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ASSESSING HEALTH INSTITUTIONAL READINESS FOR EBOLA EPIDEMIC CONTAINMENT IN NIGERIA



By

ADEKEYE JOSHUA TEMITOPE

A Research Report Submitted to the Faculty of Health Sciences, University of the Witwatersrand in partial fulfilment of the requirements for the Degree of

Masters in Epidemiology in the field of Implementation Science

May, 2018

DEDICATION

This research work is dedicated to Jehovah my God .The one who causes to become, the perfect congregator congregating his congregation. To him belong the glory, honour and power.

PREFACE

This thesis is submitted to the University of the Witwatersrand, Faculty of Health Sciences,Division of Epidemiology and Biostatistics for the fulfilment of the requirements for the Master degree in Epidemiology in the Field of Implementation Science.MSc work has been performed at the School of Public Health, with Professor Eustasius Musenge as main supervisor and with co-supervisor Professor Oyedunni Arulogun of the School of Public Health ,Univeristy College Hospital, Ibadan , Nigeria. Financial assistance was received from TDR fellowship awarded by the World Health Organization, Tropical Disease Research (WHO/TDR) from 2016 to 2017.

DECLARATION

I hereby declare that except where specific reference is made to the work of others, the contents of this research report are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other University. This research report is the result of my own work and includes nothing which is the outcome of work done in collaboration, except where specifically indicated in the text.



…… **Date: -May 2018**

Signed(Candidate)

University of the Witwatersrand, Faculty of Health Sciences,

School of Public Health

27 St' Andrew's road, Parktown, Johannesburg

May, 2018

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DEFINITION OF TERMS

Terminology		Definition
Readiness	**:**	Intentions, attitudes and beliefs concerning the degree to which changes/innovations are required and the organization's ability to effectively embark on those changes. It is the mental forerunner to the demeanours of either refusing or making change effort.
Motivation	**:**	Beliefs about the improvement and the improvement supports that add to innovation use.
General capacity	**:**	These comprise of infrastructure, expertise, abilities, circumstances, settings and processes that the innovation will be applied.
Innovation specific capacity	**:**	The working realities that permit or prevent innovation growth and application. It is the technical field of the service system, comprising of technological equipment, abilities, skills and knowledge that are required to put a particular innovation in place.
Climate	**:**	How workers jointly observe, assess and sense their present working environment.
Organisational innovativeness	**:**	The overall way workers receive change—the organizational learning milieu.
Leadership	**:**	Determining how the authorities package and render aid to organisational activities specific to the implementation of innovation.
Structure	**:**	The processes that affect the daily functioning of an organization

Staff Capacity	**:**	The overall expertise, professional knowledge and abilities of the workers.
Evidence-Based System for Innovation Support (EBSIS).		Existing support targeted, specific strategies which can be used to build readiness that are workable and admissible in order healthcare settings .These strategies include delivering training, providing technical assistance (TA), and developing quality assurance/quality improvement (QA/QI) systems.

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ABSTRACT

Background: This study investigated the health institutional readiness to implement innovations for combating Ebola epidemic outbreak in the post-epidemic era between the periods of June 2016 and May 2017 in Nigeria at healthcare facility levels.

Rationale: There is paucity of literature on the subject of organisational readiness to implement innovations in the health space. Previous studies often depict readiness as a minor element of the implementation space .In this study, readiness is considered as an instrumental element with strong essence in the implementation framework.

Objectives: the study was guided by four objectives;(1) to assess readiness to implement innovations in response to Ebola epidemic outbreak containment;(2)to identify the drivers/detrminants of motivation , general and innovation-specific capacities to implement innovations in response to Ebola epidemic outbreak containment and (4)to investigate predictors of readiness to implement innovations in response to Ebola epidemic outbreak containment.

Methods: The sequential exploratory cross-sectional mixed method design was employed. The study population was 785 health care workers (HCWs) and non-health workers working UPTH and four affiliated sites .The purposive sampling was used for qualitative study while Stratified random sampling technique was utilised for the quantitative study. Qualitative data were collected from fifteen respondents while a total of 511 questionnaires were administered at the study site. The qualitative data was analysed using inductive thematic analysis. The quantitative data was analysed using univariable analysis , multivariable analysis, exploratory factor analysis and confirmatory factor analysis /structural equation modelling (SEM)

Results: From the qualitative study, quality improvement was perceived as most useful in influencing all the tree sub-components of readiness and readiness. Training is perceived as most useful in building readiness while it is perceived to be moderately useful in influencing the sub-component of readiness. The OLS estimates indicates that QI/QA exert a positive and significant effect on motivation (β=0.004, $p<0.05$) and general capacity score (β= 0.28 $p<0.05$) while it inversely but significantly exerts influence on innovation specific capacity (β=-0.21x 10-3, $p<0.05$).The SEM /pathway analysis showing the direct and indirect routes of interactions among variables that predict institutional readiness reveals that after adjusting for confounders, all the explanatory variables have significant effect on readiness except gender which was dropped from the final model.

Conclusion: Health institutional readiness is a vital element in the implementation space. The strength of evidence of how Evidence-Based System for Innovation Support (EBSIS) can influence readiness was established. Though readiness is a rate-determining step in ensuring robust and effective implementation outcomes, exploring innovation outcomes and their amplification through explicitly target readiness dynamics and subcomponents as part of an innovation implementation process is a desideratum that requires stakeholders in the health sphere and implementation space to fill the void.

Keywords: innovation, readiness, innovation specific capacity, general capacity, motivation resilience Ebola Virus disease.

LIST OF ABBREVIATIONS

ABBREVIATIONS	MEANING
ANOVA	Analysis of Variance.
BMSH	Braithwaite Memorial Specialist Hospital
CDCP	Centre of Disease Control & Protection
CFA	Confirmatory Factor Analysis
EACL	Ebola Assessment Clinic and Laboratory
EBSIS	Evidence-Based System for Innovation Support
EFA	Exploratory Factor analysis
ETC	Ebola Treatment Centers
EVD	Ebola Virus Disease
IORs	Inter-Organisational Relationships
ISR	Implementation Science Research.
MLR	Multiple Linear Regression
OLS	Ordinary Least Squares
PFHF	Port Frontline Healthcare Facilities
PH	Port Harcourt
PPEs	Personal Protective Equipment(s)
PPS	Probability Proportional to Size
QI/QA	Quality Improvement/Quality Assurance
SEM	Structural Equation Modelling
UPTH	University Teaching Hospital Port Harcourt
WHO	World Health Organization

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CHAPTER 1: INTRODUCTION

This section gives an overview of the concept of health institutional readiness and espouses the importance of readiness in acheieving quality implementation outcomes. The chapter starts by highlighting the gory picture of the Ebola epidemic, the need to assess organisational readiness to implement innovations to combat the Ebola Virus Disease (EVD) and describes organisational readiness as a super-subset of epidemic preparedness. Furthermore, an effort was directed towards providing a definitional clarity of the term institutional/organisational readiness, its sub-components and the drivers. Lastly, the research questions and research objectives were highlighted.

1.1 Background

The years 2013-2015 witnessed the spread of the viral disease known as Ebola Virus Disease (EVD) in West Africa received international attention so much that the World Health Organization (WHO) declared it as the most lethal international health emergency in modern times (Baize et al. 2014; Front Page Africa 2014). The Ebola pandemic during the years 2013 to 2015 had a devastating impact on the countries of Sierra Leone, Guinea and Liberia, with a few regional and global sparks and this has reulted in 25,178 cases and 10,445 deaths in the three most affected nations by 1 April 2015. The epidemic collapsed the healthcare systems, economies, and the very social fabric of life within the sub-region itself (Baize *et al.* 2014; Adams, Lloyd & Miller 2015). The diagnosis of the first case of Ebola in Lagos, Nigeria in July 2014 set off alarm bells around the world it could lead to a mammoth record of untold hardships and death due to the country's population desity(WHO 2014a). The index case in Nigeria was a Liberian-American, Patrick Sawyer, who flew from Liberia to Nigeria's most populous city of Lagos on 20 July 2014 (Fasina *et al.* 2014). According to the WHO, 20 cases and eight deaths were confirmed in Nigeria. Four of the dead were health care workers who had cared for Sawyer. In all, 529 contacts were followed, and all completed a 21-day mandatory period of surveillance (Fasina et al. 2014). By 20 October 2014, the World Health Organization declared Nigeria Ebola-free (Courage 2014; WHO 2014a).

As some healthcare workers had close contact with their EVD patients, they became infected with the virus. This was because these workers did not observe strict medical precautions. In fact, the mourners at some burial sites also contracted the virus as they had direct contact with the corpses (Centre for Disease Control & Prevention 2014). Any physical contact with

an infected person is practically a death sentence since EVD is highly contagious (Fasina *et al.* 2014). Thus, health workers who strive to combat the spread of the virus are mostly at risk. Some of the measures used for control are safe burial, isolation of affected persons and the use of personal protective equipment (PPE). Some of these workers were disinclined to help fight the spread of EVD (Ilesanmi & Alele 2015).Furthermore, the management of EVD was challenging; available PPEs were insufficient, and the task itself was arduous (Fasina *et al.* 2014).

The active containment of EVD comprises a method with many involvements: epidemic preparedness, case management and organisational/institutional readiness (Ilesanmi & Alele 2015: Oesterreich *et al.* 2014). This study investigated the institutional readiness to implement innovations for combating borderless epidemic outbreak using the Ebola experience in the Nigerian context as a case study. Furthermore, this study will highlight how health support system can aid the delivery system to readily implement innovations (Holt & Vardaman 2013).

1.2 Problem Statement

In the global health systems, there is a better understanding of causal pathways of diseases (in this context epidemic) and the interventions that can alleviate symptoms, promote health and wellness and contain the conditions (Greenhalgh *et al.* 2004). However, while emphasis has been laid on epidemic preparedness (Greenhalgh *et al.* 2004; Durlak & DuPre 2008), very few scholars have explored the role of organisational readiness for implementing innovations, accelerating epidemic preparedness and containment (Scaccia *et al.* 2015). A major point of difference between epidemic preparedness and organisational readiness is the involvement of innovations (Scaccia *et al.* 2015). While health organisations can have in place a clear and comprehensive preparedness plan for epidemic containment, they may not readily embrace, implement and sustain innovations that can help accomplish intended outcomes. Hence, readiness is a sub-set of epidemic preparedness which is a rate-determiner in effectively implementing innovations among organisations (Fixsen *et al.* 2005).

In previous studies on the subject matter of this study, readiness is often depicted as a minor element of the implementation space as the emphasis is laid on epidemic preparedness and surveillance systems (Flaspohler *et al.* 2008). In this study, however, readiness is considered as an instrumental element with strong essence in the implementation framework since,

according to Powell et al. (2012), it involves assessing needs, setting goals, identifying best/encouraging practices, planning and appraisal.

This study is geared towards filling the highlighted voids namely, assessing the health institutional readiness to implement innovation to contain EVD which is a critical step towards accomplishing effective and efficient epidemic preparedness. Further, this study roots readiness in a conceptual model (see Figure A1.1 in Appendix II) that accentuates the method in which innovations can be fortified and applied. Wandersman *et al.* (2008) proposed the interactive systems framework (ISF) for dissemination and implementation in which there exist bi-directional associations between providers and support staff that affect how innovations are dispersed and applied.

Moreover, the study has spotlighted the need for health institutions to distil their state of organisational readiness to foster implementation of innovations that will drive optimal health delivery (Weiner 2009). The organizational context, factors that drive readiness and sub-components are grey areas that require academic and empirical interrogations. Hence, the motivation for this study.

1.3 Justification of the Study

With apt readiness at national, state and local levels, EVD is containable, and the likely effects on health care systems as well as the larger society can be alleviated. The frequent movements of people across the borders of nations with active EVD transmission and other countries with a high risk of EVD transmission has amplified the danger of a possible introduction of EVD in those nations. If EVD outbreak is not discovered and contained early, the consequences can be dire and even have socio-political and economic impacts.

This study demonstrated how building readiness to implement innovations is an invaluable element of epidemic preparedness plans for instant confirmation, examination and reaction to suspected cases of EVD. Further, the study espoused the factors influencing readiness and its sub-components as the findings will inform relevant stakeholders involved surveillance and containment of a wide-spreading disease such as EVD.

Initially, readiness as a concept was not discussed in Wandersman *et al.* (2008) model. However, the workings of the support system in building the capability of the delivery system to apply innovations led to the inclusion of a more all-inclusive readiness-creating approach

that involves motivation and capacities" (Wandersman *et al.* 2008; Flaspohler *et al.* 2008) . As well, building readiness in the delivery system necessitates that the support system possesses its readiness to endorse readiness-creating policies.

In general, the adoption of a state of readiness for innovation is unlike the preparation to initiate a particular innovation. This study concerns itself chiefly with the former. To effectively support the needs of healthcare providers in the adoption of innovations both clinical and non-clinical functions during periods of immense change, organisations need to embrace a comprehensive readiness program as part of their general preparedness and change plan.

1.4 Literature Review

The illness known as the Ebola Virus Disease (EVD) is a severe, viral and deadly ailment among humans. Its mode of transmission could be either from one human to another or from a wild animal to a human (WHO 2014b; Rowe et al. 1999). The name "Ebola" comes from the Ebola River after the disease was discovered in the Democratic Republic of Congo in 1976 (Centre for Disease Control and Prevention 2014). Clinicians, epidemiologists and virologists were rapt by its discovery as it had a significant fatality rate due to its transmissibility estimate to be between 25% and 90% (Grard *et al.* 2011).

1.4.1 Organisational Readiness in Implementation Science

In the implementation science field, readiness on the part of organisations is connected to the enhanced prospect of realising innovative results. Organizational readiness is assessed by x-raying "organisational capability (both broad and innovation-specific) and organisation motivation" (Scaccia, Cook, Lamont, Wandersman, Castellow et al. 2015). In search of achieving important and helpful outcomes from innovations, establishments guarantee that precise resources are made ready, and defined subcomponents are made available. Likewise, the strength of the capacity of an organisation can motivate the adoption and implementation of innovation which ultimately yields desirable outcomes."(Greenhalgh *et al.* 2004). Following Scaccia *et al.* (2015) and Weiner *et al.* (2008), for this study Organizational readiness to implement innovation is defined as an attitudinal outlook of the members of an organisation to embrace and apply an array of thoughtful capabilities, activities, processes to accomplish positive organisational and innovation outcomes.

1.4.2 Components of Organisational Readiness

Organizational readiness comprises of an organisation's enthusiasm to apply a specific innovation, the overall structural context and capacities, and their exact capabilities for a particular innovation (Scaccia *et al.* 2015). In this study, the organisational readiness model proposed by Scaccia *et al.* (2015) is adopted. According to the model, there are three dimensions involved in the readiness of an organisation-motivation (M), general Capacity(C) and Innovation specific capacity(C). These are shown empirically in the following equation:

$$\mathbf{R = MC^2} \quad \text{..... (Equation 1.1)}$$

The model bears a similitude to Albert. Einstein's equation of relativity, $E=mc^2$ (Einstein 1915) because the interactions between the three components of readiness have same letters (mc^2) (Scaccia *et al.* 2015).

Each of these constructs is interactive and is quantifiable individualistically; they offer a nuanced and actionable comprehension of readiness (Scaccia *et al.* 2015). The relationship above (represented as $R = MC^2$ empirically) infers that some organisations may be rated in some areas of readiness (e.g. motivation) but low in other areas (e.g. innovation specific capacity) (Scaccia *et al.* 2015). A cross-sectional evaluation of readiness can be done at any time of the lifespan of innovation (represented by time, t) (Scaccia *et al.* 2015). Thus, organisations can be said to be 'more ready' or 'less ready' during time t. The constituents of readiness may also change positively or negatively over time contingent on a diversity of interior and exterior impacts. This relationship has both qualitative and quantitative usefulness conditional to the accuracy of the measurement model (Scaccia *et al.* 2015).

1.4.1.1 Motivation for an Innovation

Motivations are principles about innovations that enhance the use of innovation. They are the cerebral and affective insights of innovation that drive an organisation to adopt an innovation. A number of researchers have called motivations the features of innovations (Simpson 2002; Rogers 2003; Greenhalgh *et al.* 2004; Flaspohler *et al.* 2008; Damschroder *et al.* 2009). They have also given motivations an alternate definition—the observed needs and force for change. Hall & Hord (2010) defined motivations as the emotional state, concerns, views and considerations are given to a specific matter or duty. The factors influencing motivation discusses organisations' feelings about innovations and how such beliefs influence their decisions to apply and sustain innovations use (Rafferty *et al.* 2013). Thus, the traditional

notion of "buy-in" (Flaspohler *et al.* 2008) can be further split up into specific, measurable and finally actionable factors.

Motivation-influencing factors have to do with not only the combined insights of innovation but also the accounting of whether and how these insights partake in the drive to adopt innovations. They play some roles in how individuals and organisations intellectualise the practical concerns of innovation. Combined views (such as shared resolve) play a part in the efforts of implementation (Weiner 2009). Accordingly, motivation building includes producing substitute conditions that escalate the commitment to change (Rogers 2003; Miller & Rollnick 2013; Aarons & Sommerfeld 2012). When a support system injects motivations into the delivery system, they create cognisance that the innovation can boost the organisation instead of merely transferring real skills (Greenhalgh *et al.* 2004).

Resistance is a common term to represent "negative" motivations (Weiner *et al.* 2008; Hall & Hord 2011; Ford *et al.* 2008). Negative perceptions mean factors that cause low motivation, and these factors can hamper backing for a change (Rafferty *et al.* 2013). However, resistance to change is not necessarily the contrast of readiness. Instead, it is a condition of lesser readiness, not non-readiness. Recognizing resistance areas is an opening for positive organisational growth (Ford *et al.* 2008). This is in resonation with the readiness model which contends that any level of the readiness components, though low, offers facts about how to give backing to the process of implementation.

There is ample evidence in research works that considers how individuals view and contemplate on innovation. A review of diffusion studies by Rogers (2003) mentioned that 49% to 87% of the variance in adoption rates of innovations is explicable with five innovation-specific variables: trialability, relative advantage, observability, complexity and compatibility. However, the model of Rogers (2003) does not have potential traditional application in the facilitation of implementation (Damschroder & Hagedorn 2011).

In Table A 1.1 in Appendix II, the following motivation-influencing factors are neither stable nor permanent structures of innovation, and they do not forecast implementation of themselves (Greenhalgh *et al.* 2004: Scaccia *et al.* 2015). Rather, these factors are principles about innovation and innovation support; they may change through the thoughtful activities of the support system.

1.4.1.2 Innovation-Specific Capacities

Innovation-specific capacities are the specialised, technical and human conditions essential to effectively apply a specific innovation (Flaspohler *et al.* 2008). At the organisational stage, innovation-specific capacities are the functional actualities that permit or prevent innovation advancement and application. It is the technical purview of the service system (Glisson 2007). These capacities comprise abilities, skills and information and industrial equipment needed to make a precise innovation functional (See Table A 1.2, Appendix II). They are also known as process-specific capacities since they have direct relations to innovation use (Livet, Courser & Wandersman 2008).

1.4.1.3 General Capacity

General capacities refer to the capacities, features and the total workings that are linked to the capability to apply or develop any innovation (Flaspohler *et al.* 2008). General capacities comprise the infrastructure, expertise, abilities, setting, milieu and procedures in which the innovation will be released (Greenhalgh *et al.* 2004). These capacities can be applied to diverse types of innovations and across manifold situations at the organisational level. More often than not, general capacities must be put in place if the innovation-specific capacities are to be applied and continued over at the long run (Livet *et al.* 2008; Greenhalgh *et al.* 2004; Fixsen *et al.* 2005). General capacities are expected to be normally distributed through organisations. An organisation having low general capacity is expected to be distressed somehow with deficient elements averting the organisation from functioning helpfully and creatively.

It is a system-level activity to build general capacities. It can relate to diverse types of organisational responsibilities (Glisson 2007; Fixsen *et al.* 2005). This activity is an extensive and intricate process, particularly when tackling more steady features like organisational culture. Some of the processes policies connected to the general capacity are highlighted in Table A1.3 in Appendix II.

1.4.2 Factors of Organisational Readiness for Change

Many researchers have made individuals the centre of analysis for the success of organisational change (Judge et al. 1999). Over the past few decades, it has been observed that this is how to get an employee to embrace effective and successful change programmes (Cinite et al.2009; Holt et al. 2007; Bernerth 2004; Armenakis et al. 1993). Many predictors

like change agent role, proper process, need for change, the capability of an organisation, participation, culture, belief, environment, and commitment have been found to be related to employee readiness (Rafferty & Simons 2006; Madsen et al. 2005; Cunningham et al. 2002).

These predictors can be categorised by an individual, psychological, workplace, environmental, cultural and social factors. However, the predictors can be classified into two classes, individual and workplace factors (Table 1.1). Desplaces (2005), Ilgen &Pulakos (1999) have supported that magnitude of a particular person, and workplace characteristics may lead to the development of a positive attitude and behaviour towards change readiness.

Table 1.1: Organisational Readiness Factors

Category	**Factor(s)**	**Reference(s)**
1. Organisational level Factors		
	Organisational Commitment	(Elias 2009); Madsen et al. (2005)
	Perceived Organisational Support	Holt et al. (2007); Rafferty and Simons (2006); Eby et al. (2000).
	Personal Valence	Holt et al. (2007); Armenakis & Harris (2002).
	Social Support, Active and Passive Job	Cunningham et al. (2002).
	Appropriateness	Holt et al.(2007); Armenakis & Harris (2002); Weber and Weber (2001).
	Communication	Holt et al. (2007); Wanberg and Banas (2000)Armenakis &Fredenberger (1997).

	Decision Latitude	Cunningham et al. (2002)
	Job Knowledge and Skills	Miller et al. (2006); Cunningham et al. (2002); Hanpachern (1998).
	Perceived Organisational Support	Holt et al. (2007); Rafferty &Simons (2006); Eby et al. (2000).
	Management and Leadership Relationships	Miller et al. (2006); Hanpachern et al.(1998).
	Personal Valence	Holt et al. (2007); Armenakis & Harris (2002).
2. Individual-level Factors		
	Adaptability	Lehman et al. (2002).
	Autonomy	Weber and Weber (2001).
	Trust (in management; Peers; Senior Leaders)	Rafferty and Simons (2006); Weber & Weber (2001); Eby et al. (2000).
	Participation	Rafferty and Simons (2006); Cunningham et al. (2002); Weber & Weber (2001); Eby et al. (2000); Wanberg & Banas (2000); Armenakis and Fredenberger (1997).

	Personal Resilience	Wanberg & and Banas (2000).
	Work Irritation	Wanberg &Banas (2000).

A considerable amount of the extant literature has explored organisational readiness sphere linking to a workplace and individual factors (Elias 2009; Holt *et al.* 2007; Madsen *et al*.; Weber & Weber 2001; Cunningham *et al* .2002). However, the bearing of both dynamics can be envisaged by organisation assertiveness, acuities and capacities (Scaccia *et al.* 2015). Subsequently, the components and subcomponents of readiness are examined in the next section of this review.

1.5 Conceptual Framework for this Study

A simple conceptual framework of the determinants of readiness to implement innovations to contain EVD and the interaction path shown in Figure 1.1 was proposed based on the record of Evidence-Based System for Innovation Support (EBSIS) employed in Nigeria and the available variables in the datasets.Targeted, specific strategies can be used to build readiness through the Evidence-Based System for Innovation Support (EBSIS). EBSIS strategies include delivering training, providing technical assistance (TA), and developing quality assurance/quality improvement (QA/QI) systems (Wandersman *et al.* 2012) and each of these components has its literature and is evidence-based (Wandersman *et al.* 2012). Tools are assets shaped for organising, summarising and communicating knowledge (e.g. computer programs, worksheets, manuals, etc.) (Wandersman *et al.* 2012).

Training is a prearranged, instructional exercise envisioned to enhance knowledge, skills and right attitude acquisitions which boost the performance of the trainee (Wandersman *et al.* 2012). However, training itself is commonly inadequate in producing the intended change in an organisation (Wandersman et al. 2012; Beidas & Kendall 2010). Technical assistance is the personalised support system action and practical approach that comes after training (Wandersman *et al.* 2012; Durlak & Dupre, 2008; Chinman *et al.* 2004). Quality assurance (QA) and Quality Improvement (QI) strategies engage data and tools to evaluate/enrich quality performance.

The ability to assess an innovation has positive links to implementation quality (Powell *et al.* 2012; Labin, Duffy, Meyers, Wandersman, & Lesesne 2012; Greenhalgh *et al.* 2004;

Flaspohler *et al.* 2008). It is suggested that the use of $R = MC^2$ assists in recognising the actual level of organisational readiness among the three components. An examination for each element of organisational readiness distinctly isolates areas where improvements are necessary; it also stresses areas of relative strength that can be used as a springboard to improve organisational readiness over time. Based on the original levels of each readiness component, precise types of capacity-building and motivation-building strategies can be known, provided and finally assessed for effectiveness. The proper support strategy needs to be grounded in the evidence-base for each component of readiness (Armenakis *et al.* 1993; Wensig *et al.* 2011). Outstandingly, support strategies occur in the background of the support providers/recipients relationships (Wandersman *et al.* 2012). The provision of support strategies that are conveyed with quality should yield better levels of the targeted components; consequently, it should boost organizational readiness to apply innovation with quality). (Wandersman *et al.* 2012; Rogers, 2003; Rafferty *et al.* 2013; Powell *et al.* 2011; Klein *et al.* 2001).

Conclusively, in a study conducted by Weiner, Amick, and Lee (2008), they extensively reviewed the readiness change measurement literature and identified 43 instruments for assessing readiness. Among other things, they identified age, gender, length of professional service as likely drivers of organisational readiness. These factors are also examined in this study.

Age, gender, occupational level, number of years of professional experience, number of years of service at the study site and occupational levels are covariates that can affect readiness to implement Innovations effectively(Rafferty *et al.* 2013). Targeted, defined plans can be engaged to create readiness through EBSIS. The plans of EBSIS comprise providing training, communication, stakeholder's management, sponsorship of the innovation, rendering technical assistance (TA) and enforcing quality assurance and quality improvement (QA/QI) systems (Wandersman et al. 2012). QA/QI practices should ultimately influence readiness as it is routinely executed and this is depicted as broken line in Figure 1.1. Each of these mechanisms has its evidence-base and literature (Wandersman *et al.* 2012). The conceptual framework for this study encapsulates three categories of variables:

1. the explanatory variables that constitute EBSIS which are the readiness-creating;

2. the demographic characteristics that influence the readiness building process via EBSIS and
3. the components of readiness.

In this study (1) and (2) are combined as drivers of readiness to implement innovations to contain EVD. Subsequent research can consider introducing the demographic attributes as moderating variables. Figure 1.1 highlights the interplay and route of the interaction of the variables and how they influence readiness. The direct, indirect effects of these variables on the level of readiness of an organisation are reported in chapters 3 and 4 of this study.

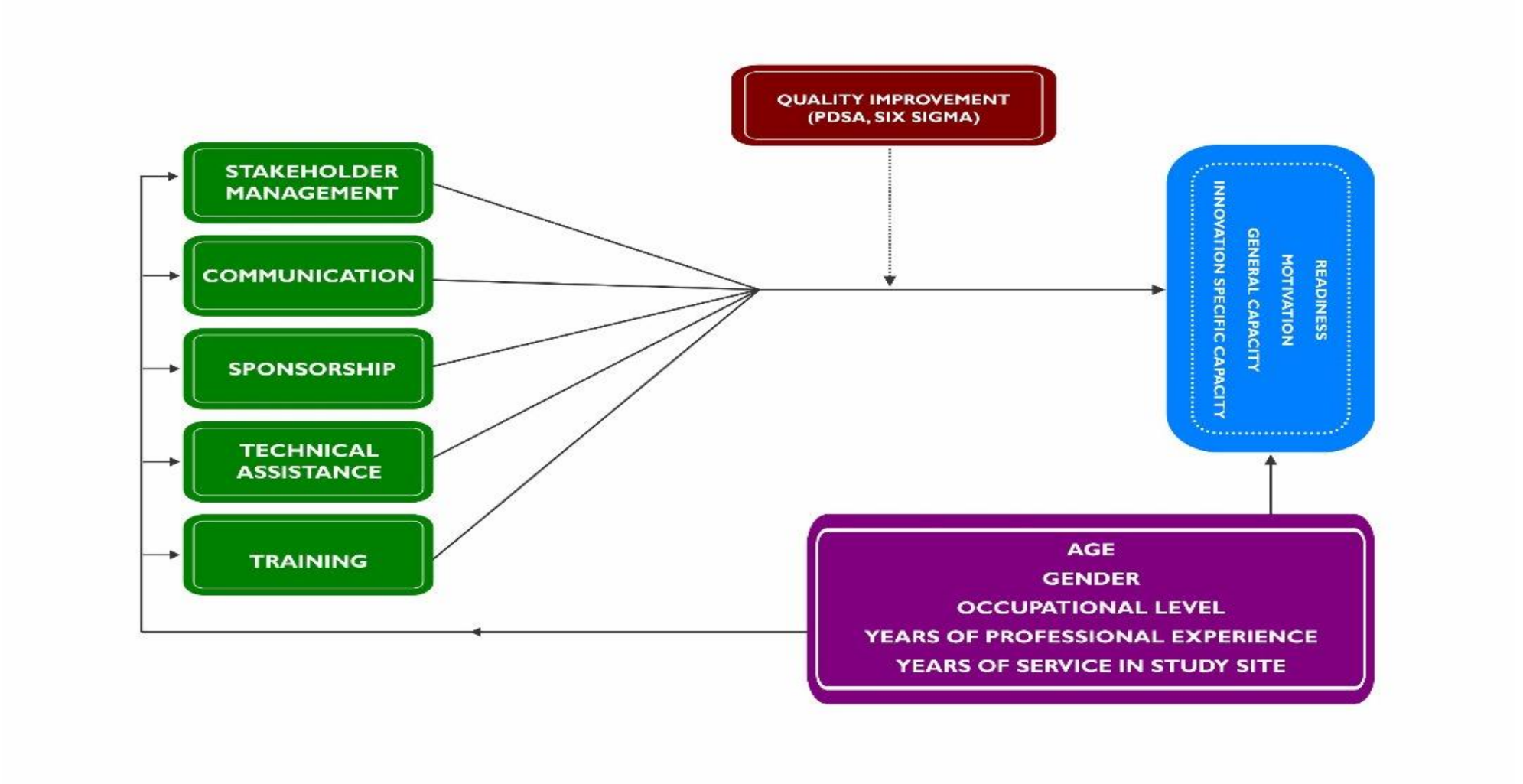

Figure 1.1: Conceptual Framework of determinants of institutional readiness to implement innovations for Ebola epidemic containment.

1.6 Research Question

Keeping in view the identified research gaps highlighted in the problem statement, this study seeks to answer the following questions:

What is the state of health institutional readiness for Ebola epidemic outbreak containment in Nigeria in the post-epidemic era between and what are the predictors of health institutional readiness to implement innovations for Ebola epidemic outbreak in Nigeria in the post-epidemic era between June 2016 and May 2017?

1.7 Research Objectives

1.7.1 Aim

This study aims to investigate health institutional readiness of the delivery and support systems to implement innovations for Ebola epidemic outbreak in the post-epidemic era June 2016 and May 2017 in UPTH Nigeria at healthcare facility levels.

1.7.2 Specific Objectives

1) To assess the state of readiness to implement innovations in response to Ebola epidemic outbreak containment.

2) To identify the drivers/predictors of motivation,general and innovation-specific capacities to implement innovations in response to Ebola epidemic outbreak containment.

3) To investigate predictors of readiness to implement innovations in response to Ebola epidemic outbreak containment.

Objective one was achieved through a qualitative study while objective two to four were accomplished through quantitative investigation.

1.8 Overview of the Research

This research work explored the components, subcomponent and drivers of health institutional readiness for Ebola epidemic containment in Nigeria using UPTH as a case study. The approaches to the inquiry are mapped at a glance in Figure 1.2:

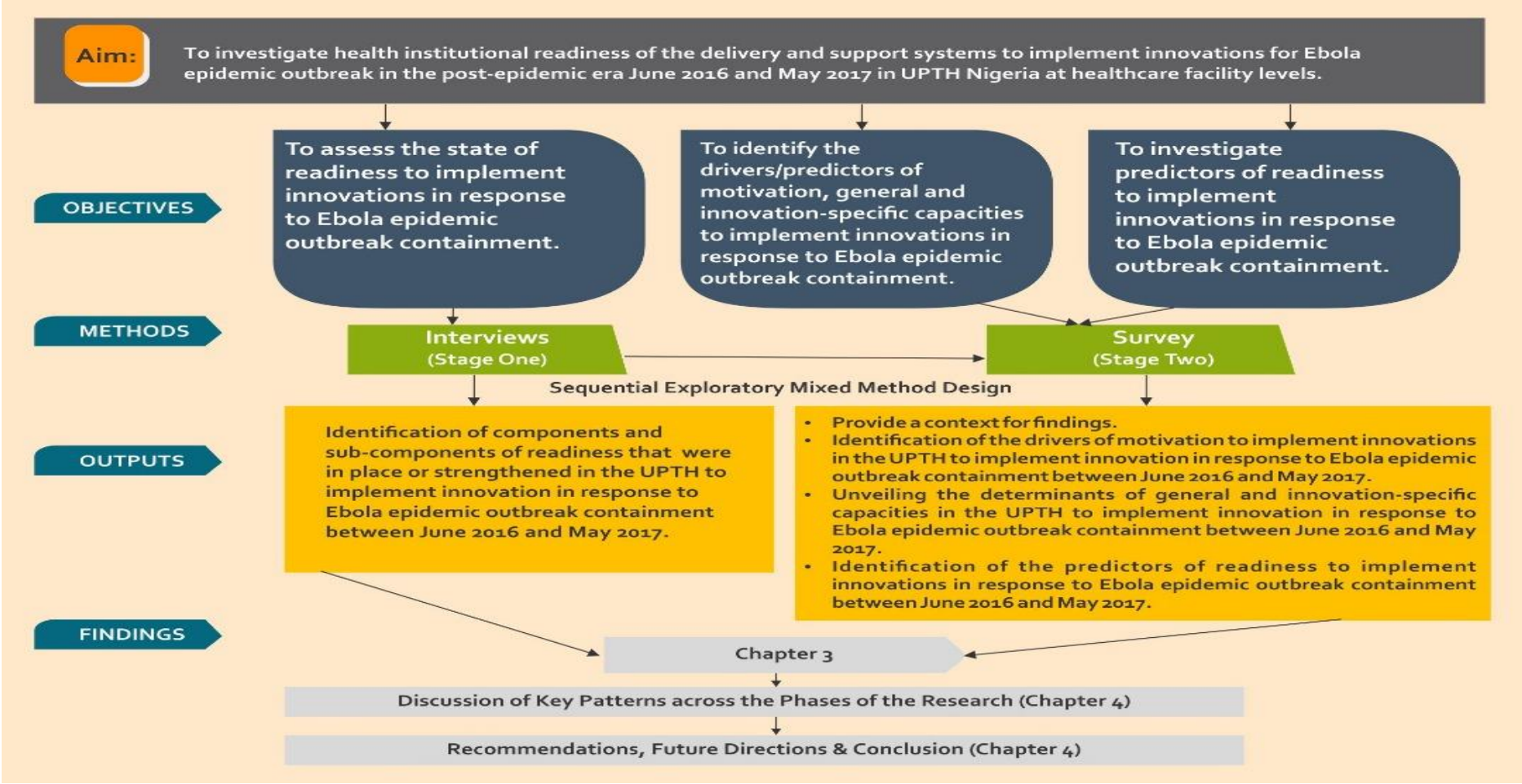

Figure 1:2: Overview of the Research

CHAPTER 2: METHODOLOGY

2.1 Chapter Overview

This chapter presents in brief the settings of the study, its design, the study population and the sampling techniques of the diverse parts of this research. Further, it elucidates the research instruments adopted in the study, the procedure used to collect data as well as the data analysis. Finally, it presents checking of instruments' validity and their reliability and the ethical issues involved in the study.

2.2 Study Design

A study adopted a crossectional a sequential exploratory mixed methods design.The study site which is the case study for this research is the University Teaching Hospital Port Harcourt's (UPTH), Rivers State, Nigeria and 4 affiliate health facilities(BMSH, ETC, Port Health Clinic and Private Laboratory) between periods of June 2016 and May 2017.This study is considered a case study research because the term case study refers to both a method of analysis and a specific research design for examining a problem, both of which are used in most circumstances to generalize across populations.

The sequential exploratory mixed methods design was carried out by initially conducting the qualitative study through expert and key informant interviews, adjusting study instruments followed by collection of primary data through survey. Qualitative data were collected from fifteen respondents, the questionnaire for qualitative survey was subjected to face-validity, some sections were amended and the quantitative survey was carried out. The qualitative responses informed the development and embellishment of the quantitative tool(questionnaire).The quantitative data were collected through a questionnaire survey using REDCap and printed questionnaires. A total of 511 copies of questionnaires were administered at the study site. Figure 2.1 summarises the research strategy and design adopted in this research.

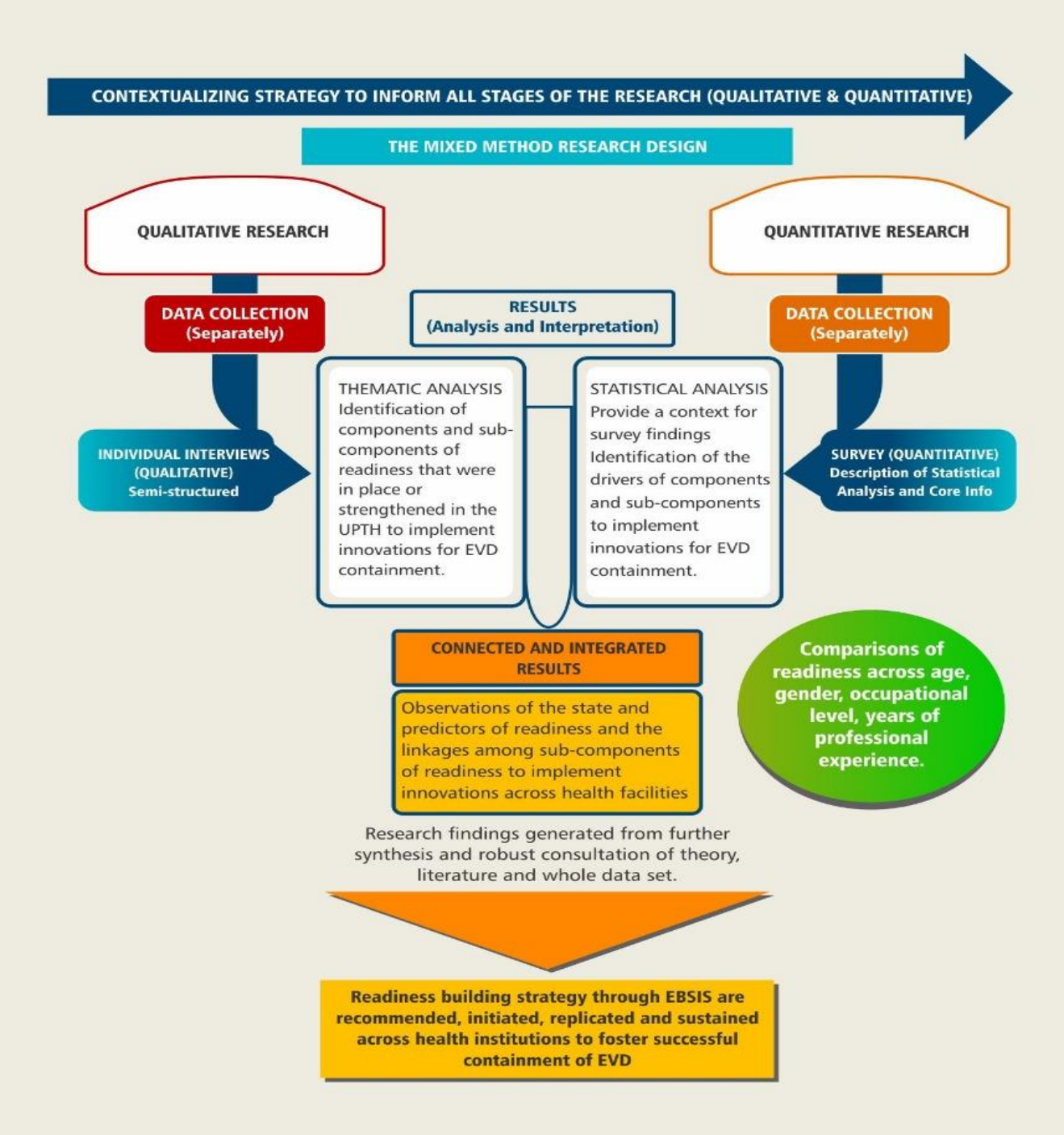

Figure 2.1: Mixed method study design and strategy

2.3 Study Site

The study was conducted at the University Teaching Hospital Port Harcourt's (UPTH) health facility, and its associated health institutions that participated in combating Ebola virus disease in

Rivers State, Nigeria. The affiliated organisations include Ebola Assessment Clinic, Port Frontline Healthcare Facilities, Braithwaite Memorial Specialist Hospital (BMSH) , laboratory and Ebola treatment centres (see Figure.2.2). UPTH is situated at East-West Road, Port Harcourt, Rivers State (See Figure A2.1 in Appendix III).

There are three tiers of management at the hospital: the Board of Management, Hospital Management Committee (HMC) and the Departments. The outpatient and inpatient sections of the hospital attend to almost two hundred thousand patients every year, with more than three thousand surgeries performed annually. The average bed occupancy rate in 2014 has increased by more than seventy percent(Port Harcourt Medical Journal, 2014). Apart from the medical services it offers, UPTH also provides clinical education and training to healthcare professionals, nurses and medical students.

2.4 Target Population

The target study population in this research work were all healthcare workers(delivery system) and non-healthcare workers (support system) at UPTH and its affiliated facilities involved in the EVD containment process. In its report titled Treatment Research Group for Ebola Disease in Nigeria, the Federal Ministry of Health (2014) reported that seven hundred and eighty-five workers are active in the facilities and departments linked to the Ebola virus prevention and treatment at UPTH and its above-mentioned affiliated health institutions. Thus, it is safe to state that the population for this study is 785.

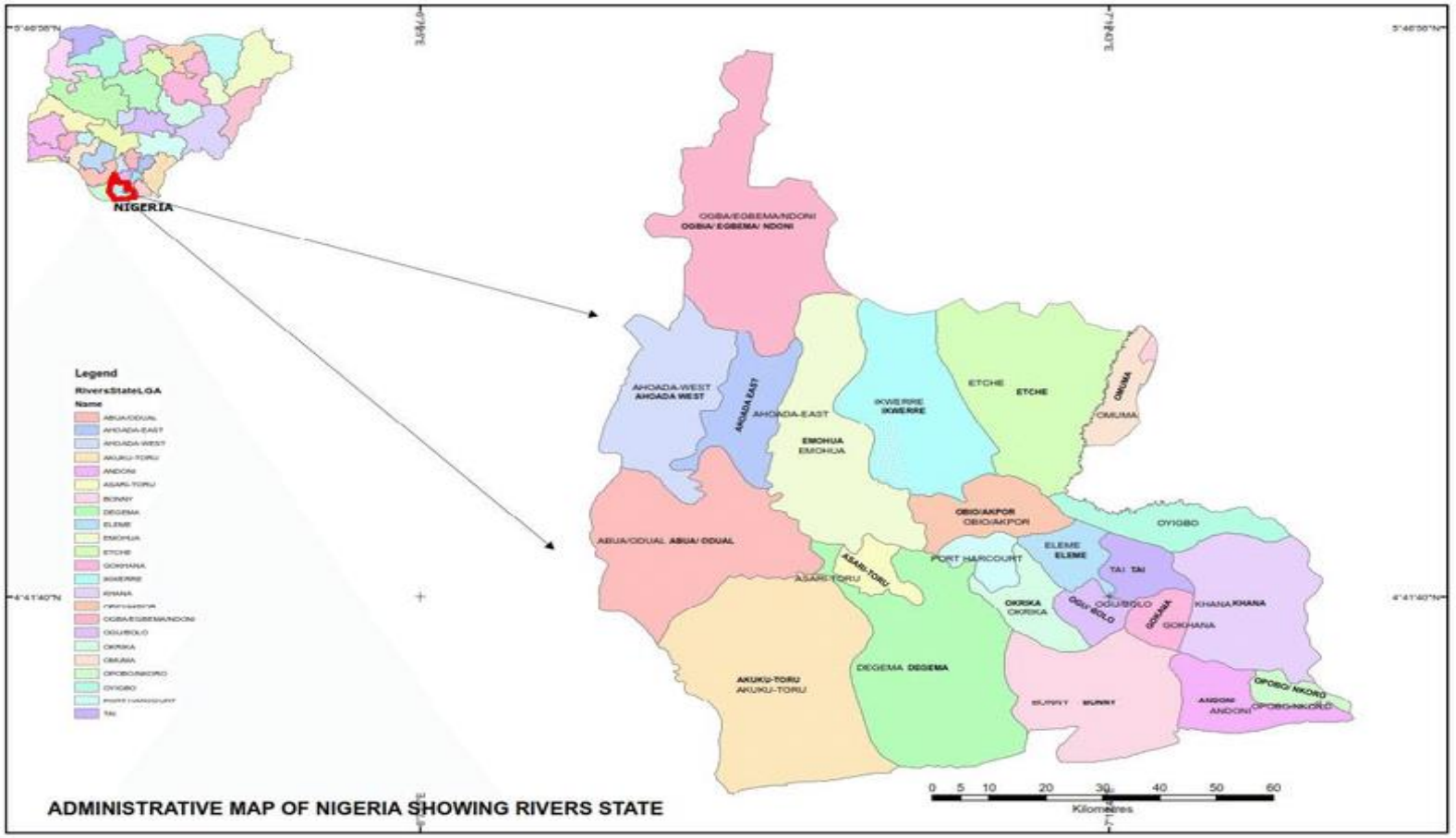

Figure 2.2: Map showing the location of study site and affiliate health facilities.

2.5 Sampling Procedure

In this study, a sample size fifteen participants were purposively selected for the qualitative study. The basis for the selction is age, years of professional experience, gender, years of service at studysite, field of expertise and involvent in Ebola epidemic containment process. In the quantitative study, a total of 511 participants have been chosen for this study representing 61.5% of the target population (785) were employed for the quantitative study.

2.5.1 Sampling Method and Sample Size Estimation

2.5.1.1 Sampling Method and Sample Size for Qualitative Survey

The purposive sampling was deemed as apt for this study and was employed based on the fact that it seeks to reveal multilevel workers' perceptions. A non-probability sampling procedure was used for the selection of the participants. For this reason, a purposive sample was used to select experts and workers from different specialities and sectors.These specialities include emergency medicine, anatomical pathology, field epidemiology, finance and microbiology and information technology(IT).

Fifteen respondents (see Table 2.1) were purposively recruited for this research based on their involvement in EVD containment, and they gave salient facts that aided in accomplishing the study's objectives. The respondents also offered face-validity of the questionnaire, and the appropriate corrections were made corrections after the validation. The factors used to select the respondents are age, years of professional experience, gender, years of service at studysite, field of expertise and involvent in Ebola epidemic containment process .

The key informants are the experts and top-level staffers healthcare workers(delivery system) non-healthcare workers (support system) and the ancillary workers.

Table 2.1: Interview Participant

Interviewees	Number
Key informants	6
Workers	9
Total	15

2.5.1.2 Sampling Method and Sample Size for Quantitative Survey

Stratified random sampling technique was utilised to obtain the desired sample size of 511(see -- the stratified random sampling plan, Figure 2.3).The Probability Proportional to Size (PPS) was used to allocate the sample based on the stratum. The PPS method lets every layer be equally represented; the larger the layer, the more the required samples (Neymaan 1934.). Hence, 511 copies of questionnaires were administered at the study site.

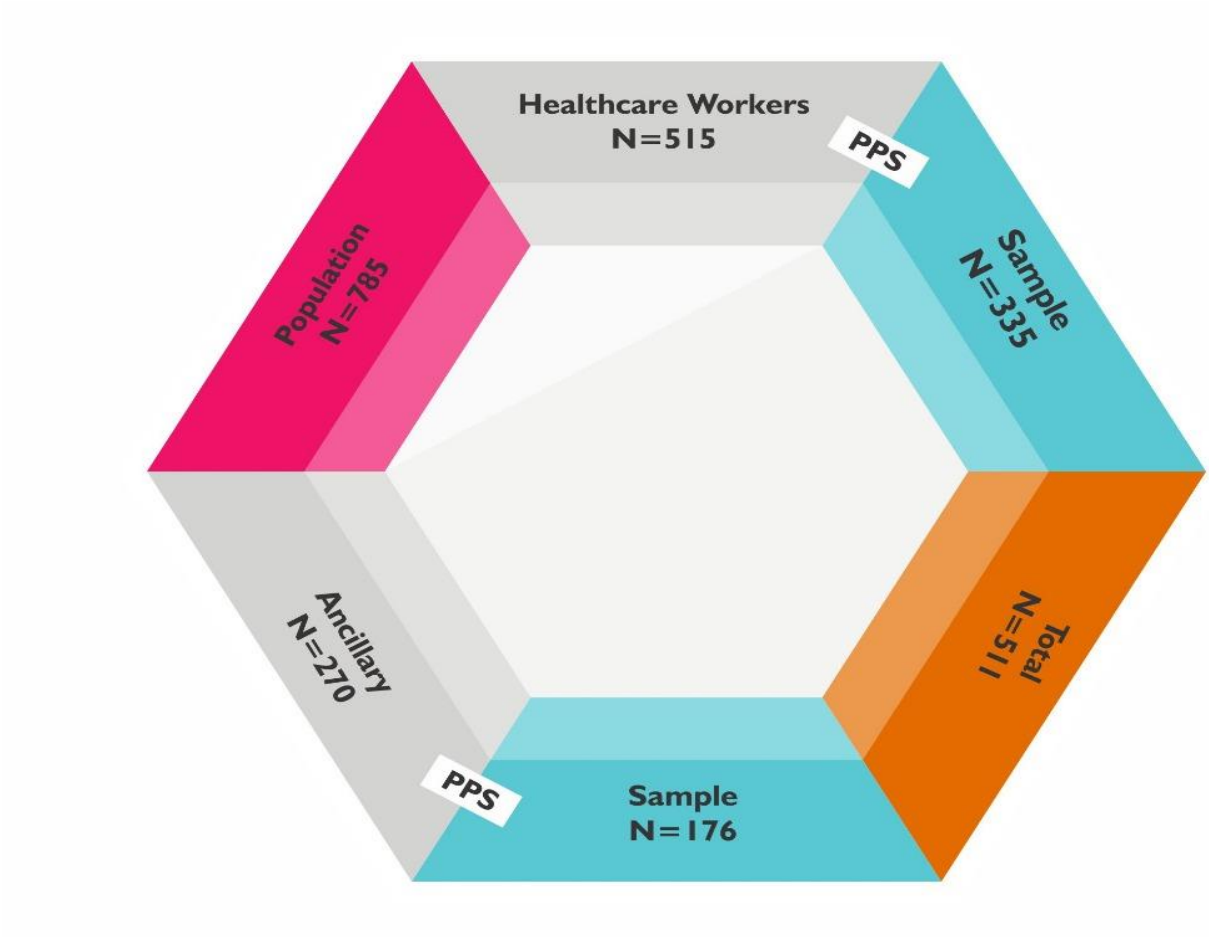

Figure 2.3: Probability Proportional to Size (PPS) for sample size estimation

The stratification was based on 65 % of the population of each stratum. The use of RedCap and printed questionnaires aided in reaching these members of the population.Respondents to the questionnaire survey were employees in the delivery and support systems at UPTH and its affiliated health institutions.

Table 2.2 shows a summary of the stratification of the sample. A large sample size helped to get ample data that is required to address the research questions.

Table 2.2:Sample distribution according to stratum

Stratum	Sub-components of Stratum	Population	Number of Respondents
Support System			
	Management	30	19
	HR	50	33
	Health IT/ICT	50	33
	Finance and Logistics	140	91
Sub-total		270	176
Delivery System			
	Port Frontline Healthcare Facilities(PFHF)	170	111
	Ebola Assessment Clinic and Laboratory(EACL)	95	62
	Ebola Treatment Centers(ETC)	250	162
Sub-total		515	335
Total		785	511

2.6 Data Collection Tools and Techniques

The study began with a qualitative method and followed by quantitative method.

2.6.1 Instrument for Qualitative Data

The semi-structured interview protocol (see Appendix IV) was employed to obtain relevant data

that captures Objective 1 of this study. The overall goal was to generate the evidential basis for the state of readiness to implement innovations for the containment of EVD. The collected data unveiled the readiness of the health institutions to implement innovations for EVD containment.

2.6.1.1 Design of the Instrument

The interview procedure was intended to capture the variables of interest. It has 7 main questions under different groups: specifying questions, probing questions, structuring questions, indirect questions and direct questions.

While the interview procedure was being designed, efforts were made to ensure that the questions in it covered the purview of the research objectives. Extant literature on organisational readiness in implementing innovations was extensively consulted. Further, a 10-step approach was used to ensure that the interview procedure is enlightening, vibrant, comprehensible and dispassionate. The key points of the approach are as follows:

Larger research questions were written down. The extensive areas of facts that are pertinent to answering these questions were emphasised.

1. Each major area had questions developed for it. Sub-questions were asked within thematic areas recognized from the literature.

2. The tone of the interview language was in tune with the abilities of the respondents.

3. The wording of the questions was cautiously done to stimulate the respondents to answer as reasonably as possible.

4. Instead of asking “why”, the questionnaire was designed to ask “how” and “what” so that process stories can be received, not satisfactory “accounts” of performance.

5. The questions were structured to draw more thorough responses to critical questions.

6. A few “warm-up” questions preceded each interview. The respondents were able to answer them easily and at appropriate length so that they can get into the mood of questioning mildly.

7. Occasionally, alterations were made to the interview procedure to guarantee its logical flow.

8. Questions that could embarrass respondents or prove to be too difficult for them to answer (e.g. "What is the future of organisational readiness for EVD Containment in your

organisation?") were asked near the end of the interviews as an interactive bond would have been established.

9. The last question has a terminal tone for the interview, and it leaves each respondent with the feeling that he/she has been listened to.

2.6.1.2 Data Collection Using Interview Protocol

In the course of data collection for the qualitative investigation, different three data collection and measuring instruments were employed. These are semi-structured interview protocol was used to collect the data. Hence, trained data collectors were employed to interview the purposively selected respondents.

2.6.1.3 Recruitment and Training of Interviewers

The interviews conducted by three interviewers who were recruited and trained.Their expertise aided in the collection of voluminous data of high quality. The interviewers were intensely and inescapably concerned with making meanings that supposedly are present within the participants. The interviewers were trained in three training sessions to view the research themes from the interviewees' perspective and to comprehend why they have a distinct perspective. The manual used for the training contained characteristics of a qualitative research interview, namely:

1. low structural degree enforced by the interviewer;

2. the dominance of open questions; and

3. Concentration on precise situations and action categorisations in the interviewee's world, instead of mere concepts and general estimations.

The role of the interviewer is challenging. They asked questions, documented answers and endeavoured to keep the interview session exciting and meaningful for the interviewees.

2.6.1.4 Semi-Structured Interviews

The semi-structured interviews were conducted over a period of 5 days. The interview clarified vague statements, allowed the exploration of innate and evolving themes and yielded a deeply experiential account of the state of health institutional readiness to implement innovations for EVD containment at UPTH and Rivers State.

2.6.1.5 Validity of the Instrument

The validity of the qualitative research instrument was confirmed outside the linguistic boundaries of a quantitative paradigm. The leaning that rather stresses the use of rigour to guarantee reliability and validity in qualitative research was adhered to in this section of the research. Rigour is a reference to the display of veracity and capability in qualitative research by observing detail and accuracy to guarantee the genuineness and dependability of the research process.

The following were the steps taken in this study:

1. Credibility: Data documentation (notes, transcripts, recordings, etc.) was done intensively to validate close links between the data and interpretation. Consistent deliberations were held, and alterations were made in line with propositions and recommendations.

2. Dependability: In quantitative research, dependability is similar to the concept of reliability. The aim of this test was to find consistency and stability in the inquiry process. To ensure a traceable, logical and clearly documented research process in a reflexive manner, the study gave a comprehensive account of the research process.

3. Authenticity: The question items were developed using an extensive theoretical basis as discussed in Chapter One. The interview procedure was developed after a vigorous search of the literature and extensive discussions with experts and academicians. The interview timetable was first drafted before the questionnaire.

4. Confirmation: To ensure that the data and interpretations of the findings were comprehensive and confirmed the findings, an audit process was employed to work forward and backward through the research process. The purpose of the interpretation process was not to oversimplify findings to a population; rather, it was to identify recognized ideologies and inclinations related to the research topic.

The steps discussed above described the qualitative research process of what was done, how it was done and why it was done. They also indicated the observance of the acknowledged criteria for qualitative research, thus ensuring the genuineness and dependability of this research phase.

2.6.1.6 Reliability

The qualitative instrument was developed using a triangulation technique which involved the use of two or more approaches, theoretical perspectives, investigators, methods and sources of data on

the theme of organizational readiness and thus authenticating the correspondence among them. These were helpful in circumventing the personal prejudices of the investigator and prevail over the shortcomings inherent in studies that used one investigator, one theory or one method, thereby raising the reliability and validity of the study (Denzil 1989).

Inter-coder reliability test was carried to ensure consistency when coding the emerging and recurring themes. This was carried out by duplicating research efforts using four experts and substantial agreement of results was observed among the duplications.

2.6.2 Instrument for Quantitative Data

2.6.2.1 Design of Instrument

The questionnaire was designed as a data gathering instrument for the quantitative study. The literature review and the outcome of the interview served as the guide for its content. It was designed for anonymous completion by the respondents. Accompanying each questionnaire was a covering letter for the consideration of the respondents (see Appendix IV). The covering letter elucidated the purpose of the study and it guided the respondents on how to complete the questionnaire.

Since an already-existing, generally-accepted instrument (questionnaire) was not found in extant literature (practice), structured questionnaires were developed from the constructs of the heuristics model ($R=MC^2$) according to Scaccia *et al*. (2015). The constructs were polished and revised to conform to the literature overview (See chapter one), the conceptual framework (See Figure 1.1 in chapter one), the semi-structured interviews (See Appendix IV) and the research objectives(See Sub-heading 1.7 in chapter one). Consequently, the quantitative tool were developed and therefore linked with the qualitative results.

In this study, the self-report method was employed in which the respondents answered with paper and ink on a structured questionnaire while a few answered through REDCap.

2.6.2.1.1 Preparation of the Multi-Item Scale

The questionnaire comprised five sections (see Appendix VI). Section A. elicited nominal data except for the item on the respondents' age, which was on the ratio level of measurement. Sections B-E supported an ordinal level of measurement. A 7-point Likert scale was applied. The Likert technique consists of a series of statement to which one responds using a scale of possible

answers. 7-Strongly agree, 6-agree, 5- moderately agree, 4- Indifferent, 3-moderately disagree, 2-disagree and 1-strongly disagree (see Table 2.3).

Table 2.3: 7-point Likert Scale used in the Questionnaire Development.

Strongly Agree	Agree	Moderately Agree	Indifferent	Somewhat Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

2.6.2.1.2 Key Constructs

Demographic Variables: Section A comprised characteristics. This section had questions like: sex, age, occupational level years of professional experience and years of service at UPTH. These variables were captured in questions 1-5 of the research instrument.

Motivation Constructs: Section B comprised constructs for motivation. Five items were employed to capture sub-components of motivation. These variables were captured in Items 6-10 of the research instrument.

General Organisational Capacities Constructs: Section C comprised constructs for general organisational capacities. Nineteen items were employed to capture sub-components of general organisational capacities. These variables were captured in Items 11-29 of the research instrument.

Innovation Specific Capacities Constructs: Section D comprised constructs for innovation specific capacities. Thirteen items were employed to capture sub-components of innovation specific capacities. These variables were captured in Items 25-37 of the research instrument.

Evidence-Based System for Innovation Support Constructs: Section E comprised constructs for Evidence-Based System for Innovation Support namely: trainings, communication, stakeholder's management, sponsorship of the innovation, technical assistance and quality assurance and quality improvement. These variables were captured in Items 38-71 of the research instrument. Table A2.1 summarises, the items, constructs and the pages in this study (see Appendix III).

2.6.2.2 Pre-Testing of the Instrument

It was not feasible to conduct a pilot study due to some bottlenecks that delayed granting of permission to conduct the study at Rivers State. Hence, the questionnaire was pre-tested and assessed for face validity and content validity.

Five major experts and informants in the qualitative interview received the questionnaire, and there were furnished with the conditions for assessing it. The conditions included relevance of items, clarity of items and technical reliability.Refinement came in the form of integrating the propositions of the experts. Most of their propositions related to trivial linguistic aspects and explanation of some vague terms. Also, a statistician evaluated the questionnaire in order to detect any anomalies that could obstruct data-analysis. No amendments were proposed in this case.

2.6.2.4. Design in REDCap

The forms used for data collection were tested to confirm that all the compulsory data are collected properly before moving to production mode. The forms were sent to production mode to facilitate data entry, data review and data analysis. The respondents that willingly gave their email addresses responded using REDCap.

2.6.3 Administration and Collection of the Questionnaires

REDCap is a safe, web-based application for constructing and handling online databases. It was used to complement the printed paper-based questionnaires. During the REDCap data forms design, the study was designated as a cross-sectional, survey-based study. A request for new project was made and it was approved in less than forty-eight hours. The forms were designed with the intention of successfully collecting and ordering data. As such, they are enormously fluid, expandable and customizable. Single data fields were created and the Matrix of Field was used to add options such as the Likert scale measures. The matrix creation was essentially the writing of many questions simultaneously, as all questions used the same set of answers.

2.6.3.1 Recruitment and Training of Data Collectors and Data Entry Personnel

In order to ease a well-timed and effective process of data collection, 12 data collectors and 4 data entry employees were employed. These were trained in two days, and the WHO Training and Practical guides for data collectors was used to guide them. The training contained seven main parts:

Introduction and background: This was to explain the aim of the survey to the would-be data collectors. The data collector introduced themselves to one another.

Selection of participants: This part was where the data collection team was trained on how to choose would-be respondents.

Conducting survey: This part explained the use of informed consent and how to explain the aim of the study to the respondents. The significance of neutrality was accentuated, and so was the necessity to remain polite, frank and well-behaved. Further, the data collectors were trained on the right way to ask questions and how to probe for more information without suggesting answers for the respondents.

Filling of questionnaire: This part taught the team on the right way to precisely fill the questionnaire.

Methodical consideration of the questionnaire as a group: During this part, the group read aloud and discussed each question. Every team member had a clear and understanding of each question.

Assessment of the capacity of the data collection team: A test was conducted to ascertain that all team members have learnt well the key lessons of the training programme.

Field practice: A key part of the training. The whole data collection team went to the field with the trainers. Respondents were chosen and each member conducted the survey interviews under the watchful eyes of the trainers. **A**t some point, the trainers reviewed some logistic issues (stationeries, transportation, etc.) with the team.

2.6.3.1 Questionnaire Administration and Collection

As indicated in the sample and sampling procedures described below, a sample size of 511 was employed in this study. The following methods were used to distribute and collect the questionnaires: The questionnaires were packaged according to the facilities. 6 sites were involved in the study UPTH, BMSH, Ebola treatment centers, Port frontline healthcare facilities, Ebola Assessment Clinic and Laboratory and Airport. Two data collectors were assigned to each site. The printed questionnaires were administered to the identified and selected sites and the collection took place over a period of two weeks (April 24 2017 to May 12 2017).

2.6.3.1 Validity of the Instrument

In this study, both face and content validity were used. The content validity in this study was done using a qualitative method to triangulate and authenticate the quantitative results. The study covered nearly all of the agents of change in the healthcare system over a great sample size of 511, thus raising the sampling validity.

In addition, face validity was done when five experts on the research subject screened the questionnaire (survey instrument) and declared that it captures the features of interest. They studied the items in the questionnaire by looking through it scrupulously. Their intent was to evaluate whether each of the measuring items corresponds with any given conceptual domain of the concept. They approved the questionnaire as a suitable measure for the study's objectives.

2.6.3.1 Reliability of the Instrument

The quantitative instrument was subjected internal consistency test to reinforce the reliability of the survey instrument. In this study, the internal consistency of results was measured across items within a test (i.e., how closely related a set of questions are as a group) with the Cronbach alpha. The Cronbach alpha is the average of all probable split-half coefficients, and it was regarded to be the measure of scale reliability. For all the constructs in the tool, the alphas were over 0.70, meaning that the survey instrument had a high internal consistency.

2.6.4 Permission to Obtain Data

The current project got the authorisation to collect data from the Ethics Review Board of the Rivers State Ministry of Health in Nigeria dated 28th March 2017 with the number MH/PRS/391/VOL.2/407 (see Appendix IX).

2.7 Statistical Software Used For Data Management and Analysis.

2.7.1 Qualitative Data

The R statistical tool (cran.r-project.org)was employed to analyse the qualitative data.The RQDA and Text Mining (TM) packages were used to generate a word cloud (see Figure A3.1 in Appendix X). .Before conducting thematic analysis, the responses in the interview transcript were extracted using the Text Mining package as it unearths frequently occurring words, associations between words as well as other text mining functions.

2.7.2 Quantitative Data

The quantitative data originally in the REDCap and Excel sheet was exported, saved, cleaned and analysed using Stata 14 (StataCorp 2015).

2.8 Data Cleaning

The quantitative data was explored, reviewed and checked for consistencies. Observations with missing data were dropped, and Inconsistencies may arise from faulty logic, out of range or extreme values.

2.9 Data Management

2.9.1 Qualitative Data

Qualitative data was recorded on tape, and the tape recordings were transcribed into a word processing application (MS Word). In turn, the transcribed data were coded into themes for later analysis. Two research assistants and two external experts were assigned to cross-validate the qualitative data. The data collected through printed questionnaires were entered into the Excel sheets and exported into Stata 14. The data was cleaned and stored appropriately.

2.9.2 Quantitative Data

The quantitative data obtained through REDCap was exported to Stata 14 (StataCorp, 2015).REDCap uses the metadata defined in the data dictionary to create syntax files for Stata. The Data Export tool was employed as it contains instructions for linking the exported syntax and data files. The data collected through printed questionnaires were entered into the Excel sheets and exported into Stata 14. The data was cleaned and stored appropriately. To avoid losing the data, data were stored in paper and protected in locked filing cabinets.

2.9.3 Obtaining the Final Data Sets Used For Analysis

2.9.3.1 Final Qualitative Data Set

The following steps were taken in the process of inductive thematic qualitative analysis:

1) Audio data was recorded using a digital voice recorder, while another tape recorder was used to record audio for backup in the event of electronic failure and faults, and also to ensure that nothing is missed. Notes were also taken to serve as an alternate backup option, thus providing the context to the interviews.

2) Recorded responses from the interview were transcribed verbatim. This was done transcription within a short time by two experts to ensure that they were completed quickly.

3) After the recordings were transcribed, the whole texts and field notes were read aloud carefully so that all who heard it could come to a consensus of the completeness of their content before the coding process commenced.

4) Using the RQDA and Text Mining (TM) packages, the transcribed texts were ordered in significant themes and categories. As the analysis continued, more sub-themes and sub-categories were introduced to recognise trends, relationships and meaning connections. This coding process involved three steps: open, axial and selective coding. Open coding consisted of identifying and naming of sections of meaning from the transcripts and field notes concerning the research topic. Open coding concentrated on extensiveness/specificity of comments, frequency, consistency, context, phrasing, wording, etc. As a result, the sections of meaning the transcripts and field notes were plainly marked (highlighted) and labelled descriptively. Axial coding consisted of revising and inspecting the original codes that were identified all through the earlier procedure stated above. Patterns and categories were noted in this step and organised regarding coherence, context and causality. Lastly, selective coding involved a careful perusing of all codes that were recognized for linkage, contrast and comparison to the research topic (question) in addition to a dominant theme or likely important linkage.

5) The codes were ultimately assessed for importance to the research aims.

6) Connected codes were then itemised in categories according to the research aims and theoretical framework from the literature study.

2.9.3.2 Final Quantitative Data Set

The data saved in the Excel spreadsheet were imported into Stata 14. Since the original data was in Excel, it was reshaped "wide to long". String and numeric variables were clearly identified. Data cleaning was carried out through the identification of missing observations, and these were dropped. The **recode** command in Stata was employed to create new variables without modifying the original. The Do-file was generated to store Stata syntax and was essential for replication and modification purposes.

2.9.4 Creation of new variables

The conversions were carried out in two forms-

1. Ordinal categorical data was converted to a continuous scale and composite scores.

2. Interval data that are on a continuous scale were converted to categorical data

Table 2.4 summarises the variables, their scale of measurement, conversion. Furthemore, the Stata syntax employed in the conversion is reported in Appendix XII of this research thesis.

Table 2.4: Creation of new variables and Categories of variables

Variable	**Definition**	**Initial level of Measurement**	**New Scale of Measurement**
Age	the length of time in years that a person has lived or a thing has existed	Interval	Categorical
Years of professional experience	The number of years of experience that a respondent has worked in his field and related endavours	Interval	Categorical
Years of service at UPTH	The number of years a respondent has worked at UPTH	Interval	Categorical
Sponsorship	The act of authorising, legitimisation, and demonstration of ownership for a specific change initiative/innovation.	Ordinal	Continuous
Stakeholder Management	The process of forming, monitoring and maintaining constructive relationships with individuals by influencing their expectations of gain resulting from adopting and implementing an innovation appropriately	Ordinal	Continuous
Communication	Transmission, imparting, conveying, reporting, presenting, passing on, handing on, relay, conveyance,exchanging of information by speaking, writing, or using some other	Ordinal	Continuous

	medium.		
Training	process of developing and strengthening the skills, instincts, abilities, processes and resources that organizations and communities need to adopt and implement innovations.	Ordinal	Continuous
Quality improvement/assurance	a systematic, formal approach to the analysis of practice performance and efforts to improve implementation process implemnatition outcomes and innovation outcomes.	Ordinal	Continuous
Technical Assistance	The providing of advice, assistance, and training pertaining to the installation, operation, and maintenance of innovation.	Ordinal	Continuous
Motivation	perceived incentives and disincentives that contribute to the desirability to use an innovation	Ordinal	Continuous
General capacity	attributes of a functioning organization (e.g., sufficient staffing, effective organizational leadership) and connections with other organizations and the community (	Ordinal	Continuous
Innovation specific capacity	he human, technical, and fiscal conditions that are important for successfully implementing a *particular* innovation with quality	Ordinal	Continuous
Readiness	the conditions that are necessary to ensure quality implementation throughout the entirety of the innovation's lifespan (exploration, preparation, implementation, and sustainment;	Ordinal	Continuous

2.10 Variables and Data Analysis per Objective

2.10.1 The First Objective

Objective 1 : To assess readiness to implement innovations in response to Ebola epidemic outbreak containment.

Type of Data : qualitative data

Variables : Motivation and its sub-components, general capacity and its subcomponents, innovation specific capacity and its sub-components.

Reliability Measure : Triangulation technique, Inter-coder reliability test.

Validity Measure : Credibility, Dependability, Authenticity Confirmation

Method of analysis: Inductive thematic analysis.

2.10.2 The Second Objective

Objective 2 : To identify the drivers/predictors of motivation, general and innovation-specific capacities to implement innovations in response to Ebola epidemic outbreak containment.

Type of Data : Quantitative data

Variables : Motivation and its sub-components, general capacity and its subcomponents, innovation specific capacity and its sub-components., Training, communication, stakeholder's management, sponsorship of the innovation, technical assistance (TA) and enforcing quality assurance and quality improvement (QA/QI) systems and covariates (Age, gender, occupational level, number of years of professional experience, number of years of service at study site and occupational levels)

Reliability Measure : Triangulation technique, Inter-coder reliability test.

Validity Measure : Face and content validity of instrument

Method of analysis: Univariate analysis (t-test and & one-way ANOVA), multivariable analysis (linear regression) per outcome variable

2.10.3 The Third Objective

Objective 3 : To investigate predictors of readiness to implement innovations in response to Ebola epidemic outbreak containment

Type of Data : Quantitative data

Variables : Training, communication, stakeholder's management, sponsorship of the innovation, technical assistance (TA) and enforcing quality assurance and quality improvement (QA/QI) systems and covariates (Age, gender, occupational level, number of years of professional experience, number of years of service at study site and occupational levels) & Readiness

Reliability Measure : Cronbach alpha.

Validity Measure : Face and content validity of instrument

Method of analysis: Multivariable analysis (linear regression) to establish direct effects, Exploratory factor analysis to reduce dimensionality, Confirmatory factor analysis /structural equation modelling (SEM) to establish the direct effect, indirect effect and adjust for confounders. Regression diagnostics: normality test (Shapiro-Wilk test the kernel density, histogram box and dot plots), homoscedasticity (White's test and the Breusch-Pagan test) and leverage points assessment (the leverage vs squared residuals).

2.11 Description and Justification of the Analytical tools used in the study

2.11.1 *t*-test

It is a common trend to apply the *t*-test to a test statistic that follows a normal distribution when the scaling term value in the test statistic is known. If the scaling term is replaced by an estimate based on the data because its value is unknown, then the test statistics will (under some criteria)

follow a Student's *t*-distribution. Then, the *t*-test can be used, for instance, to significantly distinguish between two sets of data.

The (1) statistical significance and (2) effect size of the t-test are two of its primary outputs. The first is an indication of whether the difference between sample averages will probably represent a real difference between populations while the second is an indication of whether such difference is big enough to be essentially significant.

2.11.2 ANOVA

This is a statistical method used to test variances between two or more averages. It is called “Analysis of Variance", not "Analysis of Means" because interpretations about means are done after variance has been analyzed. It is used for testing general (not specific) differences among means. It tests the non-specific null hypothesis (often called the omnibus null hypothesis) that all population means are equal. When this null hypothesis is rejected, it is concluded that no less than one population mean is different from a minimum of one other mean.

This research question was addressed using a one-way ANOVA. ANOVA was fitting because it reveals whether there are important variances between the means of three groups or more. Each of the demographic variables used assessed as independent variables had three or more groups.

2.11.3 Factor Analysis

The factor analysis techniques was employed for data reduction to identify groups or clusters of variables. The factor producing group variables reveals the relationship of variables to the factor. Factor analysis comprises core dimensions at which variables seem to come together meaningfully. This was attained by searching for variables with high correlation with other variables in a group but has no correlation with variables outside that group .Factor analysis offers tools which make it possible to analyze the structure of correlations among large numbers of variables through the definition of sets of highly interrelated variables called *factors* .

At first, this study employed the exploratory factor analysis to take data in a group for a factor and applied the confirmatory factor analysis techniques to verify the group of measurement variables pertaining to a factor for investigating the hypotheses. The principal component extraction is the linear grouping of observed variables that separate subjects by the maximization of the variance of their component score . Also, in order to evaluate the sufficiency of extraction and the number of

factors, the Scree plot and eigenvalues methods were employed. The confirmatory factor analysis (CFA) is a technique typically used to verify *a priori* hypothesis about the relationship between a group of measurement items and their individual factors.

2.11.4 Multiple Linear Regressions (MLR)

This is a statistical technique that employs a number of explanatory variables to forecast the effect of a response variable (Mueller 1996). MLR's goal is to create a prototype for the relationship between the explanatory and response variables. Given in n observations, the model for MLR is:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_p x_{ip} + E_i, \text{ where } i = 1,2, ..., n.$$

MLR uses a set of random variables to attempt to find the mathematical relationship that links them. This relationship (known as the model) creates a linear (straight line) relationship that best estimates all the separate data points.

Assumptions:

1. The residuals of regression follow a normal distribution.
2. The dependent variable and the independent variables are assumed to have a linear relationship.
3. The residuals are almost rectangular-shaped and are homoscedastic.
4. It is assumed that there is no multicollinearity in the model (i.e., there is no high correlation between the independent variables).

The core task in multiple linear regression analysis is the attempt to fit a single line through a scatter plot, or a multi-dimensional space of data points. In the simplest form, this analysis has one dependent variable and at least independent variables. The former variable is called the regressand (outcome variable) while the latter variables are called the regressors (predictor variables).

MLR analysis has three major uses. The first is its use to identify the strength of the effect that the independent variables have on a dependent variable. Also, MLR can be used to predict the effects of changes, to understand the extent to which the dependent variable changes when the independent variables change(Mueller 1996). A third use of MLR analysis is for predicting future values and trends. MLR analysis can thus be employed to get point estimates(Mueller 1996). Another important consideration in the choice of a model for MLR analysis is the model fit. When

independent variables are added to a MLR model, it always raises R^2 (i.e., the amount of explained variance in the dependent variable). Thus, when too many independent variables are added to a model without any theoretical justification, the outcome is an over-fit model.

2.11.5 Regression diagnostics of the residuals

Prior to drawing inferences from analysed data, one must ensure that the data is normally distributed and the variables are properly related. In multivariable analysis, an essential supposition is to shape the data in order to reveal the variation.

2.11.5.1 Normality

The supposition of normality claims that a mean's sampling distribution is regular or that the distribution of means across samples is regular. In statistics, kurtosis and skewness test, the Kolmogorov-Smirnov (K-S) test and the Shapiro-Wilk test are used to measure the normality of a data distribution (Field 2006; Tabachnick and Fidell 2007; Hair et al. 2006). The kernel density, histogram box and dot plots (see Figures A 3.2-A3.4, Appendix XV) were used to visually inspect and evaluate the distribution. The residuals of the readiness score reveal evidence of normality in the distribution. The Shapiro-Wilk tests was employed to ascertain the results of the visual inspection. Kolmogorov-Smirnov (K-S) test is an empirical distribution function (EDF) where the EDF of the data is compared with the theoretical cumulative distribution function of the test distribution. However, the Shapiro-Wilk test uses correlation between the data and the equivalent normal scores. Table A3.2 presents the outcomes of the normality test. Additionally, the Stata syntax employed for the regression diagnostics test is presented in Appendix XIX: of this research report.

2.11.5.2 Homoscedasticity

Homoscedasticity is a reference to the estimation of the variance between the independent variables and the dependent variables. It is assumed in multiple regression analysis that the variation of variables should be constant (Field 2006). Hair et al. (2006) stated that homoscedasticity assumes that dependent variable(s) show identical levels of variance across the range of predictor variable(s) (Tabachnick and Fidell 2007; Field, 2006). Graphical and statistical methods are used to measure homoscedasticity (Field 2006; Hair et al. 2006). A commonly-used graphical method is plotting the residuals against the predicted values. The Stata-plot command was used to draw a plot that gives the pictorial inspection of homoscedasticity. When inspected, the plot reveals the data points have *the same* scatter, an indication of homoscedasticity. This is

proven from the views in Figure A 3.5 (appendix XVII) there are equal distances of the points from the line. Further diagnostics was carried out by checking for influential cases or leverage points. (see Figure A 3.6 in Appendix XVII).

2.11.6 Structural Equation Modeling (SEM)

SEM is a chain of statistical procedures that permits composite relationships between one (or more) independent variables and one (or more) dependent variables. It uses a system of linked regression-style equations, a path diagram and a conceptual model to capture complex and dynamic associations within a network of observed and unobserved variables. SEM looks like regression in appearance, but fundamentally it is not. There is a clear distinction between dependent and independent variables in a regression model. However, in SEM such concepts are applied relatively because one dependent variable in a model equation can become an independent variable in another component of the SEM system. This reciprocity of roles is what lets SEM to conjecture causal relationships.

There are *endogenous* and *exogenous* variables in SEM models. Endogenous variables are dependent variables in no less than one of the SEM equations. They are so named because they could become independent variables in other equations in the SEM equations. Conversely, exogenous variables are always independent variables in SEM equations. SEM equations model both the causal relationships between endogenous and exogenous variables, and the causal relationships among endogenous variables.

In applying the measurement model appraisal approach, the validity of the construct was tested by CFA. To use this approach, the the extent to which all the manifest variables of the same construct relate to each other was tested. Additionally, measurement model evaluation by confirmatory factor analysis guarantees the complete validity of the model. Hence, this study has used goodness-of-fit indices measurement models .The measurement model of the CFA was assessed by using the maximum likelihood (ML) estimation method. The researcher model fit indicators for model validation was employed to solve the possible problem of an undependable χ^2 (Chi-square) statistics and standard errors caused by the application of the ML estimation method.

SEM was employed in this study to allow simultaneous analysis of all the variables in the model instead of separately. In addition, measurement error is not aggregated in a residual error term. Likewise, the path diagrams and the calculation of direct, indirect and total effects helps in

establishing the robustness of the model and its adjust for counfounders. Its most prominent feature is the capability to deal with latent variables, i.e. nonobservable quantities like true-score variables or factors underlying observed variables(Edwards & Bagozzi ,2000).

2.11.7 Inductive thematic analysis.

The principal objective of the inductive approach is to enable the findings of the research is emerge from the recurring , overriding or substantial themes inherently laden in the raw data without the manacles enforced by structured methodologies(Flick 2002). Dominant themes are frequently masked because of the presumptions in the data collection and analysis processes imposed by quantitative data analysis .

The inductive thematic analysis shapes the research through the following processes:

I. It condenses wide-ranging and speckled raw transcript data into a transitory, summary layout.
II. It establishes clear links between the research objectives and the findings generated from the unprocessed data thereby ensuring transparency and defensibility of the study
III. It develops theory or model about the fundamental structure of understandings or methods noticeable in the raw data.

2.12 Ethical Considerations

2.12.1 Protection of the Rights of the Institutions Involved

The ethical consent was sought from the Wits Human Research Ethics Committee (HREC) and Ethics Review Board of the Rivers State Ministry of Health in Nigeria. As a result, Wits HREC (Medical) gave its consent on 25 November 2016, issuing a clearance certificate with number M161127 (Appendix VIII). The full ethical consent from the Ethics Review Board of the Rivers State Ministry of Health in Nigeria was dated 28th March 2017 with the number MH/PRS/391/VOL.2/407 (Appendix IX).

2.12.2 Protection of the Respondents

The informed consent (see Appendix VII) was secured from the study respondents, and they were assured of confidentiality before conducting the interviews. The respondents were meticulously informed about the aim and gains of the study before commencing the interviews. The respondents who consented to be part of the study were mandated to read and sign the consent

form as a formal way of indicating that they agreed of their volition. The forms were signed and returned to the field data collector.

2.12.3 Scientific Integrity

To protect the integrity of scientific knowledge, the following actions were avoided:

1. The building of data from nothing, reporting on a non-relevant subject matter or presenting a report that does not mirror an actual research work.
2. Plagiarising a material and presenting ideas that are not original.
3. Refusing to acknowledge the sources of data consulted and all individuals who contributed to the study.
4. Distorting the result of findings to give backing to preconceived viewpoints.
5. Preventing respondents from voicing their actual opinions to give backing to preconceived notions.

CHAPTER 3: RESULTS

This chapter aims to examine the enormous data collected for this study with the view of reporting the results in an orderly fashion. Finally, in agreement with the tenets of the organisational structure of research, the chapter also deemed it imperative to commence with the findings of the qualitative study and funnelling it to the subsequent analysis of quantitative data.

3.1 Results of the Qualitative Research

This section presents the findings of the qualitative study. The drivers and components of health institutional readiness for Ebola epidemic containment were identified and explored through robust consultation during the expert interviews. The following subsections present the results of the in-depth interviews, and at a glance the reader can decipher the findings of the research.

3.1.1. Objective 1: Assessment of the Readiness in the UPTH to Implement Innovations in Response to Ebola Epidemic Outbreak Containment between June 2016 and May 2017.

3.1.1.1 Emerging Themes and Observed inter-relationship among Variables

In agreement with the tenets of the thematic research organisational structure, an effort was made to familiarise with the assortment of materials collected, sifted and sorted. The recurring themes and issues which arose as a product of the questions asked during the interviews led to the construction of a schematic diagram (Figure 3.1) that illustrates the components and sub-components of health institutional readiness to implement innovations for Ebola epidemic containment. Also, the diagram illustrates the interplay among the sub-components readiness as distilled from the qualitative data gathered through interviews. A theme **("Resilience")** which is not mutually exclusive to the original categories and sprang up as crucial issues.

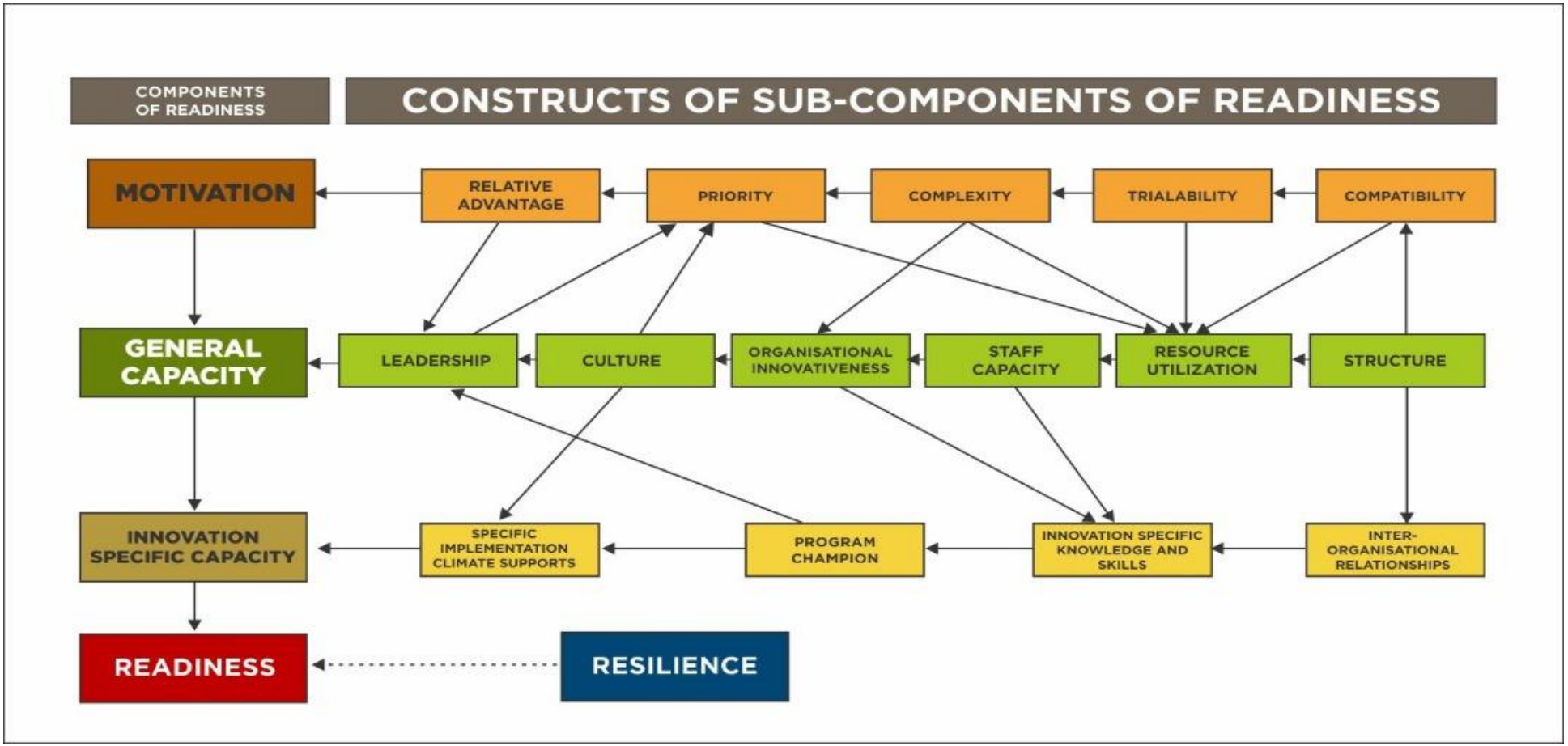

Figure 3.1: Inter-relationship between the sub-components of Organisational/Institutional Readiness to implement innovation as distilled from the interview.

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A cursory consideration of Figure 3.1 shows that some components of motivation, general and innovation specific capacities have a moderating effect on one another. By inspection, it can be stated that the existing organisational structure shapes the compatibility index of innovation. Compatibility, in turn, influences the extent of resource utilisation. Furthermore, the presence and activities of a program champion evoke the necessity for leadership and resource utilisation.

Likewise, perceived complexity of innovation is likely to influence the extent of resource utilisation and organisational innovativeness. Leadership influences how priority will be given to the implementation of the innovation and thus by extension, educe resource utilisation.

Correspondingly, the fact that innovation is "more trialable" or is marked by trialability has a resounding effect on resource utilization by an organisation. Organisational culture influences the extent to which priority is given to the implementation process and quality as well as the complexion of the specific implementation support climate of an organisation.

It has been observed that some of the components do not exhibit a form of direct or indirect relationship. A likely explanation for this is that the organisation under study (UPTH and affiliated health facilities) might not have adequately addressed some concepts of motivation, innovation specific capacity and general capacity. Moreover, some of the components overlap when building capacity for innovations and the participants might not have isolated them to infer their contribution to the readiness building process.

As the sifting of the qualitative data progressed, it was observed that the subcomponents of readiness appear to exert influence on other components of readiness which corroborates with the findings illustrated in Figure 3.1. In Table 3.1, the interactions between the variables are summarised. The implication of this result is that policymakers and program managers could examine the need to change or introduce certain variables or factors at the certain phase of their readiness building programs and readiness sustainability initiatives.

Table 3.1: Summary of the interactions among Readiness sub-components, Readiness components and Readiness

Construct	Motivation	Innovation specific	General Capacity	Readiness
Relative Advantage	X	-	X	X
Compatibility	X	-	X	X
Complexity	X	-	X	X
Trialability	X	-	X	X
Priority	-	-	X	X
Leadership	X	-	XX	X
Culture	-	X	XX	X
Staff Capacity	-	X	XX	X
Structure	X	XX	X	X
Organizational Innovativeness	-	X	X	X
Innovation-Specific knowledge, skills and abilities	-	X	-	X
Specific Implementation Climate Supports	-	X	-	X
Interorganisational Relationships	-	X	-	X
Program Champion	-	X	X	X

-no perceived interaction; X perceived direct association; XX perceived indirect association.

The selected verbatim quote highlighting the interrelationship and perception of the constructs can be found in Table A3.1 in Appendix XI of this research report. Table 3.2 presents how the components of readiness and readiness can be impacted by support system activities. This was generated from the observation report and the checklist given to the

interviewees. Furthermore, it presents the connotative rendition and delineation of the impact of EBSIS on the components of health institutional readiness qualitatively synthesised. Although the quantitative scores of the strength of evidence of the inter-relationship among the sub-components are not established, the reported observations further amplify how EBSIS impacted on the overall state of readiness and implementation outcomes. The indicators range from less useful (*) to most useful (*****).

By inspection, the participants indicated that only four (training, stakeholder's management, communication and quality improvement) out of the six EBSIS were perceived as "most useful" in or enhancing building readiness to implement innovations for EVD containment.

Quality improvement was perceived as most useful in influencing all the three sub-components of readiness and readiness. A noteworthy paradox in the result is that stakeholder's management is perceived as less useful in influencing the general capacity and innovation specific capacity required to implement innovations for EVD containment. Likewise, sponsorship appears to have little influence on the motivation to implement innovation within the context of EVD containment at the study site. Technical assistance is considered as most useful in stimulating motivation, general capacity and readiness respectively while it is perceived as moderately useful in influencing innovation specific capacity to implement innovations. Conclusively, it can be inferred that training is perceived as most useful in building readiness while it is perceived to be moderately useful in influencing the sub-component of readiness.

From the analysis, the identified components and subcomponents of readiness were further espoused using constructs that highlights the variables and mainstreamed into items in the questionnaire for the quantitative enquiry. A new construct for general capacity (**Climate**) was introduced into the questionnaire. The next section of focuses on the analysis and interpretation of the quantitative data generated from the survey.

Table 3.2: Matrix indicating impact of EBSIS on Components of Readiness and Readiness Outcomes

Response Variable	Evidence-Based System for Innovation Support					
	Training	Stakeholder's Management	Sponsorship	Communication	Technical Assistance	Quality Improvement
Motivation	***	*****	**	*****	*****	*****
General capacity	***	*	*****	*****	*****	*****
Innovation specific capacity	***	*	*****	*****	***	*****
Readiness	****	*****	****	*****	****	*****

*less useful ⟶ most useful *****

3.2 Results of the Quantitative Study

3.2.1 Reliability Analysis

In this study, the Cronbach Alpha reliability test was employed to mitigate issues about common method variance. The reliabilities, upon careful checks, ranged from 0.77 to 0.81, which is an acceptable range for an exploratory study according to Nunnally (1978). The general Cronbach Alpha of the scales adopted is 0.81, an indication that the reliability of the scales is rationally high and depicts high internal consistency among the measurement items.

Motivation, General Capacity and Innovation Specific Capacity to implement innovation to contain EVD all had Cronbach's Alpha reliability scores of 0.81, 0.90 and 0.73 respectively (see Table 3.3) these scales are way above the benchmark of 0.7 (Nunnally, 1978). To ascribe equal weight to each aspect of concerted cultivation, a summation of all items belonging to each aspect was taken to arrive at a standardised total. Across the subscales, a coefficient of 0.82 was reported for the Cronbach's alpha, an indication of good reliability. Also, a summation of the varied aspects of readiness was done and then standardised the sum was realised. This gave rise to a concerted readiness measure with standard deviation (1) and mean (0). The summary of the reliability scores of each item is presented in Table A3.2 in Appendix XIII. Furthermore, the Stata syntax employed for the reliability test is presented in Appendix XIV.

Table 3.3: Reliability Measures of the Readiness and its components

	Variable	Cronbach alpha
1.	Motivation	0.81
2.	General Capacity	0.90
3.	Innovation Specific Capacity	0.73
4.	Readiness	0.82

3.2.2 Descriptive statistics and Univariate analysis

The demographic characteristics of the participants in this study were subjected to analysis.. The results are summarised in Table 3.4.

Table 3.4: Descriptive statistics and Univariate analysis.

Variable		Motivation	Innovation Specific capacity	General Capacity
	N=486(%)	Mean (standard error)	Mean (standard error)	Mean (standard error)
Gender[1]		61.71(00.95)[a]	79.96(0.99)[a]	80.28(0.90)[a]*
Male	282(58.02)	61.21(01.25)[a]	80.04(1.30)[a]	81.91(1.18)[a]
Female	204(41.98)	62.41(01.47)[a]	79.84(1.52)[a]	78.02(1.38)[a]
Age(yrs)		61.71(20.97)	79.96(21.77)	80.28(19.84)
20-29	88(18.11)	62.76(20.93)	76.96(22.10)	82.57(21.22)
30-39	216(44.44)	61.49(20.63)	80.63(22.91)	81.12(19.36)
40-49	141(29.01)	61.46(21.28)	81.53(21.00)	78.52(20.19)
50-59	35(07.20)	60.57(22.24)	78.35(16.96)	74.90(14.92)
60-69	6(01.23)	66.67(25.28)	72.10(15.99)	89.49(27.87)
Occupational Level		61.71(20.97)	79.96(21.77)	80.28(19.84)
Top Management	19(3.91)	64.36(18.27)	75.73(21.50)	72.63(21.60)
Health Staff	308(63.37)	61.55(20.56)	81.49(22.53)	81.28(19.54)
Non-Health worker	159(32.72)	61.71(22.12)	77.50(20.07)	79.25(20.07)
Years of professional experience [2]		61.71(20.97)	79.96(21.77)	80.28(19.84)
1-10	217(44.65)	61.32(21.38)	79.00(22.72)	82.28(20.67)
11-20	186(38.27)	62.06(20.16)	82.24(21.37)	79.59(18.26)
21-30	64(13.17)	63.17(21.72)	77.93(21.19)	75.63(20.15)
31-40	19(03.91)	57.89(22.65)	75.51(14.33)	79.92(22.29)
Years of service at study site [2]		61.71(20.97)	75.96(20.68)	80.28(19.84)
1-5	128(26.34)	62.99(21.71)	73.80(21.54)	81.34(20.80)
6-10	225(46.30)	60.89(19.77)	77.00(20.33)	81.27(19.80)
11-15	102(20.99)	60.76(22.54)	77.00(20.98)	76.35(19.54)
16-20	27(05.56)	66.46(21.85)	75.19(18.62)	81.88(16.35)
21-25	4(00.82)	59.29(19.15)	65.00(17.94)	80.00(14.49)

* Statistically significant P-value at <0.05. [1]mean ±standard error, [2]mean ± standard deviation, [a]t-test score, omnibus F test for a one-way ANOVA.

The results indicate that the marginal difference in **innovation specific capacity** between male and female respondents is statistically significant (p= 0.036). However, there is no significant difference in the **motivation scores and general capacity scores.** Additionally, omnibus F test for a one-way ANOVA showed that the effect of age categories on **motivation scores** was insignificant (F 4,481**)** = 0.17, p = .95). Likewise, omnibus F test for

a one-way ANOVA established that there is no significant difference in the **general capacity** scores (F (4,481) = 0.90, p =.47) and **innovation specific capacity scores** (F (4,481) = 1.64, p = .0.16) across age categories respectively.

Furthermore, an analysis of variance showed that the effect of respondents' occupational level on **motivation scores, general capacity scores and Innovation Specific Capacity scores** respectively was examined. The results of omnibus F test for a one-way ANOVA was insignificant for the 3 components of readiness [**motivation scores**-(F (2,483) = 2.03, p = .13: general capacity scores- (F (2,483) = 2.15, p = .12) and; **Innovation Specific Capacity scores**-F (2,483) = 2.03, p = .13)]. Post hoc analyses using the Scheffé post hoc criterion for significance indicated that there is no significant($p>0.05$) difference in the average motivation scores mean **general capacity scores** and mean **innovation specific capacity scores** across the respondents' occupational level.

The results indicate that the marginal difference in innovation specific capacity scores between male and female respondents is statistically significant (p= 0.036). However, there is no significant difference in the **motivation scores and general capacity scores**. Additionally, omnibus F test for a one-way ANOVA showed that the effect of age categories on **motivation scores** was insignificant (F 4,481**)** = 0.17, p = .95). Likewise, omnibus F test for a one-way ANOVA established that there is no significant difference in the general capacity scores (F (4,481) = 0.90, p =.47) and **innovation specific capacity scores** (F (4,481) = 1.64, p = .0.16) across age categories respectively.

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An analysis of variance showed that the effect of Respondents' years of professional experience on **motivation scores** was insignificant (F (3,482) = 0.35, p = .79). Likewise, an

analysis of variance showed that the effect of respondents' occupational level on, mean **general capacity scores** was insignificant (F (2,483) = 2.15, p = .12). Correspondingly, an analysis of variance showed that the effect of Respondents' years of professional experience on **Innovation Specific Capacity scores** was insignificant (F (3,482) = 2.0, p = .11). An analysis of variance showed that the effect of Years of service at UPTH and affiliated health facilities on average **motivation scores** across the Years of service at UPTH and affiliated health facilities categories was insignificant (F (2,483) = 0.62, p = .0.65). An analysis of variance showed that the effect of Years of service at UPTH and affiliated health facilities on **general capacity scores** was insignificant (F (2,483) = 0.84, p = .59). Post hoc analyses using the Scheffé post hoc criterion for significance indicated that there is no significant(p= .50) difference in the average **general capacity scores** across the Years of service at UPTH and affiliated health facilities categories. An analysis of variance showed that the effect of Years of service at UPTH and affiliated health facilities on **Innovation Specific Capacity scores** were insignificant (F (2,483) = 1.28, p = .0.28).

3.2.3. Objective 2: Drivers/Predictors of Motivation,General and Innovation-Specific Capacities to Implement Innovations in Response to Ebola Epidemic Outbreak Containment.

Table 3.5 reports the OLS estimates predicting motivation to implement innovations for containing EVD. The ten predictors in the model were able to account for 3% of the variance in **motivation score,** F (11,474) = 16.67, $p < .005$, $R^2 = .03$ but it was significant.

An examination of the regression output reveals that among all the explanatory various variables only QI/QA exert a positive and significant effect on motivation (P-value=0.003). Although QI/QA is not strongly related to **motivation score**, a unit increase in QI/QA scores increase in the motivation score by 0.004%. Moreover, Communication, Sponsorship, and Stakeholders management exerts positive but insignificant effect on the motivation to implement innovation score: 1% increase in the Training score, Stakeholder's Management score, Sponsorship score and Communication score respectively is predicted to increase **motivation score** by 0.001%,0.001%,0.0002% and 0.002% respectively.

By inspection, the result reveals that female members of the respondents are more motivated than males, but the difference is not significant.The result revals that a 1% increase in the

number of females is predicted to increase **motivation** to implement innovation score by 0.026%.

Table 3.5 : Regression Output of the drivers of Components of Readiness

	Multivariable Analysis					
Variable	Motivation		General capacity		Innovation Capacity	Specific
	β	Std. Err.	β	Std. Err.	β	Std. Err.
Quality Improvement	0.004*	0.001	0.28	0.05	$-0.21 \times 10^{-3*}$	$0.78 \times 10^{-3*}$
Training	0.001	0.001	0.02	0.06	-0.25×10^{-2}	0.83×10^{-3}
Stakeholder's Management	0.001	0.002	-0.12	0.07	0.11×10^{-2}	0.93×10^{-3}
Sponsorship	0.002×10^{-1}	0.002	-0.50	0.07	$-0.57 \times 10^{-3*}$	0.9×10^{-3}
Communication	0.002	0.001	-0.45	0.06	$0.27 \times 10^{-4*}$	0.87×10^{-3}
Technical Assistance	-0.004×10^{-1}	0.001	0.71×10^{-3}	0.00	0.11×10^{-3}	.0007364
Years of Professional Experience	-0.001	0.006	-0.18	0.27	-0.54×10^{-2}	0.38×10^{-3}
Age	-0.003	0.001	0.20	0.21	0.31×10^{-2}	0.30×10^{-2}
Service years in study site	0.005	0.008	-0.04	0.33	0.78×10^{-4}	0.47×10^{-2}
Gender	Ref	Ref	Ref	Ref	Ref	Ref
Female	0.026	0.040	-0.44	1.73	-3.70*	1.80
Occupational level	Ref	Ref	Ref	Ref	Ref	Ref
Health Staff	-0.077	0.110	9.61	4.80	0.78	0.68×10^{-2}
Non-Health Worker	-0.096	0.113	4.95	4.90	0.56×10^{-1}	0.70×10^{-2}
_cons	3.751	0.250	123.10	10.75	4.33	0.15×10^{-2}

* * Statistically significant P-value at <0.05.β. =regression coefficient, Std. Err=standard error estimate

Correspondingly, an examination of the relationship between occupational level of the respondents reveals that as the respondent's levels move from health staff status to top management and non-health staff to top management respectively, the **motivation to implement innovation** score decreases by 0.08% and 0.1% respectively, but the inverse relationship is insignificant.

Likewise, Table 3.5 reports the OLS estimates predicting **general capacity** to implement innovations for containing EVD scores (Model 1) and **innovation specific capacity** to implement innovations for containing EVD scores (Model 2). The ten predictor model was able to account for 28% and 5% respectively of the variance in **general and innovation-specific** capacities to implement innovations. By inspection, the regression output indicates that in model 1 the QI/QA exert a positive and highly significant effect on the **general capacity score** ($p=0.000$). On the other hand, QI/QA weakly but inversely ($\beta=-0.21x\ 10\text{-}3$) related to **innovation specific capacity** and it is highly significant ($P=0.00.$)

Further consideration of the regression output in model 1 shows that Training is positively ($\beta=0.02$) but insignificantly ($p>0.05$) predicts general capacity. 1% increase in training inputs predicts 0.02% increase in the general capacity of the health facilities to implement innovations. Stakeholder's Management scores, Sponsorship scores, Communication scores exert negative or inverse effect on **general capacity** to implement innovation as he reported regression coefficients are -0.12,-0.50 and-0.45 respectively. However, the inverse influence of stakeholder's management is insignificant ($P>0.05$) while 1% increase Communication and Sponsorship scores significantly ($p<0.05$) predicted a decrease in **general capacity** scores by 0.5 and 0.45% respectively. Technical assistance predicts weak positive and insignificant ($\beta=0.71x10\text{-}3$, $p>0.05 =0.3$) increase in general capacity when its index/score is increased by 1%.

Likewise, a close examination of the relationship between Years of professional experience, years of service in University of Port Harcourt Teaching Hospital (UPTH) /affiliate study sites and general capacity to implement innovation to contain EVD indicated that 1 unit increase in the Years of professional experience, years of service in study sites predicts a decrease in general capacity and by 0.18% and 0.04% respectively. However, the relationships are not statistically significant ($p>0.05$).

Noteworthy is the relationship between occupational level and **general capacity**. It was observed that as we move the level of the worker shift health worker status towards top

management, the **general capacity** is positively and marginally (p=0.05) predicted to increase by 9.61%. Likewise, the difference between top management and non-health workers predicts the **general capacity score** to increase by 4.95% though not statistically significant (p>0.05).

In model 2, we observed that Training is negatively associated with **innovation specific capacity**; every additional dosage of training reduces innovation specific capacity score by approximately (-0.25x10-2) but insignificantly (p>0.05) predicts **innovation specific capacity.** Stakeholder's Management scores exhibit a positive but marginally significant association **innovation specific capacity**(β=0.11x10-2, p=0.07). Moreover, Sponsorship scores and Communication scores exert negative (β=-0.57 x 10-3) and positive (β=0.27 x 10-4) on **innovation specific capacity** respectively. Although the both variables exhibit a weak association with **innovation specific capacity**, the relationship is highly statistically significant (p= 0.00). Additionally, Technical assistance predicts weak positive and insignificant (β=0.11x10-3, p>0.05) increase in **innovation specific capacity** when its index/score is increased by 1%.

In the same way, when the relationship between age Years of professional experience, years of service in University of Port Harcourt Teaching Hospital (UPTH) /affiliate study sites and innovation specific capacity EVD was examined. The result indicated that in a 1yr increase in age the Years of professional experience, years of service in study sites predicts **innovation specific capacity** by 0.31 x10-2 %, -0.54 x 10-2 %and 0.78 x 10-4 % respectively. The association is nonetheless, statistically non-significant (p>0.05).

Correspondingly, the relationship between occupational level and **innovation specific capacity** was explored. It was observed that a change in occupational level from health worker to top management status, the difference in the **innovation specific capacity scores** increase by 0.78%.Furthermore, a change in occupational level from non-health worker to top management status, the difference in the **innovation specific capacity scores** increases by 0.06%. However, the relationship between the occupational level is statistically non-significant (p>0.05).

3.2.4 Objective 4: Predictors of Institutional Readiness to Implement Innovations

In this section, an effort was made to establish the relationship between the explanatory variables using linear regression and SEM (direct and indirect effects).

Table 3.6: Output of the OLS estimates of the predictors of readiness

Multivariable Analysis		
Variable	Readiness	
	β	**Std. Err.**
Quality Improvement	-0.150**	0.030
Training	-0.045	0.030
Stakeholder's Management	0.031	0.036
Sponsorship	0.220**	0.036
Communication	0.170**	0.034
Technical Assistance	0.021	0.029
Years of Professional Experience	-0.190	0.150
Age	0.130	0.120
Service years in study site	-0.004	0.190
Gender		
Female	-1.000	0.960
Occupational level	1.000	1.000
Health Staff	4.930	2.670
Non-Health Worker	2.430	2.730
_cons	48.780	5.350

* * Statistically significant P-value at <0.05., β. =regression coefficient, Std. Err=standard error estimate

The OLS estimate of the predictors of readiness is presented in Table 3.6 while the SEM outputs showing direct and indirect effects are presented in Figure 3.1 and Figure 3.2 respectively.

Out of the six EBSIS constructs, only quality improvement, sponsorship and communication have a significant effect on readiness. By inspection, 1% increase in the dosage of quality improvement activities has a negative impact on readiness by .15% while 1% increase in the amount of sponsorship and communication increases the readiness score by .21% and .17 % respectively. Further consideration of the regression results indicates that as we move from non-health workers to top management(non_health_top_mgt), a 1% shift results in the increase in readiness by 2.43% and it is marginally significant (p=0.065). The gender differentials in readiness were examined. The results indicate that female are more motivated by males by a margin of 1%, but it is not statistically significant. The years of professional experience and years of service at study site also indicate that inverse but insignificant relationship with readiness.

3.2.4.1 Regression diagnostics

Therefore, this study has attempted to confirm these relationships by scrutinising the normality and homoscedasticity of the data before making inferences.The kernel density, histogram box and dot plots (see Figures A3.2-A3.4, Appendix XIV) were used to visually inspect and evaluate the normality of the distribution. The residuals of the readiness score reveal evidence of normality in the distribution. The Shapiro-Wilk test reported in Table A 3.3 in Appendix XVI show that there is an overwhelming evidence of normality (p>0.05). Visual inspection of the plot of homoscedasticity *of variance* between the independent variables and the dependent variables reveals the data points have *the same* scatter, an indication of homoscedasticity (see Figure A3.5). The results of the IM test and the Breusch-Pagan test confirmed homoscedasticity of the data (see Table A3.4, Appendix XVII). Further diagnostics was carried out by checking for influential cases or leverage points. The plot of the leverage-versus-squared-residual indicated that the few outliers are not influential and cannot alter the effect of the regression result (see Figure A3.6 Appendix XVIII).

3.2.4.2 Path Analysis

The Average Direct Effect (ADE) of the explanatory variables on readiness was estimated by holding constant all intermediate variables (see Figure 3.2). The output results show the

unmediated effect, and it replicates the linear regression estimates reported in Table 3.6.The output of the unmediated effect estimates is reported in Table 3. 7. Likewise, the Stata syntax employed for the SEM is presented in Appendix XX of this research report. The assessment of the model fit is presented in Table 3.8.

3.2.4.2.1 Direct Effect

Table 3.7: SEM outputs of direct estimates of the predictors of readiness

Factor	**β**	**Std. Err.**
Quality Improvement	-0.150**	0.030
Training	-0.045	0.030
Stakeholder's Management	0.031	0.036
Sponsorship	0.220**	0.0360
Communication	0.170**	0.0340
Technical Assistance	0.021	0.029
Years of Professional Experience	-0.190	0.150
Age	0.130	0.120
Service years in study site	-0.004	0.190
Female	-1.000	0.960
Occupational level	1.000	1.000
Health Staff	4.930	2.670
Non-Health Worker	2.430	2.730
_cons	48.780	5.350

* * Statistically significant P-value at <0.05., β. =regression coefficient, Std. Err=standard error estimate

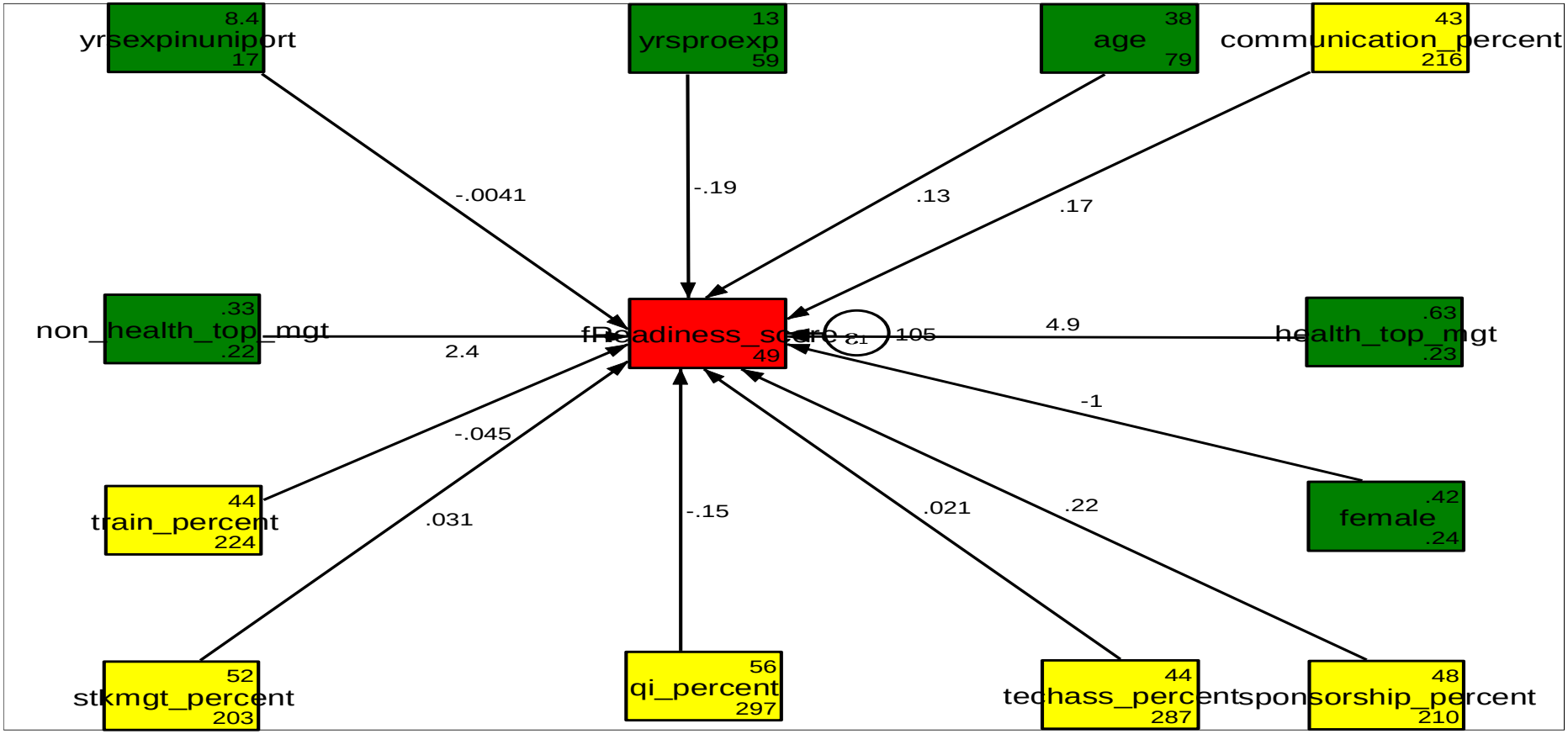

Figure 3.2: Pathway modelling showing direct effects of the predictors of health institutional readiness to implement innovation for EVD containment in Nigeria 2017.

3.2.4.2.2 Assessment of Model Fit

To evaluate whether the model was valid, the overall fit of the model to the observed data was checked. The results for the goodness of fit indices are shown in Table 3.8. Complete and incremental fit indices were tried, and it was discovered that the model satisfactorily represented the dependent and independent proposed constructs. To find a model fit, the root-mean-square error approximation was applied and returned a result of 0.053 indicating as good model fit as the cut-off value is 0.05 (Garver and Mentzer 1999; Hair *et al.* 2006).

Table 3.8: Measurement Model of Institutional Readiness to Implement Innovation

Model Fit* Indicators	χ^2/df	RMSEA	NFI	CFI
	1.86	0.053	.981	.974

χ^2 – Chi-square; df – degree of freedom; RMSEA – Root mean square error of approximation; NFI – Normal fit index; CFI – Comparative fit index.

To measure the model goodness-of-fit, the normated fit index (CFI) and Tucker-Lewis Indices (TLI) measures were applied. These gave results of .981 and .974 respectively, and none of these was below the 0.95 benchmark (Mueller 1996; Hair et al. 2006; Doll et al. 1994; Diamantopoulos and Siguaw 2000).

The, the absolute fit measures showed that the SEM represented an acceptable fit for the collected sample data except for the χ^2 statistic. The χ^2 statistic, divided by the degree of freedom also showed good fit (64.47) and a p-value of 0.325. The Absolute Fit Indices evaluates whether a researcher's theoretical model properly fits the observed data gathered. The Likelihood Ratio Test (popularly known as the "Chi-square" test (CMIN)), is the only statistically-based measure of fit which uses data values and its related "probability" (or p-value) to show that data is not statistically-significant where there is a good model fit. Nevertheless, the χ^2 statistic is very sensitive to sample size and thus is not dependable as a basis for acceptance or rejection (Vandenberg 2006; Schlermelleh-Engel et al. 2003). The final inference is that the proposed model maintains a good fit from the observed result as the RMSEA measures revealed goodness of fit. Also, the CFI and TLI displayed good fit indices for the model.

3.2.4.2.3 Indirect Effect

The pathway analysis demonstrates the direct (Figure 3.2) and indirect (Figure 3.3) routes of interactions among variables that predict institutional readiness. In Table 3.9 the computation of the direct, indirect and total effect predictors of institutional readiness is summarised. All of the connected arrows show pathways that were statistically significant whether directly or indirectly. By inspection communication (.16) and sponsorship (.22) have a positive predictive effect on readiness. Increase in the communication strategy and sponsorship activities results in significant increase in the readiness of health facilities to implement innovation to contain EVD. Figure 3.3 details the indirect pathways for readiness (arrows indirectly linked to the red square via green and yellows squares respectively). In our analysis, participants' age and a number of years at study site indirectly impacted on readiness through years of professional experience and number of health workers relative to the top management. The greatest direct impact on readiness is a number of health workers relative to the top management (β=2.9) adjusting for years of professional experience, number of non-health workers relative to the top management (**non_health_top_mgt)**.

Moreover, when health_top_mgt is an endogenous variable the following variables indirectly impacted on readiness: age, number of years of service at study site and number of years of professional experience had positive predictive effect on readiness as the regression coefficient scores are 0.6, 0.5 and 0.008 respectively and are statistically significant while train_percent and non_health_top_mgt had negative (β=-0.94 and -0.001 respectively) predictive effect on readiness.

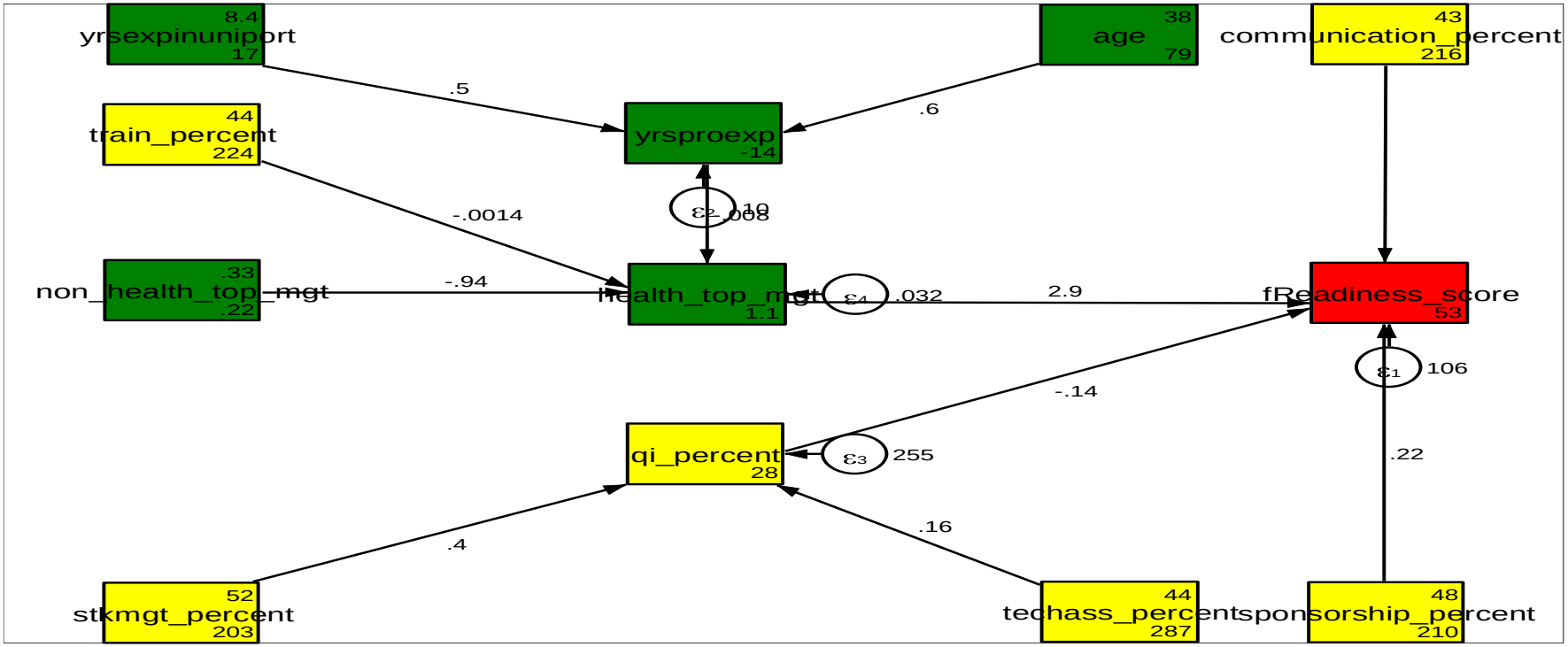

Figure 3.3: Pathways modelling is showing indirect effects of the predictors of health institutional readiness to implement innovation for EVD containment in Nigeria 2017. Key for variable names : number of years of service at study site (**yrsinuniport**), number of years of professional experience(**yrsproexp)**, percentage scores of training on implementation of innovation (**train_percent**), percentage scores of QI practices and measures to aid effective implementation (**qi_percent**), percentage scores of technical assistance to aid implementation of innovation (**techass_percent**) percentage scores of sponsorship to foster implementation success (**sponsorship_percent**) percentage scores of stakeholder's management (**stkmgt_percent**) number of non-health workers relative to the top management as reference (**non_health_top_mgt**) number of health workers relative to the top management as reference (**health_top_mgt**) and percentage scores of communication strategy and activities to aid implementation of innovation (**communication_percent**) . Other the arrows pointing from exogenous (explanatory) to endogenous variables and error term(ε) placed on all for endogenous variables suggested by the modification indices for expected parameter change.

Further observation of Figure 3.2 and Table 3.9 reveals that **qi_percent** had a direct negative predictive effect on readiness (β=-0.14). However, when **qi_percent** is an endogenous variable the following variables indirectly impacted on readiness: **techass_percent** had a positive predictive effect on readiness, as an increase in the technical assistance capacity to aid implementation of innovation result increase in the level of organisational readiness to contain EVD. Similarly, **stkmgt_percent** (stakeholder's management, β=-0.14) has a positive predictive effect on readiness. An increase in the index of stakeholder's management activities that are readiness building driven results in a significant increase in the readiness of the health facilities to implement innovations that are geared towards EVD containment.

Table 3.9 : SEM output is showing the direct, indirect and total effects of the determinants of readiness.

	Direct effects on the readiness as shown in Fig. 2 conceptual framework				Indirect effects on Readiness	Total effects on Readiness
Factor	health_top_mgt	Yrs of Prof.Experience	Quality Improvement	Readiness		
Yrs of Prof.Experience	-0.008*				-0.023	-0.023*
Training	-0.001				-0.004*	-0.004*
non_health_top_mgt	-0.943				-2.741*	-2.741
Age		0.600			0.014	-0.014
Service years in study site		0.504			-0.012*	-0.012*
health_top_mgt				2.910		2.910*
Sponsorship				0.220		0.220*
Stakeholder's mgt.			0.400		-0.054*	-0.054*
Communication				0.160		0.160*
Quality Improvement				-0.140		-0.140*
Technical Assistance			0.161		-0.022	-0.022*

*p>0.05; Indirect effects computed as the product along the related pathways, i.e. to calculate indirect effect of number of years of service at study sites; 0.5 x -0.08x 2.9= - 0.012

CHAPTER 4: DISCUSSION

4.1 Overview

In extant literature, some factors and subcomponents are linked with a rising probability of attaining outcomes. Establishments that want to have results of their innovations ensure that these factors and subcomponents exist. However, being aware that certain capabilities and factors influencing motivation are linked to enhanced innovation results does not mean organisations are "more ready". Establishments need to know how possible they can successfully put these factors in place. What are the determinants of health institutional readiness to implement innovations to contain EVD? The latter was examined in the progression of this research. The next section highlights how the research objectives were achieved during the study.

4.2 Linking Empirical findings to the Research Objectives

This study aims to investigate health institutional readiness of the delivery and support systems for Ebola epidemic outbreak in the post-epidemic era between 2016 and 2017 in Nigeria at healthcare facility levels. The study was set to accomplish three research objectives:

I. To assess readiness in the UPTH to implement innovations in response to Ebola epidemic outbreak containment between June 2016 and May 2017.

II. To identify the drivers/predictors of motivation,general and innovation-specific capacities to implement innovations in response to Ebola epidemic outbreak containment.

III. To investigate predictors of readiness in the UPTH to implement innovations in response to Ebola epidemic outbreak containment between June 2016 and May 2017.

4.2.1 Objective 1: Assessment of Organisational Readiness to Implement Innovations.

The sub-components of readiness that were in place or improved on to enhance the readiness of the health facilities to implement innovations for EVD containment distilled during the qualitative interview are Relative Advantage ,Compatibility, Complexity, Trialability, Priority, Leadership, Culture, Staff Capacity, Structure, Organizational Innovativeness, Innovation-Specific knowledge, skills and abilities, Specific Implementation Climate

Supports, Inter-organisational Relationships and Program Champion. These sub-components influence one another as illustrated in figure 3.1.

Further examination of the readiness building strategies utilised by the health facilities indicated that training, stakeholder's management, sponsorship, communication, technical assistance and quality improvement were employed by the management of UPTH, directors at the State and Federal Ministries of health to build readiness.This is in tandem with the principles of *"empowerment evaluation, improvement and capacity-building"* (Fetterman & Wandersman 2005). It is evident that this measure enhances the readiness index of health organisations in Nigeria by explicitly addressing distinctive components of readiness(Fasina et al. 2014). The deficits in readiness were addressed through effective leadership, prompt funding, aggressive utilisation of resources and resilience of the health systems. A sub-component of readiness that was not addressed in the qualitative study is organisational climate. This was subsequently assessed in the quantitative study.

4.2.2 Objective 2: Drivers/Predictors of Motivation,General and Innovation-Specific Capacities to Implement Innovations in Response to Ebola Epidemic Outbreak Containment.

The study demonstrated how certain factors could influence motivation to implement innovations in healthcare context especially when combating a borderless disease such as Ebola. The variables that summed up to give a composite motivation scores are relative advantage, compatibility, complexity and trialability. Although the association between the explanatory variables (communication, sponsorship, stakeholders management, technical assistance, training and quality improvement/quality assurance, age category, gender, occupational level of respondent, years of professional experience, years of service in University of Port Harcourt Teaching Hospital (UPTH) and affiliate study sites) and each of these subcomponents of motivations were not reported. The study identified the factors that significantly affect to motivations implement innovation in the Nigerian health care system.

Only one EBSIS technique advanced toward significance for motivation to implement innovations. QI had a positive and significant effect on motivation. QI tends to be more entangled than other EBSIS activities; as such there a contributory component of QI that makes this a more expedient strategy for attaining motivation outcomes could be present.

Communication, Sponsorship, Stakeholders Management and Training all had a positive but insignificant effect on motivation.

Technical assistance had a negative effect (β=-0.004 $x10^{-1}$). This implies that the use of technical assistance means it is less likely for motivation outcomes to be attained. Wandersman et al. (2012) agreed with this as they mentioned that the use of technical assistance would not be enough to have eagerness and motivation outcomes. Despite the fact that the statistical significance of this finding was outside the range of significance (i.e. p>0.05), it proposes that when not combined with other EBSIS strategies, technical assistance may be risky. Since technical assistance has widespread availability through websites without any supplementary guidance or oversight, future research to examine the rationale behind this strategy is crucial.

One counter-intuitive finding of note was the minimal evidence that addressing training did not necessarily lead to better motivation scores and quality of implementation. Although training was a major theme in the EBSIS literature (Greenhalgh *et al.* 2004; Powell *et al.* 2012; Rogers *et al.* 2003). Lamb et al. (2013) showed that it must not be employed in isolation as a cumulative introduction of training, QI, and then tools led to statistically significant improvements in measures of motivation and readiness.

The result reveals that female members of the respondents are more motivated than males, but the difference is not significant. Comparable studies on gender differentials in motivation at the workplace to apply innovations reveal that men value supposed ‘instrumental values' as motivational factors at work more than women do. Conversely, women give more importance to inter-personal relationships at the workplace than men do; they cherish being treated respectfully by their bosses, and they always seek to balance their family and professional lives. Women value the supposed ‘soft issues' more than the men. Therefore, the steps involved in applying innovations and the implementation process itself are slightly tilted towards women in compatibility terms, though this is insignificant (Vašková 2005).

This study also revealed that scores for motivation increases as one moves from top management levels to the lower levels. A possible clarification for this trend is that workers in the middle and lower ranks tend to show more positive approaches about science-based staff training and the practicality of EBPs when compared to their senior colleagues. Thus,

the appetite for knowledge and enhanced proficiency is higher in lower level workers (Rieckmann, Daley, Fuller, Thomas & McCarty, 2007; Lundgren *et al.* 2011).

Noteworthy is the fact that years of professional experience had a negative impact on motivation (β=-0.001). Although not significant, it reflects the inertia on the part of long-serving professionals and their resistance to change. Hence a stakeholder's buy-in is vital toward evoking and increasing motivation to embrace innovation, implement innovation and sustain the use of innovation.

Likewise, the study revelead how certain factors could influence General and Innovation-Specific Capacities to implement innovations in healthcare context especially when combating a borderless disease such as Ebola. The variables that summed up to give a composite General capacity scores are priority leadership staff capacity structure culture climate structure culture organisational innovativeness resource utilisation innovation-specific knowledge, skills and abilities specific implementation climate supports inter-organisational relationships program champion. Similarly, variables that summed up to give **Innovation-Specific Capacity** are Innovation-Specific knowledge, skills and abilities, Specific Implementation Climate Supports and Program Champion. Based on the regression output it was observed that QI/QA exert a positive and highly significant effect on the general capacity score (p=0.000). On the other hand, QI/QA is weakly but inversely related to Innovation Specific Capacity and it is highly significant (P=0.00). The implication of this is that QI tends to be more involved in enhancing the general capacity of the health institutions to implement innovations. Hence, there may be a contributory component of QI which makes it a more convenient strategy for attaining innovation outcomes through general capacity than innovation specific capacity.

The prominence of QI to implementation results and readiness cannot be overstated. For instance, Olson et al. (2006) stated that continuing QI backed the development of a body of practice for the care of diabetes. Schwoebal & Creely (2010) supported the notion that establishments should use QI for safety ethos by energetically employing and deciding on team members who are interested in "reporting, analysing and providing feedback." Advances in a childcare worker's ability to interconnect and interact with children's families were qualitatively evaluated through employee interviews after training (Douglass & Klerman 2012). Widespread training on QI aided in alleviating the turnover for care

providers in delivering teenage pregnancy prevention interventions (Philliber & Nolte 2008). Sipilä *et al.*(2008) also extolled the fact that QI reinforces the process of training and building readiness in organizations and specified that a continuing TA and QI program for inter-professional care management resulted in collective treatment practices, increased evidence-based knowledge of well-known volume diseases, acquisition of new skills and learning of tools for patient education and self-measurement.

The study also examined the relationship between training and general and innovation specific capacities. The results indicated that Training has positive but insignificant influence on general capacity while it is negatively associated with innovation specific capacity although insignificantly. A likely explanation for this is that the complexion of the training may not be compatible with the existing capacities of the health institutions. Training is a premeditated instructional exercise meant to make the knowledge, skills and attitudes acquisition easy to improve the performance of the learner (Furjanic & Trotman 2000; Wandersman *et al.* 2012). In this context, the learners are the workers in the support and delivery systems and the relevant stakeholders that are involved in the EVD containment project. Hence, the training needs must be evaluated and tailored to align with the organizational climate and designed to appeal to the workers to foster improved innovation outcomes.

Furthermore, we examined how Stakeholder's Management scores, Sponsorship scores, Communication scores influence general capacity and innovation specific capacity respectively. It was observed that stakeholder's management had a negative and marginally significant impact on general capacity while for innovation specific capacity; it had a positive but marginally significant effect. This suggests that the more stakeholder management initiatives deal with innovation-specific capacity factors that affect motivation, the less probable those initiatives deal with general capacities. This is proof that the 'general capacity' and 'innovation specific capacity' concepts have not been completely addressed in institutional support systems. Correspondingly, we observed that communication had a negative impact on general capacity, but it was marginally significant while communication exerts a weak positive effect on innovation specific capacity, but it was marginally significant. These relationships indicate that when a communication strategy concentrates on a minimum of one innovation specific capacity constituent or as a whole, it was less probable for it to deal with no less than one component of general capacity, and this is so the other way

round. Although Flaspohler *et al.* (2008) did not find this to be true, this study underscores the importance of having a proper communication strategy aimed at general and innovation specific capacity when training staff for innovation.

Additionally, it was observed that sponsorship had a negative and significant impact on general capacity while it had a positive and significant impact on innovative specific capacity. This result may signify a deficit in the sponsorship strategy; the sponsorship activities are not readiness component specific. Since the factors and subcomponents of organisational readiness were revealed to be independently connected to innovation results, a wider method to building readiness can be provided. Such approach must address both innovation and general, specific capacities to show that it is an improvement in the activities of the Support Systems.

4.2.3 Objective 3: Predictors of Healthcare Facilities Readiness to Implement Innovations

The study employed structural equation modelling to instigate the complex relationships among the predictors of readiness by examining the direct, indirect and total effects of the factors on health institutional readiness to implement innovations.

This study's observation of all the factors revealed that they all have a significant relationship with institutional readiness except gender which was discarded from the model. The researcher observed QI have a negative but significant effect on readiness (β=-1.4). This is a stark difference from the contents of existing literature. Lamb et al. (2013) remarkable study revealed that the increasing introduction of training, QI and then tools resulted in statistically significant enhancements in the measures of organisational structure. Although the EBSIS framework presented within it the QA and QI together, they both had negative and significant effects on institutional readiness. While the interviews were ongoing, the QI outcomes were mailed to each participant or posted on walls for the view of all team members, assisting the respondents to note the changes which stemmed from the QI/QA process. Also, the respondents mentioned that the available QI results were obtained in a puzzling manner, thus affecting preserved observability. Correspondingly, a QI/QA-only support strategy was unsuccessful because end users informed that the data was too intricate to understand and use.

Communication and sponsorship are vital readiness building components within the EBSIS framework. The SEM results show that they have a positive and significant impact on institutional readiness to implement innovations to contain EVD in the Nigerian context.The inference that can be drawn is that there is evidence that the activities associated with communication and sponsorship enhance health institutional context. This corroborates with the qualitative data where experts mentioned that eclectic communication channels and sponsorship strategies were employed to ensure that the delivery and support system embrace the innovations, implement innovations and sustain the use of the innovations.

Training as a support system activity has a negative impact on readiness via **health_top_mgt**. This implies that there is a deficit in the training inputs or a dosage of the training activities does not take to cognisance the occupational levels during capacity building plans. This negative effect is significant and requires efforts on the part of the support systems to identify training needs of the various cadres of workers.

Other vital readiness building components within the EBSIS framework were Stakeholder's Management and Technical Assistance. The SEM outcomes showed that both had a positive and significant impact on institutional readiness to implement innovations and contain Ebola Virus Disease in Nigeria. Thus, the inference that can be drawn here is that there is proof that activities linked with Stakeholders Management and Technical Assistance boost health in the institutional context. This validates the qualitative data where specialists mentioned that extensive Stakeholders Management and Technical Assistance activities/inputs were needed to guarantee that delivery and support system encircles the innovations, apply innovations and maintain the use of the innovations.

4.3 Integration Suggested Readiness Bulding Strategies Distilled from the Qualitative and Quantitative Study.

The findings of the qualitative and quantitive study have been harnessed to provide invaluable information of effective readiness building strategies which are evidence-based. Figure 3.4 presents the overall readiness buiding strategy adopted in the Nigerian context which can be replicated across the country and in other regions.

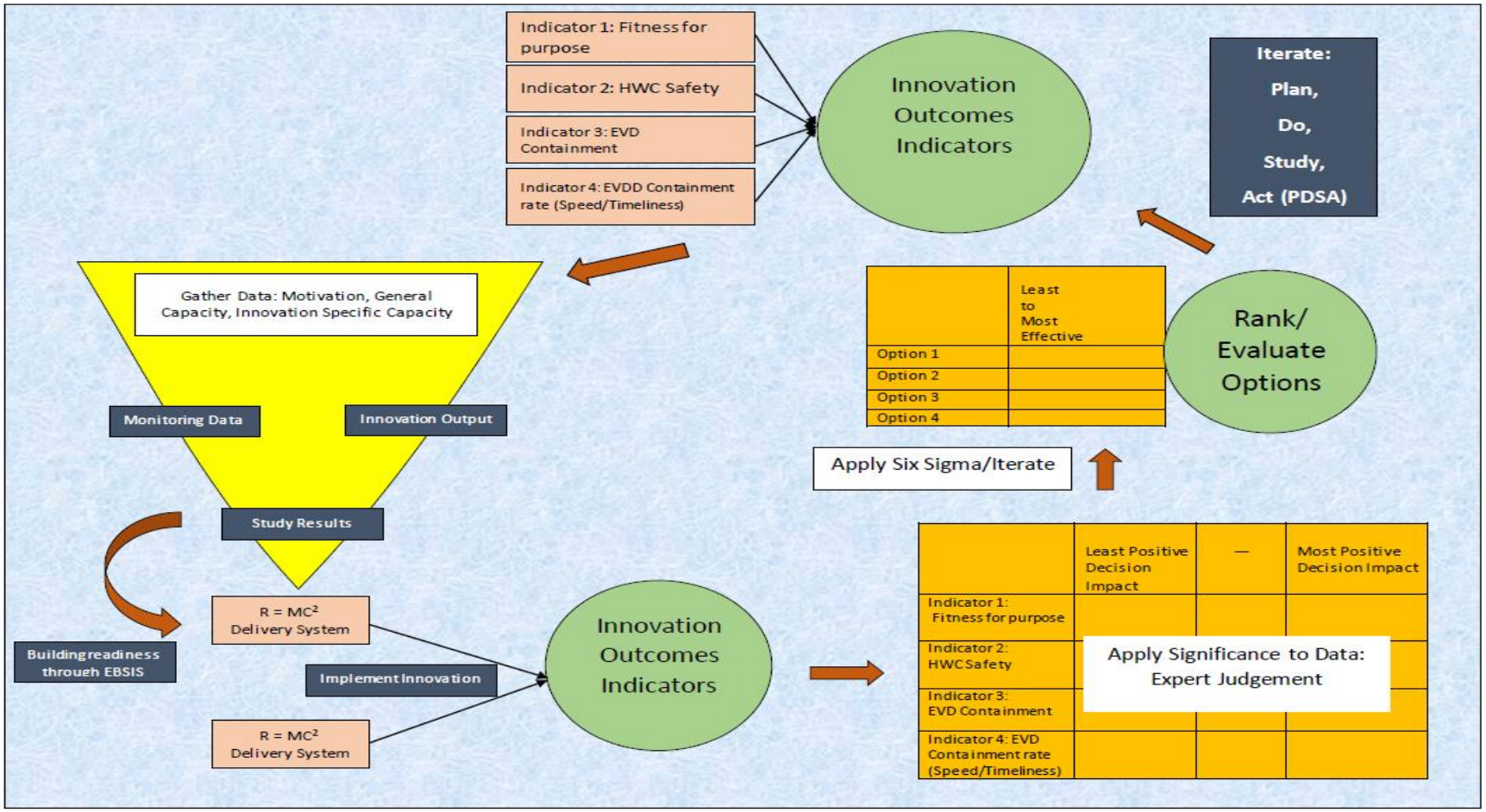

Figure 4.1 : Readiness bulding strategies employed in Nigeria for effective containment of EVD distilled from the qualitative and quantitative study.

A cusory consideration of the above model reveals that QI played a pivotal role in the implementation of the innovations that aided swift containment of EVD in Nigeria.Emphasis was laid on the innovation outcomes-(1) fitness for purpose;(2)health worker's safety(3) EVD containment rate in other words timeliness of containment.The participants suggested that PDSA model of quality improvement was sparingly adapted during the implementation process. It is recommended that employing the model of quality improvement can help in achieving effective innovation and implementation outcomes.

4.4 Limitations of the Study

Construct Bias. While the readiness model presented in this study strived for comprehensiveness, it is probable that other constructs affecting organisational readiness are not represented. One of this is organisation momentum (Osher 2014 cited in Scaccia 2014) while another is resilience (interviews at UPTH 2017).

Publication Bias. As it is the case with all research theses, some details (relevant articles) may have been omitted from this work. This problem is common to all studies on readiness since many of the studies are case studies from single organisations and discuss the narratives of a specific. Likely, most organisations do not present a true representation of their internal innovation change processes in academic literature.

Design Limitations. The cross-sectional survey design employed in this study is such that data on each participant is recorded only once and it would be difficult to infer the temporal association between an explanatory and an outcome variable. Therefore, only an association, and not causation, can be inferred from this cross-sectional study. Also, the qualitative is limited by subjective responses of participants which may not give an accurate picture of the phenomenon under investigation. Moreover, the study was also subject to interviewer bias. Data collectors were therefore trained on data collection, and the technical words (jargons) were simplified and contextualised.

4.5 Strength of the Study

A foremost strong point in the method analysis is the use of SEM which adjusted for confounders. Furthermore, the combination of qualitative and quantitative analysis methods aided understanding the complexion of organisational readiness in LMIC context such as Nigeria. Inferences from the study can help in drawing up readiness and emergency

preparedness plans and fostering significant innovation and implementation outcomes in health facilities, sentinel and ancillary signal sites state-wide, nationwide and by extension across Africa.

4.6 Future Opportunities for Dissemination of the Research Findings

An administrative synopsis of this study and its complete report will be sent to the relevant agency of the Rivers State Ministry of Health in Nigeria in order to assist with reviewing, planning and targeting interventions and execution of innovations/change to promote Ebola virus disease containment. Manuscripts of this study will be sent to scientific journals for pertinent peer reviews. Conference abstracts are also being written from the key themes of this study to further publicise the outcomes of this research to the significant scientific community to assist public health interventions and application of the study's findings.

4.7 Future Directions

Granted, this thesis gave preliminary evidence that elements of the EBSIS framework had a significant impact on readiness; the research identifies key areas where the support system can interact with the delivery system to foster optimal implementation quality and substantially positive innovation outcomes. Paramount to this grey areas is the need to further explore the complex interrelationships between the drivers of motivation and subcomponents of innovation-specific and general capacity to comprehensively unveil the synergistic cum or antagonist interactions that exist in the ISF space. Kane et al. (2014) suggested the use of QCA (qualitative comparison analysis). According to the QCA, the necessary and sufficient conditions that predict outcomes of interest are evaluated through set theory and linear systems. The items identified are coded, and the proportions of cases that significantly relate to outcomes are reported (Ragin 1999; Kane et al.2014). This approach could contribute to the learning curve as some factors could be identified as more critical to achieving readiness to implement innovations innovation outcomes than other subcomponents.

Furthermore, it is imperative to develop standard models that will evaluate readiness while still retaining the entire components of $R=MC^2$. We recommend that for LMIC's subsequent studies could consider $R=R^*MC^2$ model where R= readiness, R* = resilience, C = general capacity and C = innovation specific capacity.

4.8 Conclusion

Health institutional readiness is a vital element in the implementation space.The strength of evidence of how Evidence-Based System for Innovation Support (EBSIS) can influence readiness was established. It is imperative for health institutions to ensure EBSIS fit when employing its elements in building readiness and influencing the subcomponents of readiness. There is a need for periodic evaluation of the readiness index of the health institution to implement innovations or change that will ensure effective and optimal health care delivery. What is more, though readiness is a rate-determining step in ensuring robust and effective implementation outcomes, exploring innovation outcomes and their amplification through explicitly target readiness dynamics, and its subcomponents as part of an innovation implementation process is a desideratum that requires stakeholders in the health sphere and implementation space to fill the void.

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APPENDICES

Appendix I: Plagiarism Declaration Report

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

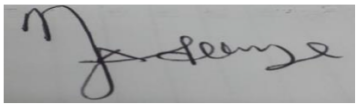
SENATE PLAGIARISM POLICY: APPENDIX ONE

I ADEKEYE JOSHUA TEMITOPE (Student number: 1321241) am a student

registered for the degree of Master in Epidemiology in the Field of Implementation Science in the academic year 2016-2017.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature:  Date: 29-September 2017

Appendix II: Delivery Systems Ability to Implement with Quality

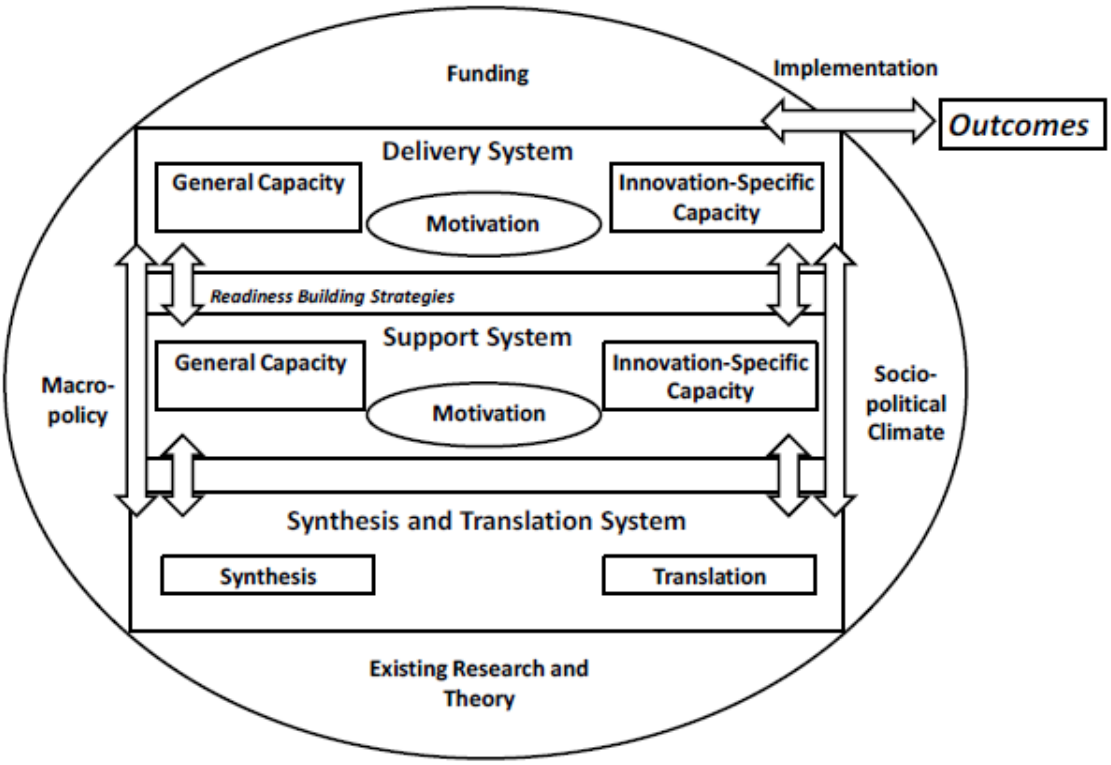


Figure A1.1: Delivery System's ability to implement with quality (Wandersman, Chien, & Katz 2012).

Table A1.1: Sub-Components Motivation-Influencing Factors .

Influences on Motivation	Definition	References
Relative Advantage	Degree to which a particular innovation is perceived as being better than what it is being compared against; can include perceptions of anticipated outcomes	Armenakis et al. 1993; Damschroder et al. 2009; Gladwell 2001; Hall & Hord 2010; Rafferty et al. 2013; Rogers 2003; SAMHSA, 2010; Schoenwald & Hoagwood 2001Weiner, 2009
Compatibility	Degree to which an innovation is perceived at being consistent with existing values, cultural norms, experiences, and needs of potential users	Chinman et al., 2004; Durlak & Dupre 2008; Fetterman & Wandersman 2005; Greenhalgh et al. 2004; Rafferty et al. 2013; Rogers 2003; Simpson 2002
Complexity	Degree to which innovation is perceived as relatively difficult to understand and use	Damschroder & Hagedorn, 2011; Fixsen et al. 2005; Greenhalgh et al., 2004; Meyers, Durlak & Wandersman 2012; Rafferty et al. 2013; Wandersman et al., 2008.
Trialability	Degree to which an innovation can be tested and experimented with	Armenakis et al. 1993; Greenhalgh et al. 2004; Rapkin et al. 2012; Rogers 2003.
Observability	Degree to which outcomes that result from the innovation are visible to others	Beutler 2001; Chinman et al. 2004; Damschroder et al., 2009; Ford et al. 2008; Rossi, Lipsey, & Freeman 2004
Priority	Extend to which the innovation is regarded as more important than others	Armenakis et al. 1993; Damschroder et al. 2009; Klein, Conn, & Sorra 2001

Source: Scaccia et.al (2015)

Table A1.2: Sub-Components of Innovation-Specific Capacities .

Types of Innovation-Specific Capacities;	Definition	Authors
Innovation-Specific knowledge, skills, and abilities	Knowledge, skills, and abilities needed for the innovation	Fixsen et al. 2005; Greenhalgh et al. 2004; Simpson 2002; Wandersman, Chien, & Katz, 2012
Program Champion	Individual(s) who put charismatic support behind an innovation through connections, expertise, and social influence	Atkins et al. 2008; Damshroder et al. 2009; Greenhalgh et al. 2004; Gladwell 2002; Grant, 2013; Rafferty et al. 2013; Rogers 2003
Specific Implementation Climate Supports	Extent to which the innovation is supported; presence of strong, convincing, informed, and demonstrable management support	Aarons et al. 2011; Beidas et al. 2013; Damschroder et al. 2009; Fetterman & Wandersman, 2005; Greenhalgh et al. 2004; Hall & Hord, 2010; Rogers 2003; Schoenwald & Hoagwood 2001; Weiner et al. 2008.
Interorganizational Relationships	Relationships between a) providers and support systems *and* b) between different provider organizations that are used to facilitate implementation	Aarons et al. 2011; Flaspohler et al. 2004; Powell et al. 2012

Source: Scaccia et.al(2015)

Table A1.3: Subcomponents of General Capacity

Types of General Capacities (non-exhaustive)	Definition	Authors
Culture	Expectations about how things are done in an organization; how the organization functions	Beidas et al. 2013; Drzensky et al. 2012; Glisson 2007; Glisson & Schoenwald 2005; Hemmelgarn et al. 2006; Livet, Courser, & Wandersman 2008
Climate	How employees collectively perceive, appraise and feel about their current working environment	Aarons et al. 2011; Beidas et al. 2013; Damschroder et al. 2009; Glisson 2007; Greenhalgh et al. 2004; Hall & Hord 2010; Lehman et al. 2002
Organizational Innovativeness	General receptiveness toward change; i.e., an organizational learning environment	Damschroder et al. 2009; Fetterman & Wandersman 2005; Greenhalgh et al. 2004; Klein & Knight, 2005; Rafferty et al. 2013; Rogers 2003
Resource Utilization	How discretionary/uncommitted resources are devoted to innovations	Armstrong et al., 2006; Greenhalgh et al. 2004; Klein et al. 2001; Rogers 2003; Simpson 2002
Leadership	Whether power authorities articulate and support organizational activities	Aarons & Sommerfield, 2012; Becan, Knight & Flynn 2012; Beidas et al. 2013; Fixsen et al. 2005; Grant 2013; Rafferty et al. 2013; Simpson et al. 2002
Structure	Processes that impact how well an organization functions on a day-to-day basis:	Damschroder et al., 2009; Flaspohler et al. 2008; Greenhalgh et al 2004: Lehman et al. 2002; Rafferty et al. 2013; Rogers 2003
Staff Capacity	General skills, education, and expertise that the staff possesses	Flaspohler et al., 2008; McShane & Van Glinow 2009; Simpson et al. 2002

Source: Scaccia et.al (2015)

Appendix III: Satellite Map showing the location of UPTH at East West Road

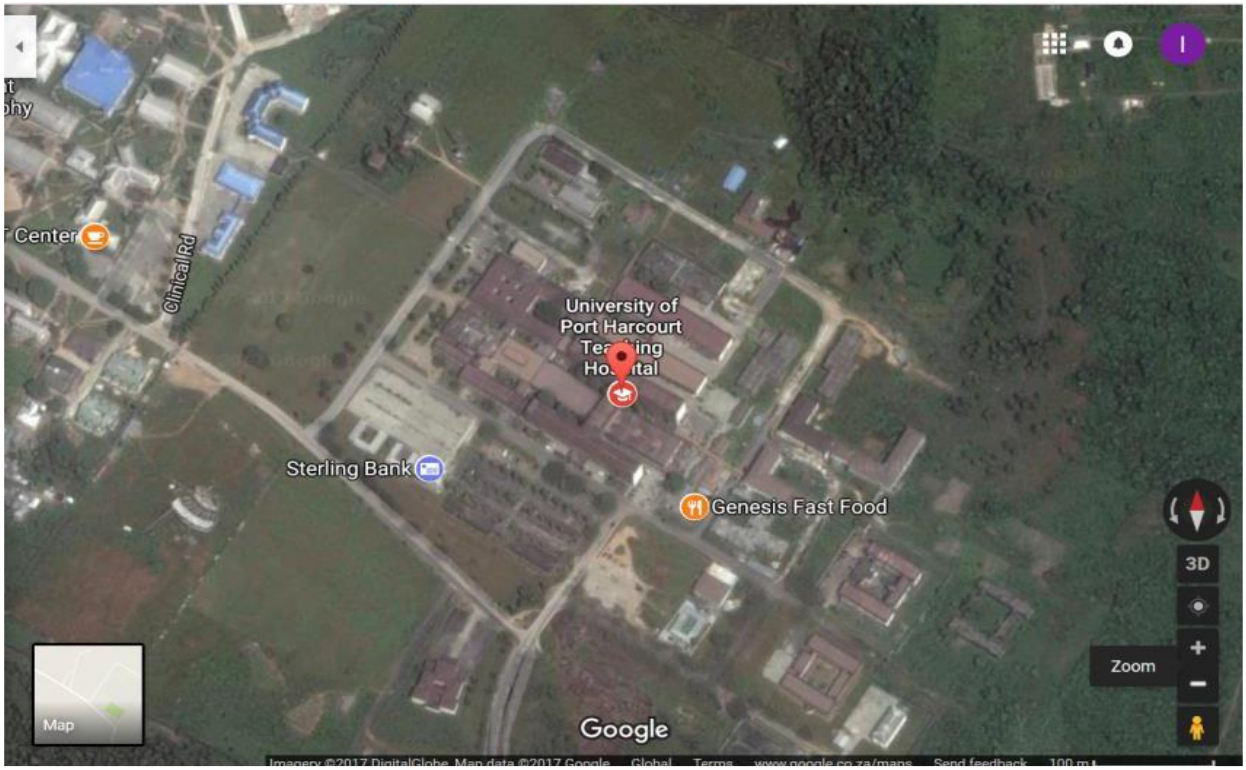


Figure A2.1: Satellite map showing the location of UPTH at East-West Road, Port Harcourt, Rivers State

Table A2.1: Items, Level of Measurement and Category of Variables in the Quantitative Instrument.

Item	Sub-component of readiness	Level(s) of measurement	Category of variable of readiness
1.	sex,	Nominal	**Demographic Characteristics**
2.	age,	Interval	
3.	occupational level	Categorical(Nominal)	
4.	years of professional experience	Interval	
5.	years of service at UPTH	Interval	
6.	Relative Advantage	Ordinal	**Motivation**
7.	Compatibility	Ordinal	
8.	Complexity	Ordinal	
9.	Trialability	Ordinal	
10.	Priority	Ordinal	
11.	Leadership	Ordinal	**General Capacity**
12.	Culture	Ordinal	
13.	Staff Capacity	Ordinal	
14.	Structure	Ordinal	
15.	Culture	Ordinal	
16.	Climate	Ordinal	
17.	Structure	Ordinal	
18.	Structure	Ordinal	
19.	Culture	Ordinal	
20.	Organizational Innovativeness	Ordinal	
21.	Organizational Innovativeness	Ordinal	
22.	Resource Utilization	Ordinal	

23.	Resource Utilization	Ordinal	
24.	Structure	Ordinal	
25.	Organizational Innovativeness	Ordinal	
26.	Staff Capacity	Ordinal	
27.	Staff Capacity	Ordinal	
28.	Staff Capacity	Ordinal	
29.	Organizational Innovativeness	Ordinal	
30.	Innovation-Specific knowledge, skills and abilities	Ordinal	**Innovation specific capacity**
31.	Innovation-Specific knowledge, skills and abilities	Ordinal	
32.	Innovation-Specific knowledge, skills and abilities	Ordinal	
33.	Specific Implementation Climate Supports	Ordinal	
34.	Innovation-Specific knowledge, skills and abilities	Ordinal	
35.	Innovation-Specific knowledge, skills and abilities	Ordinal	
36.	Innovation-Specific knowledge, skills and abilities	Ordinal	
37.	Interorganizational Relationships	Ordinal	
38.	Specific Implementation Climate Supports	Ordinal	
39.	Specific Implementation Climate Supports	Ordinal	
40.	Specific Implementation Climate Supports	Ordinal	
41.	Specific Implementation Climate Supports	Ordinal	
42.	Program Champion	Ordinal	
43.	Communication	Ordinal	**E vi de nc e- B**

44.	Communication	Ordinal	
45.	Communication	Ordinal	
46.	Communication	Ordinal	
47.	Communication	Ordinal	
48.	Sponsorship	Ordinal	
49.	Sponsorship	Ordinal	
50.	Sponsorship	Ordinal	
51.	Sponsorship	Ordinal	
52.	Sponsorship	Ordinal	
53.	Stakeholder Management	Ordinal	
54.	Stakeholder Management	Ordinal	
55.	Stakeholder Management	Ordinal	
56.	Stakeholder Management	Ordinal	
57.	Stakeholder Management	Ordinal	
58.	Technical Assistance	Ordinal	
59.	Technical Assistance	Ordinal	
60.	Technical Assistance	Ordinal	
61.	Technical Assistance	Ordinal	
62.	Technical Assistance	Ordinal	
63.	Training	Ordinal	
64.	Training	Ordinal	
65.	Training	Ordinal	
66.	Training	Ordinal	
67.	Training	Ordinal	
68.	Quality Improvement/Assurance	Ordinal	
69.	Quality Improvement/Assurance	Ordinal	
70.	Quality Improvement/Assurance	Ordinal	
71.	Quality Improvement/Assurance	Ordinal	

72.	Quality Improvement/Assurance	Ordinal	
73.	Quality Improvement/Assurance	Ordinal	
74.	Quality Improvement/Assurance	Ordinal	
75.	Quality Improvement/Assurance	Ordinal	
76.	Quality Improvement/Assurance	Ordinal	

Appendix IV: Interview Guide

Interview Guide for Assessing Health Institutional Readiness for Ebola Epidemic Outbreak Containment in Nigeria

Introduction

• Kindly provide information about yourself and your position in your company (Background, Job experience, Task etc.)?

Perception of organisational readiness for change and innovation use during Ebola Epidemic.

1. How can you define organisational readiness for change and innovation use? What does it mean to you?
2. What does it mean to your organization?
3. Is there a committee that addresses readiness for change and innovation use during Epidemic occurrence such as Ebola Outbreak in your company?

Motivation

4. How does the following factors shape the workers adoption of innovation/change during epidemic occurrence such as Ebola Outbreak?
    a) Relative advantage (Degree to which a particular innovation is perceived as being better than what it is being compared against; can include perceptions of anticipated outcomes).
    b) Compatibility(Degree to which an innovation is perceived at being consistent with existing values, cultural norms, experiences, and needs of potential users).
    c) Trialability(Degree to which an innovation can be tested and experimented with).

General capacity

5. **How can you describe the capacity of this hospital in terms of ability to implement change**

    1. Climate(How employees collectively perceive, appraise and feel about their current working environment)

2. Organizational innovativeness(General receptiveness toward change; i.e., an organizational learning environment)

3. Leadership(Whether power authorities articulate and support organizational activities)

4. Structure(Processes that impact how well an organization functions on a day-to-day basis)

5. Staff capacity (General skills, education, and expertise that the staff possesses).

Innovation specific capacity.

6. **How can you describe the capacity of this hospital in terms of ability to implement change**

a) Innovation-Specific knowledge skills, and abilities (Knowledge, skills, and abilities needed for the innovation).

b) Program champion(Individual(s) who put charismatic support behind an innovation through connections, expertise, and social influence)

c) Inter-organizational relationships(Relationships between a) providers and support systems and b) between different provider organizations that are used to facilitate implementation)

Additional Questions

7. What is the future of adopting and embracing innovation during epidemic occurrence such as Ebola outbreak in your organisation?

Which direction is your organization taking concerning use of Evidence-based system for Innovation support (such as Tools, Training, Technical assistance, QA/QI and Stakeholder's Management to foster readiness for change during Ebola outbreak.

Appendix V: Questionnaire Cover Letter

Dear Respondent,

I am a post-graduate student studying towards my MSc in Epidemiology in the field of implementation Science at the University of the Witwatersrand, Johannesburg South Africa. The aim of my study is to assessing health institutional readiness for Ebola outbreak containment in Nigeria using the University of Portharcourt Teaching hospital as a case study. I believe that my study would make a contribution to improving the preparedness and readiness for managing innovations that will help stem the tide of Ebola flare-ups in Nigeria and by extension the global health community.

As one of the selected respondents, your views are invaluable to the success of this study. Your responses to the questions are highly appreciated and it should not take more than forty minutes of your time and we want to thank you in advance for your co-operation. We guarantee that all information will be handled with the utmost CONFIDENTIALITY. Thank you very much.

Adekeye Joshua

Appendix VI: Questionnaire

SECTION A

DEMOGRAPHIC DATA

INSTRUCTION: Please, tick the right box (es) that best answer(s) the stated information about yourself.

Gender

Male ☐ Female ☐

Respondent's age…….

Occupational level

Top management ☐ Health staff ☐ Non-health worker ☐

Years of work experience in health sector…….

Years of work experience at UNIPORT Teaching Hospital……..

SECTION B

MOTIVATION FOR THE IMPLEMENTATION OF CHANGE

INSTRUCTION: The thrust of this section is for you to identify and explicate some inventive characteristics which motivate you to accept an innovation and be prepared to apply it during an EVD (Ebola Virus Disease) outbreak. Please tick the box that best suits your opinion. Your participation is totally of your own volition and you will at no time be required to give information about yourself. All information you supply will be kept strictly confidential.

You are to rate each statement accordingly on a scale of 1 (strongly disagree) to 7 (strongly agree). Please provide your expert information concerning the level of your motivation in applying evidence-based innovation as a response to an EVD outbreak.

S/N	I feel motivated to apply innovation for change because…	Strongly Disagree						Strongly Agree
		1	2	3	4	5	6	7
1.	It encompasses techniques, equipment and skills that ensure greater effectiveness' than the Orthodox approach to EVD outbreak							
2.	It is in tandem with present methods and practices							
3.	Its implementation methods are effortless and need no special training							
4.	It is tested and trusted, which is dependable and efficacious							
5.	It has more efficiency than the existing tedious procedure thus not eliciting any fear of implementing it							

SECTION C

GENERAL ORGANIZATIONAL CAPACITIES

INSTRUCTION: The thrust of this section is for you to supply expert opinion on the characteristics and assets which your organization has to handle an EVD outbreak as well as the links it has with other establishments and communities.

For all of the statements found below, tick the appropriate boxes which best describe your organization. Please refrain from thinking about yourself; instead, think of your organization as a whole. The information supplied herein will aid the researcher of this study to better determine the diverse strategy types and support organizations needed to address cases of EVD outbreaks.

S/N	At the moment in my organization,…	Strongly Disagree						Strongly Agree
		1	2	3	4	5	6	7
6.	There is a leadership structure which supports the benefits accruing from applying innovation to combat instances of EVD outbreaks							
7.	There are members of staff who often discuss the gains of applying innovation for combating instances of EVD outbreaks							
8.	There are members of staff who qualify to be called innovation champions for their roles in the implementation of innovations and combating instances of EVD outbreaks							
9.	There is a vibrant mission statement							
10.	The members of staff all follow the mission statement							
11.	The work environment is free from stress							
12.	All decisions by members of staff which support matters relating to client-care are often supported							

13.	Each member of staff has a precise job description							
14.	All members of staff keep the lines of communication open							
15.	Efforts are made to identify several funding sources which can help to implement innovation and combat instances of EVD outbreaks							
16.	Efforts are made to access several funding sources which can help to implement innovation and combat instances of EVD outbreaks							
17.	A part of the organisation's financial resources is used to implement innovation and combat instances of EVD outbreaks							
18.	Greater attention is given to the financing of programmes that allow implementation of innovations which help to combat instances of EVD outbreaks							
19.	There is a data collection process for EVD indicators from all patients							
20.	Modifications to treatment programmes are done according to data collected							
21.	There are high quality and proficient members of staff							
22.	There are members of staff with good experience of working in instances of EVD outbreaks							
23.	There are members of staff who implement best practices in delivery services							
24.	Some services are adjusted to meet the cultural needs of some clients							

SECTION D

INNOVATION-SPECIFIC CAPACITIES

INSTRUCTION: The thrust of this section is for you to supply expert opinion on fiscal, technical and human conditions needed to apply a specific innovation successfully in instances of EVD outbreaks.

For all of the statements found below, deliberate thoughtfully on whether each of them aptly describe your organization. Please refrain from thinking about yourself; instead, think of your organization as a whole. The information supplied herein will aid the researcher of this study to better determine the diverse strategy types and support organizations needed to address cases of EVD outbreaks.

S/N	At the moment in my organization,…	Strongly Disagree						Strongly Agree
		1	2	3	4	5	6	7
25.	We ensure prompt treatment of patients							
26.	We enhance simple access to treatment							
27.	We strive to eliminate obstacles which thwart peoples' efforts from getting quality treatment							
28.	There is room for clients to choice from an array of diverse treatment programmes							
29.	Measures are taken to expedite rapid client transition between various treatment levels							
30.	An evaluation of several life needs of clients is available							
31.	Information relating to the resources and needs of clients							

	are collected							
32.	The expertise from various health facilities was harnessed to contain EVD							
33.	There is support for clients who are efficient at attaining their recovery goals							
34.	Family members or important social supports are involved in clients' treatments							
35.	Family member participation is permitted during the recovery planning Process							
36.	We promote recovery by carrying out outreach activities in the community							
37.	We have key staffs that consistently advocate for implementing innovations , new programs and ensure sustainability of utilisation of the innovations							

EVIDENCE-BASED SYSTEM FOR INNOVATION SUPPORT(EBSIS) VALUATION
For each of the statements shown below, enter between the numbers 1 to 7in the column to the right according to how you feel each statement best describes your organization's capability in managing change. You are to rate each statement accordingly on a scale of 1 (strongly disagree) to 7 (strongly agree).

S/N	Communication - Notifying the affected persons concerning the change	Response - Enter a number between 1 and 7
38.	My organization has a strategy and vision that are clearly-defined with continuous communication of any changes with all stakeholders.	
39.	We set priorities and repeatedly communicate changes in projects and other contending initiatives.	
40.	My organization employs numerous means of communication to inform its stakeholders	
41.	My organization uses clear, concise and consistent language to disseminate messages about changes in its projects.	
42.	My organization has certain structures which are meant to detect possible	

	flaws in its use of effective communication.	
	Sponsorship – Providing active support for change at a senior managerial portfolio in an organization, and exploiting this support to attain anticipated results	
43.	There is the presence of an executive sponsor for the change initiatives in the organization	
44.	The executive sponsor exercises obligatory authority over the organization's staff, processes and structures in order to sanction and finance change initiatives	
45.	The executive sponsor creates awareness of the need for change	
46.	The executive sponsor will vigorously and perceptibly cooperate with the project team during the course of the whole change process	
47.	The executive sponsor ends disputes and decide on issues bordering on change project schedule, scope and resources.	
	Stakeholder Management – Acquiring approval for changes from those involved and either directly or indirectly concerned. Bringing the right persons into the design and implementation phases of changes ensure the correctness of the changes	
48.	The executive sponsor is eager and capable of building a sponsorship partnership for change, and can handle confrontation from all stakeholders.	
49.	There is a celebration of change accomplishments, both openly and covertly	
50.	The message passed from various levels of management to all stakeholders is dependable and integrated	
51.	The organization design change initiatives to suit the precise needs of each stakeholder group	
52.	The use of exceptional tactics are used to handle antagonism and clamor for change from many stakeholders.	
.	**Technical Assistance – Preparing people to get ready to adjust to changes by ascertaining that these have the right data and tool sets.**	
53.	An organized change management method is adopted and implemented on change projects coupled with an evaluation plan .	
54.	The members of change management teams are recognized and the managers and staff members receive trainings on Implementing fidelity monitoring tools.	
55.	Change management and project teams keep track of their progresses and expertly resolve interrelated matters through defined project management processes. Project plans are incorporated in the change management plan.	
56	Resources needed to embark on change projects are discovered and assessed according to a project plan.	
57.	There is a feedback process that is used to constantly ascertain how efficiently change has been adopted by stakeholders	
	Training – Preparing the applicable resources for the change process	
58.	The organization identifies and fortifies the abilities and attitudes vital for the change process	
59.	They also identify the abilities and information needed for moving to the state of change	

60.	There is a continuous evaluation of skills on change projects and the lapses are identified for change	
61.	Training is established and planned proactively according to observed flaws in skills and the evaluation of needs	
62.	Training involves adaptable methods, e.g. Internet based, Internet broadcasts, printed guides, in-class trainings, etc.	
	Quality Improvement/Assurance– "quality of care and services" **during change process and use of innovation**	
63	Hospital employees are given adequate time to plan for and test improvements	
64	Each department and work group within this hospital maintains specific goals to improve quality	
65	The hospital's quality improvement goals are known throughout the organization	
66	The hospital regularly checks equipment and supplies to make sure they meet quality requirements.	
67	The hospital tries to design quality into new services as they are being developed.	
68	The hospital views quality assurance as a continuing search for ways to improve.	
69	Over the past few years, the hospital has shown steady, measurable cost reduction while maintaining or improving quality.	
70	Data on patient satisfaction are widely communicated to hospital staff.	
71	The hospital uses data from patients to improve services.	

THANK YOU.

AppendixVII: Consent Form

STUDY NUMBER

INFORMATION SHEET
A STUDY ON ASSESSING HEALTH INSTITUTIONAL READINESS FOR EBOLA EPIDEMIC OUTBREAK CONTAINMENT IN NIGERIA

Good day, my name is _____. I am speaking to you on behalf of our research team. We are conducting a research to assess health institutional readiness for Ebola outbreak containment" here in UPTH, River State. The primary investigator for this study is Mr. Adekeye Joshua, a student enrolled in Masters of Science (MSc) Epidemiology programme at the University of the Witwatersrand, Johannesburg. The research is being supervised by Professor Musenge, Associate Professor at *School of Public Health at the University of the Witwatersrand*, Johannesburg and co-supervised by Professor Arulogun, Professor at *School of Public Health at the University College Hospital Ibadan*. I would like to invite you to consider participating in a project entitled ***"assessing health institutional readiness for Ebola outbreak containment"***

1. Before agreeing to participate, it is important that you read and understand the following explanation of the project procedures, benefits, risks, discomforts and precautions, as well as your right to withdraw from the study at any time. You need to understand what is involved before you agree to take part in the study.
2. If you have any questions do not hesitate to ask me.
3. You should not agree to take part unless you are satisfied with all the procedures involved.
4. If you decide to take part in this study, you will be asked to sign/thumbprint this document to confirm that you understand the study. You will be given a copy to keep.

Why are we doing this study?

- Research is a way to learn the answer to a question and use the answers to improve health care services.
- The assessment of the acceptability of the data collection tools used for Tuberculosis (TB) contact tracing is informed by the expressed challenges faced in the information, data management and M&E identified in TB surveillance systems.
- There is also duplication of data collected by community health workers and limited use of this data at the district, provincial and national level

  This study aims to investigate health institutional readiness of the delivery and support systems to implement innovations for Ebola epidemic outbreak in the post-epidemic era June 2016 and May 2017 in UPTH Nigeria at healthcare facility levels.

How long do you have to be part of the study?

- The total length of this study is 5 months.

What will happen if you take part in this study?

- If you agree to take part in this study, you will be part of those that will fill the questionnaire and participate in the interview. During the interview, we will ask you some questions about your understanding of organisational readiness and its components. We will also find out how some activities such as training , stakeholder's management will has helped improve state of readiness for change in your organisation .This discussion may last about 30-60 minutes.
- If today is not a good day for us to talk with you, we will arrange for a date that you are free to talk to us.
- We will provide light refreshment if you desire to have a drink and snacks .
- There is no cost to you for participating in the study.
- You will **NOT** be paid to participate in this study.

What are the benefits of being in the study?

- By participating, you will be helping us to strengthen our understanding of what readiness is and how ready we are as a country to embrace change to combat epidemics such as Ebola virus disease.
- You will also be helping in finding efficient ways to build and improve readiness in healthy organisations and among workers.

What are the risks and discomforts of being in this study?

- The study involves asking questions regarding your life and experiences. Talking about these things can be disturbing or emotional. You may feel uncomfortable answering a question. If you do not feel comfortable then you can refuse to answer the question. Please also note that confidentiality cannot be guaranteed in the focus group discussion since there will be other people there. Psychological /mental and emotional support will be provided to you by study staff if you feel you need it.

What happens if you do not agree to take part in this study?

- Your participation in this study is voluntary. You may withdraw (stop taking part) from the study at any time. If you withdraw from the study, we will not collect any further information from you for research purposes. We will use only the information we collected up to the point that you withdrew for research purposes, if you agree to this.
- If you refuse to participate, you will not be stopped from receiving any future health services from any clinic that you may attend.

How is the information collected during this study going to be kept confidential?

- All information collected during the course of this study will be kept secure and confidential/kept secret: Mr Adekeye Joshua, Professor Musenge and Professor Arulogun are responsible for this. All personal information is only available to study staff and kept in a locked and secured cabinet. All datasets will be password protected so that only authorised personnel in the research team will have access to the data
- Your name will not be recorded in during the interview. Actual responses to questions will only be identified using a personal unique identifier that only the study staff can trace back to you. Reports about the study may be made, but you will not be personally identified in any report about this study.
- Please also note that confidentiality cannot be guaranteed in a focus group as the responses will be in a group setting.
- Participants will also complete a separate consent form to give permission for the investigators to audiotape interviews and focus group discussions. Part of this consent will also include allowing their discussions to be quoted or not.

What if you have more questions you wish to ask about this study?

If you have any questions about this study, please ask us now. If you have any questions later, you may also telephone ***Mr Joshua Adekeye +2348035750644 and +27736816468***. The committee giving ethical approval for this study are the Human Research Ethics Committees for the University of the Witwatersrand. If you have any questions or concerns about your rights as a person taking part in a research study you may contact the chair of the ethics committee, Professor Cleaton-Jones (011 717 2301) at the University of the Witwatersrand, or via the administrator Mrs Anisa Keshav at:

- Telephone +27 (0) 11- 717- 1234
- Fax: +27 (0) 11-717-1265
- Email: anisa.keshav@wits.ac.za
- Address: Wits Research Office, 10th Floor Senate House, East Campus

STUDY NUMBER

INFORMED CONSENT FORM

"ASSESSING HEALTH INSTITUTIONAL READINESS FOR EBOLA OUTBREAK CONTAINMENT" IN UPTH, PORT HARCOURT, RIVERS STATE NIGERIA.

University of the Witwatersrand : Mr. Adekeye Joshua
University of the Witwatersrand : Professor Eustasius Musenge,
University of Ibadan : Professor Oyedunni Arulogun,

- I have read the information sheet or had it fully explained to me (or the information sheet about this study has been read to me) and I understand what will be required of me and what will happen to me/ required of me if I take part in the study.

- My questions concerning this study have been answered by

_____	_____	_____
(Name of study staff member)	(Signature of study staff)	(Date)

- I understand that I may withdraw from this study at any time without giving a reason and without being penalised or losing any benefits to which I am normally entitled.

- I agree to take part in the study:

_____	_____	_____
(Participant's name/initials)	(Signature or thumbprint)	(Date)
_____	_____	_____
(Witness name/initials)	(Witness signature or thumbprint)	(Date)
_____	_____	_____
(Translator's name/initials)	(Translator's signature or thumbprint)	(Date)

STUDY NUMBER

INFORMED CONSENT FOR AUDIO-TAPING OF INTERVIEW AND FILLING SURVEY QUESTIONNAIRE

I hereby confirm that I have been informed by the researcher,_____ about the nature, conduct, benefits and risks of this study: "ASSESSING HEALTH INSTITUTIONAL READINESS FOR EBOLA OUTBREAK CONTAINMENT"

I have also received, read or had read to me, and understood the above written information (Participant Information Sheet and Informed Consent) regarding this study.

By signing this consent form I agree for the interview to be audio-taped.

I may, at any stage, and with no prejudice, withdraw my consent to audio-taping the interview.

I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to be audio-taped.

I agree for any parts of the discussion to be quoted: **YES / NO** (answer to be circled)

PARTICIPANT:

Printed Name	Signature / Mark or Thumbprint	Date and Time

I, _____ *(NAME OF RESEARCHER)*, hereby confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

RESEARCHER:

Printed Name	**Signature**	**Date and Time**

If the information sheet and consent form were translated or explained to the participant, please enter the name of the translator or person explaining the informed consent form here together with their signature:

TRANSLATOR / OTHER PERSON EXPLAINING INFORMED CONSENT (DESIGNATION):

Printed Name	**Signature**	**Date and Time**

If the participant gave verbal consent, please enter the name of the person who witnessed the consent here and their signature:

WITNESS (If applicable)**:**

Printed Name	***Signature***	***Date and Time***

Appendix VIII: Certificate of Ethics

R14/49 Mr Joshua Temitope Adekeye

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M161127

NAME: (Principal Investigator)	Mr Joshua Temitope Adekeye
DEPARTMENT:	Public Health, Division of Epidemiology and Biostatistics University of Port Harcourt Teaching Hospital
PROJECT TITLE:	Assessing the Health Institutional Readiness for Ebola Epidemic Outbreak in Nigeria
DATE CONSIDERED:	25/11/2016
DECISION:	Approved
CONDITIONS:	South African Human Research Ethics Committees (HRECs) have no standing outside South Africa. Ethics approval is also required from local HRECs in Nigeria
SUPERVISOR:	Dr Eustasius Musenge and Prof Oyedunni Arulogun
APPROVED BY:	Professor A Dhai, Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	20/12/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in November and will therefore be due in the month of November each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix IX: Local Ethics/Permission to Conduct Research

GOVERNMENT OF RIVERS STATE OF NIGERIA
Office of The Permanent Secretary, Ministry of Health

MH/PRS/391/VOL.2/407

26th March, 2017

Adeleye Joshua
Department of Implementation Science,
Division of Epidemiology and Biostatistics
School of Public Health
University of Witwatersrand
Johannesburg, South Africa.

Sir,

APPROVAL TO CONDUCT RESEARCH TITLED "ASSESSING THE HEALTH INSTITUTIONAL READINESS FOR EBOLA EPIDEMIC OUTBREAK CONTAINMENT IN NIGERIA"

Your application on the above subject matter refers.

I write to inform you that the Ministry of Health has considered your request/ research proposal.

In view of the above, I write to convey approval to you to carry out the above research. You are however expected to liaise with the Public Health Department, Ministry of Health for necessary guides to conduct the research.

At the end of your survey/ research you are expected to deposit copies of your findings/ report with the Ministry, please.

Please be assured of my highest regards.

Dr. Opubo C. Idoniboyeobu *MBBS (Benin); DCH (Innsbruck); FWACP; MPH (Liverpool), JP.*
Director/Head of Planning, Research and Statistics
Rivers State Ministry of Health

For: Permanent Secretary, Ministry of Health

Block A, 2nd Floor, Rivers State Secretariat Complex, Port Harcourt, Rivers State.
Tel: +234 84 234 389 +234 34 47992
www.riverstatemoh.gov.ng

GOVERNMENT OF RIVERS STATE OF NIGERIA

Office of The Permanent Secretary, Ministry of Health

MH/PRS/391/VOL.2/407 28th March, 2017

Director
Public Health Services
Rivers State Ministry of Health
Port Harcourt.

Sir,

MR ADEKEYE JOSHUA: "ASSESSING THE HEALTH INSTITUTIONAL READINESS FOR EBOLA EPIDEMIC OUTBREAK CONTAINMENT IN NIGERIA"

The bearer, Mr Adekeye Joshua is a postgraduate student of the School of Public Health University of Witwatersrand, Johannesburg South Africa.

As part of the fulfilment for the Master's degree in Epidemiology, he is required to conduct a research on "Assessing the health institutional readiness for Ebola epidemic outbreak containment in Nigeria".

To this end he is expected to administer questionnaires as well as conduct key informant interviews on health care workers in the Ebola treatment centre who have consented to participating in the study. Attached is a copy of his research proposal for your necessary action.

Kindly accord him the necessary cooperation and support.

Please be assured of my highest regards.

Thank you.

Yours sincerely,

Dr. Opubo C. Idoniboyeobu *MBBS (Benin); DCH (innsbruck); FWACP; MPH (Liverpool), JP.*
Director/Head of Planning, Research and Statistics
Rivers State Ministry of Health
For: Permanent Secretary, Ministry of Health

Cc:

1. **Permanent Secretary, Ministry of Health**
2. **Mr Adekeye Joshua**

Block A, 2nd Floor, Rivers State Secretariat Complex, Port Harcourt, Rivers State.
Tel: +234 84 234 389 +234 34 47992
www.riverstatemoh.gov.ng

Appendix X: Word Cloud

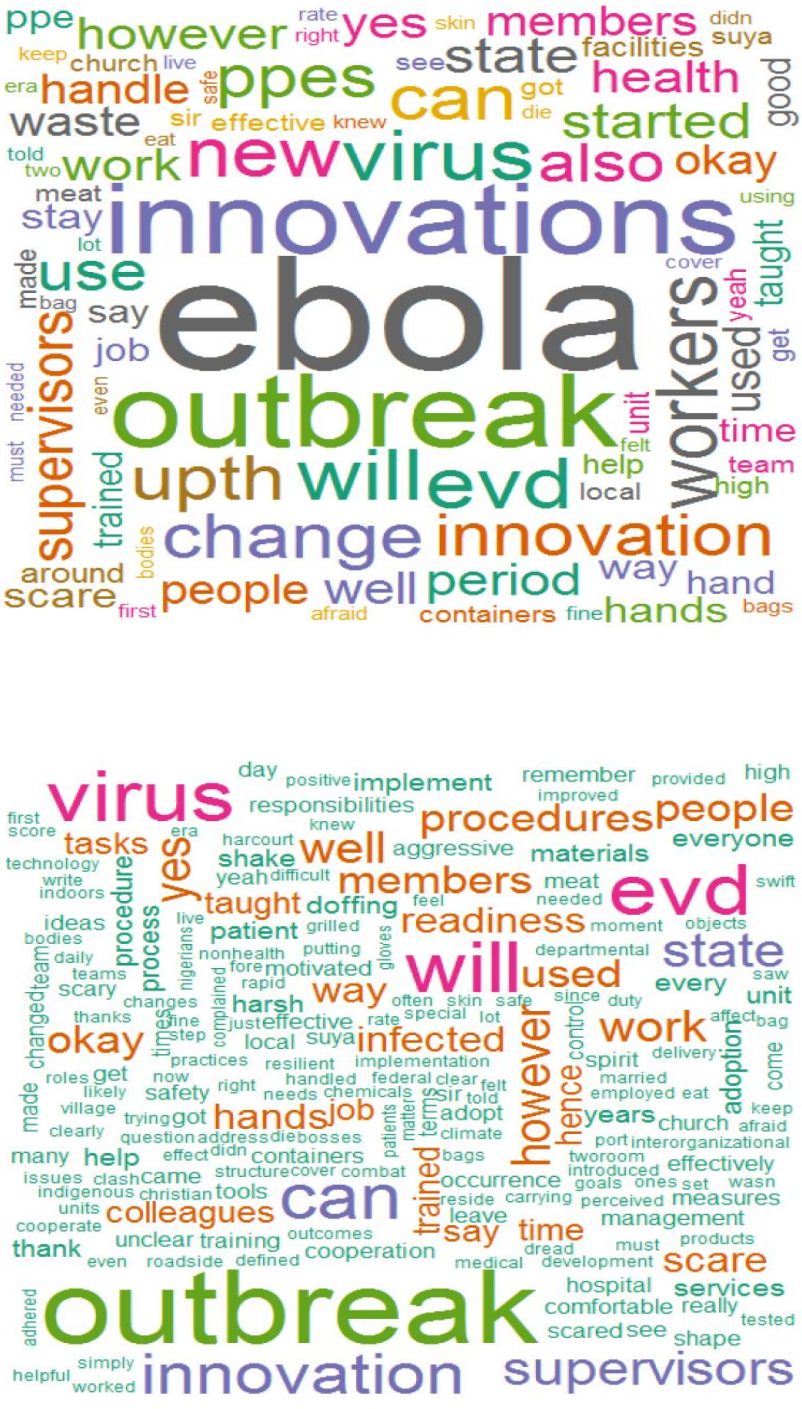


Figure A 3.1 : Word Cloud

Appendix XI: Matrix of Interrelationship between Constructs

Table A3.1: Constructs and Selected verbatim quote

Response/construct	Selected verbatim quote
Relative Advantage	All the participants gave unifying responses on how the perceived "relative advantage" of the innovations influenced the level of motivation of the workers to embrace and implement the innovation. "…I am well aware of the dangers associated with handling Ebola waste...hence I ensured strict adherence to the recommended procedures which are new to my colleagues and…We also ensured that Ebola-associated waste that has been appropriately activated and incinerated on-site before being transported and disposed…I was unusually vigilant and usually harsh when my colleagues are lax in their adherence to procedures". (Supervisor, Works and Services Department, UPTH). "…We were aware of how some HCWs got infected by the EVD…..although the PPE was not comfortable…I adhered to the blueprint of the comprehensive infection control program…every day I studied the continuous safety checks for EVD before I leave home for work…who wan die…Na so my brother…I fear Ebola o" (Matron, Accident & Emergency Department, UPTH).
Compatibility	There were mixed responses on how the perceived "compatibility" of the innovations influenced the level of motivation of the workers to embrace and implement the innovation during the EVD outbreak in Nigeria. "I am well aware that workplace exposure and hazards could cause devastating effects on health and quality of life….as a Mortician am used to wearing boots….nose mask, apron, gloves and laboratory coat/scrubs. Hence when similar but more sophisticated tools were introduced during the EVD outbreak in Nigeria I was not reluctant to use them as am concerned about my safety and that of my community….also the packaging and the flare associated with using something that add glitter to your work is an additional incentive as well" (Mortician , BMSH). "…The fact that our existing facility has the capacity to carry out Ebola laboratory diagnosis has ensured swift documentation of long-established cases and fast release of persons with alleged Ebola cases who eventually tested

	Ebola negative…" (Medical Laboratory Scientist). "…The weather is quite hot and I find it difficult to stay longer in the new suits…it causes causing extreme discomfort…in as quickly as 25 minutes, my colleagues starts complaining…sweating profusely…Productivity is poor and we are at risk of risk being infected by with increased rate of doffing…" (Nurse, Anatomical Pathology).
Trialability	All the participants indicated that "trialability" was a motivating force to embrace and implement the innovations. "…I participated in a training where some of the innovations were tried and tested…I was confident that if I adhere to the precautionary measures, I won't be infected…also we have seen that some of the PPEs, procedures and tools worked in order areas…also in Lagos some of our colleagues expressed their confidence in the new procedures and tools…Hence I was convinced that they can work here in Rivers State…" (Medical officer, Intensive Care Unit, UPTH).
Leadership	Respondents indicated that the concise periodical coaching calls they received were meaningful and useful in helping them to maintain focus on leadership qualities and aspirations and enhanced investigative in developing leadership issues such as gathering buy-in and support from middle-level management. "…'the first-level' leaders—those who oversee individuals providing direct healthcare services especially from the ministry of health, UPTH, State hospital supported the supports implementation of innovations such as new technologies and task-shifting during the EVD outbreak here in PH…they contributed to the positive provider outlooks toward adopting the innovations". (Director of Administration, UPTH). "…the government of Rivers State, Directors in the Federal and State Ministry of Health VCs, CMDs, and other regional health administrators employed Full-Range Leadership (FRL) model in ensuring swift delivery of innovations and containment of the EVD"(Chief Matron, BMSH). "...they provided the resources and support that staff needs to complete their daily tasks and implement new procedures/innovation that will address the rapid containment of EVD in PH". (Chief Matron, BMSH). "…we receive emails on a daily basis emphasising the importance of implementing innovations and adherence to guidelines…our supervisors attend team meetings to communicate new developments and practices during the EVD outbreak" due to effectiveness of using effective evidence-based practice (EBP) to the mission of the organization and

	in assuring effective client or patient outcomes". (Laboratory Scientist, UPTH).
	The participants agreed that all the change agents and program Champion were assigned to various units and departments to put charismatic support behind adopting the innovations. The program champions, according to the respondents, were vigorous in communicating the innovation, and they aptly established the application of the innovations map out plans for the sustainability of the implemented innovations. However there were mixed responses on their role in fostering readiness to implement EBP. "…the change agent/program champion worked with the case management team, units team head to ensure success in implementing the innovations….Furthermore, they work with three social mobilizer teams that were trained and sent to do house-to-house, personal visits within exact radii of the houses of alleged Ebola contacts…these aided in the swift implementation of innovations that fostered the control of the EVD" (Resident Field Epidemiologist, UPTH). "...the UPTH had innovation champions that visited facilities twice in a week and collaborate with emergency medical services providers, inter-facility transport, state and local public health departments and other pertinent partners to communicate the innovations and demonstrate how it can be successfully implemented……these program comprise recognizing transport provider(s) with apt training on waste treatment..." (Protocol Officer, Works and Services Department, UPTH). "In some units the innovation champions heightened their commitments to introduce and implement innovations, ignored naysayers and proceeded ahead with full-scale implementation…this was unfair and unprofessional..." (Senior Medical Officer, Port Health Clinic, River State).
Change Agents and Program Champion	All the participants alluded to the fact that IOR was a unique facet of innovation specific capacity that assisted them implementing innovation to contain the Ebola pandemic. "…all hand was on deck to ensure we are able to implement new ideas and technologies to fight Ebola….the surveillance unit will call the treatment centres…the ministry of health sent emails to the Air and Sea Ports clinics, all stakeholders across departments and organisations unitedly implemented the innovations….we were scared and aggressively applied what is necessary till WHO declared Nigeria Ebola-free". (Chemical Pathologist, UPTH). "Our facility, and a number of private laboratory scientist worked with Port Health Services, who carried out early contact tracing at airports….we have also worked with major airlines and other partners to guarantee warning any EVD

	outbreak through the International Health Regulations mechanisms. For instance, there was an instance where a suspected case had to be reclassified as 'confirmed' when the RT-PCR (reverse transcription–polymerase chain reaction) discovered Ebola virus in the patient's blood sample. However, that wouldn't have been the outcome if the results of RT-PCR tests on the two blood samples had been negative…" (Senior Medical Microbiologist, BMSH). "We applied a joint health care system, call centres and unplanned integrated IT support units which, despite being a lengthy process which, efficiently dispersed information and simplified the management of the Ebola virus disease across stakeholder departments and organisations". (IT officer, Department of Planning, Research and Statistics).
Inter-organizational Relationships	All the participants alluded to the fact that IOR was a unique facet of innovation specific capacity that assisted them implementing innovation to contain the Ebola pandemic. "…all hand was on deck to ensure we are able to implement new ideas and technologies to fight Ebola….the surveillance unit will call the treatment centres…the ministry of health sent emails to the Air and Sea Ports clinics, all stakeholders across departments and organisations unitedly implemented the innovations….we were scared and aggressively applied what is necessary till WHO declared Nigeria Ebola-free". (Chemical Pathologist, UPTH). "Our facility, and Lancet Laboratory scientist worked with Port Health Services, who carried out early contact tracing at airports….we have also worked with major airlines and other partners to guarantee warning any EVD outbreak through the International Health Regulations mechanisms. For instance, there was an instance where a suspected case had to be reclassified as 'confirmed' when the RT-PCR (reverse transcription–polymerase chain reaction) discovered Ebola virus in the patient's blood sample. However, that wouldn't have been the outcome if the results of RT-PCR tests on the two blood samples had been negative…" (Senior Medical Microbiologist, BMSH). "We applied a joint health care system, call centres and unplanned integrated IT support units which, despite being a lengthy process which, efficiently dispersed information and simplified the management of the Ebola virus disease across stakeholder departments and organisations". (IT officer, Department of Planning, Research and Statistics).

Appendix XII: Stata Syntax Employed in Converting Ordinal Data to Continuous Scales

***Combining variables to continous scores**

```
egen Mtotal= rowtotal(motiv_ready01-motiv_ready05)

tab Mtotal

egen gcaptotal= rowtotal(gcap01-gcap19)

tab gcaptotal

egen ispeccaptotal= rowtotal(ispeccap_01-ispeccap_13)

tab ispeccaptotal

egen commtotal= rowtotal(comm_ready01-comm_ready05)

tab commtotal

egen spontotal= rowtotal(spon_ready01-spon_ready05)

tab spontotal

egen stkmgtotal= rowtotal(stkmg_ready01-stkmg_ready05)

tab stkmgtotal

egen techasstotal= rowtotal(techass_ready01-techass_ready05)

tab techasstotal

egen traintotal= rowtotal(train_readiness01-train_readiness05)

tab traintotal

egen qitotal= rowtotal(qi_readiness01-qi_readiness09)

tab qitotal
```

*** generating percentage scores**

```
gen Motivation_percent= Mtotal*100/35
```

```
tab Motivation_percent

gen GeneralCap_percent=gcaptotal*100/133

tab GeneralCap_percent

gen InnovationSpecCap_percent=ispeccaptotal*100/91

tab InnovationSpecCap_percent

gen communication_percent= commtotal*100/35

tab communication_percent
```

Appendix XIII: Survey Questionnaire Items Relations with Constructs Components of Readiness and the Corresponding Cronbach Alpha(α) scores.

Table A3.2: Cronbach alpha scores of Questionnaire Items.

Item	Statement	Constructs	Cronbach α	Components of Institutional Readiness
1	It encompasses techniques, equipment and skills that ensure greater effectiveness' than the Orthodox approach to EVD outbreak	Relative Advantage	0.7793	MOTIVATION
2	It is in tandem with present methods and practices	Compatibility	0.8108	
3	Its implementation methods are effortless and need no special training	Complexity	0.8109	
4	It is tested and trusted, which is dependable and efficacious	Trialability	0.8118	
5	It has more efficiency than the existing tedious procedure thus not eliciting any fear of implementing it	Priority	0.8128	
6	There is a leadership structure which supports the benefits accruing from applying innovation to combat instances of EVD outbreaks	Leadership	0.8000	GENERAL CAPACITY
7	There are members of staff who often discuss the gains of applying innovation for combating instances of EVD outbreaks	Culture	0.7961	
8	There are members of staff who qualify to be called innovation champions for their roles in the implementation of innovations and combating instances of EVD outbreaks	Staff Capacity	0.7952	
9	There is a vibrant mission	Structure	0.7930	

	statement			
10	The members of staff all follow the mission statement	Culture	0.7952	
11	The work environment is free from stress	Climate	0.7930	
12	All decisions by members of staff which support matters relating to client-care are often supported	Structure	0.7916	
13	Each member of staff has a precise job description	Structure	0.7923	
14	All members of staff keep the lines of communication open	Culture	0.7921	
15	Efforts are made to identify several funding sources which can help to implement innovation and combat instances of EVD outbreaks	Organizational Innovativeness	0.7981	
16	Efforts are made to access several funding sources which can help to implement innovation and combat instances of EVD outbreaks	Organizational Innovativeness	0.7990	
17	A part of the organisation's financial resources is used to implement innovation and combat instances of EVD outbreaks	Resource Utilization	0.8006	
18	Greater attention is given to the financing of programmes that allow implementation of innovations which help to combat instances of EVD outbreaks	Resource Utilization	0.7950	
19	There is a data collection process for EVD indicators from all patients	Structure	0.7951	
20	Modifications to treatment programmes are done according to data collected	Organizational Innovativeness	0.7943	

21	There are high quality and proficient members of staff	Staff Capacity	0.7937	
22	There are members of staff with good experience of working in instances of EVD outbreaks	Staff Capacity	0.8010	
23	There are members of staff who implement best practices in delivery services	Staff Capacity	0.7970	
24	Some services are adjusted to meet the cultural needs of some clients	Organizational Innovativeness	0.7965	
25	We ensure prompt treatment of patients	Innovation-Specific knowledge, skills and abilities	0.8059	**INNOVATION SPECIFIC CAPACITY**
26	We enhance simple access to treatment	Innovation-Specific knowledge, skills and abilities	0.8091	
27	We strive to eliminate obstacles which thwart peoples' efforts from getting quality treatment	Innovation-Specific knowledge, skills and abilities	0.8094	
28	There is room for clients to choice from an array of diverse treatment programmes	Specific Implementation Climate Supports	0.8061	
29	Measures are taken to expedite rapid client transition between various treatment levels	Innovation-Specific knowledge, skills and abilities	0.8060	
30	An evaluation of several life needs of clients is available	Innovation-Specific knowledge, skills and abilities	0.8065	
31	Information relating to the resources and needs of clients are collected	Innovation-Specific knowledge, skills and abilities	0.8069	
32	The expertise from various health facilities was harnessed	Interorganizational	0.8066	

	to contain EVD	Relationships		
33	There is support for clients who are efficient at attaining their recovery goals	Specific Implementation Climate Supports	0.8095	
34	Family members or important social supports are involved in clients' treatments	Specific Implementation Climate Supports	0.8091	
35	Family member participation is permitted during the recovery planning Process	Specific Implementation Climate Supports	0.8143	
36	We promote recovery by carrying out outreach activities in the community	Specific Implementation Climate Supports	0.8133	
37	We have key staffs that consistently advocate for implementing innovations , new programs and ensure sustainability of utilisation of the innovations	Program Champion	0.8119	

Appendix XIV: STATA Syntax and Output of Reliability Measures

***Generating cronbach alpha and factor scores**

alpha motiv_ready01-motiv_ready05,item std

factor motiv_ready01-motiv_ready05

factor motiv_ready01-motiv_ready05, pcf

rotate, blanks(.3)

predict mfactor

alpha gcap01-gcap19,item std

factor gcap01-gcap19

factor gcap01-gcap19, pcf

rotate, blanks(.3)

predict gfactor

alpha ispeccap_01-ispeccap_13,item std

factor ispeccap_01-ispeccap_13

factor ispeccap_01-ispeccap_13, pcf

rotate, blanks(.3)

predict ispeccapfactor

***generating readiness score and checking crobach alpha of readiness constructs**

gen fReadiness_score percent= (Mtotal +gcaptotal + ispeccaptotal)*100/231

alpha gcap* motiv_* ispeccap_*, item std

Output of the Reliability test for Readiness Constructs

Items	obs	Sign	item-test correlation	item-rest correlation	Average Interitem correlation	Alpha
gcap01	486	+	0.4058	0.3350	0.0857	0.7715
gcap02	**486**	**+**	**0.5120**	**0.4486**	**0.0836**	**0.7667**
gcap03	486	+	0.5341	0.4726	0.0832	0.7657
gcap04	486	+	0.5935	0.5373	0.0820	0.7629
gcap05	486	+	0.5310	0.4692	0.0833	0.7658
gcap06	486	+	0.5922	0.5359	0.0821	0.7630
gcap07	486	+	0.6281	0.5753	0.0814	0.7612
gcap08	486	+	0.6101	0.5555	0.0817	0.7621
gcap09	486	+	0.6158	0.5617	0.0816	0.7618
gcap10	486	+	0.4583	0.3909	0.0847	0.7691
gcap11	486	+	0.4330	0.3639	0.0852	0.7703
gcap12	486	+	0.3872	0.3153	0.0861	0.7723
gcap13	486	+	0.5394	0.4783	0.0831	0.7654
gcap14	486	+	0.5349	0.4734	0.0832	0.7656
gcap15	486	+	0.5581	0.4986	0.0827	0.7646
gcap16	486	+	0.5713	0.5130	0.0825	0.7639
gcap17	486	+	0.3774	0.3050	0.0863	0.7727
gcap18	486	+	0.4858	0.4204	0.0842	0.7679
gcap19	486	+	0.5011	0.4369	0.0839	0.7672
motiv_rea~01	486	+	0.1062	0.0255	0.0916	0.7840
motiv_rea~02	486	+	0.1013	0.0206	0.0917	0.7842
motiv_rea~03	486	+	0.0735	-0.0074	0.0923	0.7853
motiv_rea~04	486	+	0.0389	-0.0419	0.0929	0.7867
motiv_rea~05	486	+	0.0374	-0.0434	0.0930	0.7868
ispeccap_01	486	+	0.2575	0.1799	0.0886	0.7778
ispeccap_02	486	+	-0.0098	-0.0903	0.0939	0.7886
ispeccap_03	486	+	0.1605	0.0804	0.0905	0.7819
ispeccap_04	486	+	0.0195	-0.0612	0.0933	0.7875
ispeccap_05	486	+	0.0645	-0.0164	0.0924	0.7857
ispeccap_06	486	+	0.1491	0.0689	0.0908	0.7823
ispeccap_07	486	+	0.2463	0.1683	0.0889	0.7783
ispeccap_08	486	+	0.2536	0.1758	0.0887	0.7780
ispeccap_09	486	+	0.2359	0.1575	0.0891	0.7788
ispeccap_10	486	+	0.2282	0.1496	0.0892	0.7791
ispeccap_11	486	+	0.2345	0.1562	0.0891	0.7788
ispeccap_12	486	+	0.1486	0.0684	0.0908	0.7823
ispeccap_13	486	+	0.1568	0.0767	0.0906	0.7820
Test Scale					0.0871	0.7793

Appendix XV: Normality of Residuals for Readiness scores

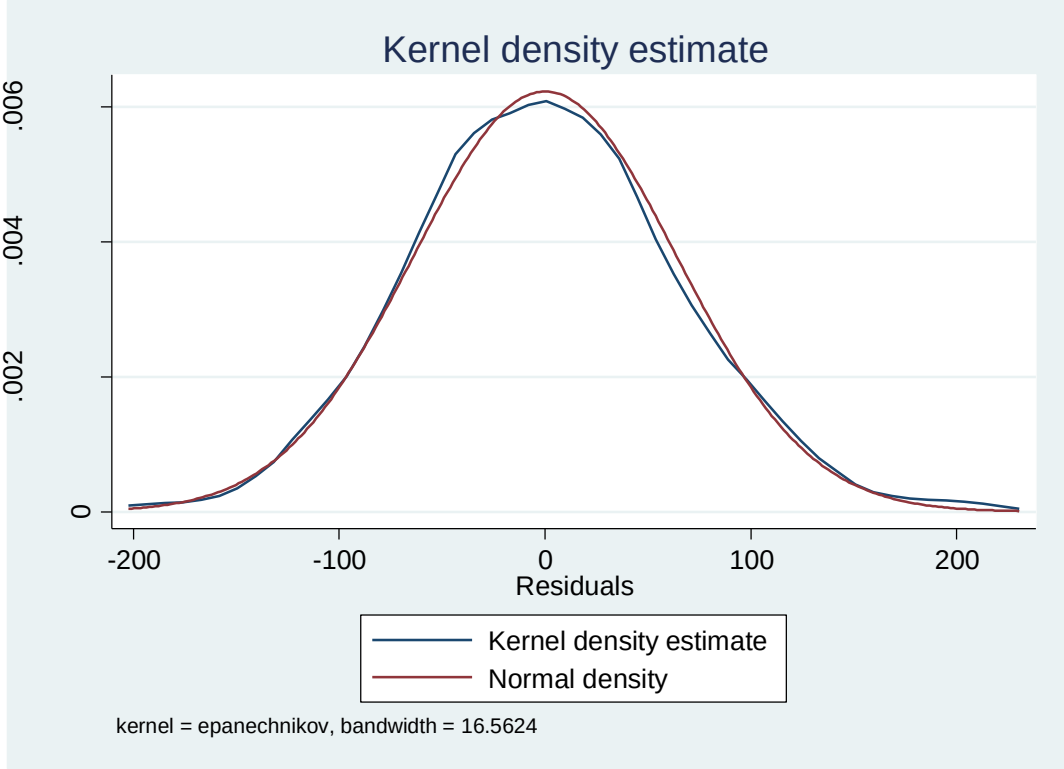


Figure A3.2: The kernel density showing normality of residuals for Readiness scores

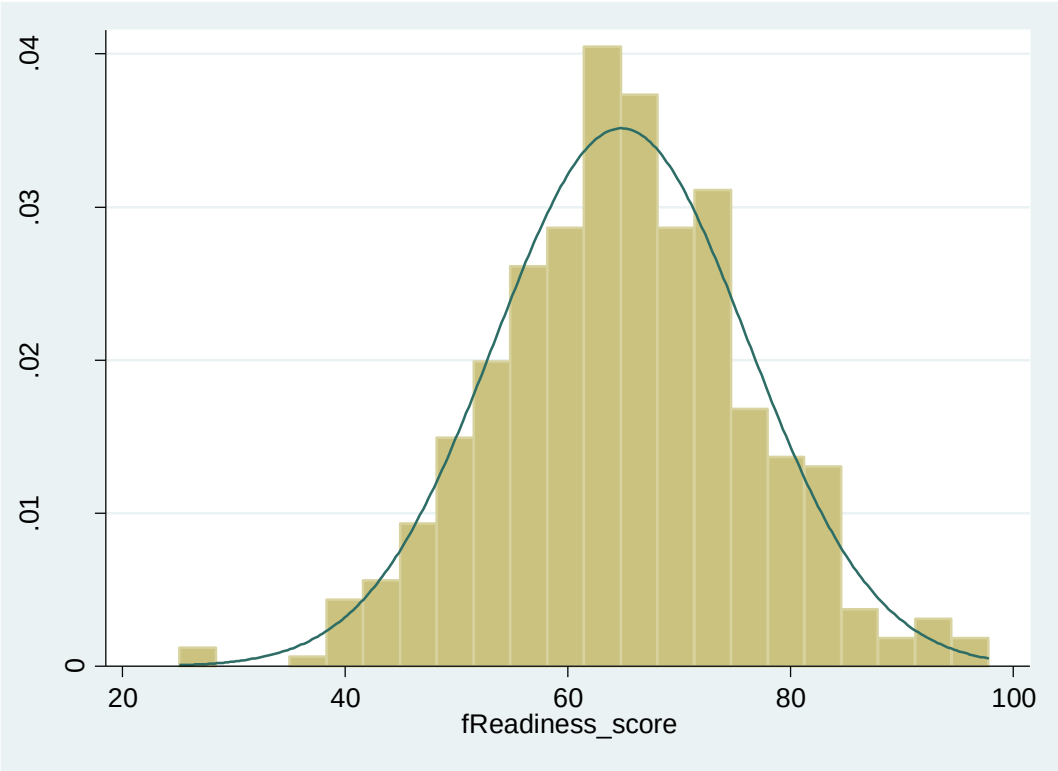


Figure A 3.3: Histogram plot for normality test for the distribution of the readiness

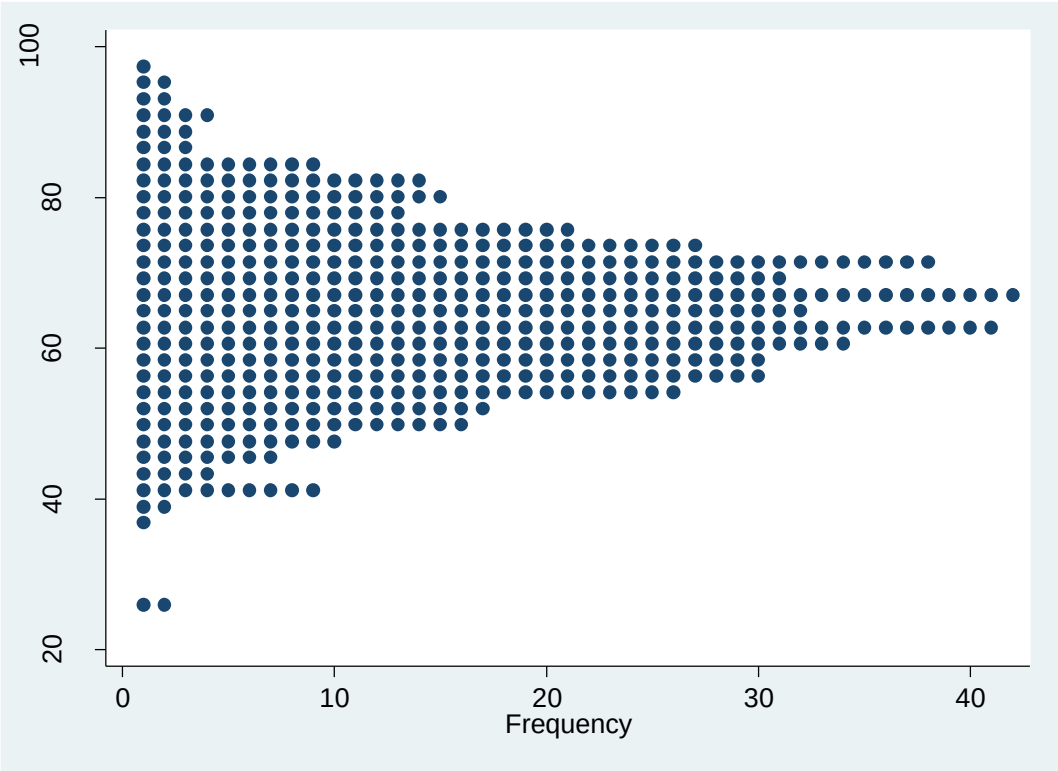


Figure A3.4: Dot plot for normality test for the distribution of the readiness scores

Appendix XVI: Shapiro-Wilk Test For Normality

Table A3.3: Shapiro-Wilk test for normality

Variable	Obs	W	V	z	Prob>z
r	486	0.99690	1.016	0.038	0.48481

NB: The p-value of 0.48481 is not significant indicating the strength of evidence of normality of the residuals for the readiness score distribution.

Appendix XVII: Test for Homoscedasticity of Variance

Table A3.4 : Cameron & Trivedi's decomp decomposition of IM-test

Source	Chi^2	df	p
Heteroskedasticity	62.80	61	0.4124
Skewness	7.10	10	0.7159
Kurtosis	0.91	1	0.3411
Total	70.80	72	0.5178

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of fReadiness_Score

         chi2(1)      =     1.10
         Prob > chi2  =   0.2933
```

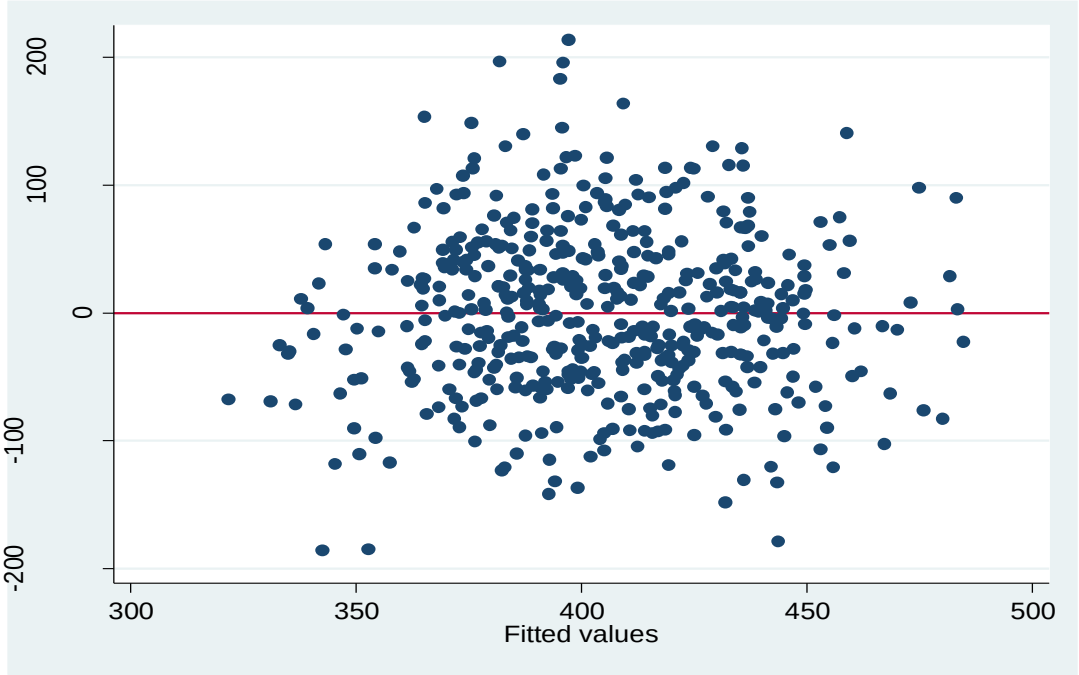


Figure A3.5: Plot the residuals versus fitted (predicted) values.

From the figure, it can be seen that the pattern of the data points gets quite narrow towards the right end, an indication of homoscedasticity (Tabachnick and Fidell, 2007). The White's test and the Breusch-Pagan test was carried out to authenticate proof of homoscedasticity; **imest command** was used for the former while **hettest command** was used for the latter.

Appendix XVIII: Graph Leverage-Versus-Squared Residual Plot

Lvr2plot (graph leverage-versus-squared-residual plot)

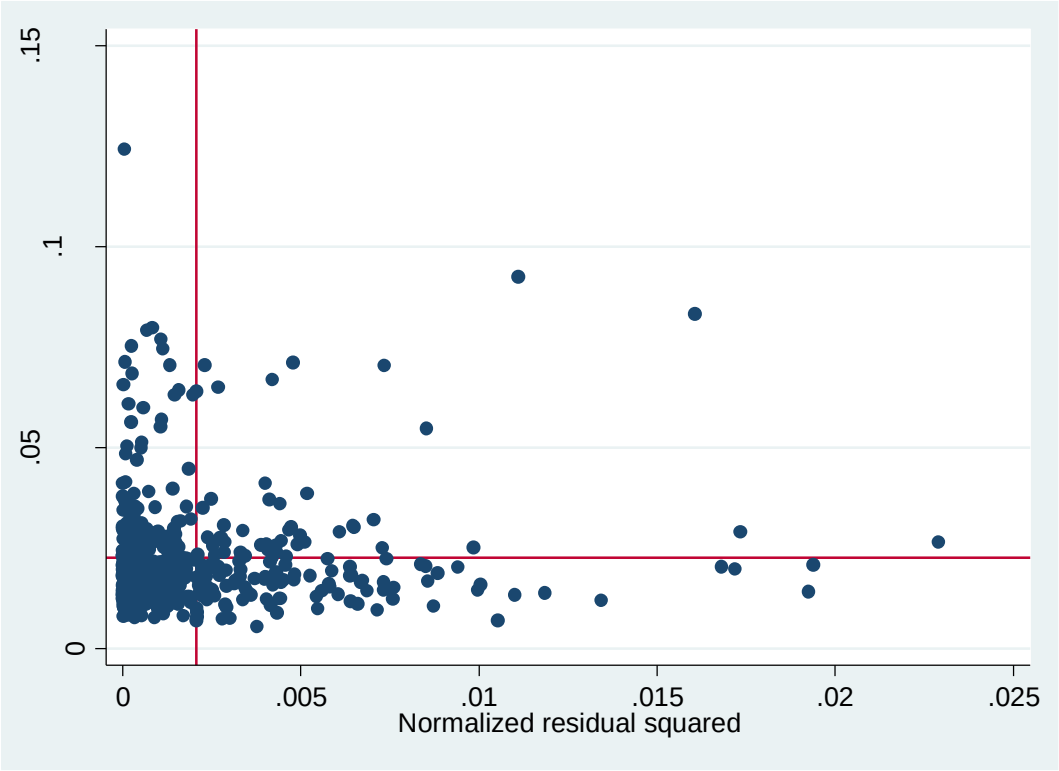


Figure A3.6 : Lvr2plot (graph leverage-versus-squared-residual plot)

Appendix XVIX: STATA Syntax for Regression Diagnostics of Readiness Residuals

***generating a dotplot**

dotplot fReadiness_Score

*generating a histogram normality plot

hist fReadiness_Score, normal

* a histogram normality plot

*Shapiro-Wilk test for normality

swilk fReadiness_Score

Appendix XX : Stata Syntax SEM Estimates

*** generating female score as gender**

gen female=_Igender_2

*** generating scores for compoenent of occupational level**

gen health_top_mgt= _Ioccu_lvl_2

gen non_health_top_mgt= _Ioccu_lvl_3

***output of SEM estimates**

sem (qi_percent -> fReadiness_Score,) (age -> fReadiness_Score,) (communication_percent -> fReadiness_Score,) (sponsorship_percent -> fReadiness_Score,) (stkmgt_percent -> fReadiness_Score,) (train_percent -> fReadiness_Score,) (female -> fReadiness_Score,) (yrsexpinuniport -> fReadiness_Score,) (health_top_mgt -> fReadiness_Score,) (non_health_top_mgt -> fReadiness_Score,) (yrsproexp -> fReadiness_Score,), nocapslatent

***checking for goodness-of-it**

estat gof, stats(all)

***checking for modification indices to suggest am improved model**

estat mindices.