of the innovation process Kiribati experienced in adopting the IPCP innovation package. In line with this and the research questions, quantitative and qualitative data sources were utilised within the context of the case study method.

9.2 The questions, the answers, the recommendations

9.2.1 Research question 1: How can the success of IPCPs be enhanced in LMI country healthcare settings?

It is generally recognised that the lower the economic status of a given population or nation, the greater the significance and impact of infectious diseases and HAI in mortality and decreased quality of life (Isturiz and Carbon 2000; Starling 2001; World Health Organization 2002; Rosenthal et al. 2003a; Yalcin 2003). Hence, the importance of infection prevention and control programmes in LMI countries is evident. However, as detailed in Chapters Three, Four and Five, the available literature which examined infection control programmes in LMI countries consisted predominantly of review papers or case study reports, focusing on the adoption or modelling of individual

components of an infection control programme rather than the implementation of a comprehensive plan.

Available literature reflected that studies in high-income countries were more prevalent in available publications and this focus was also more upon the adoption of individual complimentary components rather than a comprehensive package. This was mainly due to comprehensive programmes having been established in these settings for significant periods of time (Raza et al. 2004).

The case study presented in this dissertation explored how a comprehensive IPCP was adopted in a LMI country setting, using multiple data collection methods to provide evidence of its presence. Two literature reviews were conducted in conjunction with this to explore how IPCP adoption could be enhanced in LMI countries. The first, Chapter Four, identified that available studies focussed mainly upon the implementation of individual infection control programme components such as surveillance, rather than on the comprehensive adoption of the available advice, whether designed for high income or LMI settings, and measurement of the success of such endeavours. By examining such situations, lessons may be learnt on how to best adapt the advice to specific healthcare environments or create resource specific advice, assisting with ease of use in the LMI context.

The Kiribati case study provided a valuable example in the LMI context of how to adopt an IPCP and subsequently how to enhance adoption in other LMI or resource poor settings. The documentation of the adoption of the Kiribati IPCP highlighted the processes that facilitated the development of the present programme. It was clear from this case study that infection control action followed on from an external key stimulus (SARS), thus health workers need to able to identify key events (particularly an external event or review) that may be used to focus their organisation's attention on the need for an IPCP. It was also important that health staff in key positions identified gaps in the current practices, advocated for change and took practical steps toward implementing an IPCP. As it was the local staff that took action, the infection prevention and control activities were made relevant to the local needs and available resources of the healthcare environment. The IPCP process was then consolidated through appropriate organisational changes in the health services themselves.

Recommendations:

1. Healthcare workers from LMI settings must be involved with the adaptation of evidence based infection prevention and control guidelines to assist in the adoption process (Chapter Four).
2. Infection prevention and control activities chosen for inclusion in a programme must be relevant to the needs and resources of the healthcare environment (Chapter Four).

The second review, Chapter Five, was based upon the findings of the first. It identified a limited literature that explored or described the use of a theoretical framework to inform the adoption process of an IPCP. The Diffusion of Innovations process in an organisation (Rogers 2003) was found to be a possible model and one which could be used to enhance the success of comprehensive IPCP adoption in LMI countries.

Recommendations:

3. Future research is required to investigate and report on theoretical frameworks that can inform the adoption of infection prevention and control principles and practices (Chapter Five).
4. Future research is required to investigate and report on the adoption and implementation of comprehensive IPCP and individual components in LMI country or healthcare environments, with a view to provide guidance for LMI countries as to how to identify and take advantage of opportunities to adopt and successfully sustain a programme (Chapter Four).

9.2.2 Research question 2: Can the classic Diffusion of Innovations model be used to explain the level of success?

Using the Diffusion of Innovations process in organisations (Rogers 2003) as a framework for investigation, this case study was conducted to explore the adoption of a comprehensive IPCP in a LMI country, the Republic of Kiribati. Semi-structured interviews and a review of the programme's documentation, as reported in Chapter Seven, provided a chronological account of the progress of the programme over time up to the present day. By following the progress of the adoption it was clear that the activities of the persons and the organisation involved aligned with the initiation and

implementation sub processes described by Everett Rogers (2003). These processes identified the use of stimuli, key personnel, champions and organisational restructuring as being integral to the success of the adoption process.

Recommendations:

5. Healthcare workers and administrators should exploit the opportunities provided by external stimuli such as shocks to the health care system, in order to introduce an IPCP (Chapter Six)
6. Key people and healthcare workers themselves need to be involved in order to make the IPCP applicable and unique to their healthcare environment (Chapter Six).
7. Input and feedback on the progress of IPCP adoption should be sought through open communication, audits and marketing of the innovation to administrators and healthcare workers. Champions within the health system who can assist in its integration should be identified. Practical ways to demonstrate how the innovation benefits the healthcare worker and the patient need to be provided (Chapter Six).
8. The resources available both within, and external to, the healthcare system should be used to find suitable solutions and move innovations ahead (Chapter Six).

The evidence of the Kiribati case study provided weight to the argument that a theoretical framework can assist in the adoption of comprehensive IPCP and associated individual complementary components. It also suggested that others' experiences of adopting an IPCP also may have followed such a diffusion of innovation process but this may have not been recognised due to lack of similar research.

Recommendations:

9. The IPCP should be incorporated into the day to day work of the healthcare worker so that it becomes an integral part of health service delivery (Chapter Six).
10. Chronicling of the adoption process of a comprehensive IPCP to identify the key stimuli, events and persons responsible for the initiation of the process and reporting of this within the organisation needs to be explored in future research

and reported in the literature so that other countries may benefit from such experiences (Chapter Six).

To confirm the presence of the IPCP in Kiribati, a pilot infection prevention and control programme evaluation (IPCPE) was developed and carried out in conjunction with a survey of healthcare worker knowledge, application and confidence with the IPCP that had been used previously. The findings of these collectively demonstrated that the IPCP had become routinised into the provision of health service delivery in Kiribati. Though the IPCPE was a pilot tool, it provided detailed information and baseline data for the programme, highlighting areas in need of improvement and strengthening. The healthcare worker survey identified those areas which required further attention in the training and professional development of clinicians within the organisation.

Recommendations:

11. The adoption of an IPCP should be confirmed and monitored through the use of evaluation tools such as the IPCPE and healthcare worker surveys of knowledge, application and confidence. The findings of such monitoring should be communicated to the participants and the organisation to assist in the routinising of the programme (Chapter Seven).
12. The findings of IPCP evaluations should be shared with other LMI country and healthcare settings through publication and conference/meeting attendance (Chapter Five).

These recommendations point to the value of this study and the need for its implementation into the larger LMI health care community. The next section discusses the significance of this study, followed by a presentation of the study's limitations.

9.3 Significance of this study

This case study of the successful adoption of an IPCP in the Republic of Kiribati highlighted the elements which can assist in improving health care and health outcomes in less advantaged regions in the world. Exploring the chronology of IPCP adoption in a LMI country and mapping this process within the diffusion of innovation framework provided valuable insight that can be shared with potential adopters from similar

countries who may be seeking resolutions to their own infection prevention and control issues.

The Kiribati case was of particular interest as the healthcare organisation appeared to have been able to address issues that often prevented the adoption of IPCP in other LMI countries. Methods to overcome these issues included ensuring that IPCP is adapted to the local environment and context, making use of available resources and targeting interventions to those infectious diseases of local importance. These methods were integral to the Diffusion of Innovations framework in an organisation.

It was important that this story was chronicled and shared with other countries and their health care providers as it evolved. This was achieved through the publication of the findings of this study and presentations at international forums. In this way the lessons learnt were disseminated in a timely manner, to maximise the opportunities for other LMI countries to modify their own practices and achieve more effective and timely implementation of an IPCP.

9.4 Limitations

The literature reviews performed in this study and reported in Chapters Three, Four and Five, sourced only articles that were available in English. This was a limitation of the study as there may have been reports available in languages other than English from LMI countries. This could be an area of further research for scholars with access to multi-lingual resources.

The information to support the premise that the Kiribati IPCP followed a Diffusion of Innovations framework was limited by the availability of documentation and interview participants, as reported in Chapter Six. Prior to 2005 there was no documentary evidence of the absence or presence of an IPCP and thus information was purely dependant on the recollections of the interview participants. The researcher, though known to the organisation, was not I-Kiribati which may have had an effect on the interviewees' desire to disclose. The amount of information gained from these interviews however did not appear to reflect any reservations on the part of the participants.

This was a case study of an individual situation. Hence, the findings of this study cannot be generalised to other LMI country situations, though lessons learnt may be valuable. The findings of this study were applicable to the population and organisation represented. The findings of the healthcare worker survey and IPCPE reported in Chapter Seven stand alone as a baseline, as there had been no pre-programme assessment performed. The findings from these tools could be used to reassess its status in the future. As mentioned in Chapter Seven, the relationship between the programme evaluation results and the survey scores cannot be statistically correlated, though they can be used together to authenticate the educational component of the programme. Recommendations for future research include the testing of both the IPCPE and the survey tool in other settings and other populations to increase the ability to generalise the findings.

9.5 Conclusion

The findings have demonstrated that the classic Diffusion of Innovations for organisations is a model that explains the adoption of the IPCP in the Republic of Kiribati. It may be concluded that this model is useful as a framework for LMI countries to follow in the adoption of a comprehensive IPCP. The Kiribati case clearly demonstrated the successful and consistent progression of the innovation process in an organisation through initiation and implementation; this was demonstrated through application of the staged model of Diffusion of Innovations for organisations. The routinisation of the programme was confirmed through the evaluation of the current IPCP and the status of healthcare worker infection control knowledge and skill and their confidence in applying this in practice. This case clearly identified the importance of involving the end users in the innovation process as well as the particular role of champions in supporting implementation.

The Kiribati case illustrated how an IPCP can be adopted with little involvement from external agencies and how important it is to recognise performance gaps to catalyse change in the healthcare environment. The awareness of staff within the health system to identify opportunities is paramount, as is their ability to advocate for change and seek the resources to enable it. By presenting a story of successful adoption, other LMI countries can feel inspired to venture on a similar journey.

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Appendices

Appendix 1: Interview participant information sheet and consent form

(printed on UoW letterhead)

PARTICIPATION INFORMATION SHEET FOR INTERVIEWEES

TITLE: Infection prevention and control programme: A Diffusion of Innovations case study in the Republic of Kiribati.

PURPOSE OF THE RESEARCH: This is an invitation to participate in a study conducted by researchers at the University of Wollongong. You are invited to participate due to your involvement in infection prevention and control activities in Kiribati. This project is concerned with exploring how infection prevention and control programmes are adopted in low- and middle income countries, utilising Kiribati as a case study.

INVESTIGATORS

Dr Heather Yeatman	Dr Michael Jones	Ms Peta-Anne Zimmerman
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METHOD AND DEMANDS ON PARTICIPANTS

If you choose to be included, you will be asked to participate in an interview conducted by a member of the research team, at a time of your convenience. The researcher will conduct an interview, no longer than 60 minutes, to explore how the infection prevention and control activities have been adopted in Kiribati. The interview will be audio recorded to ensure accuracy of reporting the data. Typical questions in the interview include: your role in the Kiribati healthcare system, your role in the infection prevention and control activities, how the infection prevention and control programme has developed, how long it has taken for the programme to develop and be adopted, what has influenced the adoption of the infection prevention and control programme.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from the 60 minutes of your time for the interview, we can foresee no risks for you. Your involvement in the study is voluntary and you may withdraw your participation from the study at any time and withdraw any data that you have provided to that point. Confidentiality cannot be assured as your position, but not your name will be identified in the research, thesis and publications. Refusal to participate in the study will not affect your relationship with the University of Wollongong or the researchers.

FUNDING AND BENEFITS OF THE RESEARCH

This research will provide a basis for improved future infection prevention and control programme adoption strategies. This research will be included in a Doctor of Public Health Dissertation.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UoW Ethics Officer on (02) 4221 4457.

Thank you for your interest in this study.

CONSENT FORM FOR

Infection prevention and control programme: A Diffusion of Innovations case study in the Republic of Kiribati.

Peta-Anne Zimmerman

I have been given information about "Infection prevention and control programme: A Diffusion of Innovations case study in the Republic of Kiribati", and discussed the research project with Peta-Anne Zimmerman who is conducting this research as part of a Doctor of Public Health program, supervised by Heather Yeatman in the School of Health Sciences at the University of Wollongong.

I have been advised of the potential risks and burdens associated with this research, which include the possibility of being identified through the research and have had an opportunity to ask Peta-Anne Zimmerman any questions I may have about the research and my participation. I understand that every attempt will be made to preserve the confidentiality of my identity and the information that I provide.

I understand that my participation in this research is voluntary, I am free to refuse to participate and I am free to withdraw from the research at any time. My refusal to participate or withdrawal of consent will not affect my relationship with the researcher or my relationship with the University of Wollongong.

If I have any enquiries about the research, I can contact Peta-Anne Zimmerman (+61 412333870)**,** Heather Yeatman (+61 2 4221 3153) and Michael Jones (+61 0 2 4221 4706) or if I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on +61 2 4221 4457.

By signing below I am indicating my consent to

- an interview of no more than 60 minutes

I understand that the data collected from my participation will be used for thesis completion and academic papers and I consent for it to be used in that manner.

Signed **Date**

..../...../.....

Name (please print)

.....

Interview Guide

- Can you please give a description of your role and position?
- How long have you held this position?
- What has been your previous experience in the Kiribati healthcare system?
- What role do you have in the infection control programme?
- How long have you been involved in infection control?
- Can you please give a description of your experience and training in infection control?

The innovation

- Can you please describe your understanding of the infection control programme?
    - What does it entail?
    - What are the activities of the programme?
    - What staff are associated with the programme?

- Can you describe how the programme came to be, how did it begin?
- What factors do you feel contributed to the adoption of infection control activities in Kiribati?
    - Events
    - People/organisations
    - Communication with other bodies, countries

- What are the future plans for infection prevention and control in Kiribati?
- What do you see are the future needs for Kiribati in regard to infection control?

Prompts:

Communication channels

- What, do you think, really started the ball rolling with infection control in Kiribati?
- How has information about infection control made a difference to the adoption of activities?
- How was this information made available to you and others involved in infection control?
- Can you please talk about any published guidelines or input from other organisations that has been received to assist infection prevention and control implementation in Kiribati/(facility name)?

Time

- When, do you think, did things start to change in infection control in Kiribati?
- Can you think of any events, and when they occurred, that have influenced the adoption of infection control activities? Can you describe these?

Social system

- Who has been involved in the adoption of infection control activities in Kiribati?

- In your opinion, have there been any key people or groups who have been particularly influential in adopting infection control activities? Who are they, how have they been influential?
- Have there been people or groups that have been unhelpful? Who are they, how have they not been helpful?
- How have the activities been accepted within the healthcare community?
- How have the activities been accepted within the Pacific region?
- Can you describe any problems that have been encountered in the adoption of the activities?
- Do you foresee any future problems in infection control adoption?

Appendix 2: Healthcare worker survey and participant information sheet

(Printed on UoW letterhead)

PARTICIPATION INFORMATION SHEET FOR SURVEY PARTICIPANTS

TITLE: Infection prevention and control programme: A Diffusion of Innovations case study in the Republic of Kiribati.

PURPOSE OF THE RESEARCH: This is an invitation to participate in a study conducted by researchers at the University of Wollongong. You are invited to participate due to your involvement in infection prevention and control activities in Kiribati. This project is concerned with exploring how infection prevention and control programmes are adopted in low- and middle income countries, utilising Kiribati as a case study.

INVESTIGATORS:

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METHOD AND DEMANDS ON PARTICIPANTS

If you choose to be included, you will be asked to participate in survey of infection control knowledge and application. The survey is anonymous and should take no longer than 15 minutes to complete. Please return the completed survey to the designated area in your department.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from the 15 minutes of your time for the survey, we can foresee no risks for you. Your involvement in the study is voluntary and you may withdraw your participation from the study at any time up until the survey is returned to the researcher, after that it will not be able to be identified to be withdrawn. Refusal to participate in the study will not affect your relationship with the University of Wollongong or the researchers.

FUNDING AND BENEFITS OF THE RESEARCH

This research will provide a basis for improved future infection prevention and control programme adoption strategies. This research will be included in a Doctor of Public Health Dissertation.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UoW Ethics Officer on (02) 4221 4457.Thank you for your interest in this study.

Healthcare Worker Survey

Demographic information:

Please write down or tick the appropriate response unless otherwise asked.

1. Age:_____years.

2. Sex:
    a. ☐ Male
    b. ☐ Female

3. Designation:
    a. ☐ Registered nurse
    b. ☐ New graduate registered nurse
    c. ☐ Senior Nursing Officer
    d. ☐ Nurse aide
    e. ☐ Medical officer

4. How long have you been working since basic training?
    a. ☐ 0-4 years
    b. ☐ 4-8 years
    c. ☐ 8-12 years
    d. ☐ 12 years or greater

5. Have you had any experience in caring for patients with infectious disease?
    a. ☐ Yes, go to Q6
    b. ☐ No, go to Q7

6. What kind of infectious disease did the patient have?
    a. ☐ Respiratory tract infections (eg. Influenza, TB, whooping cough)
    b. ☐ Bloodborne infections (eg. HIV, hepatitis B, etc)
    c. ☐ Skin, wound and eye infections (scabies, conjunctivitis)
    d. ☐ gastrointestinal tract infections (Enterovirus)
    e. ☐ Urinary tract infections
    f. ☐ Not sure

g. ☐ Others _____ (please specify)

7. Have you ever undertaken any post-basic training course or subject or attended inservice or orientation sessions regarding standard and additional (transmission-based) precautions?
   a. ☐ Yes, please complete Q8
   b. ☐ No, go to knowledge section

8. How much time did the training course, session or subject spend on standard and additional (transmission-based) precautions?
   _____Months _____Weeks _____Days _____Hours

Healthcare Worker Survey:

Knowledge

For each of the following questions, please circle "one" answer that best reflects your opinion. The results of this questionnaire are for research purposes only. Please answer all questions.

No.	Statements	Answer	
1.	Used needles should be disposed of into a sharps container/box	T	F
2.	Standard precautions should apply to situations that might lead to contact with vaginal discharge	T	F
3.	Masks and goggles are not necessary if procedures and patient-care activities are unlikely to cause splashing of blood or body fluids	T	F
4.	Standard precautions should be applied to all persons regardless of their infectious status	T	F
5.	Gloves are necessary in all procedures when caring for patients with HIV	T	F
6.	Standard precautions should apply to situations that might lead to contact with tears	T	F
7.	Standard precautions should apply to situations that might lead to contact with saliva	T	F
8.	Standard precautions should apply to situations that might lead to contact with urine or faeces	T	F

9. Gloves, protective eyewear, and masks should be worn by all staff assisting with endotracheal intubation T F

10. Gowns, gloves, mask, and protective eyewear should be worn whenever there is potential for splash and/or droplet exposure to patient's blood T F

11. Staff who have any 'sores', or broken skin on hands should be covered with an occlusive dressing T F

12. When you have contact with a coughing patient who does not wear a mask, what kind of precautions should you apply?
    1. ☐ No protective measures required
    2. ☐ Only a mask and apron required
    3. ☐ Only gloves required
    4. ☐ Gloves and mask required
    5. ☐ Gloves, mask, apron and protective eyewear required

13. What should you apply when you have casual contact (no direct physical care) with patients who do not require additional precautions?
    1. ☐ No protective measures required
    2. ☐ Only a mask and apron required
    3. ☐ Only gloves required
    4. ☐ Gloves and mask required
    5. ☐ Gloves, mask, and protective eyewear required

14. What precautions should you apply when you touch non-intact skin?
    1. ☐ No protective measures required
    2. ☐ Only a mask and apron required
    3. ☐ Only gloves required
    4. ☐ Gloves and mask required
    5. ☐ Gloves, mask, and protective eyewear required

15. Each of the following statements regarding infection control precautions is true, except……..

    1. ☐ Standard precautions are to reduce the risk of transmission of microorganisms from both recognised and unrecognised sources of infection
    2. ☐ Additional precautions are required to prevent cross-infection
    3. ☐ Indirect contact transmission involves contact of a susceptible host with a contaminated intermediate object, such as sphygmomanometer, toilet
    4. ☐ The microorganisms within the droplets can remain suspended in the air and transmit by the airborne route

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Healthcare Worker Survey:
Application and Confidence

For each of the scenarios below, please circle a response to each question – 1 for 'yes' and 2 for 'no'.

Scenario 1

Mr A, an ethnic Chinese 45 year old man, walked into the Emergency Department (ED) with his wife on the morning of 20 May 2003. He complained of fever, chill, fatigue, cough and shortness of breath. These symptoms started on the 10th May, the day he returned from mainland China. His temperature was 39.5˚C (oral temperature) and his chest x-ray was abnormal. He has no history of chronic diseases or surgery, and is not taking any medications. But he has smoked 20 cigarettes per day since he was 20 years old. You work in the ED, how would you respond to this situation? What type of precautions will you implement for managing the case?

No.	Statement	Yes	No
16.	Contact and airborne precautions shall be performed all time when I am caring for Mr A	1	2
17.	I will ask Mr A to wear a duckbill mask all the time	1	2
18.	It is not necessary to place Mr A in an airborne isolation room before he is confirmed as a patient with a respiratory tract infection	1	2
19.	I shall wear surgical mask, gloves, gowns and eye protection whilst caring for Mr A	1	2
20.	Mr A should not be placed in a single bed room with the door closed	1	2
21.	If I have worn gloves to care for Mr A, I do not need to wash my hands immediately after removal of gloves	1	2
22.	I am confident to apply routine practices and infection control precautions in the clinical setting	1	2

23.	I am confident to educate the reason for infection control precautions to the patient and their family members	1	2
24.	I am confident to educate and communicate with other healthcare workers in relation to infection control issues	1	2

Scenario 2

Mr B is 65 years old. He has a history of myocardial infarction (MI) over 10 years ago and accepts medications and medical treatment. Two weeks ago he was admitted into the hospital at midnight due to another MI. He has been in the medical ward for a week and his condition is improving. However, this morning he complains that he could not sleep last night because he felt very itchy over his body, especially in the area of his palms, fingers, armpits, elbows and wrists. When you look at, and try to assess, his skin, you discover some lesions over these areas; these lesions look like burrow, papules, pustules and nodules. How will you care for this patient? What strategies and precautions will you apply to protect both yourself and other staff and patients?

No.	Statement	Yes	No
25.	Gloves should be put on before entering, and removed after leaving the patient's room or dedicated bed space	1	2
26.	Conditions such as scabies can only be transmitted through indirect contact	1	2
27.	Gloves and gowns/aprons should be worn all the time when in contact with Mr B	1	2
28.	Personal articles such as slippers or soft toys should be sealed in a plastic bag for 10 days and removed from the room	1	2
29.	Mr B should be nursed in a room on his own until he has been treated with scabicide	1	2
30.	The water from washing him must be disposed of down a special drain	1	2
31.	I am confident to educate patients and their families about dealing with potential infectious skin conditions	1	2

Scenario 3

Your patient, Mrs C is a 43 year old lady who was admitted to hospital yesterday morning with a high fever (>39˚C) and she was suspected to be infected with influenza. In response, she was isolated for treatment and observation in the ward where you work, which is designated as the isolation area for H1N1 influenza. Mrs C complained that she felt very unwell with the symptoms of high fever and cough. You tried to contact the radiographer to perform a mobile chest x-ray and request them to enter the ward. The radiographer was reluctant to enter the ward and when they did they confined their movements to the nurses' station, refusing to see the patient. As you are Mrs C's care-provider, how would you manage this situation?

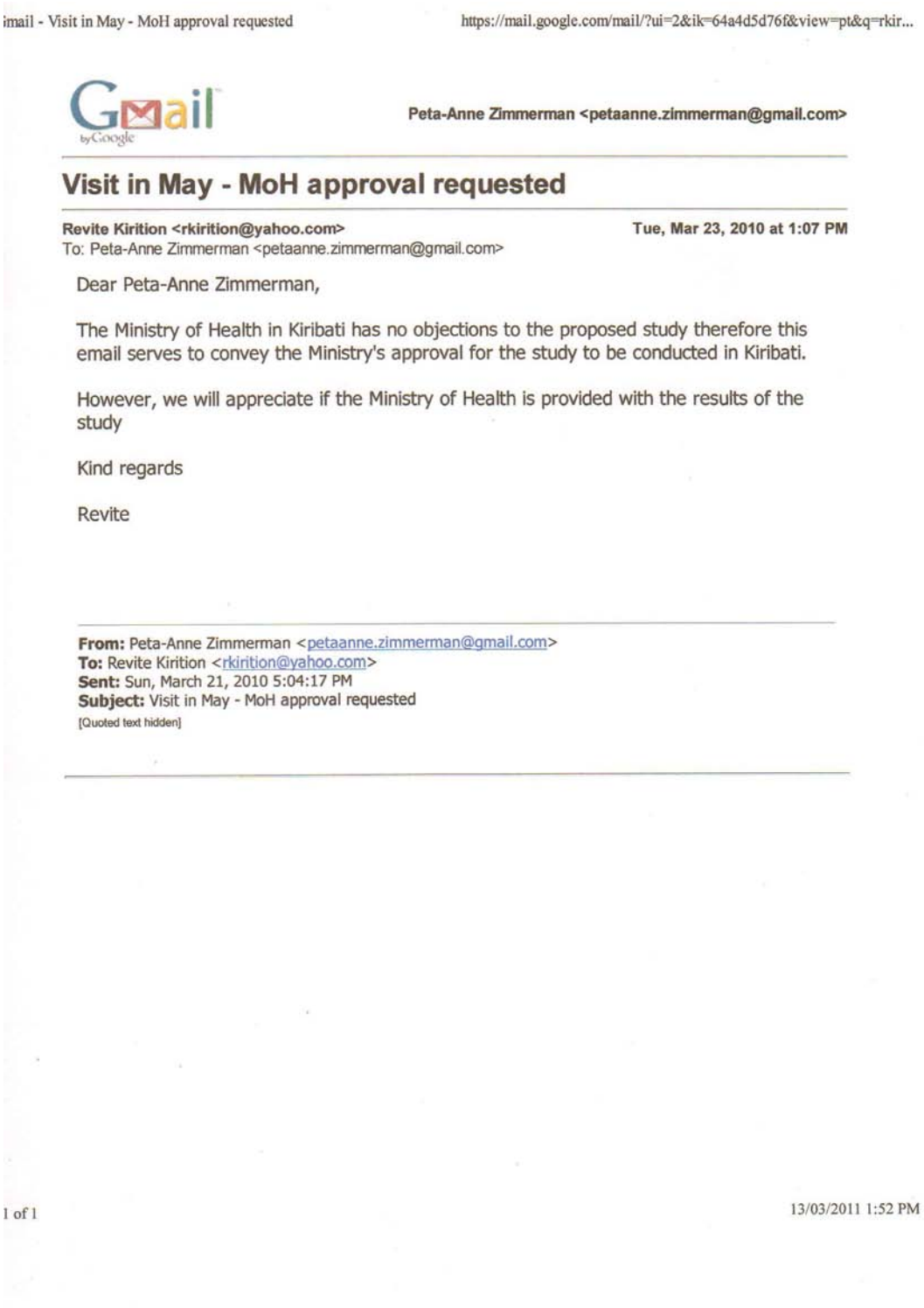
No.	Statement	Yes	No
32.	I would be confident to educate the radiographer about additional precautions	1	2
33.	I have sufficient knowledge and skills in infection control to reassure the radiographer	1	2
34.	I would be confident about protecting myself and my family from the infection risk in the situation	1	2
35.	The radiographer has a valid reason to be afraid of the infection and not approach the patient	1	2

Congratulations!!

You have reached the end of the questionnaire

Thank you for taking the time and effort to complete this questionnaire. Your assistance on providing information is appreciated. Before you return this survey, please ensure you have answered all the questions!!

Appendix 3: Study approval, Ministry of Health of Kiribati, Dr Revite Kiriton Director of Public Health



imail - Visit in May - MoH approval requested https://mail.google.com/mail/?ui=2&ik=64a4d5d76f&view=pt&q=rkir...

Gmail by Google

Peta-Anne Zimmerman <petaanne.zimmerman@gmail.com>

Visit in May - MoH approval requested

Revite Kirition <rkirition@yahoo.com> **Tue, Mar 23, 2010 at 1:07 PM**
To: Peta-Anne Zimmerman <petaanne.zimmerman@gmail.com>

Dear Peta-Anne Zimmerman,

The Ministry of Health in Kiribati has no objections to the proposed study therefore this email serves to convey the Ministry's approval for the study to be conducted in Kiribati.

However, we will appreciate if the Ministry of Health is provided with the results of the study

Kind regards

Revite

From: Peta-Anne Zimmerman <petaanne.zimmerman@gmail.com>
To: Revite Kirition <rkirition@yahoo.com>
Sent: Sun, March 21, 2010 5:04:17 PM
Subject: Visit in May - MoH approval requested
[Quoted text hidden]

1 of 1 13/03/2011 1:52 PM

Appendix 4: Ethics approval: Human Research Ethics Committee, University of Wollongong

University of Wollongong

INITIAL APPLICATION APPROVAL
In reply please quote: HE09/386
Further Enquiries Phone: 4221 4457

26 February 2010

Ms Peta-Anne Zimmerman
18 Rosegum Drive
Molendinar
QLD 4214

Dear Ms Zimmerman,

Thank you for your response to the HREC review of the application detailed below. I am pleased to advise that the application has been approved.

Ethics Number:	HE09/386
Project Title:	Infection prevention and control programme: A diffusion of innovations case study in the Republic of Kiribati
Researchers:	Ms Peta-Anne Zimmerman, A/Professor Heather Yeatman, Dr Michael Jones
Approval Date:	25 February 2010
Expiry Date:	24 February 2011

The University of Wollongong/SESIAHS Humanities, Social Science and Behavioural HREC is constituted and functions in accordance with the NHMRC *National Statement on Ethical Conduct in Human Research.* The HREC has reviewed the research proposal for compliance with the *National Statement* and approval of this project is conditional upon your continuing compliance with this document. As evidence of continuing compliance, the Human Research Ethics Committee requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforseen events that might affect continued ethical acceptability of the project.

You are also required to complete monitoring reports annually and at the end of your project. These reports are sent out approximately 6 weeks prior to the date your ethics approval expires. The reports must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

Yours sincerely

A/Professor Steven Roodenrys
Chair, Human Research Ethics Committee

cc. A/Professor Heather Yeatman, Health Sciences

Research Services Office University of Wollongong NSW 2522 Australia
Telephone: +61 2 4221 3386 **Facsimile:** +61 2 4221 4338
research_services@uow.edu.au www.uow.edu.au/research
CRICOS Provider No: 00102E

University of Wollongong

RENEWAL APPROVED
In reply please quote: EW:CJ HE09/386
Further Enquiries Phone: 4221 4457

17 February 2011

Ms Peta-Anne Zimmerman
18 Rosegum Drive
MOLENDINAR QLD 4214

Dear Ms Zimmerman

I am pleased to advise that **renewal** of the following Human Research Ethics application has been **approved.**

Ethics Number:	HE09/386
Project Title:	Infection prevention and control programme: A diffusion of innovations case study in the Republic of Kiribati
Researchers:	Ms Peta-Anne Zimmerman, A/Professor Heather Yeatman, Dr Michael Jones
Approval Date:	24 February 2010
Expiry Date:	23 February 2012

This certificate relates to the research protocol submitted in your original application and all approved amendments to date. Please remember that in addition to completing an annual report the Human Research Ethics Committee requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforseen events that might affect continued ethical acceptability of the project.

You are also required to complete a monitoring report at the end of your project. This report will be sent out approximately 6 weeks prior to the date your ethics approval expires. The report must be completed, signed by the appropriate Head of School, and returned to the Research Services Office.

Yours sincerely

A/Professor Garry Hoban
Chair, Human Research Ethics Committee

cc A/Professor Heather Yeatman, Health Sciences

Research Services Office University of Wollongong NSW 2522 Australia
Telephone: +61 2 4221 3386 **Facsimile:** +61 2 4221 4338
research_services@uow.edu.au www.uow.edu.au/research
CRICOS Provider No: 00102E

Appendix 5: Letter of acceptance of manuscript for publication – 'SARS and Kiribati: Eyes wide open'

[IJIC] Editor Decision
Ms Elizabeth Anne Scicluna [elizabeth.scicluna@theific.org]

To:
Peta-Anne Zimmerman
Thursday, 29 September 2011 5:07 PM

You replied on 24/10/2011 8:36 AM.

Ms Peta-Anne Zimmerman,

Thanks for sending us the final clarifications. Your paper has know been accepted for publication on IJIC.

It will now go through the process of copy editing and type setting and closer to the date of publication we will send you a pdf file for proof reading.

regards,

Ms Elizabeth Anne Scicluna
elizabeth.scicluna@theific.org

International Journal of Infection Control
http://www.ijic.info

Appendix 6: Letter of permission for manuscript reproduction –'SARS and Kiribati: Eyes wide open'

Re: [IJIC] Editor Decision
elizabethific@gmail.com on behalf of Elizabeth Scicluna
[elizabeth.scicluna@theific.org]

To:
Peta-Anne Zimmerman
Monday, 31 October 2011 8:18 PM
Dear Peta-Anne,

You are given permission to reproduce your paper 'SARS and Kiribati: Eyes wide open' that will be published in the first issue of 2012 of the International Journal of Infection Control as part of your PhD thesis.

Regards,

Elizabeth Scicluna
Journal Administrator
International Journal of Infection Control

Appendix 7: Letter of acceptance of manuscript review – 'Evaluating infection control in the Republic of Kiribati'

Peta-Anne Zimmerman <petaanne.zimmerman@gmail.com>

Editor handles AJIC-D-11-00547

1 message

"AJIC <ajic@columbia.edu> **Wed, Dec 14, 2011 at 2:41 AM**
To: petaanne.zimmerman@gmail.com

Ms. Ref. No.: AJIC-D-11-00547
Title: Evaluating infection control in the Republic of Kiribati.
American Journal of Infection Control

Dear Peta-Anne,

Your submission entitled "Evaluating infection control in the Republic of Kiribati." will be handled by Editor Elaine L. Larson, Ph.D., CIC.

You may check on the progress of your paper by logging on to the Elsevier Editorial System as an author. The URL is http://ees.elsevier.com/ajic/.
Your username is: zimmermanp
If you need to retrieve password details, please go to: http://ees.elsevier.com/ajic/automail_query.asp

Thank you for submitting your work to the American Journal of Infection Control.

Kind regards,

Elsevier Editorial System
American Journal of Infection Control

For further assistance, please visit our customer support site at http://support.elsevier.com. Here you can search for solutions on a range of topics, find answers to frequently asked questions and learn more about EES via interactive tutorials. You will also find our 24/7 support contact details should you need any further assistance from one of our customer support representatives.

Appendix 8: Letter of acceptance for manuscript review – 'Diffusion of Innovations: A case study of infection prevention and control programme (IPCP) adoption.'

Manuscript Reference No.: INTQHC-2012-01-0018

17-Jan-2012

Dear Ms. Zimmerman,

This message acknowledges receipt of your manuscript "Diffusion of Innovations: A case study of infection prevention and control programme (IPCP) adoption.". Thank you for this submission to International Journal for Quality in Health Care. We are pleased to consider this manuscript for possible publication.

We will shortly run some preliminary checks on the manuscript. If your submission meets Journal requirements we will send your manuscript out for peer review. We will be back in touch with you after the peer review process has been completed and an editorial decision has been made on your paper.

OPTIONAL OPEN ACCESS - Please note that if your manuscript is accepted for publication in the International Journal of Quality in Health Care, you will have the option, at an additional charge, to make your paper freely available online immediately upon publication, under the Oxford Open initiative (see http://www.oxfordjournals.org/oxfordopen/). Applicable Oxford Open charges can be found in the Authors Instructions http://www.oxfordjournals.org/intqhc/for_authors/index.html.

In any future correspondence regarding this manuscript please include the manuscript reference number INTQHC-2012-01-0018.

Thank you for your interest in International Journal for Quality in Health Care.

Sincerely,

Shirley Letts
Editorial Office
International Journal for Quality in Health Care

Supplement 1

Infection Prevention and Control Programme Evaluation

Table of contents

Instructions for Application of the Infection Prevention and Control Evaluation

General Considerations

The purpose of this evaluation is to provide a review of healthcare infection prevention and control (IPC) activities in a given healthcare facility. It does not, however, consider the risk of individual patients or specific cases. It is intended as an instrument to provide assessment of the status of the infection prevention and control programme (IPCP). It should not be considered an accreditation system. It does not consider other aspects related to care outside of surveillance, prevention, and control of healthcare associated infections (HAI). The tool may be used internally as a continuous quality improvement activity or as an external review tool by appropriately qualified IPC technical consultants (See Annexe 1).

Description of the Evaluation

This evaluation tool is an adaptation of the "Nosocomial Infection Program Rapid Evaluation Guide" created by the Pan American Health Organization [1] and the "Audit Tools For Monitoring Infection Control Standards" from the Infection Control Nurses Association [2]. To comprehensively evaluate an IPCP it is essential to examine both theoretical and practical aspects. This tool combines those most essential standards of an IPCP including how policy and guidelines translate into the healthcare environment and patient care.

The evaluation provides information on a number of aspects that should be included in an IPCP. These aspects have been organised in eight areas that include similar topics. In each area, some components considered being essential in a good programme have been selected. In each component, standards have been established to best describe an acceptable component. Then, indicators have been established so that the presence of the standards could be considered objectively. A single standard may have several indicators and a single component may have several standards. Space has been provided for each indicator to enter what source was used to verify its presence. A list of suggested verifiers is provided in Annexe 2. These simply offer orientation or sources of information for the evaluator/s that can be used to determine whether a certain indicator is present. The evaluator/s can use other methods to establish the presence of

indicators. A glossary is also provided to assist with clarification of terms used (Annexe 3).

According to this tool, evaluation of the IPCP is based solely on the presence of indicators. Some of these indicators can only be assessed by observation of the clinical situation.

The only exception to the above is the “INEFFECTIVE PRACTICES” area, in which the presence of any of the indicators is considered in a comment to the report.

General Instructions

This evaluation is designed for application within a short period of time (i.e., approximately 12 person-hours).

- All actions conducted during an evaluation have a well-defined purpose that should be made known during the activity.
- Make written notes of your observations when they occur to you or take digital photographs. Do not rely on your memory.
- The written report must be compatible with the oral comments made during the review.

Indicate whether or not each indicator is present by recording YES, NO or NON-APPLICABLE (N/A) in the evaluation. Whenever NO or N/A is recorded, a brief written description on the actual status should be provided so that there can be records for local follow-up. It is not appropriate to enter non-applicable where an improvement in a standard may be achieved. For example where a requirement exists in the programme guidelines and it is not being met a non-applicable must not be used, a NO is more appropriate. This can then be included in the action plan for programme improvements. It is however appropriate to use non-applicable if a facility is absent or a practice is not undertaken in a specific area, for example performing hand hygiene after leaving an isolation room if there is no isolation room available.

Local initiatives

Wherever there are local initiatives in place to provide solutions to local infection control issues these must be noted as it demonstrates an understanding of the need to meet a specific standard although it may not actually be met.

Instructions and Recommendations for Direct Observation

Evaluation of many of the characteristics is based on observation of how activities are conducted in practice.

- When direct observation activities are conducted, tell your colleagues what you expect to find before beginning observation. After completing the activity, summarize whether what you found was appropriate or the practices did not meet the requirements.
- Be cautious about the comments and your reactions to non-compliance of practices, particularly because the reviews are often accompanied by personnel who may have a partial or distorted understanding of the practices.
- If you observe failure to comply with techniques or inappropriate practices, it is important to take note and possibly mention it in the final report. However, this does not necessarily mean that it represents a trend unless the practice is repeated.

Specific Instructions

Some areas have special conditions to be evaluated.

INTERVENTION STRATEGIES and HEALTHCARE ENVIRONMENT AND SANITATION

These are two of the most important areas of the evaluation. It is also the area in which there are usually the most comments. The evidence-based concepts used to evaluate the preventive strategies are only some of the most well-known and least controversial concepts. Therefore, they should be included in the usual practice of all healthcare facilities.

INEFFECTIVE PRACTICES

A series of practices have been introduced in healthcare environments in the past to prevent infections. However, there is currently no basis for maintaining them, as there is

sufficient evidence that they do not prevent infection. In addition, in some cases, there is even enough information to consider that it would be advisable to eliminate these practices since they increase risk.

In this evaluation it is enough to be aware of and verify the presence of an ineffective measure that increases the risk of infection in order to include a comment about it in the final interview and the written report. The information on the presence of ineffective measures may be acquired from multiple sources. It often occurs by chance during observations in the clinical units.

SCORING

Scoring of the tool can be carried out by adding the total number of yes answers and dividing by the total number of questions answered (including all yes and no answers) excluding the non-applicable. Then multiply by 100 to get the percentage. The area "Ineffective Practices" is not to be scored in this way, but a report of the findings should be included in the final report.

Formula

$$\frac{\text{total number of yes answers}}{\text{total number of yes and no responses}} \times 100 = \%$$

To produce an overall programme score add the scores for each area together then divide by the number of areas assessed. This will provide an overall all evaluation percentage. All areas are equally weighted.

Level of compliance

Percentage scores can be allocated a level of compliance using the compliance categories below. The categories are allocated as follows:

Compliant	85% or above
Partial compliance	76 to 84%
Minimal compliance	75% or below

If when producing an overall programme compliance score one (or more) of the areas scores less than 85% then there will be a partial compliance result.

For example:

IPCP evaluation for Hospital X	
Organisation	89%
Epidemiological Surveillance of Infections	86%
Microbiology	84%
Intervention Strategies	90%
Sterilisation and High-level Disinfection	86%
Personnel Health	95%
Hospital Environment and Sanitation	85%
Total	615 divided by 7 = 88%

Overall rating will be PARTIAL COMPLIANCE due to one area falling below 85%, this being the minimum score for compliant.

Description of Hospital

<table>
<tr><td colspan="3">Name of hospital:</td></tr>
<tr><td colspan="2">City:</td><td>Country:</td></tr>
<tr><td colspan="3">Administrative status: State Private University Other:</td></tr>
<tr><td colspan="2">No. beds:</td><td>Annual discharges:</td></tr>
<tr><td colspan="2">Intensive care unit beds:</td><td>Number of annual major surgeries:</td></tr>
<tr><td rowspan="7">Mark the clinical services available with an X</td><td>Surgery</td><td></td></tr>
<tr><td>Obstetrics</td><td></td></tr>
<tr><td>Paediatrics</td><td></td></tr>
<tr><td>Internal medicine</td><td></td></tr>
<tr><td>Neonatology</td><td></td></tr>
<tr><td>Adult intensive care</td><td></td></tr>
<tr><td>Other subspecialties</td><td></td></tr>
<tr><td colspan="3">Name of evaluators:</td></tr>
<tr><td colspan="3">Date of evaluation:</td></tr>
</table>

1. Area: Organisation							
1.1 Component: Leadership							
1.1.1 Standard: Infection Prevention and Control Programme (IPCP) oversight has been established and responsibilities have been defined							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	There is an official document that designates the individuals responsible for the IPCP						
2.	The tasks described for each of the individuals responsible are present in position descriptions						
3.	Personnel responsible for infection prevention and control are at a high level in the institution.						

1.1.2 Standard: IPCP functions are directed and evaluated by the highest level of the organisation							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	There are annual IPCP goals for the facility						
2.	Evidence that decisions are made in order to achieve goals						
3.	Goals are evaluated and monitored at least once a year by the hospital management						
1.2 Component: IPCP education							
1.2.1 Standard: The IPCP is considered to be an integral part of work by all personnel							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	There is an orientation programme for new personnel and this programme is followed						

2. Area: Epidemiological surveillance of infection

2.1 Component: Personnel

2.1.1 Standard: The programme has a physician for the activities

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Physician trained in basic epidemiology and IPC						
2.	Physician is allocated 10 or more hours per week for every 100 beds						

2.1.2 Standard: The programme has a nursing professional for IPC

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Full-time professional						
2.	Trained in epidemiological surveillance, infection control, and supervision						
3.	One full-time professional for every 150 beds						

2.2 Component: Surveillance method							
2.2.1 Standard: Surveillance is conducted with active data collection methods							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	Standardised definitions of most frequent infections						
2.	At least weekly case-finding in risk groups by reviewing medical records and laboratory data						
3.	Case-finding performed by professionals						
4.	Standardized definitions of exposed individuals (denominators of rates) and of how information on such individuals is collected						

2.2.2 Standard: There is a professional microbiologist accessible for the programme							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	Access to professional microbiologist						
2.2.3 Standard: Epidemiological information is analysed to detect HAI problems and evaluate the impact of intervention							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	HAI rates with a monthly frequency of at least 80% per year for each basic indicator						
2.	Annual analysis of antimicrobial drug resistance						
3.	Annual analysis of HAI trends that identifies problems and proposes solutions						
4.	Evaluation system (e.g., prevalence) of surveillance system capacity to detect infections						
5.	Identifies epidemic outbreaks and has outbreak reports						

2.3 Component: Information circulation							
2.3.1 Standard: Information is circulated to all personnel affected							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	Report with analysis, recommendations, and known distribution						
2.	Up-to-date information is available and known in all departments involved in surveillance						

3. Area: Microbiology

3.1 Component: Diagnostic capability

3.1.1 Standard: Hospital has access to identification of the most relevant microbial agents in HAI control

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Identification of aerobic bacteria to species level in blood cultures						
2.	Identification of viral agents: hepatitis, HIV, adenovirus, influenza, respiratory syncytial virus, rotavirus						
3.	Detection of *M. tuberculosis*						
4.	Identification of *Candida*						

3.1.2 Standard: Able to routinely identify antimicrobial susceptibility of HAI agents isolated

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Identify susceptibility patterns of most frequent HAI agents						
2.	Methicillin-resistant *Staphylococcus aureus*						
3.	Vancomycin-resistant *Enterococcus*						

3.2 Component: Specimen collection and shipment standards

3.2.1 Standard: Standardized techniques and procedures

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Specimen collection and shipment manual updated at least every 3 years and circulated						

3.3 Component: Quality control

3.3.1 Standard: Microbiology activities evaluated periodically by internal and external audits

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Maintain quality control records on identification of agents and antimicrobial susceptibility studies in accordance with relevant standards						
2.	Submitted to external quality control at least once a year						

3.4 Component: Microbiological information

3.4.1 Standard: Analysis of clinical information

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Report on agents responsible for NI according to the type of specimen and department of origin						
2.	Report on antimicrobial susceptibility pattern of relevant etiologic agents						

4. Area: Intervention strategies

4.1 Component: Interventions to improve IPC

4.1.1 Standard: Hand hygiene will be performed correctly and in a timely manner using a cleansing agent, at the facilities available to reduce the risk of cross infection

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Liquid soap is available at all hand hygiene sinks						
2.	Liquid soap must be single-use cartridge dispensers						
3.	Dispenser nozzles are visibly clean						
4.	Absorbent single-use towels are available at all hand hygiene sinks						
5.	Wall mounted or pump dispenser hand cream is available for use						
6.	Antibacterial solutions/scrubs are not used for social hand hygiene						
7.	Antibacterial solutions are used for invasive procedures and surgical scrubs						

	4.1.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
8.	There are no nail brushes on hand hygiene sinks in clinical areas						
9.	The hand hygiene sinks are free from used equipment and inappropriate items						
10.	Hand hygiene sinks are dedicated for that purpose						
11.	Access to hand hygiene sinks is clear						
12.	Hand hygiene sinks are clean and intact						
13.	Elbow operated taps are available in hand hygiene sinks in clinical areas						
14.	Alcohol hand rub (AHR) is available at entrance/exits to wards and departments						
15.	AHR is directly accessible at the point of care (one for every four beds)						
16.	AHR is portable for clinical procedures						
17.	No wrist watches/stoned rings or other wrist jewellery are worn by staff carrying out patient care						

	4.1.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
18.	Staff nails are short, clean, free from nail varnish or extensions						
19.	Posters promoting hand decontamination are available and displayed in areas visible to staff before and after patient contact						
20.	Staff have received training in hand hygiene procedure within the last year. (Ask various disciplines of staff)						
21.	Patients are offered hand hygiene facilities after using the toilet/commode/bedpan						
22.	Patients are offered hand hygiene facilities prior to meals						
	Observation						
23.	Staff use the correct procedure for hand hygiene (observe practice)						
24.	Staff can indicate when it is appropriate to use alcohol rub						

	4.1.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
25.	Hand hygiene is performed in the following circumstances: (Observe practices)						
A	Before touching a patient[3]						
B	Before clean/aseptic procedures[3]						
C	After body fluid exposure/risk[3]						
D	After touching a patient[3]						
E	After touching patient surroundings [3]						
F	Prior to handling food						
G	After leaving an isolation room						

4.1.2 Standard: Clinical practices will be based on best practice and reflect infection control guidance to reduce the risk of cross infection to patients' whilst providing appropriate protection to staff

NB: This section should be undertaken over a period of time to allow for the observation of as many practice elements as possible

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Sterile and non-sterile gloves (powder free) are fit for purpose (no splitting etc) are available in all clinical areas						
2.	Gloves are observed to be worn for:						
A	Invasive procedures						
B	Contact with sterile sites						
C	Contact with mucous membranes						
D	All activities that have been assessed as carrying a risk of exposure to body fluids						
3.	Gloves are worn as single-use items						
4.	Gloves are worn immediately before an episode of patient contact or treatment, when appropriate, and removed as soon as the activity is completed						

	4.1.2 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
5.	Hand hygiene is performed before donning gloves and following the removal of gloves						
6.	Disposable plastic aprons are worn when there is a risk that clothing or uniform may become exposed to body fluids or become wet						
7.	Plastic aprons are worn as single-use items for each clinical procedure or episode of patient care						
8.	Full body, fluid repellent gowns are worn where there is a risk of extensive splashing of body fluids onto the skin of healthcare practitioners						
9.	Facemasks and eye protection are worn where there is a risk of any body fluids splashing into the face and eyes						
10.	Respiratory protective equipment is available for use when clinically indicated e.g. particulate filtration masks for open pulmonary tuberculosis						

4.1.3 Standard: Clinical practices will be based on best practice and reflect infection control guidance to reduce the risk of cross infection to patients' whilst providing appropriate protection to staff

NB: This section should be undertaken over a period of time to allow for the observation of as many practice elements as possible

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Urinary catheters and drainage bags are stored in an appropriate area (not in the sluice)						
2.	Indwelling urethral catheters are only inserted after considering alternative methods of management (reason for insertion should be documented)						
3.	There is evidence that the patient's clinical need for continuing catheterisation is reviewed and documented						
4.	Catheterisation is performed aseptically (ask a member of staff to describe the procedure)						
5.	A single-use anaesthetic lubricant is used for insertion for male and females						

	4.1.3 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
6.	Indwelling urethral catheters are connected to a sterile closed urinary drainage system						
7.	Catheter bags are positioned below the level of the bladder and suspended above floor level						
8.	Catheters are secured to prevent trauma						
9.	The connection between the catheter and the urinary drainage system is not broken except for good clinical reasons, e.g., changing the bag in line with the manufacturers' recommendations						
10.	Hand hygiene is performed before manipulating a patient's catheter						
11.	When emptying the urinary drainage bag clean non-sterile disposable gloves, eye protection and a plastic apron are worn						
12.	Hand hygiene is performed after removal of gloves						

	4.1.3 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
13.	When emptying the urinary drainage bag, a separate and clean container is used for each patient and contact between the urinary drainage tap and container is avoided						
14.	Night bags are single-use						
15.	Meatal cleanliness is maintained only as part of routine personal hygiene						
16.	Catheter specimens of urine (CSU) are only taken when clinically indicated (e.g. patient systemically unwell), or for screening for antimicrobial resistant organisms if part of local protocol						

	4.1.3 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
17.	CSU specimens are taken aseptically						
18.	Bladder irrigation, instillation and washout are not used for the prevention or treatment of catheter-associated infection						

4.1.4 Standard: Clinical practices will be based on best practice and reflect infection control guidance to reduce the risk of cross infection to patients' whilst providing appropriate protection to staff

NB: This section should be undertaken over a period of time to allow for the observation of as many practice elements as possible

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Insertion of intravascular devices is performed aseptically with hand decontamination undertaken on all occasions						
2.	Before insertion of a device the skin is disinfected with a suitable preparation (e.g. alcohol) and is allowed to dry						
3.	Cannulae dressings are changed when they become damp, loose or soiled						
4.	Insertion details relating to the cannulae have been documented						
5.	Sterile dressings are applied to cover cannulae sites						

	4.1.4 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
6.	Cannulae and lines should be labelled with a date or a suitable documentation system is in place to enable intravenous tubing and associated connections to be replaced according to local policy (e.g. 72 hours)						
7.	Injection ports and catheter hubs are disinfected according to local policy and manufacturers' instructions before and after using them to access the system						
8.	If blood or lipid emulsions are administered, sets are changed every 24 hours						
9.	Hand hygiene is performed prior to handling or manipulating intravenous lines						
10.	Intravenous fluid bags are single patient use						
11.	Intravenous giving set lines used for intermittent infusions are discarded once disconnected						

4.1.5 Standard: Clinical practices will be based on best practice and reflect infection control guidance to reduce the risk of cross infection to patients' whilst providing appropriate protection to staff

NB: This section should be undertaken over a period of time to allow for the observation of as many practice elements as possible

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Isolation facilities are available in inpatient areas						
2.	Patients requiring isolation facilities due to infection have access to them						
3.	Where a patient is being isolated for infection control reasons, the precautions are appropriate and according to local policy						
4.	Protective clothing is readily available upon entering the isolation room						
5.	Hand hygiene facilities are available, accessible and clean within the room						
6.	No inappropriate or unnecessary items are stored in the isolation room						

	4.1.5 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
7.	Where a patient is being isolated for infection control reasons, the patient is aware of the need or rationale for this						
8.	Clear instructions for staff and visitors are in place when a patient is in isolation. (e.g. confidential notice on the door)						
9.	Appropriate information leaflets are available to patients for common infections e.g. MRSA, *C.difficile*						
10.	Visitors are advised that they do not routinely need to wear protective clothing						
11.	Reusable equipment which may become readily contaminated is dedicated for the patients use only (e.g. commode, hoist, sling)						
12.	Used linen, waste and crockery have been removed from the room in a timely manner						
13.	Housekeeping staff are aware of the local policy and procedures for cleaning isolation rooms						

	4.1.5 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
14.	Separate colour coded cleaning equipment is in use for isolation facilities						
15.	Isolation precautions are discontinued when no longer necessary						

4.1.6 Standard: Main HAI prevention activities are regulated in accordance with best current knowledge

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Existence of a complete regulatory technical basis						
2.	Regulations updated within the last three years						
3.	Technical regulation contents and indications are evidence-based						
4.	Infectious foci are eliminated prior to surgery						
5.	Surgical site is not shaved with razor blade						
6.	Antibiotic prophylaxis administered within two hours before a surgical procedure						
7.	Restricted use of vancomycin						
8.	Restricted use of third-generation cephalosporins						

4.1.7 Standard: Compliance with regulations is promoted and evaluated							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	Regulations with effective activities have been circulated to personnel that should know them						
2.	Supervision of personnel compliance with regulations is performed						
3.	Evidence of compliance with basic regulations						

5. Area: Sterilisation and high-level disinfection							
5.1 Component: Sterilisation methods							
5.1.1 Standard: Sterilisation processes are controlled in order to guarantee results							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	Only sterilisation methods of proven efficacy[1] are used						
2.	Standards and procedures have been established for all sterilisation and disinfection processes						
3.	Individual chemical indicators are used						
4.	Biological indicators are used at least weekly						
5.	Surgical instruments processed are free from organic matter						
6.	All packages are labelled with processing date and follow event related sterility protocols						

[1] On the date of preparation of this document: autoclaves, dry heat, ethylene oxide in automated equipment, formaldehyde in automated equipment, hydrogen peroxide plasma in automated equipment, peracetic acid in automated equipment.

	5.1.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
7.	Undamaged containers that are appropriate for the method[2]						
8.	Preventive maintenance programme has been established for sterilisation equipment						

[2] Fenestrated boxes for use in autoclaves, use of paper packaging without memory in all paper packaging, packaging without cellulose for plasma sterilisation

5.2 Component: High-level disinfection methods

5.2.1 Standard: High-level disinfection processes are controlled to guarantee results

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Only high-level disinfection methods of proven efficacy[3] are used						
2.	Appropriate exposure time is controlled in each cycle						
3.	Chemical indicator of concentration at least weekly						

[3] On the date of preparation of this document: 2% glutaraldehyde, peracetic acid, orthophthalaldehyde (OPA). For dialysis filters 4% formaldehyde can be used

6. Area: Personnel health

6.1 Component: Prevention of infections that can be transmitted between healthcare workers and patients

6.1.1 Standard: Activities to prevent transmission of infections between patients and personnel

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Staff training on prevention of sharps injuries, splash exposures and immunisation						
2.	Written programme for hepatitis B immunisation of personnel exposed to blood						
3.	Hepatitis B programme personnel coverage = 80% of target population						
4.	Written programme for annual influenza immunisation of all clinical personnel						
5.	Personnel influenza programme coverage = 80% of target population						
6.	Written programme for rubella immunisation of susceptible women						
7.	Personnel rubella programme coverage = 80% of target population						

	6.1.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
8.	Management of blood and body fluid exposure caused by sharps injuries with articles used on patients and splash exposures						

6.1.2 Standard: Personnel infections are monitored and measures are taken to protect exposed personnel and patients							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	Management of personnel with communicable[4] infections is supervised and complied with						
2.	Occupational exposure of epidemiological[5] importance is monitored						
3.	Nurse/clinical manager in charge is aware of the action required following an inoculation injury. They should include immediate first aid, informing the manager, occupational health or ED, completion of an incident form and describe the action for high risk injuries involving blood borne viruses (Question the nurse/clinical manager in charge)						

[4] Establish whether personnel with infectious communicable diseases may be in contact with patients or whether they should be absent from work during the course of each infection.
[5] On the date of preparation of this document: exposure to blood and body fluids with high risk of containing HIV, hepatitis B or hepatitis C, and exposure to Mycobacterium tuberculosis.

	6.1.2 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
4.	Staff are aware of the first aid action required following an inoculation or splash injury (Question a member of staff)						
5.	Staff can identify where the safe handling of sharps policy is located						
6.	There is a policy and/or poster available for the management of a sharps injury or splash exposure						

7. Area: Hospital Environment and sanitation

7.1 Component: Physical plant conditions

7.1.1 Standard: Basic general structural conditions for prevention of infection

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	Permanent availability of drinking water with minimum autonomy of eight hours						
2.	Separation of≥ 1 metre between each bed/cot in all clinical areas						
3.	Participation by IPC team if remodelling or construction are performed in areas where activities of clinical importance are conducted						
4.	Availability of individual patient isolation room with operational washbasins, supplies, and closed doors. If patients with active tuberculosis are admitted to the hospital, the isolation rooms also have air extraction towards the outside.						

7.2 Component: Sanitation conditions							
7.2.1 Standard: The environment will be maintained appropriately to reduce the risk of cross infection							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	The following pieces of equipment are clean and in a good state of repair:						
A	Beds						
B	Tables						
C	Lockers						
D	Chairs and stools						
2.	All chairs and stools in clinical areas are covered in an impermeable material e.g. vinyl						
3.	Floors including edges and corners are free of dust and grit.						
4.	All high and low surfaces are free from dust and cobwebs						
5.	Curtains and blinds are free from stains, dust and cobwebs						

	7.2.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
6.	There is evidence of an effective pre-planned programme for curtain changes						
7.	Fans are clean and free from dust						
8.	Air vents are clean and free from excessive dust						
9.	Work station equipment in clinical areas are visibly clean e.g. phones, computer keyboards						
	Clean storeroom						
10.	There is an identified area for the storage of clean and sterile equipment						
11.	The area is clean and there are no inappropriate items of equipment						
12.	Hand hygiene facilities are available in the clinical room/clean store						
13.	Floors including edges and corners are free of dust and grit.						
14.	All high and low surfaces are free from dust and cobwebs						

	7.2.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
15.	Shelves, bench tops and cupboards are clean inside and out, and are free of dust and spillage						
16.	All products are stored above floor level						
	Bathrooms						
17.	Bathrooms/washrooms are clean						
18.	There is no evidence of inappropriate storage of communal items in the bathrooms e.g. single-use creams, talcum powder						
19.	Bathrooms are not used for equipment storage						
20.	Baths, sinks and accessories are clean						
21.	Bathroom wall tiles and wall fixtures (including soap dispensers and towel holders) are clean and free from mould						
22.	Bathroom floors including edges and corners are free of dust and grit.						
23.	The toilet, hand hygiene sink, handrails and surrounding area is clean and free from extraneous items						

	7.2.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
24.	Toilet floors including edges and corners are free of dust and grit						
25.	Hand hygiene facilities are available in the toilets including soap and paper/single-use towels						
	Dirty utility room						
26.	A dirty utility is available						
27.	A separate sink is available for decontamination of patient equipment						
28.	A sluice hopper is available for the disposal of body fluids						
29.	The integrity of fixtures and fittings are intact in the dirty utility room						
30.	Separate hand hygiene facilities are available in the dirty utility room including soap and paper/single-use towels						
31.	The dirty utility room is clean and free from inappropriate items						

	7.2.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
32.	The dirty utility room floor is clean and free from spillage						
33.	The dirty utility floors including edges and corners are free of dust and grit						
	Cleaners room						
34.	Cleaning equipment is colour coded						
35.	Mops and buckets are stored according to the local policy						
36.	Mop heads are laundered daily or are disposable (single-use)						
37.	Macerators and bed pan washers are clean and in working order						
38.	Dirty utility shelves and cupboards are clean inside and out and free of dust, litter or stains						

	7.2.1 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
39.	Equipment used by the domestic staff is clean, well maintained and stored in a locked area						
40.	No inappropriate materials or equipment are stored in the domestic's room						
41.	Products used for cleaning and disinfection comply with policy and are used at the correct dilution						
42.	Diluted products are discarded after 24 hours						
43.	Personal protective clothing is available and appropriately used						
44.	Information on the colour coding system in use is available in the domestic's room						
45.	Hand hygiene facilities are available for domestic use						

7.2.2 Standard: Kitchens will be maintained to reduce the risk of cross infection in accordance with legislation							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	The floor is free of dust, grit, litter, marks, water or other liquids						
2.	Inaccessible areas (edges, corners and around furniture) are free of dust, grit, lint and spots						
3.	There are no inappropriate items or equipment in the kitchen						
4.	There is no evidence of infestation or animals in the kitchen						
5.	Fly screens are in place where required						
6.	There is a policy regarding patient and visitor access to the kitchen						
7.	Cleaning materials used in the kitchen are identifiable (e.g. colour coded) and are stored separately to other ward cleaning equipment and away from food						
8.	Hand hygiene sink, liquid soap and disposable paper/single-use towels are available						

	7.2.2 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
9.	Hand hygiene is performed, a clean plastic apron and hair cover is worn to prepare and serve patient meals and drinks						
10.	Fixtures and fittings are in a good state of repair						
11.	Fixtures, surfaces and appliances are free of grease, dirt, dust, deposits, marks, stains and cobwebs						
12.	Shelves, cupboards and drawers are clean inside and out and are free from damage, dust litter or stains and in a good state of repair						
13.	Kitchen trolleys are clean and in a good state of repair						
14.	Refrigerators/freezers are clean and free of ice build up						
15.	There is a thermometer in the fridge and freezer						

	7.2.2 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
16.	There is evidence that daily temperatures are recorded and appropriate action is taken if standards are not met (refrigerator temperature must be less than 8C or as local policy Freezer temperature –18˚C)						
17.	Patient and staff food in the fridge is labelled with name and date						
18.	There are no drugs/blood for transfusion or pathology specimens in the fridge						
19.	Microwaves are visibly clean						
20.	Toasters are visibly clean						
21.	All food products are within their expiry date						
22.	All opened food is covered or stored in containers						
23.	Milk is stored under refrigerator conditions						
24.	Waste bins are foot operated and in good working order						
25.	Waste bins are clean and labelled ‘for general waste’						

	7.2.2 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
26.	Clean linen or disposable paper is available for drying equipment and surfaces						

7.2.3 Standard: Linen is managed and handled appropriately to prevent cross infection							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	Clean linen is stored in a clean designated area separate from used linen (not in the sluice or bathroom)						
2.	Clean linen is free from stains (randomly check linen)						
3.	Clean linen store is clean and free from dust						
4.	Clean linen store is free from inappropriate items						
5.	Linen is segregated in appropriate colour coded bags according to policy						
6.	Bags are less than 2/3 full and are capable of being secured						
7.	Bags are stored correctly prior to disposal						
8.	Linen skips and the appropriate bags are taken to the area required. (Staff are not carrying soiled linen or leaving it on the floor)						
9.	Gloves and apron are worn when handling contaminated linen						

	7.2.3 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
10.	Ward based washing machines are only used with the agreement of Infection Control						
11.	A washing machine if used is situated in an appropriate designated area						
12.	There is written guidance regarding the use of the washing machine						
13.	There is evidence that the guidelines are being adhered to (question staff and observe use)						
14.	If a washing machine is in use a tumble dryer is also available which is externally exhausted						
15.	There is evidence that the washing machine and tumble dryer are on a pre-planned maintenance programme						
16.	Hand hygiene facilities are available in the laundry room						

7.2.4 Standard: Waste is disposed of safely without the risk of contamination or injury							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	There is an appropriately designated Waste Officer who has undergone training within the last two years (check Job Description and training record)						
2.	All clinical waste must be transported in rigid containers						
3.	There is a dedicated compound for the safe storage of clinical waste, which is under cover from the elements and free from pests and vermin						
4.	All wards/depts should have a clinical waste storage area away from the public						
5.	Waste containers are locked and inaccessible to the public						
6.	The compound is locked and inaccessible to public						
7.	The compound has appropriate signs in the area						
8.	Returned containers are clean						

	7.2.4 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
9.	Containers are in a good state of repair						
10.	Special waste is stored separate to other waste						
11.	Special waste storage area is clearly labelled						
12.	Special waste storage area/ bin is kept locked						
13.	Sharps boxes are correctly sealed						
14.	Sharps boxes are correctly labelled						
15.	Sharps boxes are safely stored						
16.	Biological agents are made safe by autoclaving before leaving the laboratory for final disposal						
17.	There are no inappropriate items in the household or recycling bins						
18.	Spill kit and heavy duty gloves or alternative are available						
19.	There is no storage of inappropriate items in the waste compound						
20.	The area is clean and tidy (there are cleaning facilities)						

	7.2.4 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
21.	There is no storage of waste in corridors, inside/outside the hospital whilst awaiting collection						
22.	There is a system for transporting the waste through the hospital (i.e. which avoids manual handling of waste)						
23.	Clinical waste is segregated from other waste for transportation						
24.	All waste containers used for transport are clean						
25.	All waste containers are in a good state of repair						
26.	Clinical waste posters and/or a waste policy identifying waste segregation are available in all areas						
27.	All bags are tied, labelled and secured before leaving the place of generation (e.g. ward)						
28.	All waste bins are enclosed to minimise the risk of injury						

	7.2.4 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
29.	Supplies of bins labelled as "Clinical", "Household", “Hazardous” or “Glass and Aerosol” are available						
30.	Staff are aware of waste segregation procedures (Randomly question a staff member)						
31.	All waste bins are visibly clean						
32.	All waste bins in the area are foot operated, lidded and in good working order						
33.	Staff are using correct waste bags for household, glass, aerosols, batteries and clinical/hazardous waste (Visibly check bin contents)						
34.	All prescription only medicines must be disposed of as hazardous/special waste and the bin labelled accordingly						

	7.2.4 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
35.	Glass and aerosol boxes are not used for prescription only medicine bottles						
36.	Waste bags are removed at least daily						
37.	There is no transfer of clinical waste from one bag to another						
38.	There are no overfilled bags. Bags are no more than 2/3 full						
39.	Waste bags are not tied onto containers/trolleys						
40.	Suction waste must be disposed of in a manner which prevents spillage e.g. canisters/liners are disposed of into rigid leak-proof containers or suction waste has been solidified with a gelling agent						
41.	Rigid burn bins are available for disposal of body parts, equipment etc						
42.	Staff have attended a training session which includes the correct and safe disposal of clinical waste						

	7.2.4 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
43.	Internal storage is inaccessible to the public or locked						
44.	Tied bags waiting disposal are not observed in corridors. They are stored in an appropriate holding area						

7.2.5 Standard: Sharps will be handled safely to prevent the risk of needlestick injury							
		Yes	**No**	**N/A**	**Verifier**	**Local initiative**	**Comments**
1.	The bins in use comply with national standards						
2.	Bins have not been filled above the fill line						
3.	Bins are free from protruding sharps						
4.	All bins have been assembled correctly						
5.	All sharps bins are labelled and signed according to hospital policy						
6.	Sharps bins are stored safely, away from the public and out of reach of children						
7.	Bins are stored appropriately off the floor						
8.	Sharps bins are used in accordance with ergonomic manual handling principles i.e. using brackets						
9.	Once full the bin aperture is sealed or locked						
10.	Sealed and locked bins are stored in a locked room, cupboard or container, away from public access						

	7.2.5 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
11.	An empty sharps bin is available on the cardiac arrest trolley						
12.	The sharps bin on the cardiac arrest trolley is stored safely						
13.	Sharps trays in use are visibly clean						
14.	Sharps are disposed of directly into a sharps bin at the point of use (i.e. medicine trolleys and laboratory equipment)						
15.	Inappropriate re-sheathing of needles does not occur. Observe or question a member of staff.						
16.	Needles and syringes are discarded into a sharps bin as one unit						

7.2.6 Standard: There is a system in place that ensures as far as reasonably practicable that all reusable equipment is properly decontaminated prior to use and that the risks associated with decontamination facilities and processes are adequately managed

NB: All decontamination must be undertaken in accordance with local policy and manufacturers' instructions

		Yes	No	N/A	Verifier	Local initiative	Comments
1.	A written comprehensive decontamination policy, approved by the ICC is available to all staff						
2.	Staff are aware of the need to contact infection control for advice when purchasing new equipment						
3.	Manufacturers' instructions are available for the decontamination of newly purchased equipment						
4.	Staff can state the procedure for decontamination of commonly used patient care equipment e.g. commodes, mattresses, IV stands						
5.	Local decontamination of reusable surgical instruments is not undertaken in clinical areas.						

	7.2.6 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
6.	Used instruments are safely stored in an appropriate container prior to collection for decontamination in CSSD						
7.	The responsibility for the cleaning of dedicated patient equipment is clearly defined, e.g., bed frames, IV stands, commodes						
8.	The following general equipment is visibly clean:						
A	IV stands						
B	IV pumps/syringe drivers						
C	Cardiac monitors						
D	Dressing trolleys						
E	Blood pressure cuffs						
F	Pillows						
G	Mattresses						
H	Cot sides						
I	Wheelchairs and cushions						
J	Oxygen saturation probes						

	7.2.6 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
9.	Patient wash bowls are decontaminated appropriately between patients and are stored clean dry and inverted						
10.	Standard mattress covers are in a good state of repair						
11.	Disposable paper towel or reusable linen on couches/trolleys is changed between each patient use						
12.	Medications on the resuscitation trolley/resuscitaire are within their expiry date and all items are visibly clean (free from dust and body fluids)						
13.	Single-use ambu bags are used or filters to ambu bags are changed between patient use						
14.	Laryngoscope covers or blades are single-use alternatively the blades are sent back to CSSD for decontamination between each patient use						

	7.2.6 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
15.	Laryngoscope handles if not disposable are decontaminated following each use						
16.	Suction equipment is clean and dry (including canister)						
17.	Catheter is not attached (clean cover acceptable in some emergency situations)						
18.	Disposable suction liners are used and changed between patient use						
19.	Respiratory equipment is changed according to local policy and manufacturers' instructions, check						
A	Oxygen masks/nasal cannulae						
B	Wall humidifiers						
C	Nebulisers						
20.	Humidifiers are managed according to manufacturers' instructions and local policy						
21.	Ventilator tubing is protected by filters – expiratory						
22.	Ventilator is protected by a filter – inspiratory						

	7.2.6 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
23.	Ventilator equipment is on a pre-planned maintenance programme						
24.	Ventilator equipment is visibly clean						
25.	Catheter stands are available clean and in a good state of repair						
26.	Appropriate facilities are available and in working order, to ensure correct disposal (or disinfection) of bedpans and urinals e.g. macerator or washer disinfector						
27.	Washer/disinfectors reach a temperature of 87˚C						
28.	Bedpans/potties, slipper pans/bedpan holders/urinals are visibly clean						
29.	Bedpans/bedpan holders/urinals are stored inverted on racks						
30.	If reusable jugs are in use for emptying catheter bags (i.e. during irrigation) appropriate washing and disinfection facilities are available						
31.	Raised toilet seats are clean and ready for use						

	7.2.6 cont.	Yes	No	N/A	Verifier	Local initiative	Comments
32.	Commodes are clean and ready for use (check underside)						
33.	Commodes are in a good state of repair						
34.	Medical imaging check the following:						
A	Ultra sonic probes are decontaminated according to local policy and manufacturers' instructions between each patient use						
B	Gels are single patient use or dispensed in a manner to avoid contamination						
C	Sand bags are intact and covered						
D	Sand bags are visibly clean						
E	Foam supports are covered with wipeable covers						
F	X-ray cassettes are decontaminated according to local policy and manufacturers' instructions between patient use						
G	Mobile X-ray machines are visibly clean						
H	Scanners are visibly clean						

8. Area: Ineffective Practices

The following practices have been established in the past in order to prevent infections.

At present, there are no foundations to recommend maintaining them.

Practices recognized as ineffective that increase risk[6]

		Yes	No	Comments
1.	Processing with quaternary ammonium for high-level disinfection or sterilisation			
2.	Syringes or needles used in more than one patient (e.g., anaesthesia)			
3.	Use of flash sterilisation as routine method of instrument sterilisation			
4.	Surgical site is shaved with razor blade			
5.	Use of immersion in chemical agents for sterilisation			
6.	Environmental disinfection with formaldehyde			
7.	Sterilisation with formaldehyde tablets			
8.	Sterilisation of materials in plastic bags and ethylene oxide ampoules			
9	Recycling of disposable peripheral venous infusion material			
10.	Use of air conditioning without filter in operating room			
11.	Chemical decontamination of contaminated material			

[6] These concepts are based on well-designed studies that have led to the conclusion that they do not prevent infections. Rather, they increase the risk of infection.

Costly practices recognized as ineffective[7]				
		Yes	No	Comments
1.	Routine culture of personnel that are carriers[8]			
2.	Use of topical antiseptic on open wounds			
3.	Continuation of antibiotic treatment after operation concludes			
4.	Routine culture of vascular catheter tips			
5.	Disinfection of hospital waste (except for Microbiology laboratory)			
6.	Use of footwear covers in all areas of hospital (not Operating Room/Theatre)			
7.	Routine environmental cultures (e.g., air, surfaces, or soap)			

[7] These concepts are based on well-designed studies that have led to the conclusion that they do not prevent infections. Although they do not increase risk, they often cause unnecessary expenses.

[8] These cultures are not useful unless there is an epidemic with evidence that carriers should be considered as a risk factor.

Reference list

1. Pan American Health Organization, *Nosocomial Infection Program Rapid Evaluation Guide*. 2005, Washington DC: Pan American Health Organization.
2. Infection Control Nurses Association, *Audit Tools for Monitoring Infection Control Standards*. 2004, London: Infection Control Nurses Association.
3. World Health Organization, *WHO guidelines on hand hygiene in health care*. 2009, Geneva: WHO Press.

Annexe 1: Instructions for External Technical Consultants

Instructions and Recommendations for External Evaluators

Interviews

This process includes three main types of interviews:

Initial interview: This interview is usually with the hospital director, who may or may not be accompanied by other people. The objectives are as follows:

- Introduction to the local authority
- Meet the people who will accompany the evaluators during the activity
- Become familiar with the general characteristics of the hospital
- Explain which activities will be conducted in the hospital during the evaluation
- Set a time for the final meeting
- Confirm that the local authority has consented to the activity

Technical interviews: These interviews are with professionals who perform different activities in the hospital. The objective is to obtain specific information related to the guide. In order to make the most of these interviews, the following is recommended:

- You should always be accompanied by a professional from the hospital
- Interview the person in charge of the unit or activity. A meeting with personnel working under them should be held only with their consent.
- Introduce yourself and explain the reason for the interview
- Tell them what information is required

Final interview: This interview is usually with the hospital director, accompanied by other people. The objectives of this interview are as follows:

- Report the main findings of the observations.
    - Briefly summarize each area, highlighting aspects that are partially or fully acceptable as well as those that can be improved. Use clear examples. Avoid going into detail.
- Compile any information that was not included previously
- Receive comments and clarifications on your observations

- Thank the facilities and the appropriate individuals for having participated in the activity

It is strongly recommended that the team of evaluators meet alone for a few minutes before the final interview and agree on the points that will be dealt with.

Document Review

Some of the information will be obtained from documents that directly or indirectly contribute data that can be used as a basis for determining compliance with the characteristics in the guide. Document review tends to be a long and complex process. For document review:

- Focus the document review on the objectives of the guide.
- Request that your local contacts show where the information is found in the documents.
- Review by a person unfamiliar with the local documentation system may be tedious and fruitless. Be explicit about your needs.
- Avoid requesting a particular document. It is preferable to request documentation for the activities. Each hospital has its own form of documentation. For example: In order to find out about training activities, avoid requesting “committee minutes” since the information needed may not be found there. However, if you request a list of training activities performed, there may be different types of documentation (e.g., annual summaries of activities and specific training reports).

Instructions and Recommendations for Direct Observation

Evaluation of many of the characteristics is based on observation of how activities are conducted in practice.

- When direct observation activities are conducted, tell your contacts what you expect to find before beginning observation. After completing the activity, summarize whether what you found was appropriate or the practices did not meet the requirements.
- Be cautious about the comments and your reactions to non-compliance of practices, particularly because the visits are often accompanied by personnel who may have a partial or distorted understanding of the practices.

- If you observe failure to comply with techniques or inappropriate practices, it is important to take note and possibly mention it at the meeting. However, this does not necessarily mean that it represents a trend unless the practice is repeated.

Specific Instructions

Some areas have special conditions to be evaluated.

INTERVENTION STRATEGIES and HEALTHCARE ENVIRONMENT AND SANITATION

These are two of the most important areas of the evaluation. It is also the area in which there are usually the most comments. The evidence-based concepts used to evaluate the preventive strategies are only some of the most well-known and least controversial concepts. Therefore, they should be included in the usual practice of all healthcare facilities.

INEFFECTIVE PRACTICES

A series of practices have been introduced in healthcare environments in the past to prevent infections. However, there is currently no basis for maintaining them, as there is sufficient evidence that they do not prevent infection. In addition, in some cases, there is even enough information to consider that it would be advisable to eliminate these practices since they increase risk.

In this evaluation it is enough to be aware of and verify the presence of an ineffective measure that increases the risk of infection in order to include a comment about it in the final interview and the written report. The information on the presence of ineffective measures may be acquired from multiple sources. It often occurs by chance during observations in the clinical units.

Written Report

INSTRUCTIONS AND RECOMMENDATIONS FOR PREPARATION OF THE REPORT

- When the field activities have been completed, a final written report should be prepared.

- It is recommended that the report be written on the same day as the evaluation was made, particularly if more than one healthcare facility has been evaluated that day.
- This is an activity that should be performed by the entire team. If more than one facility has been evaluated on the same day, it is recommended that the facilities be analysed one at a time.

Individuals to Interview

• Facility Director
• Infection Control Committee or Programme Director
• Infection Control Professional
• Physician-Epidemiologist
• Microbiologist
• Sterilisation Supervisor
• Heads of Department: Intensive Care, Paediatrics, and Surgery
• Director of Nursing
• Personnel Health Supervisor

Proposed Programme

Activity		Estimated time (min)	Number of evaluators	Objective
Initial interview		40	All	Introduction, arrange final meeting
Meet with Infection Control Committee		90-120	All	Review information, documents, evaluate organisation and monitoring
Visit departments	Sterilisation	30-45	1	Evaluate sterilisation
	Laboratory	30-45	1	Evaluate microbiology
	Intensive care unit	30-45	1	Evaluate intervention strategies Integrate programme into routine practice Aspects of physical plant and environmental sanitation Identify
	Paediatrics	30-45	1	
	Surgery	30-45	1	
	Medicine	30-45	1	
	Others based on time available			

				ineffective practices
Meet with Personnel Health Supervisor		30-40	1	Evaluate personnel health
Meet with Governing body		30-60	All	Oral report on findings
Write report		120-180	All	Prepare report

Annexe 2: Suggested verifiers

Verifiers offer orientation of sources of information for the evaluator/s that can be used to determine whether a certain indicator is present. This list is not exhaustive; the evaluator/s can use other methods to establish the presence of indicators.

Area	**Suggested verifiers:**
1. Organisation	• Documentation signed by local authority • Official documents of the institution (programme, plans or annual report) • Minutes, reports or intervention programmes • Annual reports • Written education programme that includes healthcare associated infection (HAI) standards • Education programme compliance reports
2. Epidemiological Surveillance of Infections	• Interviews • Certificates of training • Local documentation • Surveillance record sheets • Local procedures • Various reports • Information bulletins/reports and distribution list
3. Microbiology	• Interviews • Various reports • Reference laboratory report • Manuals
4. Intervention strategies	• Standards • Guides • Manuals • Direct observation • Interviews
5. Sterilisation and High-Level Disinfection	• Interviews • Standards

	• Direct observation • Manuals • Record forms • Maintenance programme record forms
6. Personnel Health	• Care records and plan • Programme documentation • Records • Standards
7. Hospital Environment and Sanitation	• Direct observation • Meeting minutes • interviews

Annexe 3: Glossary

Glossary

access	In this document it is the condition by which a hospital provides a service that is not provided directly by it. For example, a hospital may not have a Microbiology Department. Rather, the appropriate services are provided by an external laboratory when required. In this case, the hospital has "access" to microbiology.
immunisation coverage	Proportion of vaccinated individuals out of the total number planned. In this guide, evaluation of immunological response to the vaccine is not considered.
disinfection	Procedure designed to eliminate pathogenic agents from articles and other patient care equipment in order to decrease the risk of infection. Microbial spores are not usually eliminated. A distinction is made between different levels using Spaulding's classification. High-level disinfection is considered to be of interest.
official document	Document that satisfies local requirements to be considered in compulsory compliance or knowledge. It must be signed by at least the hospital management.
sterilisation	Procedure designed to eliminate all forms of microbial life from articles and other patient care equipment in order to decrease the risk of infection.
programme oversight	A specific, stable unit that includes the individuals responsible for the safety of clinical activities (department or unit chiefs). In addition to the individuals themselves, it includes their method of communication and the hierarchical structure of the organisation.
evidence	Certainty derived from studies on a certain subject that are currently considered to be conclusive. This usually means, but is not limited to, several controlled clinical trials with similar findings.

guide	Document with recommendations for action on a specific subject. The subjects are usually technical, and they are not compulsory.
basic healthcare associated infection indicators	Minimum ongoing information that a hospital should have in order to determine the infection status. The following are considered to be minimum: central venous catheter-related sepsis, catheter-associated urinary tract infections, mechanical ventilation-associated pneumonia, surgical site infections by type of operation, and puerperal endometritis by type of delivery. These indicators may be different if a hospital has other frequent high-risk procedures.
nosocomial infection	Infection that occurs during or as a result of hospitalization, and was not present or incubating at the time of patient admission. This definition does not distinguish between severe and minor infections, nor preventable and non-preventable infection.
invasive procedure	Clinical procedure that leads to mechanical interruption of the body's barriers of defence (e.g., skin perforation or insertion of catheters that change the usual fluid flow).
manual	Reference document that organizes and summarizes the regulations, instructions, procedures, or any other type of information, usually operational, on a specific subject.
goals	Quantifiable objectives that are expected to be achieved. They are usually stated numerically in ratios, rates, proportions, or other indicators of this type
standard	Guideline that must always be fulfilled
professional	Worker with a university education and degree
immunisation programme	Activities designed to vaccinate a given population that establish who should be vaccinated, which vaccines will be used, dosage, route, frequency, and all other specifics of this objective.
programme	Organized set of resources and activities to attain a known end. It also includes the objectives, goals, and individuals responsible.

orientation programme	Organized training activities to ensure that recently hired personnel are familiar with the hospital's technical and administrative procedures.
routine	Customary practice without a rationale that is performed according to current practice.
supervision	Observation process to measure compliance with standards, instructions, care procedures, or other parameters in daily practice.
epidemiological surveillance	Ongoing information system on diseases (usually infectious diseases) in the population in order to determine their frequency, risk factors, morbidity, mortality, and early detection of epidemics.