

# **The Role of Embedded Research in Co-producing Public Health Knowledge in Non-clinical Settings to Bridge the Gap Between Research Evidence and Its Implementation in Public Health Practice**

**Abisope Rhoda Akintola**

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**School of Health and Life Sciences  
Teesside University  
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## **Supervisors:**

Prof. Dorothy Newbury-Birch, School of Social Sciences, Humanities & Law.  
Teesside University.

Dr. Stephanie Kilinc, School of Social Sciences, Humanities & Law.  
Teesside University.

**DECLARATION**

I hereby declare that the work presented in this thesis is my own and that, to the best of my knowledge and belief, it has never been published or presented for the award of any other degree or diploma of the university or other institute of higher learning.

Signed .....

Date.....

Abisope Rhoda Akintola

**DEDICATION**

Unto Jehovah, who is the teacher of all teachers, the source of all wisdom, the wealth of all knowledge, the fountain of all understanding, the possibility of all impossibilities, the ability of all inabilities, and the one who made this great work possible and a success, I dedicate this great achievement. Of a truth, *“I looked unto Him, and was lightened: and my face was not ashamed”* (Psalms 34:5 KJV).

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**LIST OF ABBREVIATIONS AND ACRONYMS**

<b>AHSNs</b>	Academic Health Science Centres and Networks
<b>AMED</b>	Allied and Complementary Medicine Database
<b>APHA</b>	American Public Health Association
<b>ASSIA</b>	Applied Social Science Index and Abstracts
<b>CDC</b>	Centres for Disease Control and Prevention
<b>CINAHL</b>	Cumulative Index to Nursing and Allied Health Literature
<b>CLAHRCs</b>	Collaborations for Leadership in Applied Health Research and Care
<b>ER</b>	Embedded Research/er
<b>Et al</b>	And others
<b>GCSE</b>	General Certificate of Secondary Education
<b>JBI</b>	Joanna Briggs Institute
<b>LA</b>	Local Authority
<b>NHS</b>	National Health Services
<b>NIHR</b>	National Institute for Health Research
<b>ONS</b>	Office of National Statistics
<b>PHE</b>	Public Health England
<b>PHP</b>	Public Health Practitioner
<b>ST</b>	Other Stakeholders (Teachers and Students)
<b>UK</b>	United Kingdom
<b>WHO</b>	World Health Organisation



## LIST OF OPERATIONAL DEFINITIONS

<b>Clinical settings</b>	These are primary, secondary, and tertiary health care settings. In these environments, the major focus is on the restoration, maintenance, and improvement of the health of an individual.
<b>Collaboration</b>	The act of working with an individual/s to produce something.
<b>Co-production</b>	A mutualistic relationship between two or more parties in which expertise is shared to gain greater insights to address an issue.
<b>Dual affiliation</b>	The act of associating with two different organisations.
<b>Embedded research</b>	Research conducted by an individual who has a dual affiliation with a host organisation and an academic institution with the aim of carrying out research agenda while maintaining mutually beneficial relationships.
<b>Evidence-based public health</b>	The use of recent best available evidence to inform practice and policy regarding decision making, improvement of public health services, and delivery of services, as well as in developing public health policies useful in addressing public health problems.
<b>Non-clinical public health setting</b>	Any non-National Health Service (NHS) setting that operates outside the primary, secondary, or tertiary health care settings. The aim is not to diagnose or treat diseases, but to focus on preventing diseases, prolonging lives, and promoting the health of the population.
<b>Public health</b>	<i>“The art and science of preventing disease, prolonging life and promoting health through the organised efforts of society”</i> (Acheson, 1988, cited in WHO, 2020)
<b>Stakeholders</b>	A group of people that has an interest in an organisation and can either influence or be affected by the activities of the organisation.

## ABSTRACT

### Background

The gap between research-based evidence and its implementation in public health practice is globally recognised. This gap can cause the resources invested in public health research to be wasted. It can also have a negative impact on the quality of public health services and the health and well-being of the population. A toolkit is a set of tools kept together in a certain place for a specific purpose (Soanes et al., 2006). Research has identified that embedded research has the potential to bridge the 'research-based evidence implementation gap'. However, there is presently no embedded research toolkit to inform public health practice in non-clinical settings of the role of embedded research which could bridge the 'research-based evidence implementation gap'. Therefore, the development of an embedded research toolkit will be useful to public health practitioners and embedded researchers to improve services and delivery.

### Aim

The overall aims of this PhD are: 1) to investigate the potential of embedded research in bridging the gap between research evidence and its implementation in public health practice. 2) to develop a toolkit on the role of embedded research in the co-production of public health knowledge in non-clinical settings to facilitate the utilisation of research evidence in public health practice.

### Methods

To achieve the overall aims, hence the following workstreams:

- 1) A literature review was undertaken to be informed of the existing literature and identify the gap in the literature around the role of embedded research in co-producing public health knowledge in non-clinical settings.
- 2) A systematic review identified and synthesised available qualitative evidence on the topic.
- 3) Semi-structured interviews were conducted with embedded researchers, public health practitioners, and other stakeholders to explore the themes that emerged from the systematic review on the topic.
- 4) The triangulation of findings informed the development of an embedded research toolkit on the topic.

- 5) The embedded research toolkit was cross-checked to know its relevance and usefulness in public health practice with some interview participants.

## **Results**

The systematic review synthesised 16 qualitative articles, that focused on the role of embedded research in co-producing public health knowledge in non-clinical settings. The main roles of embedded research were informing practice, building mutually beneficial relationships, building capacity, becoming part of the organisation, critical reflection, and managing funds allocated to the research and providing evidence for reports and future funding applications.

Evidence from the systematic review shows that the above roles can assist embedded researchers to bridge the gap between research evidence and its implementation in public health practice.

Seventeen interviews with embedded researchers, public health practitioners, and other stakeholders were conducted in four case studies sites including two local authorities, one secondary school, and one sports organisation. Case studies that involve a detailed and in-depth examination of some particular cases were adopted.

Four themes were identified: 1) building and maintaining relationships with practitioners and other stakeholders, 2) working together to produce research, 3) informing and developing future practice and research, and 4) keeping critical reflection trajectory.

The triangulation of these findings informed the development of an embedded research toolkit that can be used to inform practice of the role of embedded research in bridging the gap between research evidence and its implementation in public health practice.

## **Conclusions**

As there was no embedded research toolkit on the role of embedded research in non-clinical settings, its development will be useful to public health practitioners and embedded researchers with the following expected outcomes.

- That the public health practitioners in non-healthcare settings use the toolkit as a guide to improve service and delivery

- That more public health practitioners and academics would be informed of the potential of embedded research in bridging the gap between research evidence and its implementation in practice.
- That more organisations and more researchers would consider adopting an embedded research approach.
- That the toolkit would serve as a guide for public health practitioners on job specifications when recruiting embedded researchers.

# CHAPTER ONE

## INTRODUCTION

### 1.0 Overview

This chapter introduces this thesis which explores the role of embedded research in co-producing public health knowledge in non-clinical settings. This study aims to bridge the gap between the time research evidence is generated and when it is implemented in public health practice. To begin, public health is defined, and research evidence and its importance to public health are discussed. The following sections feature discussions of the gap between the time research evidence is generated and when it is implemented in public health practice, as well as factors responsible for the gap, co-production as an approach to bridge the gap, embedded research as a type of co-production, and the potential of embedded research in closing the gap. Finally, the aims and objectives, the structure of the PhD thesis, and a chapter summary are presented.

### 1.1 What is Public Health?

When the World Health Organisation (WHO, 1946, p.100) was established, it defined health as “*a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*”. Based on this definition, the aim of public health is to attain a fair allocation of health to the people (Colin and Wah-Yun, 2015). Although different organisations define public health in diverse ways, most definitions tend to contain the same meaning. For instance, the American Public Health Association (APHA, 2020) declares that “*Public health promotes and protects the health of the people and the communities where they live, learn, work and play*”. Similarly, Public Health England (PHE, no date) states that the reason for its existence is “*to protect and improve the nation’s health and wellbeing and reduce health inequalities*”. Meanwhile, the World Health Organisation defines public health as “*the art and science of preventing disease, prolonging life and promoting health through the organised efforts of society*” (Acheson, 1988, cited in WHO, 2020). Each of these definitions centres around the health of the people or the population. This focus is different from that found in the healthcare system in clinical settings such as primary,

secondary, and tertiary health care settings. In these environments, the major focus is on the restoration, maintenance, and improvement of the health of an individual (Colin and Wah-Yun, 2015), whilst public health aims at the improvement of the health of the whole population rather than an individual (Middleton, 2017; Kemm, 2006). Public health is focused on the prevention of diseases, the protection of health, and the promotion of well-being of the population (Faculty of Public Health, 2021; Colin and Wah-Yun, 2015; Middleton, 2017).

Public health settings vary from one country to another. For example, in some countries, public health operates within clinical settings. In England, public health operates outside the perimeter of clinical settings (Buck and Gregory, 2013; The King's fund, 2015; Milne, 2018). According to the World Health Organisation's definition of public health, a non-clinical public health setting can be defined as any non-National Health Service (NHS) setting that operates outside the primary, secondary, or tertiary care settings. The aim of a non-clinical public health setting is not to diagnose or treat diseases, but to focus on preventing diseases, prolonging lives, and promoting the health of the population (Acheson, 1988, cited in WHO, 2020). Public health teams work with partners across Local Authorities (LAs) and various non-clinical settings such as schools (Segrott and Roberts, 2019; Hayden et al., 2019), and criminal justice (Ferguson et al., 2019; Newbury-Birch et al., 2019), to actualise their goals. In order to improve the health of the people, interventions in public health should be underpinned and informed by research evidence (Colin and Wah-Yun, 2015; Brownson et al., 2003). Therefore, what follows is a series of discussions regarding the importance of research-based evidence in public health practice.

## **1.2 Research-based Evidence and its Importance in Public Health Practice**

Public health teams have achieved many landmark successes (Royal Society for Public Health, 2019). They have used immunisation to control diseases, and they have worked on the prevention and cessation of tobacco use (Centres for Disease Control and Prevention, 1993; Royal Society for Public Health, 2019). They have also ensured the provision of safe food and potable water using targeted interventions aimed at improving the health of the populations they serve (Centres for Disease Control and Prevention, 1993). Despite these achievements, Brownson (2011) said there are still

many avenues for promoting public health. To achieve this, recommendations regarding using evidence-based strategies have been suggested as possible public health initiatives by earlier studies (Brownson et al., 2003; McMichael et al., 2005; Fielding and Briss, 2006). Evidence is defined as “*information indicating whether something is true or of value*” (Soanes et al., 2006, p. 257). As such, Rimer et al. (2001) have declared that public health evidence can be regarded as the outcome of a complex series of experiments, observations, and theories. Evidence types can range from personal experiences to peer-reviewed scientific literature (Chambers and Kerner, 2007). Hence, public health knowledge could be sourced from various evidence base.

Knowledge is defined as “*information and skills gained through experience or education*” (Soanes et al., 2006, p. 419). Although there are many debates regarding the ways that knowledge can be derived or known, Brechin and Siddell (2000) have articulated three primary types of knowledge each with its own methods of accumulation: (1) empirical or explicit knowledge, which can be easily transferred from one person to another and is mostly based on research evidence; (2) theoretical knowledge, which explores a diverse theoretical framework for approaching issues and can be based on research but is mostly obtained in informal and instinctive ways; and (3) experiential or tacit knowledge, which is not easily passed on to another person because it can only be accumulated with the passage of time and by experience. This present study suggests that public health knowledge is best understood as a combination of these three types of knowledge. In other words, public health knowledge is the proper application of tacit, explicit, and theoretical knowledge to prevent diseases, prolong lives, and promote health. This present study, however, looks closely at knowledge derived, sourced, and/or developed by conducting research and amassing research-based evidence.

Research-based evidence is defined as:

*Evidence from published research articles and papers, or unpublished sources such as internally conducted evaluations. Research is only one sort of evidence, but has the advantages of greater rigour, relevance, and independence when compared to some other types of evidence (Frost et al., 2006, cited in Breckon, 2016, p. 8).*

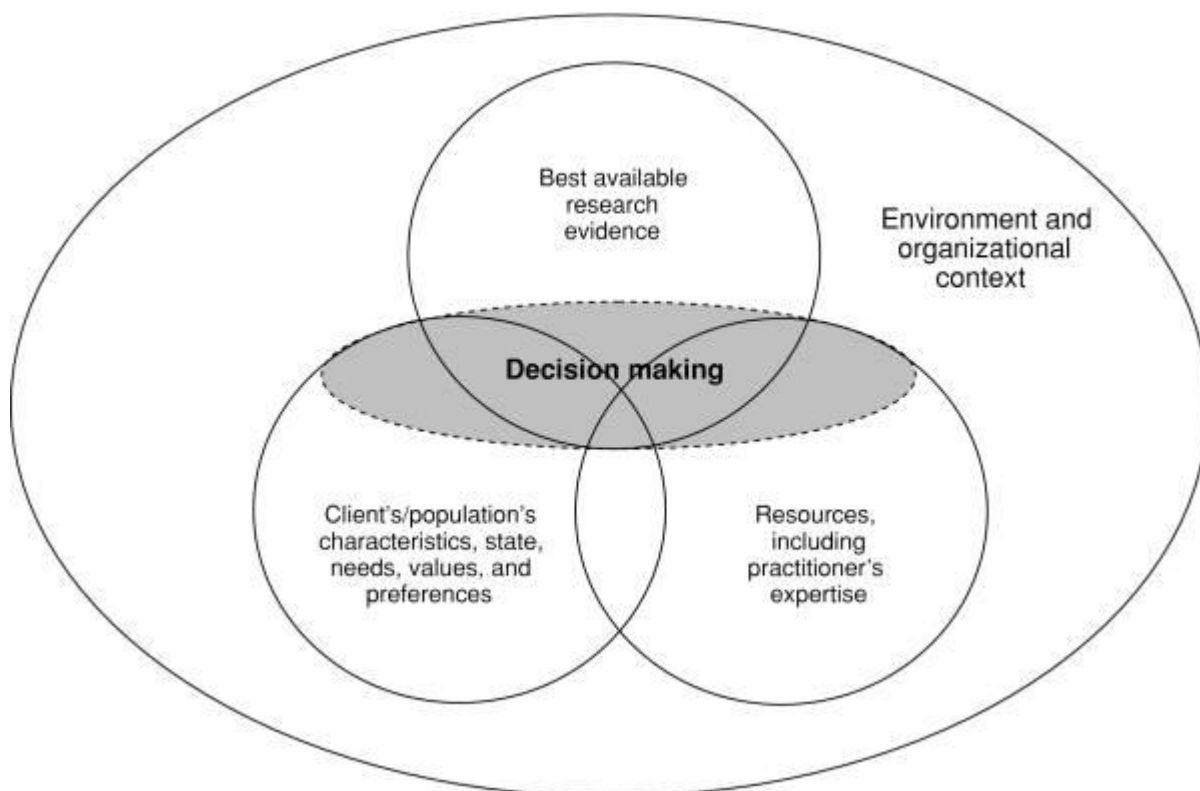
Although there are debates regarding the quality of research-based evidence, Nutley and colleagues state that the benefits of research-based evidence include the fact that it is more reliable than other sources of evidence because:

*The conduct and publication of research involves the explicit documentation of methods, peer review and external scrutiny, resulting in rigour and openness. These features contribute to its systematic nature and help provide a means to judge the trustworthiness of findings. They also offer the potential to assess the validity of one claim compared to another (Nutley et al., 2013, p. 6).*

Breckon (2016) adds that research-based evidence can provide useful information regarding what works (method) as well as where (setting or context), why (justification), and for whom (people) things work. With this information—especially information from studies that have been unsuccessful—programmes can help new public health initiatives avoid making the same mistakes as previous initiatives (Breckon, 2016).

Using research-based evidence to improve public health practices has several advantages (Brownson et al., 2009), and as such, it has been widely promoted (Orton et al., 2011). Notably, it allows access to high-quality information regarding how to improve peoples' health, and it increases the chances of implementing successful policies and programmes (Brownson et al., 2009). Public health practitioners are expected to always adopt research-based evidence when choosing, developing, and implementing programs as well as when developing policies and evaluating achievements (Carlson et al., 2008). For instance, the innovative ban on workplace smoking in Ireland (Office of Tobacco Control, 2004) which reduced the rate of smoking (Fong et al., 2006) was established based on strong evidence (Allwright et al., 2002). This corresponds with Kohatsu et al.'s (2004, p. 419) definition of evidence-based public health as "*the process of integrating science-based interventions with community preferences to improve the health of populations*". Consequently, public-health decision making must be informed by the best available research-based evidence as well as further resources such as the expertise of the public health practitioners, and the population's preferences (Satterfield et al., 2009), figure 1.





**Figure 1: Elements that Determine Evidence-based Decision Making (Satterfield et al., 2009)**

Unfortunately, public health practitioners often neglect research-based evidence and often base their practice of public health on temporary opportunities that are likely to lack either systematic planning or evidence-based support (Brownson, 2011), both of which are necessary to successfully manage public health issues. However, there is an argument that the demand for evidence that is applicable to the local setting might be responsible for the reason why advice, experience, and expert opinion are used and preferred in informing public health decision making, more than other strong types of evidence, including systematic reviews (Oliver and de Vocht, 2015). This implies that public health practitioners often based their practice on knowledge gained only from advice, experience, and expert opinion rather than a combination of knowledge from experience, advice, and expert opinion with knowledge developed through carefully executed and highly methodological research. To this end, the following sections will discuss the gap between public health recommendations developed through research-based evidence and their actual implementation in public health practices. They will also discuss factors responsible for the gap, co-production

research as a means of closing the 'research-based evidence implementation gap', embedded research as a type of co-production research, and the potential of embedded research in closing the gap.

### **1.3 The Challenges of Inadequate Use of Research-based Evidence in Public Health Practice**

The gap in the field of public health between the research-based evidence and the actual implementation of the recommendations discovered through such research is globally recognised (Di Ruggiero et al., 2017; Nutbeam, 1996). Scholars have affirmed that the delay or gap in implementing the knowledge generated through research is approximately 17 years (Westfall et al., 2007; Trochim, 2010; Green et al., 2009). Despite the amount of money invested in public health research by the government and external funders (PHE, 2015), the sector has difficulties bridging the gap between public health research evidence and the actual implementation in public health practices (McAteer et al., 2019). For example, research-based evidence is available on effective or productive health-enhancing physical activity interventions and policies, however, it seems not to be completely utilised to underpin health-related decision making (Lomas, 2000; McCaughey and Bruning, 2010; Liverani et al., 2013; Orton et al., 2011; Shine and Bartley, 2011). In the United Kingdom (UK), a total amount of £8.1 billion was spent on health-related research and development between 2009 and 2010 (UK Clinical Research Collaboration, 2012). This amount increased to £8.5 billion in 2014 (UK Clinical Research Collaboration, 2015). However, the inadequate implementation of research-based evidence in the field of public health can cause the resources invested in public health research to be wasted. This can also have a negative impact on the quality of public health services and the health and well-being of the population (Macintyre, 2003).

Bridging the gap between research-based evidence and its implementation in public health practice could have many direct and indirect advantages, such as giving value to the resources invested in public health research, providing a greater tendency of effective public health interventions, and also improve the quality, delivery, and use of public health services (Lhachimi et al., 2016). This will lead to improvements in people's health and well-being and help reduce mortality and morbidity rates (Centres for Diseases Control and Prevention, 2013). Closing the gap between research-based

evidence and its implementation in public health practice can even help alleviate the growing financial burdens on the UK's public health sector caused by recent budget cuts (Allen et al., 2014; The King's Fund, 2020), more so, the economic conditions are increasing the demand for public health services (WHO, 2014). The budget cuts imply more than a 20% reduction in per individual public health funding in several deprived LAs in England (GOV.UK, 2018), and these have impacted greatly on their ability regarding service delivery to the people (Eyre et al., 2015). Therefore, it is crucial to close the gap between research-based evidence and its implementation in public health practices to maximise every resource invested in public health while at the same time delivering quality public health services (Brownson et al., 2009). To this end, the factors responsible for the gap will be discussed and a way to bridge the gap will be explored in this PhD study.

#### **1.4 Factors Responsible for the Gap Between Research Evidence and its Implementation in Public Health Practice**

According to scholars, some of the factors associated with the problem of inadequate implementation of research evidence in practice could either originate from the researchers or the practitioners (Marshall et al., 2014; Chew et al., 2013; Proudfoot et al., 2011). This implies that both researchers and practitioners could be responsible for the creation of the gap between research evidence and its implementation in public health practice.

Evidence suggests that lack of access to research evidence is one of the barriers to the implementation of research evidence in practice (Albert et al., 2007; Armstrong et al., 2006; Bunn, 2011). Allen et al. (2014) suggest that increased connectivity between researchers and practitioners would enhance the practitioners' accessibility to research evidence. The report explained further that creating some forums where practitioners and researchers could interact would not only bring about easy access to relevant research evidence, but also would serve as a means to share learning, and link researchers and practitioners who have a common interest. Similarly, Campbell et al. (2011) and Dobbins et al. (2009) report that increasing the interaction between researchers and practitioners among other factors could facilitate the use of research-based evidence in practice (as defined and explained in section 1.2). To that end, even though there are other factors, there is a need to increase the opportunities for

practitioners and researchers to interact in order to facilitate the utilisation of research evidence in public health practice.

As there are many identified barriers to the use of research evidence in practice, the disparity between the context and the language by which researchers and practitioners operate has also been identified as one of the barriers. Friese and Bogenschneider (2009) emphasised that incompatibility in the language spoken by the researchers with regard to the scientific methods and the evidence they generate could be ambiguous for the practitioners to understand. Therefore, to overcome this challenge, scholars advise that practitioners and researchers should work collaboratively from the onset of the research while putting into consideration each other's differences (Newbury-Birch and Allan, 2019; Van der Graaf et al., 2017). Furthermore, Hobin et al. (2012) recommended that researchers need to present their research findings and their relevance to solving practical problems to the practitioners in a simple language without ambiguity. This suggests a need for an approach that would involve practitioners and researchers to carry out research agenda together, and also a need for a means to effectively communicate research findings and their relevance in a simple language to the practitioners.

Allen et al. (2014) added that the context in which the researchers operate could also serve as a challenge to the utilisation of research evidence in practice. As such, competing pressures such as teaching commitments and publishing academic papers (Oliver et al., 2019) could pose a challenge to the researchers' involvement in practical problems that could inform their research questions. Hence, there is a need for an approach for researchers to be more involved in practical problems to facilitate the conduction of research that is relevant and applicable to solving problems. Wong (2009) added that not all researchers have the relevant skills to conduct co-produced research. Therefore, there is a need to create opportunities for researchers who have relevant skills to co-produce research, to conduct research with suitable practitioners.

On the other hand, Fathimath et al. (2014) added that organisational factors such as time constraints are contributing factors to the gap between research evidence and practice as most practitioners do not have the skills and the time needed to implement research outcomes in practice. Therefore, to tackle these challenges, some studies recommended development in continuing training and commitment to quality health

delivery on the part of practitioners. They also recommended advancements in technological decision support systems as instruments to combat barriers between research evidence and practice (Aszkenasy et al., 1994; Davies et al., 1995). However, Sutton (1997) argued that achieving these may be difficult as a result of inadequate funds in health services. Hence, while there are other factors, there is a need for the adoption of a method that will bring about building the capacity of the practitioners towards conducting research that is achievable based on the available budget.

Rycroft-Malone (2014) added that the disparity of influence and power between academics and practitioners could be responsible for the wide gap between research and practice. This means the relationship between academic researchers and practitioners plays a vital role in the use of research evidence. Therefore, there is a need for a method that would enhance or build mutually beneficial relationships between academic researchers and practitioners to bridge the 'research evidence-implementation' gap.

According to Walshe and Davies (2013), the separation of the development of research evidence from the places it is to be used contributes to the challenges of using research evidence in practice. This implies that the creation of research knowledge where it is to be utilised could bridge the 'research evidence-implementation' gap. As such, co-production has been recommended by scholars to bridge the 'research evidence-implementation' gap as co-production involves the collaborative working between the researchers and the practitioners (Ryan, 2012). Hence, the adoption of co-production to produce public health knowledge by researchers, practitioners, and other stakeholders in non-clinical settings (Newbury-Birch and Allan, 2019; Groundwater and Mockler, 2002). This is essential in tackling the challenges of inadequate implementation of research evidence in public health settings.

## 1.5 Co-production

Co-production was first described by Ostrom (1996) as a way by which a commodity or service is produced through the efforts of individuals who are not of a similar organisation. Following this early definition of co-production, there are developments

on its meaning, and how it can be carried out. As opposed to Ostrom's definition of co-production, Griffiths and Foley (2009) stated that co-production could also be carried out within the members of a group. In recent times, the adoption and understanding of co-production have developed from different fields such as public health, public administration, political science, and education (McGeechan et al., 2016; Alford, 2009, 2014; Pestoff, 2006; Bovaird, 2007; Newbury-Birch and Allan, 2019).

Co-production has been identified by Realpe and Wallace (2010) as a way of sharing knowledge and decision making among providers and service users. Penny et al. (2012) added that when co-production is successfully adopted, it could enhance services, and as well empower service users to develop into a valuable instrument of change (Penny et al. 2012). Similarly, in public health, scholars confirmed that co-production is a means of improving public health services through collaborative working and the utilisation of knowledge or experience from different stakeholders, including researchers and public health practitioners to develop solutions to public health problems (Tetroe, 2007; Ryan, 2012; Bedford, 2015). As a means to involve service users in their health and well-being process, co-production tackles the assumption that the target population does not contribute to this process (Cahn, 2000). As such, co-production involves partners or collaborators to create, share and negotiate explicit, tacit, and theoretical knowledge to achieve their common aims which could bring about positive change in practice (Marshall, 2014; Newbury-Birch et al., 2016; Heaton et al., 2016).

### **1.5.1 Theoretical Approaches to Co-production**

As identified by Wehren in Morris et al. (2011), the theoretical approaches underpinning the types of co-production that exist between practitioners and researchers can be categorised into four theories. The categorisation is based on the level of incorporation between practitioners, and academics (researchers), and how knowledge is created within the collaboration. The four theories are boundary organisations, hybrid management, communities of practice, and front and backstage regions.

#### **1.5.1.1 Boundary organisations**

Guston (1999) postulated this theory which originated from the socio-political views of boundary organisations. The boundary organisations play an intermediary role

between policymakers and academics. A distinctive feature of this model is that collaborators operate in their various establishments nevertheless, they still carry out their responsibilities in their common host organisation. This could result in a level of negotiation and agreement on the aims of the co-production project, however, each collaborator handles the pressures from their establishment, to focus on the demands of the co-produced project.

#### ***1.5.1.2 Hybrid management***

Miller (2001) proposed this theory as a variation to the boundary organisations model. This model targets the practices within an academe and policy-making collaboration rather than the socio-political backgrounds of boundary organisations. Furthermore, hybrid management differs from boundary organisations in that while boundary organisations allow a measure of autonomy for each collaborator, on the contrary, this level of autonomy is almost impossible with hybrid management as collaborators are closely knitted. According to Miller (2001), a hybrid management model could be facilitated through four main processes. Firstly, there must be an adequate degree of incorporation between the researcher and the practitioner components of the work, this is to ascertain that they are united (hybridisation). Nevertheless, it is also important to deconstruct these components to tackle any fundamental assumptions (deconstruction). Although autonomy is not possible, however, there should be an agreed limit (boundary work) to assist in job allocation between the collaborators (cross-domain orchestration).

#### ***1.5.1.3 Communities of practice***

This model was proposed by Wenger et al. (2002). The model differs from other models as it involves collaborators working together on a common topic of interest, irrespective of their fields. Therefore, the greater the diversity of the specialty of the collaborators the more valuable it is for the co-production work. These diversities serve as a pool of knowledge from where they draw knowledge to actualise the target of the co-production work.

#### ***1.5.1.4 Frontstage and backstage regions***

Goffman (1990) postulated this model which investigates the disparities between the information given on a co-production project to different groups of stakeholders. The



group of stakeholders that are interested in the project, but are categorised not to be directly involved in the project is referred to as the front stage group. On the other hand, the group of stakeholders who are categorised to be more involved in the co-production project is referred to as the backstage group. This implies that the type and extent of the information given to these categories of stakeholders depend on their involvement in the co-production project. Hence, the two categories receive different information about the same co-production work.

### 1.5.2 Principles of Co-production

Heaton et al. (2016) explained that the concept of co-production is based on five main principles, which could be relevant to any type of co-production. 1) service users are recognised as the main focus and not just mere receivers of services (Needham and Carr, 2009; Ostrom, 1996), thus services are targeted to meet the service users' needs; 2) the knowledge and experience of the service users and the professionals are utilised (Boyle et al., 2010; Social Care Institute for Excellence, 2013; Boyle and Harris, 2009), hence, service users are involved in the co-production process; 3) professionals and service users understand that, with bringing both parties' efforts together, they can achieve more, than when they work independently (Boyle et al., 2010; Social Care Institute for Excellence, 2013), thus, building mutually beneficial relationships; 4) the involvement and engagement of service users with the service usually influence service structure and delivery, thus meeting present and future needs of the service users (Boyle et al., 2010; Needham and Carr, 2009); and 5) encouragement of service users' involvement in co-production by the organisation (Needham and Carr, 2009; Boyle et al., 2010). These principles focus on the same aim of, collaborative working between stakeholders (professionals, academics or researchers, service users, managers, policymakers) to achieve a common goal. Nevertheless, Heaton et al. (2016) recommended further work to investigate the nature of co-production research underpinned by the above principles of co-production in different settings. Therefore, this suggests a need to examine the nature including the role of different types of co-production research in public health settings to identify their potentials in bridging the gap between research evidence and its implementation in practice.



### 1.5.3 Opportunities of Co-production

As a way of sharing ideas and specialisations between researchers and practitioners, co-production could facilitate the utilisation of research evidence and thereby increase quality improvement (Bannister and Hardill, 2013). In England, there are Academic Health Science Centres and Networks (AHSNs), and Collaborations for Leadership in Applied Health Research and Care (CLAHRCs) which are joint organisations that bring together researchers and practitioners. They also serve as platforms for translational research, which is the process of applying available relevant knowledge to practice (Narayan et al., 2000). At the regional level, some organisations connect practitioners and researchers such as AskFuse (Fuse, no date). AskFuse is a research service that provides research support in North East England and seeks to connect practitioners to researchers based on their common interests (Fuse, the Centre for Translational Research in Public Health, Askfuse). However, there is still a need for more collaboration between researchers and practitioners such as CLAHRCs and AskFuse not just at the regional and national levels, but also in various practices and capacities at the local level to maximise the potential of co-production. Although co-production has been adopted within community settings which produced positive outcomes (McGeechan et al., 2016; Cheetham et al., 2019), these are still ad hoc and there is still a need for more of such association in every community or small-scale level.

### 1.5.4 Challenges of Co-production

Researchers agreed that co-production is a way forward to achieve improvement in public health because it could embrace and encourage the integration of research evidence into the system (Ryan, 2012; Bedford, 2015). To this end, it could facilitate the promotion of the health and well-being of the target population. Nevertheless, co-production is not without challenges as it involves recognising hierarchies of power and influences, identifying and allocation of duties, constant monitoring of the relevance of the research to the organisation as well as continuous evaluation of the outcomes (Holmes et al., 2016).

Engaging in co-production also faces the challenges of bringing different people of different backgrounds and disciplines or fields together which could result in tension as a result of difficult conversations and interpersonal conflict among others (Oliver et al., 2019). Therefore, co-production requires interpersonal skills including the ability to

manage difficult relationships (Oliver et al., 2019) which can add to the workload of the stakeholders involved and can ultimately cause stress (Graffy, 1999). Furthermore, as conflict can pose reputational risks to the researcher involved, thus, the researcher might play along with other stakeholders to avoid conflict. Hence, this can have a negative implication on the researcher's integrity.

Furthermore, as pointed out by Oliver et al. (2019) co-production can also entail investing time to build relationships with those that are involved in the co-production work, without any assurance of the benefits. Also, co-production could be challenging as it involves having to seek the support of others, while expected to return the favour. Involvement in co-production work can be demanding as it requires the stakeholders who have other commitments in their respective organisations to manage diverse expectations and workloads. For instance, having to combine academic commitments such as teaching and writing publications, with the responsibilities associated with co-production such as devoting resources and time could be challenging to manage for the researcher involved. Eventually, the end might not justify the means as not all co-production is successful nor considered as high-level research (Flinders et al., 2016), and as such might be difficult to publish findings from such co-production work. Still, the co-production research timeframe might not provide the researcher the opportunity of reflecting on their practice (Oliver et al., 2019).

In addition, involving in co-production could result in reputational risk for the researcher involved as the researcher might be used by politicians to enhance authenticity to their political stand (Himmrich, 2016). Thus, being viewed to approve such a political stand can limit the researcher's ability to work only with a certain political group – this can also impact the researcher's personal safety (Zevallos, 2017). Also, this can impact negatively on the credibility of the co-production findings as it might be viewed as biased and not a true representation but a narrative to back up a political viewpoint, thus generating “policy-based evidence” (Davey et al., 2001) rather than “research-based evidence”. On the other hand, policy-makers might be at risk of sharing sensitive information while participating in co-production work (Maybin, 2016) such as disclosing political errors.

Also, co-production can be costly as it usually involves the stakeholders travelling to the co-production site. This could be viewed as challenging for those that are involved

in the co-production project, as their presence at meetings for the co-production work is seen as crucial. Also, funding and sustainability of co-production can pose a great risk to the adoption of co-production as experienced by Duggan (2014) as discussed in section 1.6.3.2. However, Rycroft-Malone et al. (2016) pointed out that the challenges associated with co-production can be overcome if stakeholders are involved and are carried along at every stage of co-production, from design to implementation. Therefore, the success of co-production depends on but is not limited to the following: the individuals involved; how clear the aims and objectives of the project are to all those involved, and how duties are allocated (Hegger and Dieperink, 2014). This also suggests a need to critically analyse the role of stakeholders involved in co-production to overcome the challenges associated with co-production, to achieve success.

### **1.5.5 Examples of Co-production**

An ethnographical study conducted by Filipe et al. (2017) explored how knowledge is produced, shared, and translated into practice. The study found that all the stakeholders share the common opinion that co-production does not only have economic value, but also is beneficial to the public in improving service quality, availability, and sustainability. This approach to quality service improvement was achieved by involving stakeholders in decisions on issues that pertain to them, also by realising that co-production is a way to maximise resources, and by recognising the importance of the experience of the stakeholders.

These findings are similar to the critical review by Dunston et al. (2009) who reported that co-production resolves health improvement problems and, sustains the health system. This might be as a result of collaborative working between the professionals and other stakeholders. Also, the findings from Dunston et al. (2009) added that co-production advances or develops wider citizenship and democratic policy agendas. In this regard, co-production should be utilised as a transformative process that generates new communities, practices, associations, values, and different types of knowledge production. However, Heaton et al. (2016) warned that co-production could be challenging and while there are different strategies to co-produce knowledge, not all are broadly examined, and some types of co-production end in the blurring of roles.

Therefore, there is a need to critically analyse the role of different stakeholders involved in the process of co-production of knowledge to ensure its success in public health to inform practice (chapter two).

A mixed-methods study conducted by Rakhee et al. (2017) adopted co-production in training care staff in two care homes in London, to improve oral health in vulnerable older people. The mixed-methods approach gave a deeper understanding of the phenomenon being studied and enhanced the rigor of the study by merging the positivism, the philosophical assumption underpinning the quantitative research, that believes knowledge is scientific and that all data can be measured (Maltby, 2010), with interpretivism, the philosophical assumption underpinning qualitative research, that believes reality is socially constructed (Litva and Jacoby, 2002). Despite the benefits of mixed-methods, the method faces challenges of incompatibility as the qualitative and the quantitative study have different paradigms (Teddlie and Tashakkori, 2003). Based on this, the combination of both qualitative and quantitative study generates textual and numerical data respectively. Nevertheless, irrespective of the challenges, Greene et al. (1989) argued that mixed-methods have been used successfully in many studies. Therefore, Rakhee et al.'s (2017) mixed-methods research conducted semi-structured interviews with the managers and the dental teams to collect qualitative data, and pre-and post-questionnaires were used to collect quantitative data from the carers to increase the robustness of the study.

Bird (2009) argued that the use of questionnaires as data collection tools is usually problematic because of low response rates. The low response rate usually reduces the external validity of a study, and ultimately hinders how the findings from a study can be generalised to a larger population (Fincham, 2008). Rakhee et al. (2017) recorded that 64% of the care staff participated in the study. However, only 54% responded to the post-training questionnaire, therefore, this response could reduce the external validity and the generalisability of the study, as the recommended response rate for most research is 60% (Fincham, 2008). This is similar to the mixed-method study conducted by Littlecott et al. (2017) on collaborative evidence-based plans for active ageing in the UK. The study also recorded a low response rate of 50% with questionnaires, thereby reducing the external validity of the study. However, Littlecott et al. (2017) also adopted semi-structured interviews to explore the

perceptions of the participants regarding the success of the collaboration. Bryman (2004) states that a semi-structured interview allows the participants to respond to interview questions in their own way, thus, it is flexible. Therefore, the use of semi-structured interviews increases the credibility of the data collection method of Rakhee et al. (2017) and Littlecott et al. (2017) work. This also suggests the use of semi-structured interviews to collect in-depth data pertaining to a collaborative project (chapters three and four).

The overall result from the Littlecott et al. (2017) mixed-method study showed that all participants perceived that the collaboration was successful. Similarly, Rakhee et al. (2017) showed positive outcomes of co-production in training care staff, as participants recorded improvements in knowledge and confidence after the training. The evidence from these two studies complements earlier studies on co-production (Dunston et al., 2009; McGeechan et al., 2016). However, there is a need to investigate, and synthesis existing evidence on the role of individuals involved in co-production work. This suggests a systematic review would be useful in informing practice (Pearson, 2004; Aromataris and Pearson, 2014; Liberati et al., 2009), regarding the role of individuals partaking in the process of co-production to identify, categorise, and critically analyse their impact.

McGeechan et al. (2016) conducted a co-production evaluation of an asset-based method, where some residents of a community in the North East of England worked collaboratively with the academic and the practitioner in reducing the high prevalence of smoking in the community through tobacco control promotion. The researcher and the practitioner as well as the service provider built the capacity of the community volunteers towards data collection by providing training on how a smoking prevalence survey could be administered to the residents in the community. The result showed that collaborative working between academics, practitioners, and the members of the community could promote the health and well-being of the people in the community. A further study by McGeechan et al. (2018) evaluated young mothers' views of a specific intervention programme for teenage parents in the North East of England. The result showed collaborative working between the young mothers and the members of staff of the service provider. This results in positive outcomes such as tackling isolation in young mothers, improving the young mothers' childcare skills, and improvement in

their willingness to further education or seek employment. Therefore, this reinforced and echoed one of the principles of co-production that collaborative working between the service provider and service users (stakeholders) could improve engagement with service (Boyle et al., 2010). This, therefore, could tackle some public health issues such as social isolation hence, improving people's health and well-being.

In the book, '*co-creating and co-producing research evidence: a guide for practitioners and academics in health, social care and education settings*' (Newbury-Birch and Allan, 2019) a range of co-production work between researchers, practitioners, and other stakeholders conducted in diverse non-clinical settings including public health and criminal justice settings were explored. In one of the studies, Segrott and Roberts worked with "*schools to develop complex interventions for public health improvement*". Also, in the same book, Ferguson and colleagues conducted co-production research in the prison setting. They stated that the success of co-production research in the prison environment lies in the involvement of other stakeholders such as prisoners and prison staff in the research process. This echoed one of the principles of co-production that the knowledge and experience of the service users (stakeholders) and the professionals are utilised (Boyle et al., 2010; Boyle and Harris, 2009), as such, service users are involved in the co-production process.

Having explored a series of studies on co-production, all the studies confirmed that co-production involves and benefits collaborative working between various stakeholders. Thus, among other benefits, the collaborative working facilitates knowledge sharing and utilisation to achieve a common goal.

There are diverse types of collaborative working with or without research involvement (Balalden et al., 2016), which produce new types of values, knowledge, and social interaction that evolve from the processes of the co-production (Filipe et al., 2017). Having discussed co-production including co-production of knowledge - the combination of knowledge from different sources (sections 1.2), the following sub-sections will focus on co-production research, one of the elements of co-production of knowledge.

## 1.6 Co-production Research

As a way of conducting research, co-production has been identified as “*a collaborative model of research that includes stakeholders in the research process has been widely advocated as a means of facilitating research use and impact*” (Oliver et al., 2019, p.1). To this end, co-production research is becoming popular for its potentials to connect different stakeholders, including academics and practitioners to conduct relevant research useful in practice (Van de Ven, 2007; Ferlie et al., 2012; Graham and Tetroe, 2007; Greenhalgh and Wieringa, 2011; Rowley et al., 2012). Therefore, co-produced research findings are easier to incorporate or implement in practice as it involves not only the researchers but also different stakeholders, including the practitioners (Tetroe, 2007) thus, beneficial to the public for its impacts. However, there are challenges in adopting co-production research. The challenges could pose risks on its sustainability in practice as discussed in section 1.5.4.

### 1.6.1 Embedded Research: A Type of Co-production Research

Different terminologies are used for co-production research such as participatory action research, integrated knowledge translation, and action-oriented research (Tetroe, 2007) including embedded research (McGinity and Salokangas, 2014), and they could be significantly different in respect to methods based on the field of interest (McGeechan et al., 2019). Embedded research, also known as ‘researcher-in-residence’, is becoming popular as a type of co-production research (Marshall et al., 2014). Different authors used different terminologies for embedded researchers such as insider researcher (Brannick and Coghlan, 2007), knowledge broker (Langeveld et al., 2016; Yost et al., 2014), and scholar-practitioner (Smith and Wilkins, 2018). Within an embedded research model, one of the distinguishing features is that the researcher is located in the host organisation as a member of staff to carry out a research agenda with the host organisation’s staff, and at the same time maintaining affiliation with an academic institution (McGinity and Salokangas, 2014; Dixon-Woods and Martin, 2016; Dixon-Woods et al., 2012; Vindrola-Padros et al., 2019).

The dual affiliation with the host organisation and the academic institution enables an embedded researcher to carry out the role by acting as an intermediary between the academic and the professionals (Vindrola-Padros et al., 2017). Embedded research is not ethnography as its main focus is not to study the culture of the host organisation



(Cheetham et al., 2017) but rather, embedded research is an approach where researchers work collaboratively with the member of staff of the host organisation to identify, plan and carry out research and disseminate research results which answers the organisation's needs while considering the organisation's peculiar context (McGinity and Salokangas, 2014; Vindrola-Padros et al., 2017). McGinity and Salokangas (2014) among others confirm that embedded research has the potential to co-produce knowledge, however, there is a need for a systematic review to critically analyse the role of embedded research in the process of co-production of knowledge in public health settings, to inform practice (chapter two).

Different methods can be utilised by embedded researchers in carrying out their roles. Embedded researchers can adopt similar methods to knowledge brokers (individuals that assist in bridging the gap between evidence including tacit knowledge, and practice) (Roth, 2003). For example, embedded researchers can adopt a knowledge broker's method for 'building capacity' (Newlands, 1981, cited in Chew et al., 2013). Therefore, embedded researchers may be required to assist in improving the skill of other stakeholders. Also, embedded researchers can adopt 'knowledge management' methods as embedded researchers may be asked to present existing evidence to users in a simple language without ambiguity. 'Linkage and exchange' (Canadian Health Services Research Foundation, 2003) is another knowledge brokers method that can be adopted by embedded researchers. These targets could establish good relationships between practitioners and researchers, and thus facilitate the use of research evidence in practice. Hence, embedded research entails building positive relationships with practitioners which could facilitate a 'joint effort' in solving a common challenge. Additionally, embedded researchers might function as 'boundary spanners' (Chew et al., 2013). This involves connecting the internal networks of an organisation with another organisation, group, or individuals to obtain relevant information useful in the innovation stages. Therefore, an embedded researcher's role involves working with more than one organisation (Chew et al., 2013).

The role of embedded research could be achieved in the process where the embedded researcher works collaboratively with practitioners in the host organisation (Bannister and Hadill, 2013; Marshall, 2014), as such, the three categories of knowledge that were earlier discussed in section 1.2 could be co-produced. As the research element



of the co-production of knowledge is conducted through collective efforts, it is 'owned' by the embedded researcher and the host organisation (McGinity and Salokangas, 2014). Glasziou et al. (2014) and Rycroft-Malone (2014) added that research evidence is more accessible, effective, and utilised faster when produced directly with the recipients of front-line service. Consequently, the 17 years gap identified by scholars as the gap between research evidence and the implementation (Morris et al., 2011; Green et al., 2009; Trochim, 2010) could be bridged by adopting an embedded research model in co-producing public health knowledge in non-clinical settings. Hence, this suggests more co-production of knowledge that involves embedded researchers and recipients of front-line service in different settings including public health settings. As such, the collaborative working would maximise the potentials of embedded researchers in bridging the gap between research evidence and the implementation, therefore, promoting an evidence-informed practice.

### 1.6.2 Opportunities of Embedded Research

The potential of embedded research in addressing the gap between research evidence and its implementation sits in the discrete features of embedded research. Among these distinct features are, being located in the host organisation, bringing new skills, and negotiation of knowledge (Embedded research, no date).

#### 1.6.2.1 Being located in the host organisation

Embedded research involves the researcher spending time in the host organisation, and the duration of time spent per week in the host organisation varies based on the intensity of the research project (Embedded research, no date). For instance, while some embedded researchers spend one day a week (Vindrola-Padros et al., 2019), some spend two days a week (Sullivan and O'Neill, 2019; Yost et al., 2014), and some spend three days a week (Cheetham et al., 2017), in the host organisation. This is to build relationships with the host organisation's staff (Wong, 2009), to understand the context (Newbury-Birch et al., 2016), and also to become part of the organisation (Marshall et al., 2014; McGinity and Salokangas, 2014). To this end, "*by being there*" (Vindrola-Padros et al., 2017, p.71), an embedded researcher in the host organisation could have the opportunity to gain an understanding of the context in which research is to be used (Hackett and Rhoden, 2011; McGinity and Salokangas, 2014; Lewis and Russell, 2011). This could also provide the researcher with the advantage of

identifying the needs of the host organisation and attending to them through research (Lewis and Russell, 2011; Rycroft-Malone, 2014). Therefore, being located in the host organisation could provide an embedded researcher an opportunity to address practical problems facing the organisation through the utilisation of research evidence.

Also, the mutually beneficial relationship between an embedded researcher and the host organisation's staff enhances the creation, sharing, and negotiation of knowledge (Marshall, 2014). As such, the embedded researcher could offer relevant research evidence (Vindrola-Padros et al., 2017) that would meet the needs of the host organisation. Hence, this could bridge the gap between research evidence and its implementation to promote an evidence-informed practice.

Building mutually beneficial relationships is key when carrying out embedded research (Duggan, 2014; Vindrola-Padros et al., 2017), as the host organisation and the embedded researcher have something to gain from the relationship. The mutually beneficial relationships could bring about the researcher gaining benefits such as working space, support in recruiting participants for the research, and computer facilities, as in the case of Duggan (2014). The host organisation in return could gain contributions to knowledge and research skills from the embedded researcher (Duggan, 2014; Wong, 2009). Also, the relationship could provide the opportunity for the staff of the host organisation to have access to some facilities such as the library systems in the academic institution which could increase their involvement in research activities (Sullivan and O'Neill, 2019). Thus, this type of association could lead to research impact to bring about positive changes in the host organisation (Vindrola-Padros et al., 2017). In addition, an embedded researcher could also have the opportunity of experiencing how the practitioners carry out their activities, and as well as contribute to projects that are related and impactful (Wong, 2009). Therefore, carrying out embedded research in a host organisation is not a one-way beneficial relationship but a two-way beneficial relationship as a result of participatory or collaborative efforts, which could enhance the utilisation of research evidence.

### **1.6.2.2 Bringing new skills**

Often embedded researchers assist in building practitioners' research capacity (Vindrola-Padros et al., 2017). As such, practitioners in the host organisation may have the opportunity to learn new skills relating to research from the embedded researcher

(Wong, 2009; McGinity and Salokangas, 2014). To this end, capacity building will not only improve outcomes but also assist the practitioners in decision making (Compton et al., 2002). Therefore, capacity building of the host organisation's staff by the embedded researcher may increase the host organisation's staff confidence and willingness to undertake research to inform practice.

### **1.6.2.3 Negotiation of knowledge**

Carrying out embedded research gives the researcher the opportunity to work with practitioners (Wong, 2009). To this end, the embedded researcher and the host organisation's staff co-produce knowledge relevant to the needs of the organisation (Marshall et al., 2016). This gives room for negotiation and facilitation of research evidence utilisation (Hackett and Rhoten, 2011; Marshall et al., 2014; Duggan, 2014; Eyre et al., 2015). Therefore, the embedded researcher focuses on conducting participatory research with the host organisation's staff, which could produce evidence that could easily be utilised to meet the host organisation's varying needs.

In contrary to traditional research where academics go in and do research for an organisation (Vindrola-Padros et al., 2019), embedded research concentrates more on the utilisation of the research evidence rather than just publishing the research findings (Embedded research, no date). As a result, embedded research focuses not just on the rigour of research, but also on the relevance of the research to address the practical problems or needs of the organisation (McGinity and Salokangas, 2014). Negotiation of knowledge between the practitioners and the embedded researcher may also enable the researcher to offer the best evidence concerning the needs of the organisation (Allen et al., 2014). Thus, improving the service the host organisation renders to the public through utilisation of such research evidence.

### **1.6.3 The Challenges of Embedded Research and Their Possible Mitigations**

The National Institute for Health Research (NIHR) project on embedded research explored the challenges and solutions to the adoption of embedded research using three case studies in clinical settings (Vindrola-Padros et al., 2019). The study found that there are challenges to achieving embedded research adoption in the host organisation. These include the challenges of building relationships with the host organisation's staff, balancing and meeting the demands of research and the host organisation, and maintaining the dual identity (Vindrola-Padros et al., 2019).

However, there are other challenges such as organisational change (Duggan, 2014; McGinity and Salokangas, 2014), budget cuts (Allen et al., 2014), and austerity (Reeves et al., 2013) among others.

### **1.6.3.1 Building relationships**

As it takes time and effort to build trustworthy relationships, an embedded researcher could build a relationship with the host organisation's staff in many ways such as attending regular meetings, and regular face-to-face communication (Rowley, 2014). Although relationship building is usually initiated by the senior academic or managers (Vindrola-Padros et al. 2019), an embedded researcher will need time to familiarise and understand the host organisation before the research starts. Therefore, Vindrola-Padros et al. (2019) recommended an 'introductory period' of a minimum of three months for familiarisation before the embedded research starts.

Reiter-Theil (2004) added that the time to build trustworthy relationships with the practitioners may also be a risk to embedded research. As the embedded researcher is new to the host organisation's staff, this might necessitate the researcher spending more time to familiarise herself or himself with the LA staff, systems, and processes. To this end, the rate at which embedded researchers can familiarise themselves with the host organisation's staff may depend on where the researcher sits within the host organisation. Decisions about the location of the embedded researcher are critical to the success of the research (Duggan, 2014). In the case of Duggan (2014), the embedded researcher's desk was located in the administrative office which enabled him to observe how the LA ran. Therefore, the embedded researcher's location in the host organisation must be strategic to enhance relationship building and familiarisation with the host organisation's staff.

Also, the adoption of embedded research could be challenging as the host organisation's staff might think they are being exposed to scrutiny (Wong, 2009), which might lead to a lack of cooperation from the staff of the host organisation. Especially, this might happen when the host organisation staff are not well informed about the purpose and mission of the embedded researcher in the host organisation. To mitigate this, the role of the embedded researcher in the host organisation must be clear to the organisation's staff (Marshall et al., 2016). Also, there must be clarity as regards the aims and objectives of the research; the role of the embedded researcher and the

duration of the research; implications for both parties as well as the overall relevance of the research to the host organisation (Newbury-Birch and Allan, 2019; Vindrola-Padros et al., 2019; Brewster et al., 2015; Marshall et al., 2016). Therefore, this suggests a need to synthesise available evidence on the role of embedded research in co-producing knowledge in the host organisation, to inform practice.

### ***1.6.3.2 Balancing and meeting research and host organisation's demands***

Embedded research could also be faced with the challenge of the negative influence of changes, interests, and organisational pressures (McGinity and Salokangas, 2014; Duggan, 2014). Changes in staff and management could affect embedded research progress and lead to the insecurity of position. For instance, Duggan (2014) conducted an embedded research in a LA in England. However, Duggan's director left early before the research started. This affected the research negatively as there was a lack of interest in the research by the new director (Duggan, 2014). Drawing from Duggan's experience, to avoid this risk, there is a need for an agreement on the sustainability of the research before it commences.

The instability of the politico-economic status of the host organisation could also pose a great risk to embedded research (McGinity and Salokangas, 2014). Duggan (2014) mentioned that this instability had adverse effects on the financing and the completion of his project as policy changes. This may pose a challenge to the embedded researcher to navigate the research especially when the host organisation's priorities shift away from the embedded researcher's agreed project. This might eventually lead to the abandonment of the project as experienced by Duggan (2014). To minimize this risk, studies have recommended that at the beginning of embedded research, there must be mutually-agreed guidelines stating the roles and expectations of the embedded researcher as well as the host organisation (Brewster et al., 2015; Marshall et al., 2016). Also, there must be an agreement on the funding and sustainability of the research at the onset of the research.

Furthermore, embedded research could be faced with the challenge of maintaining the research rigour and at the same time adjusting to the varying circumstances in the host organisation (Vindrola-Padros et al., 2019). Hence, there is a need to review the research regularly to meet the needs and expectations of the host organisation.

### **1.6.3.3 Dual affiliation**

Challenges could arise when carrying out embedded research as a result of the position of the embedded researcher, which entails dual affiliation with the host organisation and an academic institution (Vindrola-Padros et al., 2019). This dual affiliation might raise ethical issues especially, concerning confidentiality as the embedded researcher is neither referred to as an outsider nor as an insider (Marshall et al., 2016; Duggan, 2014). As a result, the host organisation's staff might not be willing to share important information with the embedded researcher. This may be because they are uncertain of the embedded researcher's dedication and commitment to the host organisation. To mitigate this risk, there must be an agreement on the role of the embedded researcher (Brewster et al., 2015) including the sharing of information between the embedded researcher and the host organisation's staff before embarking on the project. To this end, there is a need to synthesise the role of embedded research in co-producing public health knowledge in non-clinical settings to inform public health practice.

Furthermore, embedded researchers could find maintaining their dual identity challenging (Vindrola-Padros et al., 2019). Oftentimes, the researcher spends more time in the host organisation than in the academic environment (Vindrola-Padros et al., 2019). This could jeopardise the researcher's academic commitment such as teaching. In addition, a loss of academic identity could set in as a result of spending more time in the host organisation. To mitigate this, Vindrola-Padros et al. (2019) recommended that embedded researchers should maintain regular contact with their academic supervisors.

### **1.6.3.4 Fitting into the host organisation and lack of autonomy to publish findings**

According to Groundwater-Smith and Mockler (2002) difficulty in fitting well into the host organisation's structure could also pose a challenge to an embedded researcher. This might be as a result of facing the challenge of working in a system that is different from the researcher's previous experience, or when the embedded researcher has not got enough experience. Hence, Vindrola-Padros et al. (2019) suggested that an embedded researcher might have to spend more time (introductory phase) to understand the host organisation's structure and how it runs before focusing on the

research agenda. Furthermore, it is advised that it would be beneficial to also have an academic supervisor involved in the project to ensure rigour (Newbury-Birch and Allan, 2019; Sullivan and O'Neill, 2019).

Marshall et al. (2014) and Brewster et al. (2015) emphasise the need for an agreed agenda before embarking on the research. It might take time to agree on an agenda for individual research projects however, it is a necessary preventive measure to avoid confusion, abandonment of the project, and conflicts while carrying out embedded research in the host organisation. Also, to avoid conflict in the research topic, the embedded researcher must ensure that the research area of interest of the host organisation is in line with the research area of interest of the embedded researcher and that the researcher has the skills required by the host organisation (Wong, 2009). Hence, there is a need to be clear on the role of embedded researchers as well as the strategies needed including the skills required to carry out the roles successfully.

Also, the embedded researcher might be faced with the challenge of not having autonomy in publishing findings as the research finding is jointly owned by the two parties. Also, the host organisation might not allow the researcher to publish findings if the finding is conflicting with the organisation's values and goals (Hackett and Rhoten, 2011; Wong, 2009; Jenness, 2008). Nevertheless, to mitigate this risk, there must be a mutual agreement as regards publishing and expectations before the project starts, and regular contact between an embedded researcher and the academic supervisor to get support is needed for the success of the role (Vindrola-Padros et al., 2019; Newbury-Birch and Allan, 2019).

Having explored the literature on the evidence for embedded research, how embedded research could address the gap between research evidence and its implementation in practice, the challenges of embedded research as well as possible solutions to the adoption of embedded research as a type of co-production, the findings show that clarity and agreement on the roles and expectations of the embedded research are needed at the outset to ensure its success in the host organisation. Therefore, the following sections will explore the examples of embedded research in non-clinical settings and the rationale for this PhD.



### 1.6.4 Embedded Research in the Non-clinical Setting and Rationale for this PhD

In England, public health moved from the NHS to LAs in the year 2013 (The King's fund, 2015; Milne, 2018). This reform led to the establishment of PHE that focuses on the protection and improvement of the population's health and well-being as well as reducing health inequalities at every level (PHE, no date). The movement of public health practitioners and their roles to the LAs where they would be able to work effectively with people at the local level went well. However, improvement varies, in some LAs there is still a need to close the gap between the cultures of the NHS and LAs. This includes a large disparity between the value, knowledge, and utilisation of research evidence in decision making (The King's fund, 2015). Therefore, there is a need to bridge the gap between research evidence and its utilisation in LAs, using an embedded research approach.

An example of embedded research in a non-clinical setting can be found in a study by, Cheetham et al. (2017) who conducted qualitative research in a LA. Cheetham et al. (2017) drew insights from interviews conducted by a member of the public health team to investigate how it feels to work with an embedded researcher, the impact of embedded research, and suggestions for improvements. Evidence-informed change was achieved by the embedded researcher in a number of ways: 1) the embedded researcher functioned as a sounding board by building relationships with the public health practitioners, suggesting changes to the evaluating method used for the service users, and involving in both official and unofficial communications which enabled shared learning that facilitated the use of research evidence; 2) the research capacity of the LA and the public health practitioners was built by the embedded researcher through motivating them to participate in the research process; 3) the embedded researcher functioned as a knowledge broker by offering relevant research findings useful in the LA, and also by initiating co-production with the relevant stakeholders to bring about change; 4) as an agent to speed up change and timely developments in delivery, the embedded researcher raised concerns based on comments from the service users who participated in the research. As such, prompted negotiation with the LA officials on the issue which brought about change; 5) the embedded researcher acknowledged success in battling inequalities by highlighting the importance of comments from the service users to structure services. This promoted the project that was effective and also suggested a devotion in supporting and building staff's skills;



6) as an agent to speed up change and improvement in determining effectiveness, the embedded researcher engaged in conversations with the commissioners and providers of services to adjust the performance monitoring framework, decreasing the amount of key performance indicator to concentrate on the most related results.

The findings from the study showed that the role of an embedded researcher in the LA could enable positive change by facilitating the use of research evidence in practice and also encourage research co-production with diverse stakeholders, among other roles. The findings from Cheetham et al. (2017) are similar to the findings of the narrative review conducted by Vindrola-Padros et al. (2017). The review included 17 qualitative studies on the role of embedded research and concluded that embedded research could bridge the gap between research evidence and implementation through co-production, thereby bringing about change in practice. However, there is a need for a systematic review that uses a more comprehensive and exhaustive search approach than narrative reviews (Grant and Booth, 2009) to synthesise findings from relevant qualitative studies, and also to include recent relevant qualitative studies such as Cheetham et al. (2017) on the role embedded researchers in co-producing public health knowledge in the non-clinical setting, to inform practice.

NIHR funded a project on embedded research which focuses on facilitating the implementation of evidence from health services research in decision making regarding NHS (clinical) services advancement and redesign (Embedded research, no date). The 2.5-year project has four workstreams as outlined below.

- The first workstream started in January 2018 and consisted of a literature review on embedded research and knowledge co-production.
- The second workstream included scoping to identify practical examples of embedded research initiatives across the UK by using different means such as networks and web searches. About 90 examples of embedded research were identified, however, only 45 embedded research initiatives met the NIHR embedded research team criteria. The criteria were based on their definition of embedded research which must include being located in the host organisation, bringing new skills, and negotiation of knowledge (Embedded research, no date). The 45 embedded research initiatives were studied in more detail to build

a framework of designing options for embedded research initiatives (Embedded research, no date).

- The third workstream which started in January 2019 focused on four in-depth case studies to explore how embedded researchers develop networks.
- The last workstream is to influence dissemination, which is the kaleidoscope. This focuses on increasing the utility of the findings from the project to increase its impact. This produces guidance on the role of embedded researchers such as job specifications, training among others, in clinical settings. To this end, it would be important to also explore the role of embedded research in non-clinical public health settings to develop a toolkit useful in practice.

Drawing insight from the NIHR funded embedded research team's webinar on '*a framework of designs options for embedded researcher initiatives*', the identified 45 embedded research initiatives across the UK were explored (Embedded research, no date). The team reported that embedded research initiatives are diverse. While some initiatives operate within the community or primary care setting, some operate across different settings. This finding corresponds with the narrative review conducted by Vindrola-Padros et al. (2017). The review showed that an embedded research approach could be adopted in diverse settings such as health, Judicial system, educational, social policy, and social care.

Also, in terms of timeframe, contrary to the assumption of the team, the team found that some initiatives have been going on for two or more years, one has been going on for 30 years. With regard to scale, most embedded research initiatives in the UK are relatively substantial. In terms of employment, the team expected that embedded research initiatives will have a joint contract of employment with the University and the host organisation, however, the team found that some embedded researchers are employed only by a University while a large number of embedded researchers involved in clinical settings are on NHS contracts.

Furthermore, the embedded research team shed light on a number of ways by which embedded research initiatives could be distinguished from each other (Embedded research, no date). These are based on firstly, the intent – what the embedded research initiative wants to achieve. This encompasses the intended outcome or benefit, and the political and power dynamics. For instance, while the embedded

research conducted by Langeveld et al. (2016) seeks “to create healthy public policies by setting the agenda for health and by specifying evidence-informed policy alternative”, Mischczak and Patel’s (2018) embedded research aims “to respond to the changing nature of urban and environmental change”, and Cheetham et al. (2017) evaluated “an integrated wellness model commissioned by a local authority in north east England”.

Secondly, the structure – how the embedded research initiative is organised. This includes the scale, patient and public involvement, proximity, and home. Thirdly, the processes – the core activities going on within the embedded research initiative. This covers the functional activities, researchers’ skills and expertise, learning mechanisms, and relational role. Also, it would be important to critically review the role and types of embedded research initiatives in non-clinical public health settings by conducting a systematic review.

The embedded research team aims at providing a better understanding of embedded research for organisations who have been using embedded research, encouraging more organisations to explore embedded research, increasing the number of researchers who are willing to become embedded researchers as a result of awareness of the embedded research’s impact and value, and also to assist funders to understand how to commission embedded research (Embedded research, no date). To complement the NIHR project on embedded research in the clinical (NHS) setting, this current PhD study focuses on the role of embedded research in non-clinical settings as public health operates outside of the clinical setting. The aims of this PhD are outlined in section 1.7.1.

Qualitative studies exploring the role of embedded researchers in co-producing public health knowledge have shown that public health knowledge can be co-produced by embedded researchers and practitioners (Cheetham et al., 2017; Yost et al., 2014). However, no systematic reviews have critically analysed the role of embedded researchers in co-producing public health knowledge in non-clinical settings. Hence, there is a need for a systematic review on the topic.

A clear understanding of the role of an embedded research model in non-clinical settings to co-produce public health knowledge should assist public health

practitioners in actualising their targets. These targets include but are not limited to: protecting people from public health hazards; improving the health of the population and assisting the LAs to design and provide health and social care services (Kneale et al., 2019; Faculty of Public Health, 2021; PHE, 2015). The findings from the systematic review should, therefore, provide more clarity to the benefits of adopting embedded research models in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in practice.

Overall, the systematic review (chapter two) intends to synthesise findings from relevant qualitative studies through rigorous and comprehensive search. Thus, as the evidence shows that there is a dearth of work around non-clinical settings, the aims of this current work are outlined below.

## **1.7 Aims and Objectives of this Doctoral Research**

### **1.7.1 Aims**

The overall aims of this PhD are:

- 1) to investigate the potential of embedded research in bridging the gap between research evidence and its implementation in public health practice.
  
- 2) to develop a toolkit on the role of embedded research in the co-production of public health knowledge in non-clinical settings to facilitate the utilisation of research evidence in public health practice.

### **1.7.2 Objectives**

To achieve the overall aims, there are the following objectives:

- 1) To review existing literature and identify the gap in the literature around the role of embedded research in co-producing public health knowledge in non-clinical settings (chapter one).
  
- 2) To synthesise qualitative findings from relevant studies on the role of embedded research in co-producing public health knowledge in non-clinical settings, using the Joanna Briggs Institute methodology, by systematically reviewing the relevant literature on the topic (chapters two and three).

- 3) To explore the themes that emerge from the systematic review, by conducting qualitative fieldwork with embedded researchers, public health practitioners, and other stakeholders who are working/have worked with embedded researchers in co-producing public health knowledge in non-clinical settings (chapters two and four).
- 4) To develop a toolkit that provides the role of embedded research in bridging the gap between the time research evidence is generated and when it is implemented in public health practice, by triangulating the findings of the systematic review and the findings of the qualitative fieldwork following Farmer et al's (2006) triangulation protocol (chapters two, five and six).
- 5) To cross-check the relevance and the usefulness of the embedded research toolkit in public health practice, by sending the toolkit to embedded researchers, public health practitioners, and other stakeholders for feedback and discussions on the usefulness and relevance of the embedded research toolkit in public health practice (chapter six).
- 6) To investigate the similarities and the differences in the role of embedded research in clinical settings and non-clinical settings, by comparing the overall outcome of this piece of work in non-clinical settings with the NIHR work in clinical settings (chapter six).

## 1.8 The Structure of the PhD Thesis

This thesis presents the PhD work which has been sectioned into seven separate chapters (chapter one inclusive), to achieve the aims and objectives of the PhD project. A summary of each chapter is presented below.

**Chapter Two** – The methodology and methods undertaken for the systematic review, qualitative fieldwork, the triangulation of findings and reflexivity are presented. For the systematic review: the rationale for the systematic review is presented, followed by the methods undertaken. For the qualitative fieldwork: first, the aims and objectives, the philosophical foundation, and the rationale for the approach are provided. Following these are the details of the process undertaking including study design, population, sampling, data collection, data analysis, quality assurance, and ethics. Finally, the strengths and limitations of adopting a qualitative research method are provided. For the triangulation of findings: first, the aims and objectives, and the rationale for

triangulation are provided, following these, are the methods adopted. For the reflexivity: first, the definition and the importance of reflexivity to this piece of work are provided. Then, a detailed influence of the researcher's epistemological stance and demographic characteristics on the work are enumerated. Finally, the influence of the research on the researcher is provided.

**Chapter Three:** The results and discussion of the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings are presented.

**Chapter Four-** Qualitative fieldwork results: the chapter presents the results of the thematic analysis of the qualitative interviews. Firstly, the embedded research sites are described, followed by the demographic characteristics of the participants, and then the results of the thematic analysis. Finally, the conclusion of the qualitative inquiry is presented.

**Chapter Five-** Following the systematic review (chapters two and three), and the qualitative fieldwork (chapters two, and four), chapter five presents the results of the triangulation and discussion of the findings.

**Chapter Six-** The development of the embedded research toolkit: Firstly, the methods adopted in the embedded research toolkit development are introduced. This is followed by the exploration of related existing models on the use of research evidence in practice, and how they are linked with the development of the current embedded research toolkit. Then, the embedded research toolkit is presented including the participants' initial and final views on the usefulness and the relevance of the embedded research toolkit in practice. Also, the comparison of this PhD's findings to the NIHR work in clinical settings is provided. Finally, the overview of how each phase of the PhD informed the development of the embedded research toolkit, and the strengths and the limitations of the embedded research toolkit are presented.

**Chapter Seven-** General discussion: the thesis summary, the main findings, the achievement and contribution of this PhD to the body of knowledge in public health are discussed. The strengths and limitations of this work are enumerated. Finally, the rationale for further research, recommendations for practice, and conclusions are presented.

## **1.9 Chapter Summary**

Chapter one introduced the topic, the rationale, and the aims and objectives of this PhD. The main points of chapter one are:

- The need to bridge the gap between research evidence and its implementation in public health practice.
- Co-production has been identified as a way to bridge the ‘research evidence-implementation’ gap.
- Embedded research as a type of co-production has been used in public health practice and evidence has shown that it could bridge the ‘research evidence-implementation’ gap.
- Although there are opportunities for the adoption of embedded research, there are also some challenges that could be overcome if the appropriate measures are put in place.
- The NIHR work on embedded research focused on the clinical setting (NHS), there is a need to complement the work in non-clinical settings.
- Although there are primary qualitative studies on the topic, there is no systematic review on the topic to inform public health practice.
- As different terminologies are used for embedded research, there is a need to compile the terminologies to enhance embedded research use.

## CHAPTER TWO

### METHODOLOGY AND METHODS

#### 2.0 Overview of the Chapter

The methodology and methods undertaken for the systematic review, qualitative fieldwork, the triangulation of findings and reflexivity are presented. For the systematic review: the rationale for the systematic review is presented, followed by the methods undertaken. For the qualitative fieldwork: first, the aims and objectives, the philosophical foundation, and the rationale for the approach are provided. Following these are the details of the process undertaking including study design, population, sampling, data collection, data analysis, quality assurance, and ethics. Finally, the strengths and limitations of adopting a qualitative research method are provided. For the triangulation of findings: first, the aims and objectives, and the rationale for triangulation are provided, following these, are the methods adopted. For the reflexivity: first, the definition and the importance of reflexivity to this piece of work are provided. Then, a detailed influence of the researcher's epistemological stance and demographic characteristics on the work are enumerated. Finally, the influence of the research on the researcher is provided.

#### 2.1 QUALITATIVE SYSTEMATIC REVIEW METHODS

##### 2.1.1 Overview of the Systematic Review Method Section

This section details a systematic review of the relevant available international and domestic qualitative studies on the role of embedded research in co-producing public health knowledge in non-clinical settings. First, the rationale for conducting a systematic review is provided, followed by review aim and objectives, and review methodology are provided.

##### 2.1.2 Rationale for Conducting a Systematic Review

A systematic review is a review that provides the best evidence through the findings of several studies that are identified in rigorous, comprehensive, and systematic literature searches (Grant and Booth, 2009). Evidence-based public health involves



the use of recent best available evidence to inform practice and policy regarding decision making, improvement of public health services, and delivery of services, as well as in developing public health policies useful in addressing public health problems (Shu-Chiung, 2003). Therefore, Shu-Chiung (2003) stated there is a rapid demand to inform public health practice and policy with relevant evidence that could be used to support and guide decision making to improve public health service and delivery. Thus, conducting a systematic review in this area of study should inform practice with the best evidence on the role of embedded researchers in co-producing public health knowledge in non-clinical settings.

As comprehensively conducted systematic reviews are considered as the basis for evidence-based practice (Pearson et al., 2005; Marshall and Sykes, 2010), different organisations such as Joanna Briggs Institute (JBI) (JBI, no date), Cochrane Collaboration (Cochrane Database of Systematic Reviews, 2020), Campbell Collaboration (Campbell Collaboration, 2020), The Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre) (EPPI, 2019), and International Initiatives for Impact Evaluations (International Initiatives for Impact Evaluations, 2020), support systematic reviews. Systematic reviews are considered as the highest quality of evidence, compared to evidence from randomised controlled trials, case studies, cross-sectional studies, cohort studies, and case-control studies (Rannen, 1992; Popay and Williams, 1998). One of the reasons is that systematic review involves the critical appraisal of included studies to assess the methodological quality of the included studies (Grant and Booth, 2009). Furthermore, as a transparent method is used in systematic reviews to reduce bias, it allows clarity on how their conclusions are drawn, replication of the systematic review, and also allows readers to scrutinise the method followed in the review process (Aaron et al., 2016). Moreover, a systematic review involves the synthesis of evidence from included studies to assist in the generation of clear and readily available information on a particular area of study (Munn et al., 2014). Therefore, a systematic review is conducted to identify what is known on the topic to make recommendations for practice, as well as to identify what is unknown to make recommendations for future research.

While there are systematic reviews of quantitative research (Liberati et al., 2009), there are also systematic reviews of qualitative research that follow the guidelines for

collection, synthesising, and presenting evidence (Bearman and Dawson, 2013). As JBI includes different types of studies, including qualitative studies, this current systematic review followed the methodology of the Joanna Briggs Institute manual (JBI, 2014). The JBI approach was adopted as *“it is valued for its rapid development as an international front-runner in the promotion and facilitation of evidence-based health care”* (Joanna Briggs Institute, no date). Hence, JBI focuses on providing the best available evidence to inform practice, which corresponds to the aims and objectives of this review.

Furthermore, JBI uses a meta-aggregation approach for data synthesis. Meta-aggregation is an approach to synthesise qualitative data (JBI, 2011; Noyes et al., 2011) as detailed in section 2.1.9.6 Meta-aggregation presents findings as they are; it does not aim or intend to re-interpret the findings (JBI, 2014; Munn et al., 2014). Therefore, it provides the actual data from the primary research, that is useful in informing practice. The JBI approach covers evidence generation, synthesis, transfer, and implementation, which correspond to the aims and objectives of this review. The JBI approach goes further by considering the feasibility, appropriateness, meaningfulness, and effectiveness of practice, and these determine the strength of a recommendation (Joanna Briggs, no date). To this end, JBI methodology was adopted not only to make recommendations but also to provide the level of strength for each recommendation, which would make findings from this current systematic review more easily understood and usable for the public health professionals.

Furthermore, JBI uses the ConQual approach for establishing confidence in the output of qualitative research synthesis (Munn et al., 2014; Lockwood et al., 2017). According to Munn et al. (2014), a ConQual approach is a grade used to rate the confidence and quality of the findings of qualitative systematic reviews. This provides a grade for credibility, dependability, and the overall ConQual grade for each synthesised finding. All these are adopted by the JBI approach to improve the quality of a systematic review as well as the usability of systematic review findings in practice and policy (Munn et al., 2014).

### 2.1.3 Scoping Review

To ascertain that a systematic review was needed and that there were enough primary studies on the topic, a scoping review on the topic was conducted. A scoping review is:

*a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge (Colquhoun, et al., 2014, p.1293).*

The scoping review was conducted by searching different databases such as the JBI Databases of Systematic Reviews and Implementation Reports, PROSPERO, Google scholar, and the Cochrane Database of Systematic Reviews, without applying limits on the language and year of publication. The results of the scoping review showed that while there were qualitative studies on the topic, there were no quantitative studies. Also, the result confirmed that there was a narrative review (Vindrola-Padros et al., 2017) on the topic, however, there was no systematic review regarding the topic. Therefore, it was thought essential to conduct a qualitative systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings. Consequently, this would inform public health practice and policy as of the potential of embedded research in improving service and delivery, through improved research evidence utilisation in public health practice and policy.

### 2.1.4 Qualitative Systematic Reviews

Informed by the scoping review, this current qualitative systematic review focused on reviewing relevant available qualitative studies on the role of embedded research in co-producing public health knowledge in non-clinical settings. Qualitative systematic reviews are now popular (Pope et al., 2007), as they are used to collect findings from relevant studies on a particular topic by methodically searching for primary qualitative studies on the topic, and synthesis evidence (Seers, 2015). Therefore, good quality qualitative systematic reviews are important in gathering research evidence useful in informing practice and in identifying what works and what does not (Hannes and Lockwood, 2011). The first publication of a qualitative systematic review by Cochrane Collaboration was termed as “*a new milestone*” (Gülmezoglu et al, 2013, p. 1). Since then, qualitative systematic reviews have gained more attention in health. As such, research questions that are difficult to address with quantitative studies are tackled

using qualitative research, and the qualitative findings are pulled together using a qualitative systematic review to inform practice (Sandelowski and Leeman, 2012; Pearson, 2004). For example, in health, McGeechan and his colleagues conducted a qualitative systematic review to inform understanding of cancer patients' attitudes to mindfulness (McGeechan et al., 2017). Also, Carter et al. (2018) synthesised qualitative evidence to improve the understandings of the experiences of mobile health in promoting physical activity. Thus, the importance of qualitative systematic reviews is progressively recognised to inform decision making in health.

### 2.1.5 Limitations of Conducting a Systematic Review

As a systematic review involves a rigorous, transparent, and exhaustive search that can be replicated, it is important to be conducted as a collective work by people who have a good knowledge of evidence-based approaches and those who are experts on the focus question (Russell et al., 2009). Thus, this could pose a challenge in finding the right individuals to carry out a systematic review. Also, systematic reviews follow a rigid procedure rather than being flexible, to ascertain transparency, replicability, and quality (Mallet et al., 2012). Although the rigidity in the process of conducting a systematic review could be a challenge as it does not allow flexibility, however, this is part of the attributes of a systematic review that differentiate it from a literature review (JBI, 2020).

In addition, systematic reviews are rated as the 'highest' in the hierarchy of evidence, as they provide the best evidence useful in practice (Cook et al., 1998), and therefore, they are considered as the 'backbone' for evidence-based practice (Pearson et al., 2005; Sackett et al., 1996; Marshall and Sykes, 2010). However, Rohit et al. (2016) maintained that systematic reviews are time-consuming as they involve searching, extracting, and synthesising data from relevant primary studies, hence, more time is required to conduct a systematic review.

### 2.1.6 Aim of this Section

- To systematically review the role of embedded research in the co-production of public health knowledge in non-clinical settings.

### 2.1.7 Objectives of this Section

- To synthesise findings from relevant international (for learning from other countries) and domestic studies on the role of embedded research in co-producing public health knowledge in non-clinical settings, using the JBI methodology.
- To inform the next phase of this PhD work, the qualitative fieldwork and the development of a toolkit on the role of embedded research in co-producing public health knowledge in non-clinical settings.

### 2.1.8 Review Question

The review question that this systematic review aimed to answer was:

- What is the role of embedded research in co-producing public health knowledge in non-clinical settings?

JBI approach uses PICo to state the components of a review question. PICo stands for the Population (P), the Phenomena of Interest (I) and the Context (Co) (JBI, 2021) (Table 1):

**Table 1: Breakdown of the Review Question adopting the JBI PICo approach**

P	I	Co	Types of studies
Public health embedded researchers who are involved in the co-production of public health knowledge in non-clinical settings	The role of embedded research in the co-production of public health knowledge	Non-clinical settings worldwide	All qualitative study designs

**Participants** were identified as public health embedded researchers who were involved in the co-production of public health knowledge in non-clinical settings. The embedded research team's criteria for embedded researchers were adopted to differentiate embedded researchers from other types of researchers. As explicitly explained in chapter one, these criteria require a researcher to be 1) located and spend some time in the host organisation, 2) to bring new skills to the host organisation, and 3) to be involved in the negotiation of knowledge (Embedded research, no date). The

systematic review excluded studies that focused on other types of researchers and any studies where embedded researchers were not involved in the co-production of public health knowledge.

The **phenomena of interest** component of the PICO was the role of embedded research in the co-production of public health knowledge (tacit, explicit, and theoretical knowledge or information pertaining to the prevention of diseases, prolonging lives, and promotion of health).

The **context** for this review was any non-clinical setting worldwide as clearly defined in chapter one. Although the health system may differ from one country to another, the role of embedded research in co-producing public health knowledge in non-clinical settings may be similar. As public health operates outside clinical settings, this systematic review excluded studies that investigated the role of embedded research in co-producing public health knowledge in clinical settings such as the National Health Service (NHS), primary, secondary, and tertiary care settings. The context of the review focuses on non-clinical settings which include but are not limited to public health sections in LAs, voluntary organisations, and any other organisations that work in partnership with public health teams to promote health, prevent diseases, and prolong lives through the promotion of evidence-informed policy and practice. However, this review included studies that explored both clinical and non-clinical settings provided the results were disaggregated by setting which could allow the extraction of non-clinical data only.

Only qualitative studies that aim to explore the role of embedded research in the co-production of public health knowledge in non-clinical settings were considered in this current systematic review. These qualitative studies included, but are not limited to ethnography, action research, phenomenology, feminist research, grounded theory, commentaries, and discussion papers as these qualitative research methodologies were useful in providing qualitative data for the review.

### 2.1.9 Review Methodology

PROSPERO is an international database for registering systematic reviews in public health and other health-related fields (Prospero, no date). One of the importance of registering a systematic review protocol on PROSPERO is to avoid the duplication of

the same topic by different reviewers. Therefore, this systematic review protocol was registered on PROSPERO (Akintola et al., 2019), and it can be found on the University of York, Centre for Reviews and Dissemination website.

([https://www.crd.york.ac.uk/prospero/display\\_record.php?ID=CRD42019140992](https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42019140992)).

The following sub-sections detail the step-by-step process in undertaking the review from database searches to assessing certainty in the findings.

### 2.1.9.1 Literature Searches

The search strategy for this systematic review focused on searching for both published studies and unpublished studies. A preliminary limited search was conducted using CINAHL and MEDLINE databases (JBI, 2020). Then, the analysis of the text words in the title and abstract, and the index terms used to define the relevant studies was conducted. Also, a second search was conducted by using all identified index terms and keywords on all relevant databases. The reference list of selected studies was also searched for relevant studies. Relevant studies that were published from database inception until April 2019 were considered for inclusion in the review.

#### Information sources:

Ten relevant electronic databases were searched. The electronic databases were: CINAHL, Medline, AMED, Web of Science, PsycINFO, Psychology and behavioural science collection, PsycARTICLES, ASSIA, Embase, and Scopus. For the unpublished studies, Google Scholar, Open Grey, Google, and organisational websites, such as the National Institute for Health Research and World Health Organisation were searched. Also, PROSPERO, the international prospective register of systematic reviews was searched to ascertain that the topic of this current systematic review has not been registered to avoid duplication. It was found that there was no similar systematic review on the topic. Preliminary keywords such as embedded researchers or researchers-in-residence, and non-clinical settings, or public health or non-NHS settings were used. The full search strategy is in Appendix 1.

Search terms were developed by using the papers found in the narrative literature review (Vindrola-Padros et al., 2017), scoping, and with the help of information



specialists at Teesside University Library. The databases searched were appropriate for the topic as they can provide literature that is relevant to this review. The Cumulative Index to Nursing and Allied Health Literature (CINAHL) is usually considered a reliable source of information for the professional literature of nursing, healthcare, biomedicine, and allied health (Cinahl database, 2007). The Medical Literature Analysis and Retrieval System Online (Medline) has been known as a reliable source of information for biomedical and life sciences information, including healthcare (Medline, 2018). The large spectrum covers 4,600 journals from 1950 to date. Therefore, it provides relevant information through many articles.

Allied and Complementary Medicine (AMED) hosts literature from 400 journals in different areas, including complementary medicine and rehabilitation (Vardell, 2016). As such, it was a relevant source of literature for this systematic review. Furthermore, Web of Science is a search engine platform that enables comprehensive simultaneous citation of data for many academic disciplines (Web of Science, 2018). PsycINFO provides easy access for researchers to publication and to locate behavioural and psychological literature that is relevant (PsycInfo, 2014). Psychology & Behavioral Sciences Collection is an important full-text database for psychologists, researchers, counsellors, and students. As it provides specifically strong coverage in child and adolescent psychology and counselling, it was searched for relevant articles for this systematic review.

Furthermore, PsycARTICLES is a source of full-text, peer-reviewed articles, and journals in psychology (PsycArticles, 2019). ASSIA (Applied Social Science Index and Abstracts) is an index and abstract resource that gives comprehensive information on health and social science for professionals, students, and researchers (Assia database, no date), while Embase is a multipurpose and versatile biomedical and pharmacological database that gives up-to-date information that covers the most important biomedical studies internationally, and also strong in covering drug and pharmaceutical research (Embase, 2009). Scopus is one of the main abstracts and citation databases of peer-reviewed literature that delivers an in-depth overview of research in various fields such as science, medicine, technology, and arts and humanities (Scopus, 2013).



Google Scholar is a web search engine that offers free access to many academic disciplines (Google Scholar, 2009). Open Grey is an open access multidisciplinary database that provides full-text references to 'grey literature' – that is yet to be published by major European researchers (OpenSIGLE, 2013). Open Grey ensures a thorough review and avoids being bias. Therefore, all these electronic databases were searched for relevant literature on the role of embedded research in co-producing public health knowledge in non-clinical settings.

Boolean operators (AND and OR) were used. While the 'AND' narrows the search, 'OR' widens the search. Boolean operators were used to assist in maintaining a focus on the topic and to gather only literature that is relevant to the topic (Erika and Andrea, 2010). Truncation is a method used to widen search in order to include different word endings and spellings (Erika and Andrea, 2010). Therefore, an asterisk (\*) was applied to every keyword to broaden the search and to capture all available literature on the topic. For example: Embed\* research\* captured Embedded research, Embedded researcher, Embedding research, and Embedded researchers (Appendix 1).

There was no limit to publication date so as to capture all relevant literature. There were different terminologies used for an embedded researcher. While an embedded researcher is being referred to as a 'researcher-in-residence' (Marshall et al., 2016) in the clinical setting, other settings referred to an embedded researcher as a 'scholar-practitioner' (Smith and Wilkins, 2018), 'science-practitioner' (Steens et al., 2018) and 'engaged scholar' (Van den Ven, 2007). Therefore, as terminology differs, it was important to use different search terms in this current systematic review to gather a wide range of studies adopting an embedded research approach but using different terms. The initial searches were carried out during the week of the 3<sup>rd</sup> of April 2019 while the full searches were completed by the middle of May 2019.

### 2.1.9.2 Assessing the Eligibility of Studies for Inclusion

To ensure that the articles selected were relevant, definite inclusion and exclusion criteria were established.

#### Inclusion criteria

- Qualitative articles that were based within a non-clinical setting such as school, LA, criminal justice, sports organisation, and non-governmental organisation.

- Qualitative articles that aimed at exploring the role of an embedded researcher(s) in the co-production of public health knowledge.
- The articles must involve an embedded researcher who was located and spent some time in the host organisation.
- Relevant qualitative studies that were published from database inception until April 2019, when the searches were carried out, were considered.
- The articles must involve an embedded researcher who has a dual affiliation with a host organisation and an academic institution(s).
- Discussion papers and commentaries were included if they meet the inclusion criteria of this review.
- There was no limit on the language as google translator was used to translate non-English language to the English language.

### **Exclusion criteria**

- Articles that were based within a clinical setting such as primary care setting, secondary care setting, and tertiary care setting.
- Articles that explored other aspects of an embedded researcher rather than the role in co-producing public health knowledge.
- Articles where the researcher was not located nor spent some time in the host organisation.
- Articles where the embedded researcher had no dual affiliation with a host organisation and an academic institution.

#### **2.1.9.3 Screening of Papers**

The identified studies were exported into Endnote (Clarivate Analytics, PA, USA) and duplicates were removed. The studies were screened based on their titles and abstracts for assessment against the inclusion criteria for the review. Dr. Oladipo Idowu (OI) at Teesside University acted as the second reviewer throughout this systematic review by reviewing 20% of the total selected articles at every stage. It was planned that any disagreements that may arise between reviewers would be resolved through discussion, or with a third reviewer. The disagreement that arose between the two reviewers was resolved through discussion, therefore there was no need for a third reviewer. Studies that could meet or have the possibility of meeting the inclusion criteria were retrieved in full. The full text of selected studies was assessed in detail

against the inclusion criteria. Studies that did not meet the inclusion criteria were excluded, and studies that met the inclusion criteria underwent a further process of critical appraisal and data extraction. The findings of the search were presented in a PRISMA flow diagram (Fig 5). The full-text screening of the potential articles was completed by the end of June 2019.

#### **2.1.9.4 Assessment of Methodological Quality**

Selected studies were critically appraised for methodological quality by using the JBI Critical Appraisal Checklist for Qualitative Research (JBI, 2014) (Appendix 2). The components in the critical appraisal tool aim to assess the included studies based on the following: the agreement between the philosophical perspective underpinning the study and the methodological approach used, the appropriateness of the methodological approach used to address the research question, and the appropriateness of the methodological approach and the data collection method. Also, it includes the agreement between the research methodology and the representation and analysis of data, the appropriateness of the methodological approach, and the interpretation of results (JBI, 2014). Furthermore, it consists of the declaration of the influence the belief and values of the researcher have on the study, the acknowledgement of the influence the researcher has on the researcher and vice versa, and the ethical approval from an appropriate committee. Finally, it includes the relationship between the analysis or interpretation of data and the conclusions drawn (JBI, 2014). All these components were to assess the congruity between the paradigm, methodology, and methods adopted in the primary study (JBI, 2014). The findings of the critical appraisal were presented in a narrative form and in a table (Chapter three-section 3.3, Table 6). Each study underwent data extraction and synthesis irrespective of its methodological quality. However, a further assessment was conducted to grade the level of confidence in each finding from every included primary study (Section 2.1.9.7).

#### **2.1.9.5 Data Extraction**

Qualitative data extraction from the included studies was carried out using the JBI SUMMARI standardised data extraction tool (JBI, 2014) (Appendix 3), and OI acted as the second reviewer by extracting qualitative data from 20% of the included studies. In the process of data extraction, the focus was on the population, context,

geographical location, study methods, and the phenomenon of interest related to the review question and specific objectives. Relevant data was extracted, and a level of credibility was allocated. The findings of the data extraction were presented in chapter three - section 3.4 and Appendix 4.

### 2.1.9.6 Data Synthesis

While there are different approaches to synthesise qualitative data (JBI, 2011; Noyes et al., 2011; Thorne et al., 2004), JBI SUMARI using the meta-aggregation approach was used to pool qualitative data in this systematic review (JBI, 2020). Meta-aggregation is underpinned by the philosophy of pragmatism; therefore, it provides readily usable synthesised findings that could be used to provide recommendations to assist policymakers and professionals in decision making (Hannes and Lockwood, 2011). Also, meta-aggregation is used when a particular research question needs to be answered or when seeking to collate opinions on an intervention or health problem (Noyes and Lewin, 2011). To this end, meta-aggregation was used to synthesise qualitative data from the included qualitative studies as it corresponds to the overall aim of this current review.

A finding in the meta-aggregation approach is termed as “*a verbatim extract of the author’s analytic interpretation of their results or data*” (The Joanna Briggs Institute, 2014, p. 20). As meta-aggregation aims at the practicality and the implementation of primary research evidence, the actual findings are presented as they are without been interpreted, contrary to other qualitative synthesis methods (Munn et al., 2014). Therefore, an illustration could be field notes or participants’ words. Meta-aggregation aims at the findings from the primary study, as such, it allows a mixture of different methodologies of qualitative research in one synthesis, provided the studies have the same phenomena of interest (Munn et al., 2014). To this end, meta-aggregation was used as an approach to synthesis the data as the included studies have diverse methodological approaches, but the same phenomenon of interest. Findings were aggregated to create a group of data that represents that aggregation, by collecting the individual findings and grouping these individual findings based on similarity in meaning. The groups were then synthesised to generate one comprehensive group of synthesised findings which can be used as a source for evidence-based practice. This followed the JBI SUMARI Meta-aggregative flowchart (Appendix 7) The results were

presented in the narrative form and in a table (Chapter 3 - Section 3.5, Appendix 6, and Appendix 8).

### 2.1.9.7 Assessing Certainty in the Findings

The final synthesised findings were graded according to Munn et al.'s (2014) ConQual approach for establishing confidence in the output of qualitative research synthesis. The ConQual result of a systematic review determines the level of confidence in the overall result of the systematic review (Munn et al., 2014). The ConQual depends on the type of research conducted, the dependability of the primary study, and the credibility of the individual findings (JBI, 2020). While qualitative studies are rated high, expert opinions are rated low under types of research (JBI, 2020; Lloyd, 2018). The position and strength of a study on the hierarchy of evidence are determined by the level at which the study design is prone to bias (National Health Service (NHS) Centre for Reviews and Dissemination, 1996). To this end, qualitative studies are rated as stronger than expert opinions which are at the lowest level of the hierarchy of evidence (JBI, 2020; Hoffman et al., 2013).

#### *Type of research*

Pre-ranking of papers was conducted based on the hierarchy of evidence, and according to Lloyd (2018).

Pre-ranking of papers:

- High – qualitative studies
- Low – expert opinion

#### *Dependability*

Dependability was graded based on the suitability of the research with the aims and objectives of the study (JBI, 2020). This was scored based on questions 2, 3, 4, 6, and 7 on the JBI critical appraisal tool (JBI, 2014) (Table 6), and the dependability of the study is ranked based on the ranking system below according to Lloyd (2018).

Ranking system:

- 4-5 'yes' responses, the paper remains unchanged
- 2-3 'yes' responses: move down 1 level

- 0-1 'yes' responses: move down 2 levels

### **Credibility**

A level of credibility was assigned to each synthesised finding based on the grading below (JBI, 2020; Lloyd, 2018). For instance, when all the synthesised findings from a study are 'unequivocal', the credibility of the study remains unchanged.

**Table 2: JBI Level of Credibility**

<b>Level of credibility</b>	<b>Definition</b>
Unequivocal (U)	Findings that relate to evidence beyond reasonable doubt; may include findings that are matter of fact, directly reported and not open to challenge
Credible (C)	Findings that are, albeit interpretations, plausible in the light of data and theoretical framework. They can be logically inferred from data. As interpretative they can be challenged.
Not Supported (NS)-	Findings that are not supported by the data.

Ranking system for findings:

- All unequivocal – remains unchanged
- A mixture of unequivocal/credible – downgraded one (-1)
- All credible – downgraded two (-2)
- A mixture of credible/not supported – downgraded three (-3)
- All not supported – downgraded four (-4)

According to Lloyd (2018).

As a ConQual score depends on the type of research, dependability, and the credibility of the synthesised findings, a ConQual grade table (Appendix 9) was produced with reference to Lloyd (2018). The ConQual table was used to determine the ConQual score for each synthesised finding. The overall ConQual scores were presented in chapter three – section 3.6 and table 16. These included the main elements of the review and detailed how the ConQual scores were generated. The title, population, phenomena of interest, and context for the specific review were also included in the table. Each synthesised finding from the review was then presented along with the type of research informing it, a grade for credibility, dependability, and the overall ConQual grade.

## 2.2 QUALITATIVE RESEARCH: METHODOLOGY AND METHODS

### 2.2.1 Overview of the Qualitative Fieldwork Methodology and Methods

This section details the methodology and methods of the qualitative research phase of this PhD. First, the aims and objectives, the philosophical foundation, and the rationale for the approach are provided. Following these are the details of the process undertaken including study sites, population, sampling, data collection, data analysis, quality assurance, and ethics. Finally, the strengths and limitations of adopting a qualitative research method are provided.

### 2.2.2 Aim

This qualitative inquiry aimed to explore the themes that emerged from the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings.

### 2.2.3 Research Objectives

This qualitative research phase has the following objectives:

1. To identify relevant case study areas to explore the themes that emerged from the systematic review.
2. For each case study, to conduct semi-structured interviews with an embedded researcher, and public health practitioners, and other stakeholders (teachers and students) who are working/have worked with an embedded researcher(s) in co-producing public health knowledge in non-clinical settings.
3. To identify the role of embedded research in co-producing public health knowledge in non-clinical settings.
4. To develop an understanding of how the role of embedded research could bridge the gap between research evidence and its implementation in public health practice.
5. To inform the development of the proposed embedded research role toolkit (chapter six).

### 2.2.4 Methodology: Research Philosophy

This section details the philosophical foundation underpinning the qualitative inquiry of this PhD work. It further explains the rationale for choosing the research approach

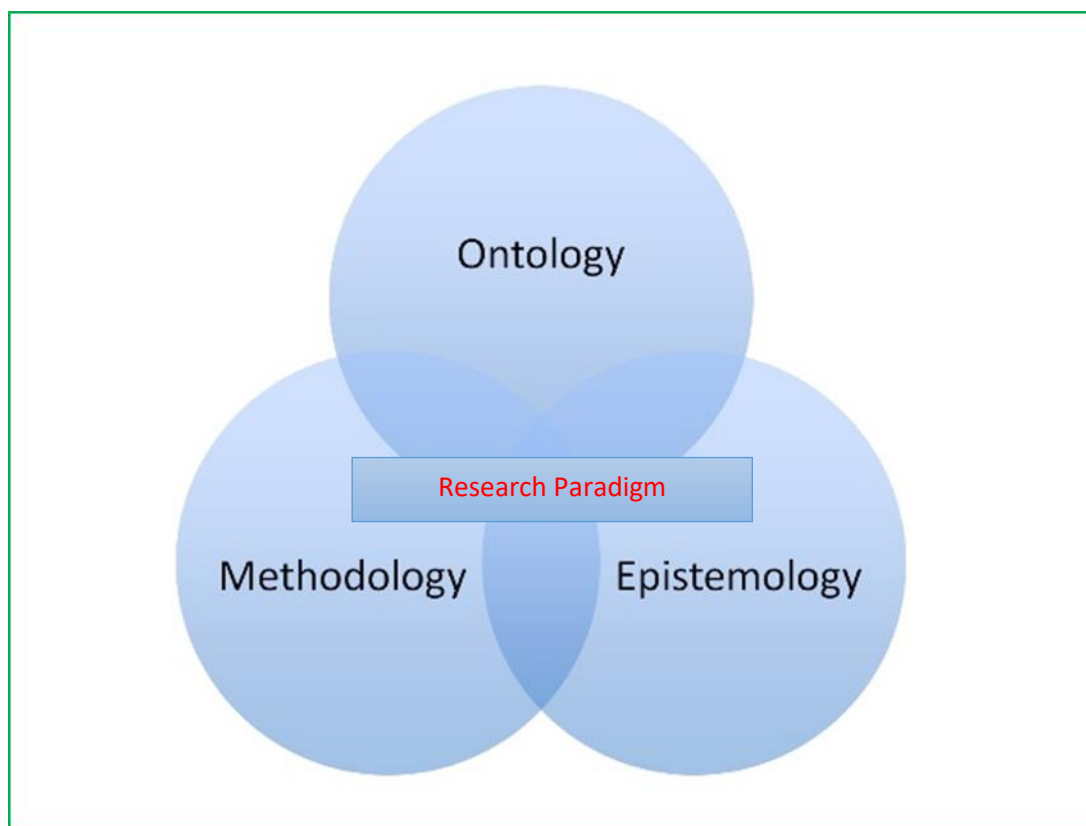
adopted based on the research design and methods which were determined by the aims and objectives of this phase of the PhD work.

#### 2.2.4.1 The Philosophical Foundation

Paradigm is a “*net that contains the researchers’ epistemological, ontological, and methodological premises*” (Kuhn, 1970, cited in Denzin and Lincoln, 2008, p.31) (Figure 2). Research is underpinned by the theoretical philosophical assumptions regarding the nature of the world, the diverse interactions within the world, and how knowledge is created (Weber, 2004). As such, research methodology entails not only the theoretical assumption underpinning a research approach but also the justification for its adoption in any study. Therefore, it provides the philosophical stance, which is the ontological and the epistemological stances on which research is conducted (Creswell et al., 2003). While ontology deals with the nature of being and existence, that is, the nature of reality (Denzin and Lincoln, 2008), epistemology is concerned with the theory of knowledge including the assumptions regarding the nature of knowledge (Mason, 2002; Weber, 2004). Furthermore, according to Denzin and Lincoln (2008) methodology is how knowledge is derived about the world and how information or data is collected for research purposes. Therefore, the methodology adopted in research is determined by the underpinned ontological and epistemological assumptions. As the main objective of this phase was explorative, a methodology that is guided by the belief that knowledge could be derived by exploring people’s views and experiences was used for this phase of the PhD. As a result, a qualitative approach underpinned by interpretivism was adopted as it could answer and meet the aims and objectives of this phase of the PhD.



**Figure 2: Relationship Between the Concepts of Ontology, Epistemology, and Methodology (Sialoombe, 2020)**



Interpretivism assumes that “*the reality is socially constructed as people’s experiences occur within social, cultural, historical or personal contexts*” (Hennink et al., 2011, p. 15). While interpretivism’s ontological assumption is that reality cannot be detached from its observer, the epistemology of qualitative research assumes that knowledge is generated through the social construction of the world (Prabash, 2012; Weber, 2004). As such, interpretivists believe that individuals construct meaning which evolves through interaction (Bowling, 2014). To this end, a qualitative approach was adopted in this present study to explore the themes that emerged from the systematic review on the role of embedded research in non-clinical settings, by drawing on embedded researchers’, public health practitioners’, and other stakeholders’ experiences and views about embedded research. In addition, as interpretivism aims more on the understanding and interpreting the meaning of human behaviour (Neuman, 2000), it does not accept one single truth or reality (Hudson and Ozanne, 1988), but rather adopt flexible research components (Carson et al., 2001) that are capable of capturing meanings in human interactions (Black, 2006) and thus provide an understanding of

reality (Carson et al., 2001). As such, diverse research components and data sources including exploration of four different case studies sites, and three categories of participants were explored in this qualitative fieldwork to collate views in order to understand the phenomenon of interest and the reality.

#### 2.2.4.2 The Adoption of a Qualitative Approach

Qualitative study is “*a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem*” (Creswell, 2008, p. 4). Hence, qualitative research seeks to provide insight and meaning to individuals’ everyday experiences (Litva and Jacoby, 2002). As interpretivism underpins qualitative research, it believes that social reality is subjective, as a result, qualitative research uses flexible data collection methods (Austin and Sutton, 2014). Consequently, different types of designs are adopted in qualitative research such as case studies, phenomenology, and ethnography (Astalin, 2013). Furthermore, qualitative research focuses on transferability rather than generalisability (Creswell, 2008; Austin and Sutton, 2014), as such, qualitative research uses a smaller sample size which is explored to provide an understanding of people’s experiences, beliefs, feelings, and meaning to generate an in-depth and rich data (Dworkin, 2012). Hence, a small sample size was used in this qualitative inquiry as the aim was not to generalise the findings to a larger population but rather to use the findings to inform the development of an embedded research role toolkit that could be used or applied in similar non-clinical settings.

Interpretivists assume that human behaviour can only be understood when the context is studied, as a result, a holistic approach is adopted in qualitative research to provide an understanding regarding the influence that the social context has on the phenomena of interest (Denzin and Lincoln, 2008). Social context is defined as the setting where social interaction occurs which involves precise, peculiar meanings and interpretations given by the individuals within the particular group (Given, 2008). As clearly discussed in chapter one, there is a similar NIHR embedded research project that has been carried out in clinical settings. However, as public health operates outside clinical settings, the qualitative fieldwork in this PhD explores the meaning and interpretations given to the phenomenon of interest by embedded researchers, public health practitioners, and other stakeholders who are involved in embedded research

in non-clinical settings. Thus, the comparison of the results from this work with the NIHR embedded research project in clinical settings (NHS) would provide an understanding of the influence that diverse social contexts have on the phenomenon of interest. This would assist in achieving one of the objectives of this PhD as stated in chapter one. To further explore the influence of social context on the phenomenon of interest of this PhD, this qualitative phase aims at exploring the themes that emerged from the systematic review by investigating the perception of embedded researchers, public health professionals, and other stakeholders on the role of embedded research in co-producing public health knowledge in various non-clinical contexts.

The following sub-sections will further detail the appropriateness and the rationale for choosing a qualitative research approach to investigate the aims and objectives of this phase of the PhD.

### ***Highly detailed data***

According to Hammarberg et al. (2016), qualitative research is adopted to answer a research question regarding a phenomenon by asking for the perspectives or views of participants. Similarly, Litva and Jacoby (2002, p.154) stated that “*the goal of qualitative research is to produce insights on the social world, within natural settings, by giving emphasis to the meanings, experiences, practices, and views of those involved*”. As such, qualitative research involves the generation of rich, detailed, and in-depth information about the phenomenon of interest through thorough, holistic, investigative, and explorative procedures (Creswell, 2008). Therefore, qualitative research was considered the most appropriate approach to achieve the aim of the second phase of this PhD which was to explore the themes that emerged from the systematic review by investigating the experiences and views of those that are involved in embedded research. This was to generate rich and in-depth information on the role of embedded research in co-producing public health knowledge in non-clinical settings which could bridge the gap between research evidence and its implementation in public health practice.

### *The use of theory*

According to Maxwell (2005) and Liamputtong and Ezzy (2005), a theory is basically how concepts relate. The main purpose of integrating theory in research is “*to provide a model or a map of why the world is as it is and to provide a conceptual view or simplification of what the world looks like*” (Maxwell, 2005, p.42). Qualitative research adopts theories that align with the underpinned paradigm guiding qualitative research (Mayan, 2009; Guba and Lincoln, 1998). Therefore, qualitative research design and methods are guided by the underlying theory. Furthermore, according to Bryman (2015) adopting a qualitative research approach could assist in the exploration of the existing theory which can as well lead to the generation of a novel theory. To this end, qualitative research was chosen as the best approach to explore the themes that emerged from the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical. More so this aligns with the overall aims of this PhD which are to provide relevant evidence- new and existing evidence, to develop a toolkit on the topic. Therefore, a qualitative approach would be useful in informing the development of a toolkit on the topic, hence, the adoption of a qualitative research approach in this piece of work.

#### **2.2.4.3 The Adoption of Case Studies as a Methodology/Design**

Qualitative research uses diverse methodologies or designs such as case studies (Yin, 2014), phenomenology (Moustakas, 1994), and ethnography (Wolcott, 2008; Fetterman, 2010) to explore a phenomenon. As a methodology in qualitative research, a case study aims at “*examining a contemporary phenomenon in its real-life context*” (Yin, 1981, p. 59). As such, while a single-site case study explores a particular setting using diverse qualitative methods, multi-site qualitative case studies involve the collection of qualitative data using similar data collection methods on the same subject of interest from more than one setting (Josee and Gerald, 2001). Thereby this does not only increase the transferability or applicability of the finding to other similar settings but also provides the opportunity to compare results across settings while maintaining the peculiarity of each site (Yin, 1981; Rogers-Dillon, 2005). Recently, the multi-site design has been used not only in case studies but also across methodologies and fields of study such as descriptive qualitative research (Nickel et

al., 2013), mixed qualitative and quantitative methods studies (May et al., 2014), and practice-based research (Chapman et al., 2007).

Furthermore, multi-site case studies aim to understand the context by providing in-depth description and analysis within sites and as well by comparing data between sites (Herriott and Firestone cited in Jenkins et al., 2018). However, as noted by Louis (1982) most multi-site case studies usually give little attention to the aspect of comparing themes between sites, while focusing more on the site-specific themes or knowledge. Therefore, a multi-site case study was adopted as a methodology or design in this piece of work not only to address each site-specific themes but also to compare qualitative data or themes across multiple sites in order to identify the similarities and differences between the sites explored (Jenkins et al., 2018). Thus, this will assist to maximise the applicability of the findings on the role of embedded research in co-producing public health knowledge in non-clinical settings in other similar settings.

One of the advantages of qualitative research is the ability to generate rich in-depth data or knowledge that can serve as a basis for health and social practices being effective and relevant to the contexts they are applied to (Polit and Beck, 2010). Hence, it is essential that the context explored in qualitative research is similar to the context to which it is to be applied, otherwise, this might result in inappropriateness and therefore, not producing positive or desired outcomes (Miller and Shinn, 2005). To tackle the challenge of inappropriateness in the context in which qualitative research would be applied, multi-site qualitative case studies are used to explore a subject of interest in more than one context to increase the applicability of the findings in various sites (Jenkins et al., 2018). Herriot and Firestone cited in Yin (1994) added that although adopting multi-case designs could be time-consuming and need larger resources, it is more thorough and robust than single-case designs.

Having discussed the theoretical foundation of the methodology chosen in this qualitative study, the following sections detail the methods used in this study.

### 2.2.5 Methods: Choosing Specific Qualitative Methods

The following section details this study's fieldwork settings, study population, sampling method, recruitment strategy, and data collection methods. It also includes data analysis methods, quality assurance, and ethics.

#### 2.2.5.1 Case Studies Sites

In England, the responsibility for public health was moved from the National Health Service (NHS) to LAs in 2013 (Buck, 2020; The King's fund, 2015). This reform led to the establishment of PHE, which focuses on the protection and improvement of the population's health and well-being and seeks to reduce health inequalities at every level (The King's fund, 2015). This qualitative study explored how two LAs in the North East of England are bridging the gap between research evidence and its implementation in public health practice by using embedded research to realise public health goals.

The names of the two LAs explored in this qualitative study were not mentioned so as not to identify either them or the people involved in the interviews. Therefore, they were identified using codes ('site one' and 'site two'). Public health operates in a diverse range of non-clinical settings. Consequently, in addition to the two LAs, one secondary school (site three), and one sports organisation (site four) were also explored. All the four sites were selected using snowball sampling as detailed in section 2.2.5.3. The researcher had no previous involvement in the embedded research projects undergone or ongoing in the four sites. The sites all feature embedded researchers who are co-producing/have co-produced knowledge with public health practitioners, and/or other stakeholders. Therefore, the embedded research projects are either completed or ongoing in the sites. This study sought to investigate the role of embedded researchers located in the sites. These endeavours were undertaken to understand how the gap between public health research evidence and its implementation could be bridged by exploring the themes that emerged from the systematic review.

#### 2.2.5.2 Population

As qualitative research focuses on depth of information as well as the disparities in the experiences of study participants, the sample size of most qualitative studies is usually

small and is designed and organised to obtain rich data (Hennink et al., 2011; Brannen, 2005). To this end, the proposed sample size for this present study was 16 participants across the sites, but 17 participants participated in the study. To increase the confidence in the results of this qualitative research, data triangulation was adopted, which involves the collection of data regarding a phenomenon of interest from more than one group of people (Denzin, 1978). Consequently, it was planned that four embedded researchers each from the four case studies sites would be interviewed, and at least three public health practitioners or other stakeholders involved in the embedded research project would be interviewed from each site to explore the themes that emerged from the systematic review. This study sought to be flexible with its sample size as what was planned at each site could be different depending on the saturation point—the point at which nothing new emerges from the collected data (Glaser and Strauss, cited in Hennink et al., 2011), and the willingness of potential participants to participate in the study. Therefore, a sampling framework was conducted to guide through the process of recruitment and selection (Table 3).

**Table 3: Proposed Participant Sampling Framework for the Qualitative Fieldwork**

Potential Case Studies Sites	Number of Participants from Two Local Authorities	Number of Participants from a School	Number of Participants from a sport organisation
<b>Job Role</b>			
Embedded researchers	2	1	1
Public Health Practitioners	6	N/A	3
Secondary School Teachers	N/A	1	N/A
Secondary School Students	N/A	2	N/A
<b>Embedded Research Sites</b>			
Site One (LA1)	4 (1 ER + 3 PHPs)	N/A	N/A
Site Two (LA2)	4 (1 ER + 3 PHPs)	N/A	N/A
Site Three (School)	N/A	4 (1 ER+ 1 School teacher +2 students)	N/A
Site Four (Sport org.)	N/A	N/A	4 (1 ER + 3 PHPs)
<b>Total Number of interviews</b>	<b>8</b>	<b>4</b>	<b>4</b>

*ER- Embedded Researcher, PHPs- Public Health Practitioners, N/A- Not Applicable.*

### 2.2.5.3 Sampling

In qualitative research, various types of non-probability sampling are used to recruit participants (DeCarlo, 2018). Purposive non-probability sampling is usually adopted to identify and select participants that have the potential to provide rich and in-depth information regarding the phenomenon of interest (Lawrence et al., 2015; Yin, 2011). Purposive non-probability sampling can be seen as being biased and not a true representation of the target population (Trochim, 2020). However, qualitative research

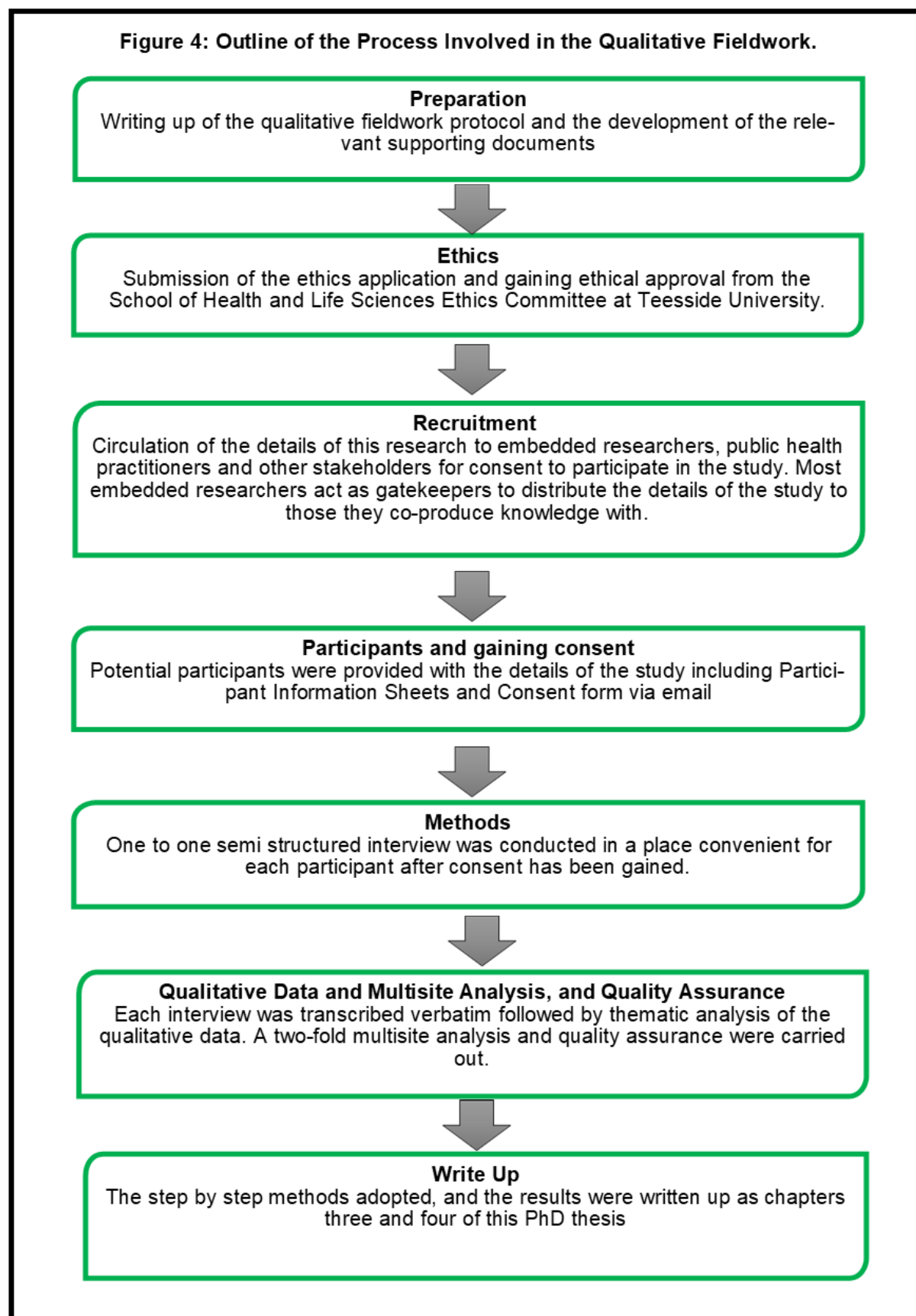


does not seek to generalise its findings to a larger population in the way that quantitative research does (Lawrence et al., 2015; Polit and Beck, 2010). Since qualitative research strives for transferability and applicability to other similar settings rather than generalisability (Noble and Smith, 2015; Leung, 2015), non-probability sampling was deemed the appropriate method for recruiting the participants in this study. This study was not designed to yield generalisable results. Rather it was designed to help develop a toolkit that could be applied to other similar embedded research sites in public health settings. To achieve this goal, this qualitative fieldwork used a purposive non-probability sampling to recruit public health embedded researchers, public health practitioners, and other stakeholders (teachers and students).

Although there are different types of purposive sampling techniques (Hennink et al., 2011), snowball sampling was used in this study to recruit participants. Snowball sampling is best suited to situations where it can be difficult to locate or recruit participants (Hennink et al., 2011; Voicu, 2011). As such, it relies on referrals of participants who are likely to generate useful data (Noy, 2008). Requests for participants who could volunteer to be part of the study were sent out as detailed in section 2.2.5.4. The participants that volunteered to take part in this research were asked to assist in the search for participants by circulating the study's details to those who might meet the study's criteria and would be willing to take part in the study. Potential participants were then assessed for eligibility before being interviewed. All the participants that volunteered to participate in this study did without any form of payment.

As noted by Hennink et al. (2011), one of the shortcomings of snowball sampling is that it is based on social networks or referrals. In such situations, it is possible that the majority of the participants may come from the same social network. To overcome this shortcoming, four different case studies sites were explored in this qualitative study to widen the range of recruitable participants. Hennink et al. (2011) have noted that using snowball sampling as a recruitment strategy in qualitative research can be a slow process, as it is based on referrals, which means that potential participants are identified one after the other. Nevertheless, as semi-structured interviews allow the analysis of interview data before interviewing the next participant (DiCicco and

Crabtree, 2006), in this study, interviews were transcribed while waiting for a referral for a new potential participant. Figure 3 outlines the process used to conduct this study's qualitative fieldwork.

**Figure 3: Outline of the Process Involved in the Qualitative Fieldwork**

#### 2.2.5.4. Participant Recruitment

Multi-site case study was used as a methodological approach for this study. According to Stake (2006), the advantages of a multi-site case study are limited if less than four cases are explored. However, if there are more than ten case studies, there may be more data that might be difficult to comprehend (Eisenhardt, 1989). The ideal sample size in a multi-site case study is between four to ten (Josée and Gérald, 2001). In light of these statements, four case studies sites were investigated in this study.

#### *Participant inclusion criteria*

- Embedded researcher: the criteria for an embedded researcher was adopted to differentiate embedded researchers from other types of researchers. As discussed in chapter one, an embedded researcher must either be located in or spend time in the host organisation. They must bring new skills to the host organisation and be involved in the negotiation of knowledge (embedded research, no date).
- Public health practitioner: public health practitioners who are currently working with embedded researchers or who have worked with embedded researchers in the past.
- Other stakeholders: these include individuals involved in embedded research initiatives such as service users, service providers, students, and teachers.

#### *Participant exclusion criteria*

- Public health researchers who were not located in the host organisation and/or did not spend time with the host organisation.
- Public health researchers who were not involved in the co-production of public health knowledge.
- Public health practitioners who were not involved in the co-production of public health knowledge.
- Other stakeholders (teachers and students) who were less than 14 years old during the period of the study.

### ***Recruitment strategy***

The details of this study were circulated to potential participants via relevant professional contacts and networks, including those identified by the Director of Studies associated with this study in November 2019. The initial email sent out contained both the consent form and the Participant Information Sheet (Appendices 14,15, and 18). In cases where there was no response, a reminder email was sent out two weeks after the initial email (Appendix 19), and another reminder was sent out one month after the initial email. After the second reminder email, failure to respond was understood as a selection of 'decline to participate'. Potential participants who were willing to take part in the study contacted the researcher directly to show their interest. Arrangements were then made to answer any questions regarding the study and to set up an interview.

#### **2.2.5.5 Methods of Data Collection: One-to-One Semi-structured Interviews**

##### ***Semi-structured interviews***

Qualitative research involves the collection of information from participants which conveys each participant's point of view. This information is then transcribed and analysed in order to create a conceptual framework representing the views, beliefs, and experiences of the participants regarding the issues under consideration (Greenfield et al., 2007; Litva and Jacoby, 2002). Many qualitative research methods—conducting interviews being one of the most common—have been created to use textual interpretation to develop an in-depth understanding of complex issues (Creswell, 2007).

Interviews can be used to create an in-depth understanding of social phenomena than that which can be achieved from purely quantitative methods (Silverman, 2000). Furthermore, interviews are most suitable for collecting information in situations where either nothing or very little is known of the phenomenon of interest (Gill et al., 2008). Therefore, interviews were ideal for generating the kind of qualitative information needed for this study, which seeks to develop detailed insights regarding the themes that emerged from the systematic review on the role of embedded research in the co-production of public health knowledge in non-clinical settings.

Gill et al. (2008) have stated that there are three types of interviews: structured, unstructured, and semi-structured interviews. Structured interviews are administered verbally with predetermined questions. Responses from participants are, therefore, limited. This makes this type of interview inappropriate for in-depth studies (Gill et al., 2008). In an unstructured interview, there are no predetermined questions or answers. The unstructured interview relies on the social interactions between the participant and the interviewer (Patton, 2002; Gill et al., 2008). This kind of interview is useful when either little or nothing is known about the subject, and/or an understanding of significant 'depth' of the subject is sought. Unstructured interviews allow the respondents to express themselves (Corbin and Morse, 2003), and the researcher has minimal control of the participant. They are generally used when conducting long-term fieldwork (Corbin and Morse, 2003). Therefore, unstructured interviews were not adopted in this PhD as the qualitative fieldwork was not a long-term project.

Semi-structured interviews are classified as in-depth interviews where pre-set open-ended questions are presented to the participant (Corbin and Strauss, 2008). The interviewer uses key questions to define the areas that need to be investigated and also has room to diverge into new ideas and topics (Britten, 1999). They are frequently employed by professional healthcare researchers (Jamshed, 2014). Gill et al. (2008) explain that the semi-structured interview format is frequently used in healthcare settings because it provides guidance regarding what to ask the participants and is therefore helpful when preparing for the interview. The approach of the semi-structured interview is much more flexible than that of the structured interview, as it gives participants the freedom to express their views in their own way (Cohen and Crabtree, 2008). Also, Gill et al. (2008) have explained that semi-structured interviews allow for an influx of information that is important and not previously thought of by either the respondent or the researcher.

Semi-structured interviews are helpful in situations where it is difficult to interview participants more than once which was the case with the participants in this study, particularly in light of the COVID-19 pandemic. For this reason, they can be conducted as a one-off or if there are changes over time, they could be repeated with either an individual or a group (Cohen and Crabtree, 2008). Semi-structured interviews can range in duration from approximately 30 minutes to an hour or even longer (DiCicco-

Bloom and Crabtree, 2006; May, 1991). With busy public health practitioners and researchers, there may only be one opportunity to conduct an interview. To this end, semi-structured interviews were adopted in this qualitative study. However, to ensure the accurate capture of interview data to enhance the transcription process, all the semi-structured interviews conducted in this PhD were audio-recorded (Pontin, 2000; Jamshed, 2014).

### *Developing the semi-structured interview schedules*

Semi-structured interviews employ the use of interview schedules (Kallio et al., 2016). Relevant interview questions that could be used to explore the themes that emerged from the systematic review were carefully planned and prepared in advance. The interview schedule was adjusted after the first interview to ensure a successful fit with the aims of the study (Hennink et al., 2011). Since there were three categories of interview participants—(ERs) embedded researchers, (PHPs) public health practitioners, and (STs) other stakeholders (students and teachers)—three sets of interviews were prepared. Although the interview questions were nearly the same for each category of participants, some of the interview questions differed in the way they were structured. Here is an example of how a question was worded differently depending on the participant: (ERs) *Can you cite an example where you have built practitioners and other stakeholders' confidence to conduct their own research?* (PHPs and STs) *Can you cite an example where an embedded researcher has built your confidence to conduct your own research?*

The major aim of the qualitative research phase of this PhD was to explore the themes that emerged from the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings. Figure 4 shows the themes that emerged from the systematic review, and Table 4 shows the themes that emerged from the systematic review and their corresponding interview questions.

**Figure 4: The Themes that Emerged from the Systematic Review (Chapters two and three)**





**Table 4: The Development of the Interview Questions as informed by the Systematic Review Findings**

The Role of Embedded Research in Co-producing Public Health Knowledge in Non-clinical Settings	Matching Interview Question
Informing practice	<p>How do you inform practice with research evidence?            Can you think of any changes in practice/policy as a result of research evidence being used?</p> <p><b>Prompt</b> – What role did you play? Who was involved? What changed? How? For who?</p>
Building mutually beneficial relationships	<p>Do you think building mutually beneficial relationships with the host organisation staff is important to the success of an embedded research project? If yes, Why?</p> <p>How do you build relationships with the host organisation's staff?</p>
Building capacity	<p>Can you cite an example of where you have built practitioners' and other stakeholders' confidence in conducting their own research?</p>
Becoming part of the organisation	<p>How do you manage the dual affiliation? <b>Prompt-</b> what are the benefits (What has helped?) and also what are the challenges?</p>
Critical reflection	<p>How often do you reflect on your role? <b>Prompt-</b> To know what works and what needs to be improved? Why is this important?</p>
Managing funds and providing evidence for reports and future funding applications	<p>Does your role require managing research funds?  <b>Prompts-</b> If yes, how do you manage this?</p>

Other interview questions were:

**Questions around role identification and background information about the participant:** These questions seek to understand and gather information about the participant and as well to have a general knowledge about the embedded research initiative. **(Eight questions)**. This was to address objective three - to identify the role of embedded research in co-producing public health knowledge in non-clinical settings.

**Questions around the embedded research initiatives:** These questions were asked to get specific and more in-depth information about the embedded research initiative **(Nine questions)**. This was to address objective four - to develop an understanding of how the role of embedded research could bridge the gap between research evidence and its implementation in public health practice.

**A question around the development of the embedded research model:** Participants' opinions were asked regarding the development of a toolkit on the role of embedded research in co-producing public health knowledge in non-clinical settings **(One question)**. This was to address objective five - to inform the development of the proposed embedded research role toolkit

The use of prompts in interviews assists the interviewer to extract more information from the interviewee (Hennink et al., 2011; DeJonckheere and Vanghn, 2018). Therefore, while some prompts were used as clarification probe to bring clarity to some questions, some prompts were used to guide the participant and as well to explore the question asked more, so that the participant could further explain to ensure that the questions were well addressed. For example, participants were asked for the role of the embedded researcher working in their organisation? This question was followed by using prompts such as "how does the embedded researcher carry out his/her work in the organisation? Full copies of the interview schedules are in Appendices 20, 21, and 22.

### ***Participant demographics form***

Marshall (1996) states that the collection of participants' demographic characteristics enables researchers to determine the suitability of each participant for the study.

Connelly (2013) states that, in addition to the descriptions of the setting and the recruitment strategy, a description of the participants is essential when conducting qualitative research. The inclusion of the participants' demographic data helps avoid the assumption that the phenomenon of interest is understood as being the same for all the participants, irrespective of their demographic characteristics. Beins (2009) also confirms that demographic data helps researchers understand how demographics influence participants' views and experiences.

Beins (2009) notes that demographic data improves a study's comparability. Therefore, this study considered demographic categories such as age group, gender, years of experience, and level of education. A participant's age group and gender are likely to influence how they build relationships with other people. Education and experience could impact on how keen a participant can be in the use of research evidence in practice. To generate demographic information, each participant was asked to complete a demographic form. The form can be found in Appendix 16, and the information generated by the form can be found in chapter four.

### ***Data collection***

Data was collected between November 2019 and April 2020. To ensure the comfort of the participants, they were offered various interview types, including face-to-face, telephone, and Skype-based interviews. Most interviews conducted before the COVID-19 pandemic were face-to-face. All the interviews conducted during the pandemic (March 2020 and onwards) were either Skype or telephone-based, as advised by the ethics department at Teesside University and as per the requirements of the interviewees' workplaces. The COVID-19 pandemic did, of course, impact the data collection phase, this is discussed in the reflexive account (Section 2.4). Before each interview, each participant was asked to complete two copies of the consent form, one for their own records and one for the researcher. Following each interview, a reflective note was taken to identify what went well and what could be done differently in the next interview (Reflexive account – section 2.4). A summary of each interview was noted in a research diary for reference. Details noted included where each interview took place, the date of the interview, and the length of the interview and how the interviewee responded to questions.

### 2.2.5.6 Qualitative Data Analysis

After transcribing the semi-structured interviews verbatim, the data was analysed. Although there are different techniques for analysing qualitative data, including template analysis (King and Brooks, 2014) and framework analysis (Ritchie and Spencer, 1994), a thematic analysis method defined by Braun and Clarke (2006) was adopted in this study. Thematic analysis was used as it is not restricted to any particular theoretical or epistemological perspective. Rather, it is a flexible method that can be used to identify themes and patterns in qualitative data (Clarke and Braun, 2013; Moira and Brid, 2017). Boyatzis (1998) and Ryan and Bernard (2000) have argued that though thematic analysis cannot be referred to as a method, it can be regarded as a tool that can be used in various theoretical contexts, including grounded theory. Braun and Clarke (2006) maintain that thematic analysis is a method for analysing qualitative data. According to Clarke and Braun (2013), the major limitation of thematic analysis is that the data can be viewed as summarised and arranged rather than analysed when interview questions are used as themes. Therefore, when analysing the qualitative data generated for this study, both deductive and inductive approaches were adopted to allow the use of both existing and new themes.

Deductive analysis involves approaching transcripts via existing themes (Boyatzis, 1988; Roberts et al., 2019). In the case of this study, the existing themes were the six themes that emerged from the systematic review. Inductive analysis involves allowing new themes besides the preconceived ones to emerge from the coding of the interviews (Caulfield, 2020; Boyatzis, 1998). In this study, the new themes were the themes that were not present in the systematic review but in the qualitative fieldwork. Thus, this makes the combination of the two approaches suitable for this PhD. The deductive and inductive analysis were conducted concurrently by coding statements that were related to the themes that emerged from the systematic review, and at the same time, relevant statements that answered the phenomena of interest of this study but that were not included in the systematic review were also coded. The dualistic techniques of deductive and inductive thematic analysis were adopted to increase the rigour of this qualitative analysis and ensures a more thorough analysis (Roberts et al., 2019). Braun and Clarke's (2006) six stages of thematic analysis using both deductive and inductive approaches were outlined in the following sub-sections.

### *Familiarisation with data*

Interview transcripts were read several times and notes were jotted down to make sure each interview's contents, breadth, and depth, were clearly understood. Meanings were searched for while keeping in mind that the searching process involves deductive and inductive approaches.

### *Generating initial codes*

Following the familiarisation phase, the 'Review' feature in Microsoft Word was used to highlight codes identified during the qualitative thematic analysis (Knoch, 2020). Codes were selected based on their connection to the research question/objectives. Participants' words and/or statements were coded based on whether they were either related or similar to the existing themes or the phenomenon of interest as well as whether a participant emphasised the importance of a statement or repeated a statement more than once. To avoid bias, a large number of statements or phenomena were coded at the initial stage. Each code and its corresponding section of the transcript was then compiled.

### *Searching for themes*

This stage entails collecting codes, organising them into prospective themes, and grouping all data pertaining to each prospective theme. Codes are not the same as themes, as themes are more compound (Caulfield, 2020). In this study, this step was performed using tables, and mind-maps (chapter four, and appendices 24 and 25).

### *Reviewing themes*

This stage involved verifying that each theme is related to the corresponding data. In this study, this was done in order to produce a definitive 'thematic map' and table for the data analysis. The coded data was reviewed to ensure that the map and table accurately showed the meanings evident in the transcripts. Two criteria were adopted for assessing themes according to Patton (1990). Internal homogeneity is used to verify that the coded data matched and/or corresponded with the theme in question (Patton, 1990; Braun and Clarke, 2006). Therefore, in this study, each theme and corresponding data was read and reviewed several times until internal homogeneity was achieved. External homogeneity was used to ascertain that the themes were

different from one another (Braun and Clarke, 2006; Patton, 1990). The themes generated from this qualitative fieldwork were read and reviewed several times to ensure each theme differs from one another. Therefore, themes were merged based on similarities. Before generating the final thematic map and table, the table and map (Appendices 24 and 25) were reviewed and adjusted until the requirements of the criteria were met.

### ***Defining and naming themes***

This stage entails critically looking at what each of the themes pertains to and what areas of the data are reflected by each theme. Each theme's scope and contents are explained in a concise manner further on in the study (chapter four).

### ***Producing the findings***

This step followed the exploration of the themes that emerged. In this step, the qualitative outcomes were organised against the themes, and the results of the qualitative data analysis were presented (chapter four).

## **2.2.6 Quality Assurance**

Trustworthiness in qualitative research refers to the extent to which the findings from qualitative research can be trusted (Lincoln and Guba, 1985). Though there are other models of trustworthiness, this study applied the most popular criteria or model of trustworthiness, Lincoln and Guba's (1985) criteria for trustworthiness. These criteria consist of four factors: credibility, dependability, transferability, and confirmability.

### **2.2.6.1 Credibility**

Credibility in qualitative research is similar to internal validity in quantitative research (Lincoln and Guba, 1985; Shenton, 2004). Long and Johnson (2000) suggest that to ensure the credibility of qualitative research, the actual description of the phenomenon being studied must be correctly presented. Shenton (2004) mentions that the use of triangulation, which Denzin (1978) defines as the use of different sources to collect data on the same phenomenon of interest, can be used to ensure the credibility of qualitative research. Therefore, different types of triangulations were used in this study.

Firstly, data triangulation which involves comparing data regarding the same phenomenon from different participants to ascertain the representations of different views (Slevin, 2002; Shenton, 2004; Carter et al., 2014) was used in this study. Data triangulation was achieved by using three categories of participants: embedded researchers, public health practitioners, and other stakeholders (teachers and students). The perspectives of these three categories of participants were captured and compared before conclusions regarding the emerged themes were drawn. Secondly, site triangulation according to Shenton (2004) was adopted in this study, as such, four different case studies sites were used. Methodological triangulation via the use of a focus group was planned so that this study would not have to rely solely on semi-structured interviews. However, as the data collection phase of this study occurred during the COVID-19 pandemic, this aspect of the study was removed.

As one of the major drawbacks of using semi-structured interviews to generate qualitative data is that the information obtained may be biased due to human nature and individual perceptions, many of the opinions of participants cannot be verified as being either true or false (Denzin and Lincoln, 2008). To combat these issues, the participants were informed before their interviews about the details of the study. They were provided with a Participant Information Sheet that included an ethical principle assurance covering issues relating to confidentiality and anonymity (Britten, 1999). This was done to increase the likelihood that the participants would offer honest responses during their interviews.

#### **2.2.6.2 Dependability**

According to Lincoln and Guba (1985), dependability is the constancy of a study's findings over time. Shenton (2004) explains that dependability in qualitative research can be attained if the researcher provides a thorough audit or account of every process undertaken so that other researchers can repeat the study. Therefore, every step taken in this qualitative study was clearly outlined from the study design to the data analysis. Also, a reflexive account which is a self-evaluation of subjectivity is presented in chapter seven of this PhD work to improve the dependability of this study by providing this study's process with transparency (Tong et al., 2007; Malterud, 2001).



### 2.2.6.3 Transferability

Transferability—or the extent to which research findings can be either transferred or made relevant to other similar settings (Merriam, 2009)—ensures the trustworthiness of qualitative research (Lincoln and Guba, 1985). Transferability demands a thick description of the setting and/or the context of the research. In this study, although the actual names of the embedded research sites explored were not disclosed for ethical reasons, a thick description of the settings was provided in chapter four to increase transferability. Also, the demographic details of the participants were documented to establish the situation/context/settings of the study. Demographic information is detailed in chapter four.

According to Shenton (2004), in order to increase transferability in a qualitative study, certain details of the study must be provided, including the number of sites investigated, the inclusion and exclusion criteria, the sample size, the data collection methods, and details regarding the period of time over which the qualitative data was collected from the participants. To ensure the applicability or transferability of the findings from this study to other settings, detailed information was therefore provided regarding all these factors in this chapter.

### 2.2.6.4 Confirmability

One of the key criteria of trustworthiness in qualitative research, confirmability deals with the extent to which research data can be credited by other researchers (Lincoln and Guba, 1985). Confirmability ensures that the data collected is actually derived from the study and is not a result of the researcher's biases. Confirmability can be achieved by acknowledging the limitations of a study and their possible effect on a study's conclusions. This study's key limitation is that the data collection and analysis were done by one researcher (AA). However, the 'audit trail', or the process by which the data was collected and analysed, was described in detail to ensure confirmability. Also, direct quotations from the participants were included in the results chapter to increase confirmability.

To ensure a full account of this qualitative study, an established Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist was used (Tong et al., 2007). COREQ is a 32-item checklist used for interviews and focus groups. The checklist



covers all aspects of the research process, including the methods adopted, the context of the study, results, data analysis, and interpretations. A copy of the COREQ checklist is included in Appendix 23.

### **2.2.7 Ethics**

Ethical approval was obtained from the Teesside University School of Health and Life Sciences Research Governance and Ethics Committee in November 2019 (Appendix 13 and 17). The major ethical considerations to mitigate the risks associated with this qualitative phase are outlined below.

#### **2.2.7.1 Confidentiality**

Qualitative research involves the gathering of a huge amount of data regarding people's views, feelings, behaviour, and experiences (Hennink et al., 2011). As such, if participants are identifiable by other members of the public it could result to harm to the participants or to the social group they belong to (Beauchamp and Childress, 1985). Therefore, Richards and Schwartz (2002) advised that confidentiality regarding the information given by the participants must be paramount. To this end, practical measures were put in place to hide the identity of the participants. The researcher working on this study offered to book rooms at the University or another place if participants prefer not to be interviewed at their place of work to ensure confidentiality. Some interviews were conducted online due to the COVID-19 pandemic, as such, these also enhance comfortability and confidentiality as participants were interviewed from their homes (Edwards and Holland, 2013) rather than their place of work.

Also, the participant information sheet made it clear that participants are not allowed to name any specific people nor give any information that could render anyone identifiable and if they do, all the data collected from them will be destroyed and are ineligible and they were reminded of this prior to the interview. Furthermore, to reduce the risk associated with confidentiality, anonymisation of participants was maintained in many ways such as the job title and the name of the organisation where the participants work was not included to conceal the identity of the participants. Also, the participants' names were not identifiable on the recordings and this piece of work. They were assigned an individual code number that was not known or accessible by anyone except the research team. These were held securely in a locked cabinet at Teesside University before the lockdown. However, due to the COVID-19 pandemic,

all data was transferred and kept in a safe locked cabinet in the researcher's study room at home for the period of this study.

### 2.2.7.2 Consent

Gaining consent from participants is required in all studies that include identifiable individuals apart from some situations whereby the ethics committee assesses that consent is impossible and when the advantages of the study are more than the potential risks (Richards and Schwartz, 2002). Therefore, to mitigate this risk in the present study, consent was gained from the participants at the beginning of the interview. Furthermore, the Participation Information Sheet details the purpose and the scope of the study, the types of questions that are likely to be asked, the method of anonymisation, and how the data will be used. In addition, the Participant Information Sheet states that participants are free to withdraw from the interview at any time and they were reminded of this prior to the interview.

### 2.2.7.3 Data Storage and Management

As the qualitative data collection process seeks confidentiality and anonymity, foolproof strategies were necessary to achieve these (Richards and Schwartz, 2002). Therefore, the storage of all data collected from participants was strictly done according to the *Data Protection Act* 1998. Hence, the assigned codes were destroyed after two weeks, and after the final submission of this work, the data will be archived for ten years and then destroyed.

### 2.2.8 Strengths and Limitations of Employing a Qualitative Research Method

As earlier discussed, the adoption of qualitative research to explore the themes that emerged from the systematic review was a suitable and appropriate approach. However, there were strengths and limitations associated with the use of this approach in this PhD work.

Qualitative research is used to develop an understanding by collecting in-depth and detailed information on a phenomenon of interest; thus, this results in the generation of a rich and robust but large amount of data (Hennink et al., 2011). As such, the process of collecting data and analysing data can be time-consuming and therefore labour intensive (Elo and Kyngäs, 2008). To tackle this, as this piece of work is part of a PhD, and all the data was collected, transcribed, and analysed by the researcher

(AA), enough time was allocated to the qualitative research phase and the timeline on the Gantt chart was regularly adjusted to suit this purpose. For this reason, the data collection started in November 2019 and ended with data analysis in July 2020, thus, nine months were allocated for the qualitative research phase of this PhD.

Another limitation of this piece of work, being qualitative research, was subjectivity. The information provided by the participants was based on their point of view. Hence, it might be difficult to objectively verify the qualitative information provided to ensure that accurate information was provided by the participant regarding the phenomenon of interest. Nevertheless, some practical measures were undertaken to ensure the credibility of this work. As earlier discussed, data triangulation and site triangulation according to Denzin (1978) were adopted in this study. These were done to increase the confidence in the outcome of the qualitative research phase regarding the themes that emerged from the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings.

A sample size of 17 participants was recruited for this study, although the sample size would have been larger than 17 but for the COVID-19 pandemic. To this end, the findings from this qualitative study could be relatable, applicable, and transferred to a similar non-clinical setting, as there was a thick description of contexts explored to enhance the transferability of the findings to other similar settings. Additionally, although adopting snowball sampling involves investing time in waiting for a response from those that are referred, the snowball sampling adopted in this study ensures the accuracy in recruiting those who can provide adequate information (Lawrence et al., 2015; Yin, 2011) regarding the topic.

### 2.2.9 Section Summary

This chapter has provided details on the qualitative inquiry that was undertaken. The following are the outline of the summary:

- A multi-site case study design was used as a methodological approach to explore the themes that emerged from the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings.
- Semi-structured interviews were conducted with three categories of participants to explore the themes that emerged from the systematic review on the topic.

- Semi-structured interviews were adopted for its strength as it is flexible and appropriate to use when it is unlikely to have the chance to interview the participant more than once. Also, it provides individual participants' views useful for exploratory and explanatory purposes to answer this qualitative study's aims and objectives.
- Snowball sampling which is a type of purposive sampling was adopted to recruit appropriate participants for this study.
- Thematic data analysis, using both deductive and inductive approaches was adopted to analyse the qualitative data.
- Quality assurance on the credibility, dependability, transferability, and confirmability was carried out using Lincoln and Guba's (1985) model of trustworthiness, also the COREQ 32-item checklist (Tong et al., 2007) was used as a guide for reporting this qualitative study.

## 2.3 TRIANGULATION OF FINDINGS METHODS

### 2.3.1 Overview of the Triangulation of Findings Methods

Following the systematic review methods (section 2.1), and the qualitative fieldwork methods (section 2.2), this section provides the triangulation of findings methods. First, the aims and objectives, the rationale for triangulation, and methods are provided.

### 2.3.2 Aim

To triangulate and discuss the findings from the systematic review (chapters two and three) and the qualitative fieldwork (chapters two and four) on the role of embedded research in co-producing public health knowledge to bridge the gap between research evidence and its implementation in non-clinical settings.

### 2.3.3 Objectives

- To compare and contrast the findings of the systematic review (chapter three) and the qualitative fieldwork findings (chapter four).
- To discuss the overall outcome of the triangulation.
- To inform the development of a toolkit on the role of embedded research in co-producing public health knowledge to bridge the gap between research evidence and its implementation in non-clinical settings (chapter six).

### 2.3.4 Rationale for Conducting Triangulation

Farmer et al. (2006, p. 377) defined triangulation as “*a methodological approach that contributes to the validity of research results when multiple methods, sources, theories, and/or investigators are employed*”. Scholars have confirmed that in order to reduce bias, triangulation could be adopted by using different sources of data (Denzin, 2009; Jonsen and Jehn, 2009). Furthermore, the interpretation of research findings could be influenced by the researcher’s philosophies and values, therefore, viewing data and a phenomenon from different viewpoints could reduce bias and enhances the credibility and dependability of a study (Fusch, 2001; Fusch and Ness, 2015).

Triangulation originated from the arts of land surveying and navigation, and it implies a way of establishing the stance of a point by observing from two separate angles or points (Sharp, 1943). Triangulation as a methodological approach was firstly used in social sciences and health in 1959 (Campbell and Fiske, 1959). Since then, triangulation has been explored in various fields of study such as political science (Davies, 2001). In recent times, triangulation has gained popularity in the area of public health (Nakkash et al., 2003; Rutherford et al., 2010). Abir and Jaclene (2012) explored the triangulation of both qualitative and quantitative methods to investigate the adjustment made by the individuals who moved to retirement areas. They found that the adoption of triangulation could improve the analysis of data and the interpretation of results. They further explained that the use of more than a source of data expands the understanding of diverse issues associated with the phenomenon of interest. This is similar to Farmer et al. (2006) who stated that the adoption of triangulation could bring about an understanding of complex health problems in diverse ways, and as such, it provides a comprehensive picture of the phenomenon of interest.

Furthermore, Erzerberger and Prein (1997) explained that the main functions of triangulation are to study complementarity, convergence, and dissonance. To this end, the three functions work toward increasing the trustworthiness (validity) of the research. This, therefore, increases the dependability and credibility of the research findings and interpretations of the results (Lincoln and Guba, 1985). Hence, different types of methods could be adopted to verify the research findings. The assumption

underpinning triangulation is that the research findings' validity is increased as various approaches are employed on the same phenomenon of interest (Erzerberger and Prein, 1997). Farmer et al. (2006) added that using triangulation in research could provide the opportunity to reach saturation of data where a complete picture of the phenomenon of interest is achieved. This agrees with what Fielding and Fielding (1986) said that through establishing the complementarity of different methods to investigate a phenomenon of interest, the understanding of such phenomenon of interest is enhanced. Erzerberger and Prein (1997) explained further that while adopting triangulation in research, it might result in dissonance in the research results as a result of conflicts or disagreement in the findings from different sources. As such, this could lead to the dismissal of earlier or initial assumptions or theories. However, Miles and Huberman (1994) said that dissonant results could be beneficial if they are used as a point of dismissal for the 'birth' and understanding of a new theory.

Triangulation could be a means to increase confidence in research findings and to reduce research bias (Murray, 1999). However, applying triangulation in research can be challenging, as the unit of analysis might not be congruent with the theoretical paradigm (Sim and Sharp, 1998). Nevertheless, irrespective of the challenges associated with the adoption of triangulation in research, it has the ability to increase the level of understanding around complex health and social problems by recognising that:

*“There is no longer one reality against which results can be verified or falsified, but that research is dealing with different versions of the world. Triangulation takes into account, that subjective knowledge and social interactions should be understood as parts of (social, local, institutional) contexts and on the historical backgrounds of those contexts” (Flick, 1992, p. 194).*

Denzin's approach to triangulation was adopted in this current piece of work as other approaches to triangulation seem to rebrand the original model from Denzin rather than creating different outcomes (Wilson, 2014; Humble, 2009). The four types of triangulations are methodological triangulation, data triangulation, theory triangulation, and investigator triangulation (Denzin, 1978). Dootson (1995) stated that the type of triangulation adopted in research is determined by the research question, and hence, should be congruent with the methodological paradigm that underpinned the research question. To this end, as the main aim of this PhD was to develop a toolkit on the topic,

methodological triangulation and data triangulation were explored as these were the two types of triangulations that are applicable and relevant to this PhD work.

#### **2.3.4.1 Methodological Triangulation**

Methodological triangulation is a type of triangulation that can occur between methods or within a method (Denzin, 1978). Methodological triangulation adopts more than one approach to investigate a phenomenon of interest (Casey and Murphy, 2009). Literature confirms that methodological triangulation could be useful in offering verification of research findings, more accurate data, improved validity and as well can provide a clearer understanding of the phenomenon of interest (Halcomb and Andrews, 2005; Foss and Ellefsen, 2002; Casey and Murphy, 2009). One of the challenges of adopting methodological triangulation in research is the use of wrong methods and failure to convey its application correctly (Oberst, 1993). However, this challenge can be overcome if there is a focused, appropriate, and concise research question (Casey and Murphy, 2009). Methodological triangulation can be challenging as it requires knowledge in methods or approaches used, however, the benefits of methodological triangulation outweigh the challenges.

In this study, methodological triangulation was adopted to triangulate the findings from a systematic review and a qualitative fieldwork on the role of embedded research in co-producing public health knowledge in non-clinical settings. Thus, knowledge was gained on how to conduct a systematic review and a qualitative fieldwork before they were adopted in this PhD.

#### **2.3.4.2 Data Triangulation in This Current Study**

According to Denzin (1978), data triangulation is where different sources of data are explored on the same phenomenon of interest to increase the validity of the research findings. To this end, data triangulation could involve the use of different categories of people, times, or space. According to Shenton (2004), site triangulation could minimise the impact which a peculiar characteristic of a site could have on the research. Shenton (2004) added that in a situation where the same results occur in various sites, this could increase the credibility of the results to the readers.

In the current study, data triangulation was adopted to explore the diverse perspectives of three categories of participants (embedded researchers, public health



practitioners, and other stakeholders/teachers/students) on the themes that emerged from the systematic review on the topic. Also, data was collected from four case studies sites (site triangulation).

### 2.3.5 Limitations of Triangulation

Exploring triangulation in research provides robustness and understanding of the phenomenon of interest (Heale and Forbes, 2013), however, like every research approach, triangulation has its own shortcomings. The adoption of triangulation could add to the complexity of the research process and as such, becomes time-demanding (Johnson et al., 2017). Also, as the exploration of triangulation in research could be complex, Noble and Heale (2019) recommended that triangulation should be carried out by skilled researchers. To this end, sufficient time was allocated to this triangulation phase.

### 2.3.6 Methods

This PhD work allowed the qualitative systematic review phase to inform the qualitative fieldwork phase. To this end, the themes that emerged from the systematic review on the topic form the basis of the interview schedules for the three categories of participants in the qualitative fieldwork in the four case studies sites. Based on the literature, Farmer et al's (2006) triangulation protocol has the most comprehensive explanation of how triangulation could be conducted (O'Cathain et al., 2010; Adam et al., 2015). More so, Adam et al. (2015) had successfully used Farmer et al's (2006) triangulation protocol to triangulate findings from a systematic review, qualitative study, and discreet choice experiment. To this end, Farmer et al's (2006) triangulation protocol was adopted in this current study.

The six steps triangulation protocol entails:

- (1) sorting,
- (2) convergence coding,
- (3) convergence assessment,
- (4) completeness assessment,
- (5) researcher comparison, and
- (6) feedback.



### 2.3.6.1 Sorting

This stage involves the categorisation of themes from each approach or method and as well from each data source based on similarity. The overall themes from the systematic review and the findings from the qualitative fieldwork were listed out. Each theme from the systematic review was merged with a similar theme from the qualitative study, to form one comprehensive theme for that category. The merged themes serve as the basis for the convergence coding matrix adopted to compare the findings from the systematic review and the qualitative fieldwork (Table 19). This process was repeated for the codes within each theme of each research component (Table 20).

### 2.3.6.2 Convergence Coding

The categories were 'convergence coded' to discover where there was dissonance (disagreement), silence, partial agreement, and agreement across the systematic review and the qualitative fieldwork in the four case studies sites (Tables 21 and 22). The convergence coding scheme according to Farmer et al. (2006), (Table 5) was adopted to determine the merging (convergence) of the findings from each component of the research based on meaning.

**Table 5: Farmer et al's (2006) Convergence Coding Scheme**

<b>Agreement</b>	There is full agreement between the sets of results on both elements of comparison (e.g., meaning and prominence are the same, provincial coverage and specific examples provided are the same).
<b>Partial agreement</b>	There is agreement on one but not both components (e.g., the meaning or prominence of themes is the same, provincial coverage or specific examples provided are the same).
<b>Silence</b>	One set of results covers the theme or example, whereas the other set of results is silent on the theme or example.
<b>Dissonance</b>	There is a disagreement between the sets of results on both elements of comparison (e.g., meaning and prominence are different; provincial coverage and specific examples provided are different).

### 2.3.6.3 Convergence Assessment

This step was to review the sections or categories to identify if there were disagreements with the other reviewers. In this present study, only the researcher (AA) reviewed the categories.

#### 2.3.6.4 Completeness Assessment

This stage conducted a comparison of the scope and nature of each method and categorise the main differences.

#### 2.3.6.5 Researcher Comparison

This step was to compare the outcomes with other reviewers or researchers involved in the triangulation. In this present study, only the researcher (AA), conducted the triangulation.

#### 2.3.6.6 Feedback

The steps undertaken to triangulate the findings were reviewed by the research team. In this present study, the whole triangulation process was conducted by the researcher (AA), however, the researcher's supervisors provided some feedback on the outcomes before the final write-up.

#### 2.3.7 Section Summary

This section has provided details on the triangulation of findings that was undertaken. The following are the outline of the summary:

- Farmer et al. (2006) triangulation protocol was adopted to triangulate the findings.
- The six themes from the systematic review: (1) building mutually beneficial relationships, (2) becoming part of the organisation to co-produce research, (3) building research capacity, (4) informing practice, (5) managing funds allocated to the research and providing evidence for reports and future funding applications, and (6) critical reflection, were triangulated with the four themes from the qualitative fieldwork: (1) building and maintaining relationships with practitioners and other stakeholders, (2) working together to produce research, (3) informing and developing future practice and research, and (4) keeping a critical reflection trajectory.
- The data collected from the three categories of participants (embedded researchers, public health practitioners, and other stakeholders) were triangulated.
- The data collected from the four case studies sites explored were triangulated.

## 2.4 REFLEXIVITY

### 2.4.1 Overview of the Section

This section provides a comprehensive reflexive account of the researcher throughout this PhD work while focusing more on the qualitative fieldwork because of its flexibility. First, the definition and the importance of reflexivity to this piece of work are provided. Then, a detailed influence of the researcher's epistemological stance, and demographic characteristics on the work are presented. Finally, the influence of the research on the researcher is provided.

### 2.4.2 Reflexivity and its Importance

Reflexivity is defined as a means of carrying out a constant internal conversation and critical self-appraisal of the stance of the researcher with clear and effective recognition of its impact on the research and its findings (Stronach et al., 2007; Bradbury-Jones, 2007). Berger (2015) explained that reflexivity involves acknowledging the impact or effect of the researcher on the research process including the data collection process and the interpretation given to the data collected. Therefore, reflexivity opposes objectivity, which is the idea that knowledge could be created without the influence of the researcher's beliefs, values, and personality on the researched (Payne and Payne, 2004). Scholars argued that reflexivity does not only involve the effect or impact of the researcher on the research (prospective reflexivity) but also involves the effect that the research has on the researcher (retrospective reflexivity) (Attia and Edge, 2017; Edge, 2011). In qualitative research, reflexivity is used to observe the pressure between the connection and the separation of the researcher and the researched which serves as a way to improve the rigour and ethics of the research (Pillow, 2003; Bradbury-Jones, 2007). Thus, reflexivity improves research quality by getting qualitative researchers to reflect on how their personality, experiences, knowledge, and attitudes may alter or assist the research process and its outcomes (Lietz et al., 2006).

To this end, acknowledging that my personal characteristics could influence the qualitative research phase of this PhD, I engaged in reflexivity throughout to improve the quality of this piece of work. Starting from the designing stage to the data analysis and presentation of findings stages by keeping a reflexive diary as mentioned in the

qualitative fieldwork methodology and methods section (Section 2.2). For instance, following each interview, I took a reflective notes to identify what was done well and what could be done differently next interview. The advantages of reflexivity include ensuring clarity, richness, trustworthiness, accountability, ethics, and personal development (Barbara, 2015). However, as providing a reflexive account could be challenging, Finlay (2002) cautioned that “*The researcher treads a cliff edge where it is all too easy to fall into an infinite regress of excessive self-analysis at the expense of focusing on the research participants*” (Finlay, 2002b, p. 532). As such, Pillow (2003) advised against extreme reflexivity, that is, it is unnecessary to endlessly talk about our position as qualitative researchers to avoid the aftereffects. Reflexivity was important in this particular project to transparently present the effect I had on the study, as well as the effect the study had on me. More so, my preconception on the topic and most especially, my personal characteristics could influence the research process including the recruitment, the data collection, and the data analysis phase. However, as suggested by Pillow (2003), I will avoid providing an endless account of my position by presenting a specific reflective account.

#### 2.4.3 Reflexive Account in Qualitative Fieldwork

According to Barbara (2015), the position of reflexivity in a study is determined by the epistemological stance underpinning such study. Within a positivist viewpoint, the effect of the researcher is mostly referred to as a methodological issue, and as such, the more thoroughly this effect is reduced, the better the quality of such study. On the other hand, within an interpretivist viewpoint, the influence of a researcher cannot be eliminated from the research (Finlay, 2002b; Lynch, 2000). Thus, knowledge is created by both the researcher and the researched, as opposed to the belief that knowledge is waiting to be discovered. As subjectivity has been identified as one of the limitations of qualitative studies, it was important for me to transparently provide the process undertaken in the study to increase its dependability (Tong et al., 2007; Malterud, 2001). More so, Jootun et al. (2009) maintained that the extent of rigour in qualitative research is the transparency by which subjectivity including personal and relational subjectivity has been acknowledged, and not how they are controlled. Hence, as an interpretivist who believes that knowledge is created by the interaction between the researcher and the researched, it was essential to transparently provide my reflexive account of the research process to ensure the rigour of this piece of work.

In contrast to objectivity, qualitative researchers have confirmed that the researcher's stance or positionality including demographic characteristics such as belief, race, and gender could affect the research process and the interpretation of results (Bourke, 2014; Berger, 2015; Hamzeh and Oliver, 2010; Bradbury-Jones, 2007; Hardy et al., 2001). Berger (2015) pointed out that the demographic characteristics of a researcher might determine the extent or the degree of access that a researcher has to participants. For example, based on studies, individuals seem to move toward or get attracted to people that have similar characteristics as them (Fries-Britt and Turner, 2001; Chang, 2002). To this end, participants might be happy to talk about their experiences with a researcher that shares the same belief or is of the same race as them. Kacen and Chaitin (2006) added that the researcher's background could impact how the researcher constructs the world, asks questions, and concludes the research. Hence, the influence that my demographic characteristics could have on this study, and the effect the study had on me will be discussed further in this reflexive account.

#### **2.4.4 Prospective and Retrospective Reflexivity**

I am an African, married, Christian woman, and a mother of two young children. I grew up in Southwestern Nigeria. I am not the first in my family to earn a master's degree, but I am the first to study for a PhD and to do so in a developed nation. I earned my BSc in Biological Science and MSc in Environmental Microbiology at Nigerian Universities, after which I joined my husband in the UK about 10 years ago. I completed an MSc in Public Health at Teesside University, UK because I believe that working in the field of public health will help me positively impact peoples' lives. Seeing how a developed nation battles with its own public health issues made me realise that not only developing nations struggle with public health. This realisation strengthened my desire to study public health at PhD level and contribute to the process of battling public health issues in both developed and developing nations.

My preconceived notion about my PhD topic was that although there was a gap between the discovery of research-based evidence and its implementation in practical situations, the gap was not so wide that it could not be closed within a few years. I held the belief that research-based evidence is implemented as soon as it is discovered. However, after conducting a review of the topic, I have come to realise that it takes an average of 17 years for research-based evidence to be utilised in practice (Trochim, 2010; Green et al., 2009; Westfall et al., 2007). Furthermore, I believed that the gap

between the discovery of research-based information and its implementation in public health practice was solely caused by unwillingness on the part of the public health practitioners to utilise the recommendations of such evidence in practice.

Nevertheless, after conducting a literature review on the topic, I have learnt that both researchers and public health practitioners are playing their own roles in the unfortunately slow revision of public health practices. This knowledge is useful to me and the current qualitative fieldwork. The knowledge helped in framing the interview questions to investigate the views of not only the embedded researchers but also the public health practitioners' and other stakeholders' views regarding the topic. Hence, three categories of participants with three sets of diligently framed interview schedules, one for each category of participant, were used as explained in chapter three. Thus, this allowed not just the embedded researchers' but also the public health practitioners' and other stakeholders' voices to be heard regarding the role of embedded researchers in their organisation. Consequently, as the responsibility of bridging the gap between research evidence and its implementation in practice lies not only on researchers, any future research that I will conduct in this area of study (co-production/embedded research) will explore the role of public health practitioners in bridging the gap, to complement this current study.

A researcher's demographic characteristics can influence their research process and research outcomes (Hamzeh and Oliver, 2010; Bradbury-Jones, 2007). As I am an African woman with a background in biology and public health, there was a possibility that my demographic characteristics, particularly my African heritage, could affect the data collection process used in this study. For instance, some participants might have found it difficult to relate well with someone from another race, and this could have negatively impacted how they answered my questions. In such a situation, the interviewee might not provide as much in-depth information as they would if they were speaking with someone of the same race. However, I have been trained to conduct qualitative studies, and before this study began, I had already conducted some study-based interviews while carrying out voluntary work in the UK. Therefore, my experience in this area assisted me when I conducted the data-collection phase of this study.

On the other hand, being an African conducting research in a European setting could also be challenging. During the recruitment phase, some potential participants who would have shown interest in the research may not have responded upon seeing my name and realising that I am not from the same race as them. Although, this could have affected the number of participants in the study, I was able to recruit 17 participants by employing snowball sampling, which relies on referrals as detailed in section 2.2. This could have been that some of the participants participated because of the person that referred them rather than their genuine interest in the research irrespective of my race.

Bearing the racial differences in mind, I adopted different strategies to break racial barriers in order to ensure the success of both my research process and its outcomes. At the start of each interview, I tried to build rapport with the participants by spending the first few minutes engaging in informal conversations with the participant. This made the participants feel relaxed and comfortable with me and helped the flow of the conversation.

Most of the interviews that took place before the COVID-19 pandemic were conducted face-to-face. All the interviews conducted during the pandemic were conducted virtually because of the lockdown. I observed that I was more comfortable with face-to-face interviews than virtual interviews. This might have been because, in the face-to-face interviews, I usually spent the first few minutes to build rapport with participants. Although, I built rapport in the virtual interviews, my experience was that it was easier to build rapport face-to-face. When I need to conduct interviews virtually in the future, I will devote more time to rapport building. I will ask more prompting questions and explore meanings when participants use slang.

In addition to its impact on my data collection methods, COVID-19 also impacted how I recruited this study's participants. I planned to recruit at least four participants from each of the four embedded research sites. However, this was not achieved at two sites due to COVID-19. It would have been unreasonable to ask public health practitioners who are front-line workers in the current COVID-19 pandemic to participate in a study. Furthermore, I planned to use both semi-structured interviews and focus group discussions. Unfortunately, because of the COVID-19 pandemic, the focus group element of my qualitative research had to be cancelled. My resilience and



determination to succeed despite obstacles, and my conversations with the supervisory team to work this out, made me devise an alternative way to improve the rigour of this PhD. Thus, I cross-checked the relevance and usefulness of the embedded research toolkit with five participants including the four embedded researchers – each from the four embedded research sites. Apart from this, other approaches were used to increase the credibility of the qualitative study. These are detailed in section 2.2. I have realised that researchers need to be flexible and adaptable as a research journey is not always linear.

I learnt and conducted qualitative data analysis during my work as a Voluntary Community Researcher, and while I was studying for an MSc in Public health. Nevertheless, before starting the qualitative data-analysis phase, I attended a face-to-face workshop on thematic data analysis. This helped me carry out the data-analysis phase successfully. Bearing in mind that the data analysis and interpretation of results could be influenced by my values and view, I explored data triangulation and site triangulation as detailed in the qualitative fieldwork methodology and methods section (section 2.2), and triangulation and discussion of findings chapters (chapters two and five) to reduce bias so as to view the phenomenon of interest from different viewpoints rather than mine.

Though the topic was advertised, I applied because I want to contribute to the facilitation of the use of research-based evidence in the field of public health. The first two years of my PhD were highly challenging. I lost Director of Studies thrice, which means that my present Director of Studies (DoS) is the fourth with whom I have worked. I was unable to register for my PhD for eight months as a result of these changes. I was unsettled until my present DoS took over from my last DoS, who left the University. My present DoS has provided me with all the support I need, and her arrival has marked a turn-around in my studies. I have learnt that the support a PhD student receives from his/her DoS is crucial to the success of the PhD. Even though I faced many challenges while travelling along my PhD journey, I was always determined to complete this PhD.

As a result of the massive changes mentioned above, some elements of my PhD were changed. In the end, I adopted case studies as a methodology as I found that case studies is explorative. Case studies allow comparisons that generate in-depth, relevant



knowledge that can benefit public health practice. Embedded research is a growing field, therefore, I adopted diverse methods apart from the ones adopted by the NIHR embedded research team, to explore the topic so as to ensure that all available evidence are captured.

## CHAPTER THREE

### QUALITATIVE SYSTEMATIC REVIEW FINDINGS

#### 3.1 Overview of the Chapter

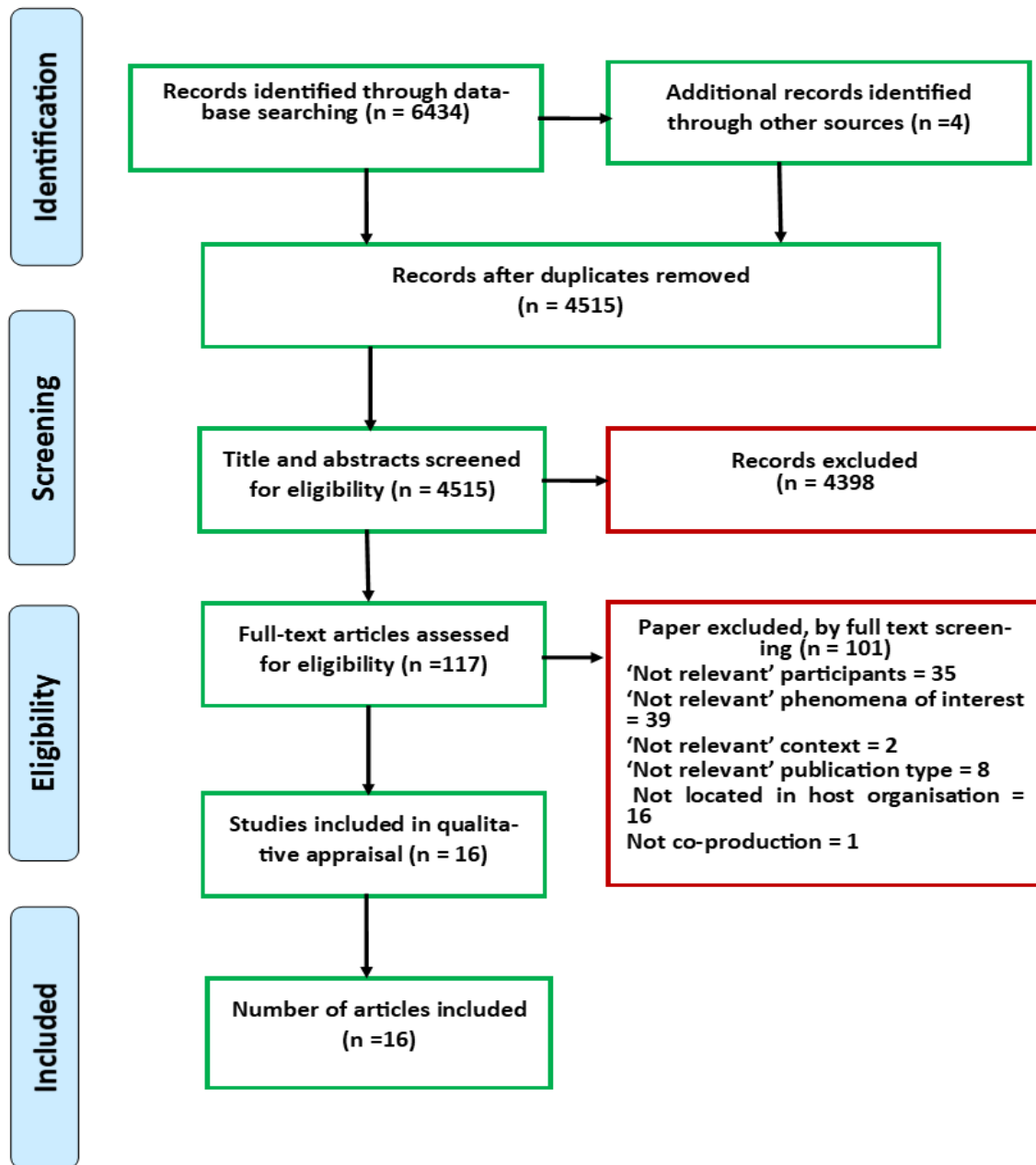
This chapter presents the result of the searches using the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) flow diagram (Page et al., 2020), followed by presenting the characteristics of the included studies, and the result of the methodological quality of the included studies. Followed these, are the result of the data extraction, and the result of the data synthesis. Finally, the result of the assessment of certainty in the findings is presented.

#### 3.2 Results from the Searches

As presented in the PRISMA flow diagram (Figure 5), 6434 studies were identified through database searching and four studies were identified from the reference list of the included studies. Therefore, a total number of 6438 studies were imported into Endnote (Clarivate Analytics, PA, USA). A total of 1923 duplicates were removed, hence, a total of 4515 studies were screened for titles and abstracts. Two articles were written in French. The abstracts were translated from French to English using google translator and were found to not be relevant. The total number of excluded studies with the reasons for exclusion are presented in the PRISMA diagram (Fig. 5).

The remaining 16 qualitative studies were included in this systematic review (Cheetham et al., 2017; McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Duggan, 2014; Hope, 2016; Jenness, 2008; Langeveld et al., 2016; Lewis and Russell, 2011; Miszczak and Patel, 2018; Rowley, 2014; Scott and Bell, 2013; Smith and Wilkins, 2018; Steens et al., 2018; Wong, 2009; Yost et al., 2014; Murdock et al., 2013) (Fig. 5, Table 6).

Figure 5: Prisma Flow Chart Showing the Total Number of Papers Identified in Literature Searches and the Study Selection Process



### 3.3 Assessment of Methodological Quality of Included Studies

Table 6 presents the results of the JBI Critical Appraisal Checklist for Qualitative Research (JBI, 2014). The results of the critical appraisal of the 16 included studies showed that all the included studies met criteria 1, 2, and 10. These criteria are related to the philosophical perspective, congruity between the research methodology and research question or objectives, and whether the conclusions drawn in the research report flow from the analysis (Table 6 and Appendix 2). Congruity between the research methodology and the methods used was present in all the included studies except four (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkin, 2018; Murdock et al., 2013). For criteria 4 and 5 which are related to the congruity between the research methodology and the representation and analysis of data as well as the interpretation of results, all the included studies met these criteria apart from three (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkin, 2018). Only one of the included studies met criteria 6, which is about the statement locating the researcher culturally or theoretically (Jenness, 2008). Criteria 7, the influence of the researcher on the research was addressed only by six of the included studies (Cheetham et al., 2017; Duggan, 2014; Hope, 2016; Jenness, 2008; Rowley, 2014; Wong, 2009).

The adequate representation of the participants' voices (criteria 8) was present in all apart from three of the included studies (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkin, 2018). Criteria 9, evidence of ethical approval by an appropriate body was clear in only seven of the included studies (Cheetham et al., 2017; Jenness, 2008; Langeveld et al., 2016; Lewis and Russell, 2011; Rowley, 2014; Wong, 2009; Yost et al., 2014). One of the 16 included studies was rated the strongest as it addressed all the ten criteria (Jenness, 2008). Three of the included studies, that were commentaries were rated as the 'weakest' as they addressed only criteria 1, 2, and 10 (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkin, 2018). All the 16 studies underwent data extraction and data synthesis irrespective of their methodological quality as they all have relevant data corresponding to the phenomenon of interest of this review. However, an assessment of certainty in the findings (ConQual) was conducted to grade the level of confidence in each synthesised finding (Table 16).

Table 6: Results of the JBI Critical Appraisal Checklist for Qualitative Research

Studies	Quality Appraisal Questions										
	Research methodology?	Research question or objectives?	Methods used to collect data?	Analysis of data?	Interpretation of results?	Is there a theoretical or cultural statement?	Is the influence addressed?	Are participant voices represented?	Is there ethical approval?	Conclusions?	Score
Brannick and Coghlan (2007)	YES	YES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	YES	3/10
Cheetham et al. (2017)	YES	YES	YES	YES	YES	UNCLEAR	YES	YES	YES	YES	9/10
Duggan (2014)	YES	YES	YES	YES	YES	NO	YES	YES	UNCLEAR	YES	8/10
Hope (2016)	YES	YES	YES	YES	YES	NO	YES	YES	UNCLEAR	YES	8/10
Jenness (2008)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	10/10
Langeveld et al. (2016)	YES	YES	YES	YES	YES	NO	UNCLEAR	YES	YES	YES	8/10
Lewis and Russell (2011)	YES	YES	YES	YES	YES	NO	UNCLEAR	YES	YES	YES	8/10
McGinity and Salokangas (2014)	YES	YES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	YES	3/10
Miszczak and Patel (2018)	YES	YES	YES	YES	YES	NO	NO	YES	UNCLEAR	YES	7/10
Murdock et al. (2013)	YES	YES	UNCLEAR	YES	YES	NO	NO	YES	UNCLEAR	YES	6/10
Rowley (2014)	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	9/10
Scott and Bell (2013)	YES	YES	YES	YES	YES	NO	NO	YES	UNCLEAR	YES	7/10
Smith and Wilkins (2018)	YES	YES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	YES	3/10
Steens et al. (2018)	YES	YES	YES	YES	YES	NO	NO	YES	UNCLEAR	YES	7/10
Wong (2009)	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	9/10
Yost et al. (2014)	YES	YES	YES	YES	YES	NO	NO	YES	YES	YES	8/10

### 3.4 Results - Study Characteristics

The 16 included studies were published between 2007 and 2018. Six studies were in LAs (Cheetham et al., 2017; Duggan, 2014; Hope, 2016; Langeveld et al., 2016; Lewis and Russell, 2011; Scott and Bell, 2013), one study was set within a prison (Jenness, 2008), and one of the studies was in a newly established secondary school (Rowley, 2014). Out of the remaining four studies, two studies were in children's services (Steen et al., 2018; Wong, 2009), one study was set within three public health departments (Yost et al., 2014), and one study was within three different third sectors (Murdock et al., 2013).

The 16 included studies were from eight different countries. Nine studies were from the UK (Cheetham et al., 2017; McGinity and Salokangas, 2014; Duggan, 2014; Hope, 2016; Lewis and Russell, 2011; Rowley, 2014; Scott and Bell, 2013; Smith and Wilkins, 2018; Murdock et al., 2013), one study was from Ireland (Brannick, 2007), one study was from the United States of America (Jenness, 2008), and a study was from Holland (Langeveld et al., 2016). Out of the remaining four studies, one study was from South Africa (Miszczak and Patel, 2018), one Belgium (Steens et al., 2018), one Australia (Wong, 2009), and one Canada (Yost et al., 2014).

There was heterogeneity in the qualitative methodologies in the reviewed studies. Two studies were action research (Cheetham et al., 2017; Langeveld et al., 2016), six were case studies (Duggan, 2014; Hope, 2016; Yost et al., 2014; Murdock et al., 2013; Miszczak and Patel, 2018; Steens et al., 2018), and one study was an autoethnography (Jenness, 2008). Out of the remaining seven studies, four studies were ethnographies (Lewis and Russell, 2011; Rowley, 2014; Scott and Bell, 2013; Wong, 2009), and three papers were commentaries (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkins, 2018). The characteristics of the included studies are summarised in Appendix 4.

### 3.5 Results of the Data Synthesis

A total of 66 individual findings were extracted from the 16 included studies (Appendix 6 and Appendix 8). A level of credibility was given to each individual finding to show the extent of support from the study: Unequivocal (U), Credible (C), and Unsupported (US) (Table 2). Out of the 66 individual findings, 57 were graded "unequivocal" while

nine findings were considered “credible” (Appendix 6). Using meta-aggregation, the 66 individual findings were grouped into 11 categories depending on their similarity, the 11 categories were further grouped into six synthesised findings (Appendix 8).

The six synthesised findings were: 1) informing practice with relevant information to make positive changes, 2) building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working, 3) building capacity of the practitioners and other stakeholders towards conducting research, 4) becoming part of the organisation to collaboratively work with practitioners and other stakeholders, 5) critical reflection on the embedded researcher’s role enables the researcher to evaluate his/her role in the host organisation, and 6) managing funds allocated to the research and providing evidence for reports and future funding applications. Full details of the findings associated with categories and synthesised findings are presented in Appendix 8. Below are the details of the six synthesised findings.

### 3.5.1 Synthesised finding 1: Informing practice with relevant information to make positive changes

This was aggregated from two categories, generated from ten extracted findings as detailed below. The results provide evidence that embedded researchers offer alternative suggestions to tackle issues in the host organisation. To this end, this brings about change in practice and policy of the host organisation.

**Table 7: Synthesised finding 1**

Findings	Categories
<p>1) a sounding board (Cheetham et al., 2017), 2) a catalyst for change, and timely improvements in delivery (Cheetham et al., 2017), 3) catalyst for change and improvement in measuring effectiveness (Cheetham et al., 2017), 4) catalyst for change and suggestions of alternatives (Langeveld et al., 2016), 5) agent of change (Langeveld et al., 2016), 6) catalyst for change (Yost et al., 2014), and 7) managing organisational politics (Brannick and Coghlan, 2007). These extracted findings reflected the role of an embedded researcher in recommending changes to bring about a positive impact within the host organisation.</p>	<p>The first category: <b>“Serving as an agent of change by making positive impacts in the host organisation”</b> is built up from seven findings.</p>
<p>1) closing practice/policy-science gap (Langeveld et al., 2016), 2) informing practice with relevant knowledge (Rowley, 2014), and 3) utilising and producing knowledge useful in practice/policy (Smith and Wilkin, 2018). These extracted findings captured how embedded researchers communicate new and existing research evidence that is relevant to solve problems to the members of the host organisation. These, therefore, bring about change in practice or policy.</p>	<p>The second category: <b>“Informing practice with relevant knowledge useful in practice which could bring about its utilisation”</b> is built up from three findings.</p>



### 3.5.2 Synthesised finding 2: Building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working

This finding was generated from two categories, derived from 17 extracted findings as detailed below. This shows the role of an embedded researcher in the host organisation involves connecting and bringing relevant stakeholders together to enhance the building of relationships. As such, this facilitates the co-production of knowledge with the combination of the explicit knowledge of the embedded researcher and the tacit knowledge or experience of the practitioners and other stakeholders.

**Table 8: Synthesised finding 2**

Findings	Categories
<p>1) acting as a knowledge broker (Cheetham et al., 2017), 2) supporting knowledge brokering activities (Langeveld et al., 2016), 3) knowledge spanner (Langeveld et al., 2016), 4) in-betweenness role between different parties (Lewis and Russell, 2011), 5) acting as an intermediary (Smith and Wilkin, 2018), and 6) engaging in multi-stakeholder collaboration structure (Steen et al., 2018). These reflect how the role of an embedded researcher could bring about knowledge exchange by connecting different relevant stakeholders together to co-produce knowledge useful in practice or policy.</p>	<p>The first category “<b>Connecting professionals, academics and other stakeholders for collaborative work</b>” was from six extracted findings.</p>
<p>1) building mutually beneficial relationships (McGinity and Salokangas, 2014), 2) establishing mutually beneficial relationships (Duggan, 2014), 3) developing a relationship with staff (Duggan, 2014), 4) transdisciplinary (Hope, 2016), 5) engaging in formal and informal</p>	<p>The second category “<b>Building relationships with practitioners to facilitate co-production of</b></p>

<p>interactions (Hope, 2016), 6) networking (Hope, 2016), 7) embeddedness (Jenness, 2008), 8) building rapport (Langeveld et al., 2016), 9) regular contact with the host organisation’s staff (Yost et al., 2014), 10) building mutual trust (Miszczak and Patel, 2018), and 11) developing a trustworthy relationship with the host organisation’s staff (Rowley, 2014). These extracted findings showed that part of the role of an embedded researcher in the host organisation is to initiate, develop, maintain and promote mutually beneficial relationships with the practitioners, as these could facilitate the identification of problems in the host organisation, and proffering solutions through collaborative working with the practitioners.</p>	<p><b>knowledge”</b> is developed from 11 extracted findings.</p>
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### 3.5.3 Synthesised finding 3: Building capacity of the practitioners and other stakeholders towards conducting research

This finding was aggregated from three categories, generated from 18 extracted findings as detailed below. This showed that an embedded researcher could support practitioners through the research process which could encourage them to engage in relevant research that could be useful in practice, thereby facilitating the utilisation of research evidence in the host organisation.

**Table 9: Synthesised finding 3**

Findings	Categories
<p>1) building research capacity (Cheetham et al., 2017), 2) problem-oriented knowledge (Hope, 2016), 3) capacity building (Jenness, 2008), 4) peer support (Miszczak and Patel, 2018), 5) facilitating the acquiring of research skills (Rowley, 2014), and 6)</p>	<p>The first category “<b>Developing the skills of practitioners towards conducting</b></p>

<p>providing training to staff (Yost et al., 2014). These reflect that the presence of an embedded researcher in the host organisation could facilitate the capacity building of the host organisation's staff towards conducting relevant research that could be utilised faster in practice.</p>	<p><b>research”</b> is developed from six extracted findings.</p>
<p>1) presenting/leading research (Jenness, 2008), 2) conducting research (Rowley, 2014), 3) collecting data (Scott and Bell, 2013), 4) engaging in research activities (Smith and Wilkin, 2018), 5) conducting and supporting research within the organisation (Wong, 2009), 6) disseminating research findings (Wong, 2009), and 7) bringing new skill (Wong, 2009). These findings captured the role of an embedded researcher in providing support to the host organisation's staff in the process of conducting relevant research.</p>	<p>The second category <b>“Facilitating and giving support through the research process to encourage participation”</b> is aggregated from seven extracted findings.</p>
<p>1) acknowledging achievements in targeting inequalities (Cheetham et al., 2017), 2) assisting in developing useful tools/services (Hope, 2016), 3) providing support in the process of development (Scott and Bell, 2013), 4) evaluating programs to support on-going development (Wong, 2009), and 5) raising the profile of the host organisation in the community (Wong, 2009). These findings denote that the role of an embedded researcher could improve services in the host organisation by providing necessary support and assistance in the process of development.</p>	<p>The third category <b>“Giving support and assisting in developing relevant tools, services and programmes useful in practice“</b> is derived from five extracted findings.</p>

### 3.5.4 Synthesised finding 4: *Becoming part of the organisation to collaboratively work with practitioners and other stakeholders*

This finding was generated from two categories, meta-aggregated from 16 extracted findings as detailed below. This summarises that being ‘embedded’ in the host organisation gives an embedded researcher the opportunity to identify issues, and thereby targeting the research agenda towards tackling the problems through collaborative working with practitioners and other stakeholders.

**Table 10: Synthesised finding 4**

Findings	Categories
<p>1) embeddedness (Wong, 2009), 2) access and flexibility (Rowley, 2014), 3) working closely with the professionals (Rowley, 2014), 4) working alongside the professionals (Miszczak and Patel, 2018), 5) being seen as a member of the organisation (Lewis and Russell, 2011), 6) being regarded as a part of the organisation (Langeveld et al., 2016), 7) part of the organisation (Murdock et al., 2013), 8) ‘embeddedness’- being located at the host organisation (McGinity and Salokangas, 2014), 9) becoming part of the organisation (Duggan, 2014), 10) located in the host organisation (Hope, 2016), 11) dual affiliation (Steens et al., 2018), and 12) access (Brannick and Coghlan, 2007). These findings indicate that the role of an embedded researcher which includes being located in the host organisation enables the embedded researcher to become part of the organisation. This assists the embedded researcher to identify problems facing the host organisation and directing research to solve such problems.</p>	<p>The first category “<b><i>Becoming a member of the host organisation</i></b>” is generated from 12 extracted findings.</p>

<p>1) participatory (Hope, 2016), 2) co-production of knowledge (Jenness, 2008), 3) collaboration (Lewis and Russell, 2011), and 4) bringing together different knowledge (Miszczak and Patel, 2018). These findings showed that the role of an embedded researcher in the host organisation could facilitate collaborative working between practitioners, researchers, and different stakeholders through the combination of different ideas to generate knowledge useful in practice and policy.</p>	<p>The second category <b>“Working together with practitioners to combine the tacit knowledge of the practitioners with the explicit knowledge of the embedded researcher”</b> is aggregated from four extracted findings.</p>
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### **3.5.5 Synthesised finding 5: Critical reflection on the embedded researcher’s role enables the researcher to evaluate his/her role in the host organisation**

This finding was aggregated from a single category underpinned by three extracted findings as detailed below. This showed that critical reflection could assist embedded researchers in their role to identify what works and what does not in order to make adjustments, improvements, or recommendations when possible.

**Table 11: Synthesised finding 5**

Findings	Category
<p>1) reflection (Duggan, 2014), 2) critical reflection (Langeveld et al., 2016), and 3) intentional reflection (Smith and Wilkins, 2018). These denoted that reflection is one of the cogent roles of an embedded researcher in the host organisation. This role assists the embedded researcher to engage in thoughtful evaluation of his/her role which enables in identifying what works and what does not.</p>	<p>The category <b>“Reflecting on the embedded researcher’s role can benefit practice”</b> is developed from three extracted findings.</p>

### 3.5.6 Synthesised finding 6: Managing funds allocated to the research and providing evidence for reports and future funding applications

This finding was developed from a single category underpinned by two extracted findings as detailed below. This summarises that an embedded researcher could assist the host organisation in managing research funds and keeping records. Also, an embedded researcher could assist in providing support during the process of applying for research funds.

**Table 12: Synthesised finding 6**

Findings	Category
1) managing funds (Jenness, 2008), and 2) providing evidence for reports and future funding applications (Wong, 2009). These captured the role of an embedded researcher could also include co-ordinating and assisting in managing research funds as well as documenting achievement and providing support in the process of applying for research funds.	The category <b><i>“Supervising research funds, keeping records and providing support for future funding applications”</i></b> is derived from two extracted findings.

The results of individual findings from each study and the illustrations from the study, including the level of credibility assigned to each finding using the JBI level of credibility table (Table 2) are in Appendix 6.

### 3.6 Results of the Assessment of Certainty in the Findings (ConQual)

Section 3.6.1 and Table 13 present the results of the dependability grade for each included study. Section 3.6.2 and Table 14 show the results of the dependability of each synthesised finding based on the dependability level of the study it was meta-aggregated from. Section 3.6.3 and Table 15 present the credibility of each synthesised finding based on the credibility of the individual findings they were meta-aggregated from.

#### 3.6.1 Results of the dependability grade for each included study

The result of the dependability grade for each included study showed that only one of the 16 included studies scored the 'highest', having addressed all the five questions attributed to dependability (Jenness, 2008). Five of the included studies scored four out of the five questions (Cheetham et al., 2017; Duggan, 2014; Hope, 2016; Rowley, 2014; Wong, 2009). They were rated 'high' according to the dependability ranking system by Lloyd, (2018). The three included commentaries scored 'low' as they addressed only one of the five dependability questions (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkin, 2018). Table 13 presented the dependability of each included study.

**Table 13: Results of the Dependability Grade for Each Included Study**

Dependability question Study	Q2. Is there congruity between the research methodology and the research question or objectives?	Q3. Is there congruity between the research methodology and the methods used to collect data	Q4. Is there congruity between the research methodology and the representation and analysis of data?	Q6. Is there a statement locating the researcher culturally or theoretically?	Q7. Is the influence of the researcher on the research, and vice-versa, addressed?	Dependability
Brannick and Coghlan (2007)	YES	N/A	N/A	N/A	N/A	1/5 - Move down 2 levels
Cheetham et al. (2017)	YES	YES	YES	UNCLEAR	YES	4/5- Unchanged
Duggan (2014)	YES	YES	YES	NO	YES	4/5 - Unchanged
Hope (2016)	YES	YES	YES	NO	YES	4/5 - Unchanged
Jenness (2008)	YES	YES	YES	YES	YES	5/5 - Unchanged
Langeveld et al. (2016)	YES	YES	YES	NO	UNCLEAR	3/5 - Move down 1 level
Lewis and Russell (2011)	YES	YES	YES	NO	UNCLEAR	3/5 - Move down 1 level
McGinity and Salokangas (2014)	YES	N/A	N/A	N/A	N/A	1/5 - Move down 2 levels
Miszczak and Patel (2018)	YES	YES	YES	NO	NO	3/5 – Move down 1 level
Murdock et al. (2013)	YES	UNCLEAR	YES	NO	NO	2/5 – Move down 1 level
Rowley (2014)	YES	YES	YES	NO	YES	4/5 - Unchanged
Scott and Bell (2013)	YES	YES	YES	NO	NO	3/5 - Move down 1 level
Smith and Wilkins (2018)	YES	N/A	N/A	N/A	N/A	1/5 – Move down 2 levels
Steens et al. (2018)	YES	YES	YES	NO	NO	3/5 - Move down 1 level
Wong (2009)	YES	YES	YES	NO	YES	4/5 - Unchanged
Yost et al. (2014)	YES	YES	YES	NO	NO	3/5 – Move down 1 level



### 3.6.2 Synthesised findings (dependability)

Table 14 presents the dependability results of each synthesised finding based on the study they were meta-aggregated from. This implies that the dependability of the primary study from which each synthesised finding was pulled determines the overall dependability of such synthesised finding. The dependability grading was conducted according to Lloyds (2018). The results showed 'downgrade 2 levels' for all the synthesised findings except synthesised finding 6 which was 'high'. However, the results of the overall dependability grade for each synthesised finding when commentaries were excluded showed 'downgrade 1 level' for synthesised findings 1, 2, 3, 4, and 5 (Appendix 10), as to 'downgrade 2 levels' when commentaries were included. The dependability grade for synthesised finding 6 remains high as it was not meta-aggregated from commentaries (Table 14, and Appendix 10).

**Table 14: Dependability Grade Results for Each Synthesised Finding Based on the Studies they were Meta-aggregated From**

Synthesised finding	Studies	Comment	Overall dependability
1. Informing practice with relevant information to make positive changes.	Cheetham et al. (2017); Langeveld et al. (2016); Yost et al. (2014); Rowley (2014); Brannick and Coghlan (2007); Smith and Wilkin (2018).	At least 1 article only 'yes' for 0-1 dependability Qs so, downgrade 2 levels (-2)  (Brannick and Coghlan, 2007; Smith and Wilkin, 2018) only 'yes' for 0-1 dependability Qs)	<b>Downgrade 2 levels</b>
2. Building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working.	Cheetham et al. (2017); Langeveld et al. (2016); Lewis and Russell (2011); McGinity and Salokangas (2014); Duggan (2014); Hope (2016); Jenness (2008); Yost et al. (2014); Miszczak and Patel (2018); Rowley (2014); Smith and Wilkin (2018); Steen et al. (2018).	At least 1 article only 'yes' for 0-1 dependability Qs so, downgrade 2 levels (-2)  (Smith and Wilkin, 2018; McGinity and Salokangas, 2014 only 'yes' for 0-1 dependability Qs)	<b>Downgrade 2 levels</b>
3. Building capacity of the practitioners and other stakeholders towards conducting research.	Cheetham et al. (2017); Hope (2016); Jenness (2008); Miszczak and Patel (2018); Rowley (2014); Yost et al. (2014), Scott and Bell (2013); Wong (2009); Smith and Wilkin (2018).	At least 1 article only 'yes' for 0-1 dependability Qs so, downgrade 2 levels (-2)  (Smith and Wilkin, 2018 only 'yes' for 0-1 dependability Qs)	<b>Downgrade 2 levels</b>
4. Becoming part of the organisation to collaboratively work with practitioners and other stakeholders	Wong (2009); Rowley (2014); Miszczak and Patel (2018); Lewis and Russell (2011); Langeveld et al. (2016); McGinity and Salokangas (2014); Duggan (2014); Hope (2016); Jenness (2008); Murdock et al. (2013); Steen et al. (2018); Brannick and Coghlan (2007).	At least 1 article only 'yes' for 0-1 dependability Qs so, downgrade 2 levels (-2)  (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007 only 'yes' for 0-1 dependability Qs)	<b>Downgrade 2 levels</b>
5. Critical reflection on the embedded researcher's role enables the researcher to evaluate his/her role in the host organisation	Duggan (2014); Langeveld et al. (2016); Smith and Wilkin (2018).	At least 1 article only 'yes' for 0-1 dependability Qs so, downgrade 2 levels (-2)  (Smith only 'yes' for 0-1 dependability Qs)	<b>Downgrade 2 levels</b>
6. Managing funds allocated to the research and providing evidence for reports and future funding applications	Jeness (2008); Wong (2009).	All articles only 'yes' for 4-5 dependability questions so, the paper remains unchanged (High)	<b>High</b>

### 3.6.3 Synthesised findings (credibility)

Table 15 presents the credibility results of each synthesised finding based on the individual findings they were meta-aggregated from. This implies that the credibility grade of the individual finding from which each synthesised finding was pulled, determines the credibility of such synthesised finding. The results showed a 'downgrade 1 level' for the overall credibility grade for all the synthesised findings except synthesised finding 6 which was 'high'. However, it was anticipated that the credibility of the individual findings from the three commentaries would be 'low', as such reducing the credibility of the synthesised findings generated from them, a table was constructed to provide the overall credibility of the synthesised findings excluding the three commentaries (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkin, 2018) (Appendix 11). The results showed 'High' for the overall credibility grade for synthesised findings 1, 3, and 5 when commentaries were excluded, as to 'downgrade 1 level' when commentaries were included. The credibility grade for synthesised finding 6 remains high as it was not meta-aggregated from the three commentaries.

**Table 15: Credibility Grade Results of Each Synthesised Finding Based on the Credibility of the Individual Finding they were Meta-aggregated From**

Synthesised findings	Studies	Comments	Credibility
1. Informing practice with relevant information to make positive changes.	<b>Unequivocal</b> - Cheetham et al. (2017) (3x); Langeveld et al. (2016) (3x); Yost et al. (2014); Rowley (2014). <b>Credible</b> - Brannick and Coghlan (2007); Smith and Wilkin (2018).	8 Unequivocal + 2 Credible	<b>A mixture of unequivocal and credible – downgraded one (-1)</b>
2. Building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working.	<b>Unequivocal</b> - Cheetham et al. (2017); Langeveld et al. (2016) (3x); Lewis and Russell (2011); McGinity and Salokangas (2014); Duggan (2014) (2x); Hope (2016) (3x); Jenness (2008); Yost et al. (2014); Miszczak and Patel (2018); Rowley (2014). <b>Credible</b> - Smith and Wilkin (2018); Steen et al. (2018).	15 Unequivocal + 2 Credible	<b>A mixture of unequivocal and credible – downgraded one (-1)</b>
3. Building capacity of the practitioners and other stakeholders towards conducting research.	<b>Unequivocal</b> - Cheetham et al. (2017) (2x); Hope (2016) (2x); Jenness (2008) (2x); Miszczak and Patel (2018); Rowley (2014) (2x); Yost et al. (2014); Scott and Bell (2013) (2x); Wong (2009) (5x). <b>Credible</b> - Smith and Wilkins (2018).	17 Unequivocal + 1 Credible	<b>A mixture of unequivocal and credible – downgraded one (-1)</b>
4. Becoming part of the organisation to collaboratively work with practitioners and other stakeholders	<b>Unequivocal</b> – Wong (2009); Rowley (2014) (2x); Miszczak and Patel (2018) (2x); Lewis and Russell (2011) (2x); Langeveld et al. (2016); McGinity and Salokangas (2014); Duggan (2014); Hope (2016) (2x); Jenness (2008). <b>Credible</b> - Murdock et al. (2013); Steen et al. (2018); Brannick and Coghlan (2007).	13 Unequivocal + 3 Credible	<b>A mixture of unequivocal and credible – downgraded one (-1)</b>
5. Critical reflection on the embedded researcher's role enables the researcher to evaluate his/her role in the host organisation	<b>Unequivocal</b> – Duggan (2014); Langeveld et al. (2016). <b>Credible</b> - Smith and Wilkin (2018).	2 Unequivocal + 1 Credible	<b>A mixture of unequivocal and credible – downgraded one (-1)</b>
6. Managing funds allocated to the research... reports and future funding applications	<b>Unequivocal</b> – Jenness (2008); Wong (2009).	2 Unequivocal	<b>All unequivocal - remains unchanged (High)</b>

X – the number of individual findings from the article. For example, 2x means two individual findings, and 3x means three individual findings

#### 3.6.4 The overall certainty in the synthesized findings (ConQual)

The assessment of the certainty in the synthesised findings (ConQual) in the majority of synthesised findings was 'very low'. However, the assessment of certainty in ***'Managing funds allocated to the research and providing evidence for reports and future funding applications'*** was high. This disparity was due to including commentaries (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkin, 2018) which were of lower methodological quality. However, when the three commentaries were excluded, the assessments of the certainty in one of the six synthesised findings remained 'high', the confidence in three of the synthesised findings was 'moderate', and the confidence in two of the six synthesised findings was 'low'. Table 16 presents the details of the ConQual result.

**Table 16: Summary of Findings (Results of the Assessment of Certainty in the Findings (ConQual))**

<b>The role of embedded researchers in co-producing public health knowledge in non-clinical settings: a qualitative systematic review</b>					
<b>Synthesised finding</b>	<b>Type of research</b>	<b>Dependability</b>	<b>Credibility</b>	<b>ConQual score</b>	<b>Comments</b>
1. Informing practice with relevant information to make positive changes.	Qualitative studies including commentaries	Downgrade two levels**	Downgrade one level*	<b>Very low</b>	*Downgraded one level due to mix of unequivocal(U) and credible(C) findings 8U+2C
	Qualitative studies excluding commentaries	Downgrade one level*	High	<b>Moderate</b>	All unequivocal 8U
2. Building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working.	Qualitative studies including commentaries	Downgrade two levels**	Downgrade one level*	<b>Very low</b>	*Downgraded one level due to mix of unequivocal(U) and credible(C) findings 15U+2C
	Qualitative studies excluding commentaries	Downgrade one level*	Downgrade one level*	<b>Low</b>	*Downgraded one level due to mix of unequivocal(U) and credible(C) findings 14U+1C
3. Building capacity of the practitioners and other stakeholders towards conducting research.	Qualitative studies including commentaries	Downgrade two levels**	Downgrade one level*	<b>Very low</b>	*Downgraded one level due to mix of unequivocal(U) and credible(C) findings 17U+1C.
	Qualitative studies excluding commentaries	Downgrade one level*	High	<b>Moderate</b>	All unequivocal 17U
4. Becoming part of the organisation to collaboratively work with practitioners and other stakeholders	Qualitative studies including commentaries	Downgrade two levels**	Downgrade one level*	<b>Very low</b>	*Downgraded one level due to mix of unequivocal(U) and credible(C) findings 13U+3C
	Qualitative studies excluding commentaries	Downgrade one level*	Downgrade one level*	<b>Low</b>	*Downgraded one level due to mix of unequivocal(U) and credible(C) findings 12U+2C
5. Critical reflection on the embedded researcher's role enables the researcher to	Qualitative studies including commentaries	Downgrade two levels**	Downgrade one level*	<b>Very low</b>	*Downgraded one level due to mix of unequivocal(U) and credible(C) findings 2U+1C

evaluate his/her role in the host organisation	Qualitative studies excluding commentaries	Downgrade one level*	High	<b>Moderate</b>	All unequivocal 2U
6. Managing funds allocated to the research and providing evidence for reports and future funding applications	Qualitative studies	High	High	<b>High</b>	All unequivocal (2U)

\* Downgrade one level due to a mix of unequivocal and credible findings.

\*\*Downgraded two levels due to dependability of the articles (all articles had either no statement locating the researcher culturally or theoretically, two studies had unclear acknowledgement of their influence on the research findings, while for five studies this was not mentioned. For three articles the congruity between research methodology, methods, and /data analysis were not applicable.

### 3.7 Discussion

The systematic review included 16 articles which were the combination of 13 primary qualitative studies (Cheetham et al., 2017; Duggan, 2014; Hope, 2016; Jenness, 2008; Langeveld et al., 2016; Lewis and Russell, 2011; Miszczak and Patel, 2018; Rowley, 2014; Scott and Bell, 2013; Steens et al., 2018; Wong, 2009; Yost et al., 2014; Murdock et al., 2013) and three commentaries (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkins, 2018). They all identified the role of embedded research in co-producing public health knowledge in non-clinical settings, which could bridge the gap between knowledge and practice. This will be discussed in the following subsections.

#### 3.7.1 Quality Appraisal

Following the results of the methodological quality of the 16 included studies, most of the studies were of 'high' quality scoring between 7 -10 out of 10 critical appraisal questions (Jenness, 2008; Cheetham et al., 2017; Duggan, 2014; Hope, 2016; Langeveld et al., 2016; Lewis and Russell, 2011; Miszczak and Patel, 2018; Rowley, 2014; Scott and Bell, 2013; Steens et al., 2018; Wong, 2009; Yost et al., 2014). The three included commentaries were grouped as 'low' quality as they scored three each out of the 10 critical appraisal questions (McGinity and Salokangas, 2014; Brannick and Coghlan, 2007; Smith and Wilkins, 2018). The question regarding 'if there is a statement locating the researcher culturally or theoretically' (criteria 6) was achieved by only one paper out of the 16 included papers (Jenness, 2008). If the statement locating the researcher culturally or theoretically has been included in the remaining 15 studies, it would have provided a more in-depth understanding of the researcher's values and beliefs, and their possible impact on the research. The lack of exploring criteria 6 as mentioned above was also reported in a review conducted by Carey et al. (2018). Although Carey et al.'s (2018) review was on a different topic, the qualitative review reported that all the eight included studies did not address criteria 6, that is, the researcher's cultural and theoretical values and beliefs including their impact on the study. Overall, the lack of exploration of the criteria mentioned above did not debar the identification of the role of embedded research in co-producing public health knowledge in non-clinical settings which could bridge the knowledge - practice gap.



### 3.7.2 Data Synthesis and Assessment of the Certainty in the Synthesised Findings

Meta-aggregation was adopted in this systematic review to synthesise the 66 individual findings from 16 included studies to provide readily usable evidence, useful in public health practice and policy. To establish certainty in the six synthesised findings, a ConQual approach was adopted according to Munn et al. (2014). ConQual goes further by assessing the credibility of each finding from each included study rather than relying only on the dependability score of the included study. The adoption of this tool made it possible to grade the confidence in the six synthesised findings, which were meta-aggregated from the 66 individual findings on the role of embedded research in co-producing public health in non-clinical settings. As the ConQual score is presented in a summary table (table 16), this assists in presenting a systematic review finding in a clear way that could facilitate the accessibility and the utilisation of the systematic review (Munn et al., 2014). Therefore, this suggests that adopting a ConQual approach in this current systematic review has assisted in presenting the role of embedded research in co-production in an easy and accessible order to facilitate the utilisation of this systematic review results in public health practice and policy.

While the meta-aggregation provided six comprehensive groups of synthesised findings that can be used as a source for evidence-based practice, ConQual provided the level of confidence in each of the six synthesised findings. As such, these offer public health professionals not only readily usable findings but also a level of confidence in each finding. As there was no systematic review on this topic before this systematic review was conducted, this shows the originality of this systematic review.

### 3.7.3 Key findings and Links to Literature

Although the context for this systematic review was the non-clinical setting, the findings echoed findings from a previously conducted narrative review in both clinical and non-clinical settings on the topic (Vindrola-Padros et al., 2017). A total of 17 studies were reviewed, and the narrative review found that embedded research could be used as an approach to co-produce knowledge in both clinical and non-clinical settings, thereby facilitating the utilisation of research evidence in practice. In this

current systematic review, the six synthesised findings on the role of embedded research in co-producing public health knowledge are:

- 1) informing practice,
- 2) building mutually beneficial relationships,
- 3) building capacity,
- 4) becoming part of the organisation,
- 5) critical reflection, and
- 6) managing funds allocated to the research and providing evidence for reports and future funding applications.

One of the roles of embedded research in co-producing public health knowledge reported by some of the included studies was “*informing practice with relevant information to make positive changes*” (Cheetham et al., 2017; Langeveld et al., 2016; Yost et al., 2014; Rowley, 2014; Smith and Wilkins, 2018; Brannick and Coghlan, 2007). Results showed that embedded researchers communicate new and existing research evidence that is relevant to solve problems to the members of the host organisation. This finding corresponds to Marshall et al. (2014) findings that the role of an embedded researcher includes the swift delivery of research evidence and their faster integration into practice. As such, this can make research evidence readily accessible and usable in public health practice and policy to improve public health service and delivery, therefore, bridging the knowledge-practice gap.

Building mutually beneficial relationships with the professionals and other stakeholders was found to be important in co-producing public health knowledge in non-clinical settings (Langeveld et al., 2016; Cheetham et al., 2017; Lewis and Russell, 2011; Smith and Wilkins, 2018; Steen et al., 2018; McGinity and Salokangas, 2014; Duggan, 2014; Hope, 2016; Jenness, 2008; Yost et al., 2014; Mischczak and Patel, 2018; Rowley, 2014). This was achieved by being located in the host organisation to enable engagement in formal and informal conversations with the host organisation’s staff, attending regular meetings, and working alongside the host organisation’s staff. Duggan (2014) categorised the types of relationships that could exist between an embedded researcher and the host organisation’s staff as “*critical friendship - working in equal relation to the project manager, critical orphanhood - unattached to the project team and critical nepotism - working in a junior position*”

(Duggan, cited in Vindrola-Padros et al., 2017, p. 72). Therefore, building mutually beneficial relationships could enable reciprocal learning between the embedded researcher and the host organisation's staff. The reciprocal learning could encourage a two-way learning, where it is not only research informing practice, but also practice informing research. As understanding the context and the practical problems facing the host organisation is essential (Newbury-Birch and Allan, 2019; Vindrola-Padros et al., 2019), building mutually beneficial relationships with the host organisation's staff could assist an embedded researcher to achieve this. Thus, this facilitates the co-production and the use of relevant research evidence with the host organisation's staff to tackle challenges in practice.

Based on the findings of this review, building capacity of the practitioners and other stakeholders towards conducting research could be achieved by providing training, consultation, and mentorship for the staff of the host organisation (Cheetham et al., 2017; Hope, 2016; Jenness, 2008; Miszczak and Patel, 2018; Rowley, 2014; Yost et al., 2014; Scott and Bell, 2013; Smith and Wilkins, 2018; Wong, 2009). This is similar to Marshall et al. (2014) findings that a researcher-in-residence, also known as an embedded researcher, must have the ability to encourage professionals to conduct research. In addition, Wong (2009) emphasised that an embedded researcher's role in the host organisation increases the host organisation's staff research capacity. Also, it can integrate research into the entire host organisation's structure including its practices, systems, and processes to encourage research sustainability in the host organisation (Nutley et al., 2009). Hence, this shows that it can bridge the gap between research evidence and practice.

The role of an embedded researcher in co-production involves becoming part of the organisation to collaboratively work with practitioners and other stakeholders (Wong, 2009; Rowley, 2014; Miszczak and Patel, 2018; Lewis and Russell, 2011; Langeveld et al., 2016; Murdock et al., 2013; McGinity and Salokangas, 2014; Duggan, 2014; Hope, 2016; Steen et al., 2018; Brannick and Coghlan, 2007; Jenness, 2008). This echoed Vindrola-Padros et al.'s (2019) findings from three case studies in three different clinical settings, that being located in the host organisation enables embedded researchers to build trustworthy relationships with the host organisation's staff. Although Vindrola-Padros et al.'s (2019) case studies were conducted in clinical

settings, however, the finding corresponds with the result of this systematic review. As such, “becoming part of the organisation” assists the researcher to gain access to data by being embedded in the host organisation. Also, by working alongside the host organisation’s staff, an embedded researcher would be able to easily identify problems in the local context, and therefore, proffer solutions through research. Additionally, this role also provides an embedded researcher with the opportunity to have access to first-hand information from practitioners. Hence, this could shape and provides insight into future research, useful in practice (Hackett and Rhoten, 2011). As such, this facilitates the utilisation of research evidence in public health practice and policy.

Critical reflection on the embedded researcher’s role enables the researcher to evaluate his/her role in the host organisation. This was identified in this review as one of the roles of an embedded researcher in co-producing public health knowledge in non-clinical settings (Duggan, 2014; Langeveld et al., 2016; Smith and Wilkins, 2018). This role allows an embedded researcher to reflect on the role to identify what works and what does not, to improve the output, meet up to expectations, and as well to recommend changes (Vindrola-Padros et al., 2017). Critical reflexivity requires an intentional effort of an embedded researcher to think about his or her position as an individual, as well as a part of the host organisation (Lewis and Russell, 2011). It was not evident that embedded researchers underwent any form of training on how to reflect. However, this could be part of the personal or professional training available for researchers in academic institutions. Thus, individual reflexivity assists embedded researchers to identify how to channel research to meet the needs of the host organisation (Lewis and Russell, 2011). Furthermore, collective reflexivity – which involves the members of the host organisation in the reflexivity process also assists in incorporating critical reflection into the host organisation’s staff routine. Thus, it helps in capacity building (Wong, 2009). ‘Managing funds allocated to research and providing evidence for reports and future funding applications’ was identified by only two of the included studies in this review (Jenness, 2008; Wong, 2009). This role could also assist in securing funds for research in the host organisation, thereby encouraging the host organisation’s staff to participate in research that could be useful in the organisation, as such, bridging the gap between research evidence and its utilisation in public health practice and policy.

### 3.7.4 Gaps in the Literature and Future Directions

Time spent in the host organisation by the embedded research could be one of the important determinants to the success of the role (Vindrola-Padros et al., 2019). Vindrola-Padros and her colleagues explained that it takes time to build trustworthy relationships and to familiarise with the host organisation. To this end, they recommended an 'introductory period' of a minimum of three months for an embedded researcher to build relationships in the host organisation before the commencement of embedded research (Vindrola-Padros et al., 2019). However, out of the 16 included studies, only four studies recorded the number of days the embedded researcher spent in the host organisation (Appendix 4). This component might have been overlooked, however, it serves as one of the significant characteristics of an embedded researcher, as earlier discussed in chapter one. Therefore, future primary research should explore the duration of time that embedded researchers spend in the host organisation and the value of this. Moreso, the duration of time spent per week by embedded researchers in their host organisations depends on the intensity of the project (Embedded research, no date), as detailed in chapter one. Therefore, exploring the time spend in the host organisation by embedded researchers would generate knowledge and more clarity on the relationship between the time spent in the host organisation by embedded researchers and the impact of embedded research in the host organisation.

Based on the findings from this review, nine out of the 16 included studies were conducted in the UK. The investigation of the role of embedded research in co-producing public health in non-clinical settings needs to be widely conducted in different countries. As such, there would be an opportunity to compare the role of embedded research in co-production across different countries.

Another gap identified in the literature was the absence of quantitative studies on the role of embedded research in co-producing public health knowledge in non-clinical settings, which was confirmed after conducting a scoping review and reading through relevant literature on the topic. Having quantitative studies on the topic would have provided numerical evidence of the effectiveness of the role of embedded research in the co-production of public health knowledge in non-clinical settings. Also, it would have offered the opportunity to conduct not just a qualitative systematic review, but a

mixed-method systematic review which is a review that combines synthesised findings from both qualitative and quantitative studies (Harden, 2010). Although qualitative and quantitative research have different paradigms (Creswell and Creswell, 2018), however, reviewing the combination of data from both approaches could have increased the level of confidence in the systematic review findings and as well improved the applicability of the review findings (Harden, 2010), in public health practice.

### 3.7.5 Strengths of this Systematic Review

This current systematic review aimed to synthesise evidence from available qualitative studies on the topic. To achieve this, the search process did not rely only on electronic databases but also, the reference list of the included studies was searched in order not to miss any relevant study (Horsley et al., 2011). Also, the search was not limited to any particular country or language, as this was to broaden the opportunity to include all relevant studies on the topic irrespective of their location and language. Furthermore, to reduce bias, two independent reviewers (AA and IO) reviewed this systematic review. While AA reviewed all the studies, IO reviewed 20% of all the studies at every stage of this current systematic review, in accordance with Stoll et al. (2019) that involving a second reviewer could assist in ensuring that all relevant studies are included in a systematic review.

### 3.7.6 Limitations of this Systematic Review

There are different terminologies used for embedded research, to this end, different search terms were used to capture all relevant studies that are on the topic but using different terminologies for 'embedded research'. However, there is a possibility that some papers might be missed as a result of the inconsistent use of terminology. Also, there was no limit on the publication date while searching for relevant studies on this systematic review. This was to ensure that all relevant literature on the topic was captured. Nevertheless, this could also be considered a limitation of this systematic review. As there was no limit on the publication date, some of the articles retrieved were not relevant to this systematic review, therefore they were excluded.

### 3.8 Conclusions

This current systematic review attests that the role of embedded research in co-producing public health knowledge in non-clinical settings could bridge the gap between research evidence and practice. The potential of embedded research to bridge this gap sits in its role in the host organisation. The ability of an embedded researcher to inform public health practice with relevant information, including research evidence, could catalyse the use of such research evidence. Also, the building of mutually beneficial relationships with the host organisation's staff facilitates rapport and trust which could assist in the sharing and resolving the challenges facing the host organisation through the use of knowledge generated from co-production. In addition, this role would assist an embedded researcher to conduct research that is relevant to solve the host organisation's problem, thus facilitating the research evidence use in public health practice. Furthermore, an embedded researcher builds the confidence of the host organisation's staff regarding research by providing necessary support and training. This capacity-building would encourage the members of the host organisation to be willing to participate in research activities, thus increase their familiarisation with research/scientific language or terminologies. The evidence showed that being part of the host organisation assists an embedded researcher not only to build relationships with the host organisation's staff but also to enable the co-production of knowledge with the host organisation's staff which could facilitate the use of the co-produced knowledge including knowledge produced from research.

Critical reflection was a way to evaluate the embedded researcher's role in the process of co-producing knowledge in non-clinical settings. Thus, this indicates that improvements and recommendations are offered regularly regarding the co-produced research to meet the needs and expectations of the host organisation while maintaining the research rigour. Overall, this would improve the general outcome or output of the role of an embedded researcher in the process of co-producing public health knowledge in non-clinical settings. There is evidence that the role of embedded research involves managing research funds, keeping records as well as assisting in applying for funds. This role would enhance the development of the host organisation as there is documentation for achievements as well as challenges to create an opportunity for improvement and recommendations for the future. Based on the evidence, the role of embedded research is essential in the process of co-production



of public health knowledge in non-clinical settings. However, as most of the results of the assessment of the certainty in the synthesised findings (ConQual scores) were classed as 'moderate' rather than 'high', therefore, it would be necessary to explore the synthesised findings by conducting an explorative study on the topic to compare and ascertain the result of this current systematic review. More so, the overall aim of this PhD is to develop a toolkit on the role of embedded research in the co-production of public health knowledge by exploring if embedded research could generate and enhance the creation and sharing of knowledge between public health researchers and practitioners to facilitate the utilisation of research evidence in public health practice.

### 3.9 Rationale for Further Work

The exploration of the six synthesised findings from this current systematic review by conducting qualitative research to compare and ascertain the results is feasible and appropriate. Qualitative work would provide more evidence that could increase the confidence in existing evidence on the role of embedded research to bridge the gap between research evidence and public health practice. Most of the included qualitative studies in this current systematic review did not include any evidence in relation to the amount of time spent by the embedded researcher in the host organisation (Appendix 4). To this end, the next stage of this current PhD study is to conduct qualitative fieldwork which will include the exploration of the time spent by embedded researchers in various non-clinical settings and explore the themes that emerged from this systematic review to increase the confidence in the findings to inform the development of a toolkit on the topic.

### 3.10 Chapter Summary

This current systematic review aimed to systematically review the role of embedded research in the co-production of public health knowledge in non-clinical settings, using JBI methodology. Following the literature searches, 13 qualitative studies and three commentaries were included in the systematic review. Below are the major findings and contributions to knowledge:

- Key roles of embedded researchers in co-producing public health knowledge in non-clinical settings appeared to be: 1) informing practice, 2) building mutually



beneficial relationships, 3) building capacity, 4) becoming part of the organisation, 5) critical reflection, and 6) managing funds allocated to the research and providing evidence for reports and future funding applications.

- The critical appraisal showed that the majority of the included studies are of high to moderate quality. However, the three included commentaries were of lower methodological quality.
- The ConQual results confirmed that including commentaries in systematic reviews could reduce the confidence in the overall results.
- Different terminologies used for embedded research were compiled to enhance its use (Appendix 5).
- Results highlighted the need for future research to explore the time spent by embedded researchers in the host organisation, so this informed the interview schedule of the qualitative fieldwork in the next phase of this PhD work.
- An exploration of the themes that emerged from this current systematic review in qualitative fieldwork would be necessary to increase the confidence in the findings.
- The development of a toolkit to highlight the role of embedded research in co-producing public health knowledge in non-clinical settings, which could bridge the gap between research evidence and its implementation in public health practice would be necessary.

The next chapter presents the findings of the qualitative research in exploring the themes that emerged from the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings.

## CHAPTER FOUR

### QUALITATIVE FINDINGS

#### 4.0 Overview of the Chapter

This chapter presents the results of the thematic analysis of the qualitative interviews conducted with embedded researchers, public health practitioners, and other stakeholders (teachers and students) across four case studies sites. Firstly, information regarding each research site is presented. The names of the sites explored in the qualitative fieldwork are not mentioned for ethical reasons, but codes are given. Then, the demographic characteristics of the participants and the results of the thematic analysis are presented. Throughout this chapter verbatim examples are used to support the themes from the interviews. Finally, the discussion and the chapter summary are presented.

#### 4.1 Case Studies Sites

##### 4.1.1 Case Studies Sites One and Two (LA1 and LA2)

Case studies sites one and two are LAs in the North East of England. The health of the people living in this region is largely worse than the England average (for example two years lesser life expectancy than the England average), as the region has higher health inequalities compared to other regions in England (Public Health England, 2016; Whitehead et al., 2014; The Northern Powerhouse Independent Economic Review, 2016; Bambra et al., 2018; The Health Foundation, 2021). Therefore, this region is rated as one of the most deprived regions in the nation. In other words, case study site one is still faced with numerous public health issues that are regarded to be worse than the England average. Public health issues in this city include alcohol consumption, teenage pregnancy, smoking, and suicide (Public Health England, 2016; Public Health England, 2018). Also, case study site two is faced with various public health issues such as child obesity, premature deaths, smoking, and mental health (Public Health England, 2016; Public Health England, 2018).

The Health and Social Care Act, 2012 gives upper tier and unitary LAs responsibilities for Public Health from April 2013 (The King's Fund, 2015), and therefore, the Local Authorities' public health teams focus on improving and protecting the health and

wellbeing of the people living within the counties. To tackle these public health issues, case study site one's LA public health team focuses on various aims including improving health outcomes for children, tackling lifestyle risk factors, tackling the social causes of poor health, and improving emotional wellbeing and mental health by offering various services. The LA adopted an evidence-based approach by employing an embedded researcher who has a dual affiliation with the LA and as well as an academic institution, to conduct research with the LA public health team. The embedded research project aimed to understand and make recommendations regarding population changes, and service needs, including health, education, housing, and social care, in the local communities.

Also, case study site two's LA public health team adopted different strategies to meet their targets. These include commissioning evidence-based services and interventions, promotion of healthy lifestyles, identifying and targeting the greatest health needs of people living in the city, and detecting, preventing, and responding to infectious diseases. Also, an embedded researcher works at the LA to provide research support to the LA's public health team to secure the targets.

#### **4.1.2 Case Study Site Three (School)**

Case study site three is a secondary school located in the North East of England. The majority of students (62%) rely on free school meals (Hayden et al., 2019). This percentage is higher than the average in the UK which is 29 percent (Gov.UK, 2017). This explains why most students attending the school could be seen as 'deprived' or not having as much opportunity compared to those at other schools in the UK. Being dependent on free school meals determines the socio-economic status of the parents or family of the students attending a school (Taylor, 2017). This corresponds with what other scholars have established, that there is a wide social gradient in breakfast eating habits, with children from 'deprived' homes having more tendency to miss breakfast compared to other children from 'privileged' homes (Moore et al., 2007; Keski-Rahkonen et al., 2003; O'Dea and Caputi, 2001).

A collaborative co-production research project was carried out in the school (Hayden et al., 2019). This involved the students, the members of school staff, and researchers from an academic institution in the North East of England. The co-production research aimed to explore the recent changes to the General Certificate of Secondary

Education (GCSE) system, focusing on how the changes impact both staff and students. The findings of the co-production research on the impact of the recent changes to the GCSE on students include themes such as confidence and workload, while the themes that emerged from the impact of the change on staff include anxiety. These, therefore, could have negative impacts on the academic performance and the health of the students and their teachers. The following sections provide the results of the qualitative fieldwork on the role of embedded research in co-producing public health knowledge in the school.

#### **4.1.3 Case Study Site Four (Sports organisation)**

Case study site four is a sports organisation that works across various areas in the North East of England to deliver Sport England initiatives. The organisation was established to encourage more people to engage in physical activities to improve their health and well-being. In order to improve the service rendered to the public, an embedded researcher was employed to co-produce research with the sports organisation members of staff.

#### **4.2 Participants' Characteristics**

Seventeen participants, four embedded researchers, nine public health practitioners, and two teachers, and two students were interviewed across the four case study sites. Three participants, one embedded researcher, and two public health practitioners were interviewed at case study site one (LA1). Seven participants, one embedded researcher, and six public health practitioners were interviewed at case study site two (LA2). Five participants, one embedded researcher, and two teachers (TR1site3 and TR2site3), and two students (ST1site3 and ST2site3) were interviewed at case study site three (School). Although two embedded researchers were involved in the project, only one embedded researcher was interviewed. Two participants, one embedded researcher and one public health practitioner were interviewed at case study site four (Sports organisation). Table 17 provides the demographic characteristics of the 17 participants including their unidentifiable codes, sex, age, and years of experience.

**Table 17: Participants' Demographic Information**

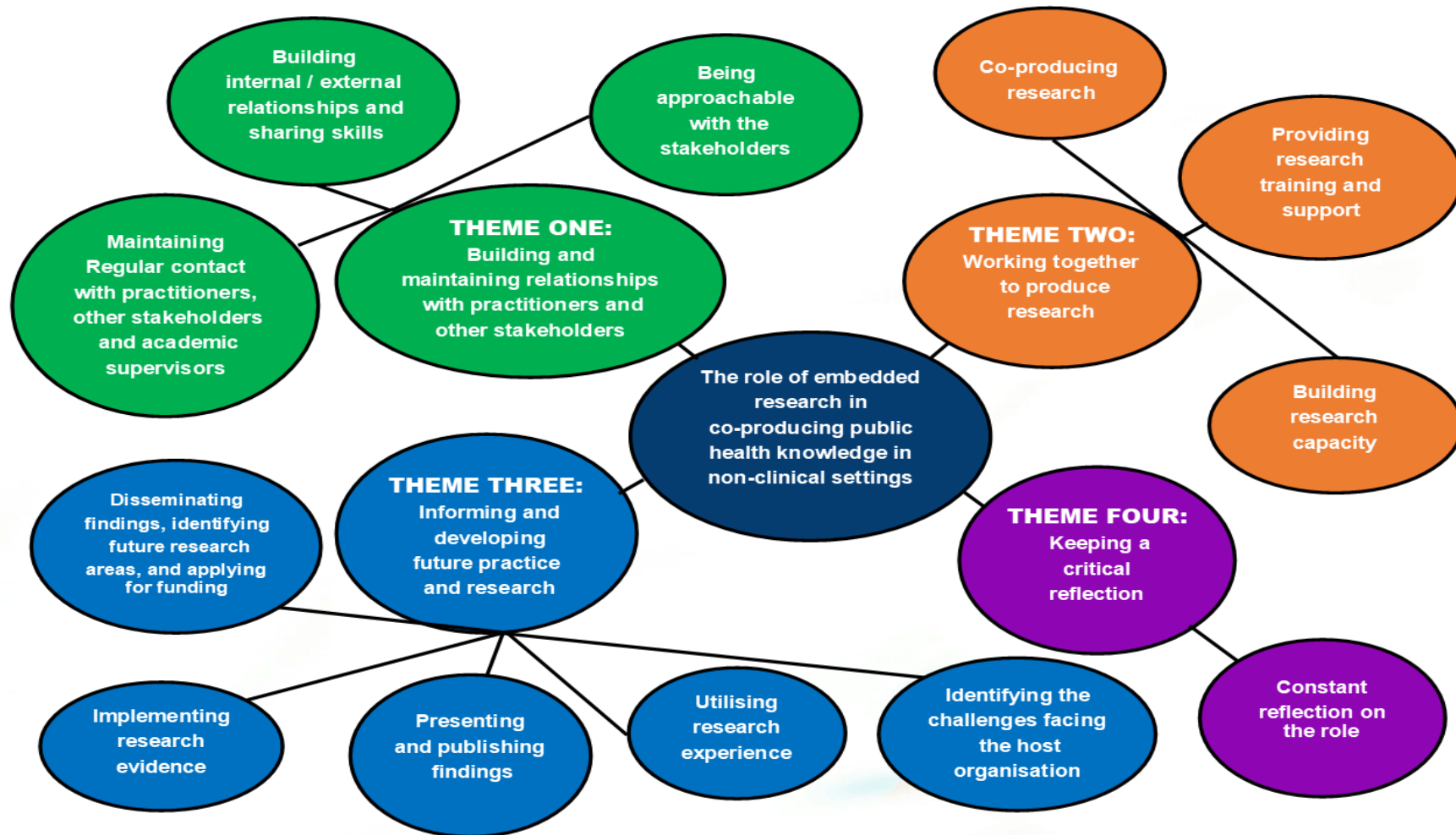
Participant	Coding	Sex	Age	Highest level of education	Years of experience
<b>Site One (LA1)</b>					
1	ER site 1	Female	41-50	PhD	7 months
2	PHP1 site 1	Female	51-60	Consultant	18 years
3	PHP2 site 1	Female	51-60	PhD	20 years
<b>Site Two (LA2)</b>					
4	ER site 2	Female	31-40	PhD	3.5 years
5	PHP1 site 2	Female	41-50	Masters	2 years
6	PHP2 site 2	Female	41-50	Masters	6 years
7	PHP3 site 2	Male	31-40	Masters	6 years
8	PHP4 site 2	Female	41-50	Masters	17 years
9	PHP5 site 2	Female	41-50	-	4 years
10	PHP6 site2	Male	41-50	BA(Hons)	20 years
<b>Site Three (School)</b>					
11	ER site 3	Female	21-30	PhD	4 years
12	ST1 site 3	Male	< 21	High School	N/A
13	ST2 site 3	Male	< 21	High School	N/A
14	TR1 site 3	Male	31-40	Masters	8 years
15	TR2 site3	Male	51-60	Postgraduate	35 years
<b>Site Four (Sports organisation)</b>					
16	ER site 4	Female	31-40	PhD	3.5 years
17	PHP1 site 4	Male	-	-	-

\*ER-Embedded researcher, PHP-Public health practitioner, ST-Student, and TR- Teacher  
 - indicates not disclosed, N/A indicates not applicable.

### 4.3 The Thematic Map of the Themes

The initial thematic map of the seven themes and twenty-eight codes identified across the four case studies sites is in Appendix 25. These were then merged further based on similarities. Fig 6 presents the final thematic map of the four themes and twelve codes. (EBP - evidence-based practice, and HO - host organisation).

Figure 2: Final Four Main Themes and Twelve Codes of Findings from Qualitative Work



#### 4.4 The Contribution of Each Participant and Site to the Results

Table 18 provides a summary of the contribution of each participant and site to the four themes that emerged from the qualitative study on the role of embedded research in co-producing public health knowledge to bridge the gap between research evidence and its implementation in the four case studies sites.

**Table 18: Participants' and Their Contribution to the Explored Themes in the Four Case Studies Sites**

Theme Participant	Building and Maintaining Relationships	Working Together to Produce Research	Informing and Developing Future Practice and Research	Keeping Critical Reflection Trajectory
<b>Site one (LA1)</b>				
ER	√	√	√	√
PHP1	√	√	√	√
PHP2	√	√	√	√
<b>Site two (LA2)</b>				
ER	√	√	√	√
PHP1	√	√	√	-
PHP2	√	√	√	√
PHP3	√	√	√	√
PHP4	√	√	√	√
PHP5	√	√	√	-
PHP6	√	√	√	-
<b>Site three (School)</b>				
ER	√	√	√	√
ST1	√	√	√	-
ST2	√	√	√	-
TR1	√	√	√	√
TR2	√	√	√	√
<b>Site four (Sports organisation)</b>				
ER	√	√	√	√
PHP1	√	√	√	√

\*ER- Embedded researcher, PHP- Public health practitioner, and ST- Student, and TR-Teacher.

√ indicates mentioned, – indicates not mentioned

## 4.5 Overview of Themes

The four main themes that emerged from the thematic analysis of the role of embedded research in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in public health are as follow:

- (1) building and maintaining relationships with practitioners and other stakeholders,
- (2) working together to produce research,
- (3) informing and developing future practice and research, and
- (4) keeping a critical reflection trajectory.

### 4.5.1 Theme One: Building and Maintaining Relationships with Practitioners and Other Stakeholders (All sites)

All participants across the four case studies sites, irrespective of their age, years of experience, and education, recounted the significance of this theme to the embedded research projects in their respective sites. They provided the benefits of the role of the embedded researchers in building and maintaining relationships with the public health practitioners and other stakeholders to facilitate the co-production of research evidence. Thus, all the participants agreed that building and maintaining relationships played a vital role in the utilisation of the co-produced research evidence and in the closing of the gap between research evidence and its implementation. The strategies adopted by the embedded researchers to achieve this theme were identified as:

- (1) building internal/external relationships and sharing skills,
- (2) maintaining regular contact with practitioners and other stakeholders, and
- (3) being approachable.

#### 4.5.1.1 Building internal/external relationships and sharing skills

Participants agreed that the embedded researchers' role entails having diverse connections built on good relationships. These relationships assist the embedded researchers in connecting their partners to other relevant organisations such as academic institutions and third sector agencies.



*I think some of that is around having this kind of good grounding so sort of beginning the role with already having made, a lot of kind of contacts, a lot of sort of good relationships been built. [...] I have a line manager in the council, who was the project manager for the first phase so we've got that continuity there [...] I also have an academic supervisor who is also my kind of my line manager from the academic side” [ERsite1]*

*“I can say that’s [having connections] actually key because they are straddling both worlds. [...] not somebody who sat in the academic institution who didn’t understand the wider context. I think these roles are really key in bridging the institutions” [PHP2site1]*

It was clear that building relationships and connecting the ‘two worlds’ is not only advantageous to both institutions but also assisted the embedded researchers to seek support from both their academic supervisor at the University they were employed and the LA they are working with. Therefore, this enables the embedded researchers to be supported fully to carry out their role successfully. It was also recognised that while embedded researchers play their role in building relationships and connecting relevant organisations, the role assisted them to understand the context in which research evidence is to be utilised. Thus, the relevance of research evidence to the host organisation facilitates its use.

Furthermore, the connection between academia and the LA made by the embedded researcher’s role provided practitioners and other stakeholders access into the Universities the researchers are affiliated with, as well as the ability to use the facilities there such as library facilities.

*“So, she became part of the team [...] there was a time we also go to the University and sit down there, sit down as a team. So, you see, you build that understanding of each other” [PHP1site2]*

*[...] so, they spent time both in the school and at the University. You could see that the students were getting something out of it [...].” [TR2site3 - Teacher]*

Meetings at the University where practitioners and other stakeholders could spend time were seen as important for closing the gap between academia and practice. This helped build a bond between the embedded researchers and the practitioners including other stakeholders working on the research project.

Participants reported that the embedded researchers assisted in improving relationships at different levels within and outside the organisations.

*“The first one is, I think it potentially changes the landscape for how schools or how students can engage with higher education institutions [...] really kind of improve on their relationship with staff. [...] I was an assistant to them rather than an Assistant Head in the school, that was quite, that was really quite interesting and I think if we were to do it again, it will be really interesting for them to see how the relationship with staff changed as the result” [TR1site3 - Teacher]*

*“[...] we are in a very strong position to get information through the health side of the University and sports, and so we got a good relationship with the University and we work very closely in the area of projects [...] So many things we are involved with that make us really close with, like that of information share, research shared. Yeah, so I think building those relationships, that is what we really doing well not just locally but nationally and in order to be able to draw down information and share information” [PHP1site4]*

It was evident that the embedded researchers assisted in connecting the host organisations to other relevant organisations such as other Universities, to build relationships that would have taken them a longer time to establish. However, as the embedded researchers invested time to build relationships, they were quite connected with several relevant stakeholders, and thus, made the connection easier. For example, participants from the school (site three) reported that the embedded researchers assisted in building relationships within the school, and between the school and a higher educational institution. A public health practitioner from the sports organisation added that the relationship-building assisted the sports organisation to have access to relevant information regarding their projects. In addition, the sports organisation worked closely with the University, and as such, they shared information as well as research. It was also stated that the sports organisation builds relationships not only with local organisations but also with other organisations nationally. This relationship-building between academia and the practitioners enabled the research they were conducting more relevant to the organisation.

A further example of this is the help given by the embedded researcher to the practitioners with speaking with external organisations. This was seen as an invaluable asset.

*“[...] we won't have that expertise in the team and we won't have an idea and to able or maybe talking to an external organisation and to do that which would cost lots of money, things like that [...] So, I think, so the embedded researcher role in what we do is infallible resource really” [PHP1site4]*

It was clear that the embedded researchers used the influence of their relationships with other organisations to connect their host organisations with other relevant

organisations. Thus, this helped the embedded researchers in playing the role of an intermediary between different organisations.

This relationship-building was seen as crucial to the success of the role, and it was felt that these relationships could determine the success of any work carried out.

*“[...] I would go as far to say I think it's the relationship that's built with the individuals who developed that project was important. [...] are the most important elements of co-production” [ERsite2]*

*“She [embedded researcher] has been there longer, excellent relationships with the volunteers, that helped to build and shape this project, so she has a very useful experience in terms of relationship-building” [PHP6site2]*

This implies that lack of relationship-building between researchers and public health practitioners can serve as a barrier to embedded research project as discussed in chapter one. Furthermore, it was evident that the relationship built with the stakeholders who were involved in the embedded research was crucial to the projects. For instance, an embedded researcher from LA2 used her skills to build relationships with the volunteers that participated in the project. Thus, this assisted in structuring the work which had a positive impact on the project. This two-way relationship with other organisations, including the local universities and research participants, was seen as a benefit of embedded research.

Findings showed that embedded researchers used their contacts and good relationships to facilitate the sharing of skills useful in carrying out embedded research projects and also enable working with other academics at the University.

*“[...] even for me just working as an individual in that organisation, I don't know everything about the research, but because you are linked with the University, that gives an avenue to ask questions and link up with people with expertise to then support an evaluation” [ERsite2]*

These connections and relationships, therefore, enable the sharing of skills useful to co-produce relevant high-quality research evidence useful to host organisations and policy makers.

As detailed in chapter one, ‘embeddedness’ is one of the distinguishing characteristics of an embedded research model of co-production. Being ‘embedded’ in the host organisation had desirable benefits in building relationships with public health

practitioners and other stakeholders. This provides the opportunity for researchers to understand the context in which the research is to be conducted and utilised and therefore, be able to be implemented. Thus, this closed the gap between research evidence and its implementation in the host organisations.

*“..and practically the embedded researcher is seen as a member of the team rather than an outsider because that's very key” [PHP1site1]*

*“You are not just going there as a researcher all by yourself, you are actually working there. It's not just like ahaa who is this? Or somebody just randomly parachuted in. There is that connection there” [ERsite4]*

Within this current study, it was clear that if the embedded researchers were not located or had spent time in the sites, they felt it would be difficult for them to build relationships, and understand the context in which the co-produced research is to be utilised.

*So, having the researcher embedded within in what we do, the researcher has the understanding of the project, and initially she has been with it from the start to finish, so she understands the journey that's been on, and she understands why it's been done, how it's been done [..] So, I think, so the embedded researcher role in what we do is infallible resource really” [PHP1site4]*

The ‘embeddedness’ gave the researchers an understanding of the projects they were involved in. As such, the embedded researchers were seen as ‘insiders’ and their ‘embeddedness’ was seen as key to the success of the work.

Furthermore, spending time in the host organisation was shown to benefit teamwork with the practitioners as well as providing the embedded researchers with benefits such as access to relevant information regarding the research project. This, therefore, helps in ensuring that the work can be more fully developed and integrated into practice.

*“So, my being inside the organisation even things like having an email address, accessing calendars all of those practical things were seen as a small kind of benefits. I think in terms of being able to request information, requesting data, having meetings, just being more within that setting really. I would say probably at least a couple of days in a week. I was familiar with quite a lot of people but obviously being there regularly I have got to know them much better basically” [ERsite1]*

*“She is part of the team. I think it's by being present, she comes in and she actually keeps in touch to know how work is going on, being visible in the team. I think it was about the benefits of working together as a team, and not me sitting on my own*

*trying to do that on my own. So, it's really good to have that separate functional approach that you know you can tap into and someone who can really lead that piece of work" [PHP2site2]*

For instance, being embedded in LA1 was able to give the embedded researcher access to some facilities such as having an email address, pass for the building, as well as data sharing and relationship-building ensured that she was seen as part of the organisation and making it easier to carry out the co-produced research. This implies that being 'embedded' in the host organisation facilitates relationship-building as well as the amount of information the host organisation shares with an embedded researcher. Similarly, one public health practitioner from LA2 confirmed that the embedded researcher spent time in the LA to build relationships. The embedded researcher usually keeps in touch to get informed of the progress of the project, as such, she was seen as part of the team. The practitioner added that being able to contact the embedded researcher for support is an advantage.

It is worth noting that the amount of time spent by the embedded researchers in their respective host organisation varied and was negotiated at the sites to suit the embedded researchers and the host organisations.

*"[...] I was familiar with quite a lot of people but obviously kind of being there regularly I have got to know them much better basically. [...] I mean it really varies; I would say probably kind of um at least a couple of days in a week" [ERsite1]*

*"Being embedded within their team I spend half of the week working within the organisation. If I am not out there collecting data, then am in the office. You know between 4 to 7 hours being with them. It's been a real pleasure to work alongside them" [ERsite2]*

*"So, we tend to have meetings where I will go in for a few hours at a time. I would probably say, probably once in a month, every 6 weeks, to spend about 2 to 3 hours, so I guess that would probably work it, I don't know, maybe an hour in a fortnight, like that because its 2 to 3 hours every 4 to 6 weeks" [ERsite3]*

*"[...] I spend two and a half days working within the organisation. [...] you want to be seen as part of that team and not somebody who just pops up every now and again" [ERsite4]*

However, building relationships and sharing skills was not seen as without its challenges with some tension between roles and expectations.

*"[...] it has become trickier splitting myself now between the organisations as they all have their roles and expectations on how they want things to be done" [ERsite2]*

*“The structure can be quite challenging as well, but probably [...] just having that balance in the relationships with the organisation you are working for and the organisation you are evaluating for. And I think yeah you have got to have that one, but that is a challenge of working in large organisation” [PHP6site2]*

The embedded researchers from LA1 and LA2 found there was some tension in working in both ‘worlds’ as a result of the responsibilities associated with it, such as building relationships, and balancing diverse responsibilities. This is due to their dual affiliation as such, they are expected to manage a large workload, managing both successfully. A practitioner from LA2 added that the structure of the organisations the embedded researcher works could also be a challenge, therefore, it is important for an embedded researcher to be able to discuss this with both sides in order that they balance the relationships between the host organisation and the academic institution.

Another notable challenge is having to manage diverse expectations including the ability to balance competing interests of the different organisations.

*“There is sort of difference in expectations because I think from the academic point of view, [...] we want publications, we want things that give us an academic output, whereas erm someone who works in the school is not going to be bothered about that sort of things. They have to see where it positively affects their school, [...] so I think having that difference in like agendas on what you want to achieve from this school research can be quite hard to manage. [...] you want different things from this piece of research is quite hard, and make sure that both sides are happy at the end of the day, and I think we did that quite well” [ERsite3]*

For instance, an embedded researcher from the school stated that the expectations from the embedded research project did differ. That is, while part of the aim of the academic input was to publish the outcome of the project to improve or boost their academic output, the school aimed for a practical positive impact of the project on the school, such as improvement in students’ engagement in academic activities. Hence, it was essential to balance the competing interests of the school and the academic side of the embedded research project.

Overall, the embedded researchers build internal/external relationships and share skills to build and maintain relationships with practitioners and other stakeholders in the sites. The next sub-sections discuss other strategies adopted by the embedded researchers to build and maintain relationships in their respective sites.



#### 4.5.1.2 Maintaining Regular Contact with practitioners and other stakeholders

Based on the participants' experiences, the embedded researchers built relationships with the practitioners and other stakeholders by maintaining regular contact.

*"I think what we did was to help build that relationship. It was not just a telephone conversation just to discuss. We actually worked side by side so there was time to actually do that embedded research. We spent time in the office, we spent like one or two days a week" [PHP1site2]*

*"Yeah, but then we did send them emails and stuff, in between [...] yeah we did have time outside of the face to face sessions and sending stuff to the teachers to sort of encourage them, 'can you remind the students that we have got to do this week', we have got to get this done by then, so I would say obviously we had the face to face sessions but then we had email correspondence as well. Maybe an hour or so a week" [ERsite3]*

The practitioners from LA2 reported that the embedded researcher maintained regular contact by face to face, or by telephone. They further explained that they worked side by side with the embedded researcher to build relationships. This implies that if the practitioners and the embedded researcher were not chanced to work together, which assisted in maintaining regular contact, it would have been difficult to build relationships. Thus, this widens the gap between academia and practice as discussed in chapter one. The embedded researchers had similar experiences. For instance, an embedded researcher from the school confirmed that she maintained regular contact to build relationships with the students and the teachers by email and face to face. This shows that it is important to develop project strategies in order to maintain regular contact with the practitioners and other stakeholders to build relationships.

According to the embedded researchers, building mutually beneficial relationships was achieved by maintaining regular contact not only with the stakeholders but also with their academic supervisors which enabled the embedded researchers to have the necessary support to achieve their role.

*"I mean knowing that I do have kind of the support at the University to draw on and also have a kind of a good working relationship with my line manager in the council as well really. I don't feel that I am lacking in any kind of support, which is a good kind of place to be in yeah. So I have monthly meetings in the University and that's very much really useful in times of keeping track of some of the other parts of my roles so around kind of trying to ensure that we can get some like academic publications and things like that so yeah" [ERsite1]*

*“Yeah, erm I speak to my academic supervisor most days, [...] about things specifically with the School Project. [...] just checking in saying where we were with things, [...] yeah, so I would definitely say it’s one of the massive advantages because having that support from her, [...] I think obviously because I am quite junior still, I just finished my PhD, so having that support from someone who has years and years of experience, it’s invaluable, like she would have answered all the questions before or she would have dealt with all of those things [...]” [ERsite3]*

For instance, an embedded researcher from LA1 reported that she had a good relationship with her academic supervisor and her line manager in the council. So, to maintain regular contact with her academic supervisor, she attended monthly meetings with her. She further explained that having a regular contact with her academic supervisor assisted her in the process of managing and delivering responsibilities and commitments associated with the academic part of her role which could assist in the development of her academic career. Thus, this means that the responsibilities associated with researchers’ academic role could serve as a barrier to the bridging of the gap between research evidence and its implementation if embedded researchers lack the support of their academic supervisors as discussed in chapter one. Another embedded researcher from the school confirmed that she maintained regular contact with her academic supervisor by using different strategies including sitting together to discuss the embedded research project. This was seen as a huge advantage as it assisted the embedded researcher in carrying out her role in closing the gap between research evidence and its implementation. Most especially, as the researcher narrated that she was seen as an early career academic member, but with the support of her academic supervisor who has a wealth of experience, she was able to navigate and overcome the challenges at a more senior level. This helped the embedded researcher grow in confidence and ability. Thus, the challenges could have served as a barrier to the closing of the gap between research evidence and its implementation in the school, if the embedded researcher failed to maintain regular contact to build a good relationship with her academic supervisor (as discussed in chapter one).

Another strategy that was mentioned regarding how the embedded researchers maintained regular contact to build relationships with the practitioners and other stakeholders was ‘attending formal meetings’.

*“Interestingly, the researcher has always been on the co-production committee and she attends the meetings, so she is excellent, much better than me because she*



*has been there longer, [...] that helped to build and shape this project [...]"*  
**[PHP6site2]**

*"So, I have to go to all their team meetings that's gonna help you form a lot of relationships. Meetings are where the real connection starts to happen. So, you have to invest that time"* **[ERsite4]**

Participants agreed that the embedded researchers built relationships with the staff by attending formal meetings. For example, one practitioner from LA2 reported that the embedded researcher attends the public health team meetings, and has been an integral part of the co-production committee (steering group). This was seen as a way to build relationships with the practitioners. Therefore, the embedded researcher was seen as part of the organisation, and that assisted in improving the embedded research project. Other participants including the embedded researchers had similar experiences. For example, an embedded researcher from the sports organisation reported that she invests time in attending team meetings so that she can build relationships with the practitioners.

Furthermore, it was reported that being engaged in other activities in the host organisation can also assist an embedded researcher to maintain regular contact to build relationships with the practitioners and other stakeholders.

*"Okay, the researcher gets involved not just in the research part thing, she gets involved in everything, we work as a team, the researcher is involved in team meetings we are holding, workshops, training, everything that we do the researcher is in and so the researcher is very much part of the team [...] if there was a case of an external coming in to sit with us once a week or twice a week, it might be a very difficult relationship and because the researcher is embedded with us the researcher works flexible around what we do, the researcher understands what we do and everyone in the team and each individual came on really well, the bond is there and communication"* **[PHP1site4]**

One public health practitioner from the sports organisation explained that apart from attending formal meetings, the embedded researcher was engaged not only in the research work but also with other activities in the sports organisation. Hence, the embedded researcher understands the activities in the organisation. This helped the embedded researcher to build relationships with the team members as she was seen as part of the team, and thus, these facilitate shared learning, bonding, and communication. The practitioner in this setting added that building relationships would have been difficult to achieve if it had been an external researcher coming in once or twice a week. Thus, the lack of relationship-building could have negatively impacted

the work as the researcher might find it difficult to understand the context in which the research evidence is to be utilised and could have served as a barrier to the co-production research.

As well as making use of formal meeting, the embedded researchers adopted 'informal conversations' to maintain regular contact to build relationships with the public health practitioners and other stakeholders.

*"For me, I am quite like a chatty person and I think that's like the characteristics of an embedded researcher. You need somebody who is easy to get on with lots of different people. You need to have that ability to do that. Otherwise, you gonna struggle to form a relationship especially if you aren't there as often as what you would be if it's a full-time job" [ERsite4]*

*"Yeah, informal conversations, not always been like work work work but to invest time. I would go to three Christmas lunches, you know [...] they added me on Facebook and what's app group where we share things that we might find in a new paper or a press release or something related, so in this what's app group we share with each other. We continue to share with each other outside the office, the structured office time [...] and also the fact that you are able to create that relationship when you are on Facebook you see people's lives outside of work that helps people to know you more a little bit better without them having a conversation with you. That's just, that's just normal part of having a nice working life with people you really enjoy working with" [ERsite2]*

One embedded researcher from the sports organisation mentioned that being friendly helped her to build relationships with diverse kinds of people in the sports organisation. Bearing in mind that she is a part-time staff member in the organisation, she maximised her time to build relationships with the practitioners. Another embedded researcher from LA2 added that she and the practitioners engage in casual discussions and interactions through social media outside working hours. They spend time together outside working hours such as having Christmas team lunches together. These were seen as strategies to maintain regular contacts to build and maintain relationships with the practitioners. Consequently, building relationships through engaging in informal conversations between the embedded researchers and the practitioners was felt to enhance formal working performance.

A practitioner from the sports organisation added that engaging in informal conversations also helped in building a trustworthy relationship with the embedded researcher.

*“[...] We have that relationship and some other things you can visit, particularly when things get tough, it’s easy enough to fall back on different conversations on sport [...] These conversations increase our relationship and trust, we trust each other”*  
**[PHP1site4]**

The practitioner further explained that he has a good relationship with the embedded researcher and so they engage in informal conversations at difficult times thereby developing a relationship that is based on trust.

Overall, the embedded researchers maintain regular contact to build and maintain relationships with the practitioners and other stakeholders. The next sub-section discusses how being approachable assisted the embedded researchers to build and maintain relationships with the practitioners and other stakeholders.

#### 4.5.1.3 Being Approachable

Results showed that the embedded researchers built relationships with the practitioners and other stakeholders by being approachable.

*“Yeah anytime she is talking to us she doesn’t talk to us as a researcher, she talks to us like a normal person so that really sort of build the connection”* **[ST1site 3 - Student]**

*“[...] actually that is really important. She is actually brilliant in terms of building relationships and she is very easy to get along with, so that is her personal touch. And she is a really really nice woman”* **[PHP6site2]**

The school students who were involved in the research recounted that the embedded researchers related to them as though they were equals, and so they were able to approach and relate with the researchers freely. The students added that although it was their first experience with research, the fact that the researchers were approachable encouraged their participation and the success of the co-production research they were carried out. This approachability was seen as important in other sites also as the practitioners from LA2 confirmed that the embedded researcher was friendly and pleasant. Thus, this assisted the embedded researcher to build relationships with the practitioners.

Results showed that the embedded researchers used diverse strategies to ensure that they were approachable to the practitioners and other stakeholders to enhance relationships building.

*“[...] keeping them motivated but I think one other thing the researchers were really good at, [...] was appealing to their stomachs. You know I think you know bringing something in, [...] you can sit down and have something to eat together, that social bit, not relying on the kind of meetings where you talk but actually let someone have something to drink, that one helped break down some of those barriers and I think that worked really well” [TR2site3 - Teacher]*

*“If we got in there and we sort of, oh this is what we are gonna do today, like very formal, practical, they will be like oh this is really boring, but we go in and came up with cakes and doughnuts, and we are gonna have a chat about a lot of things, that is how it works [...] that’s how to work with young pupils and how to speak to them, because that is a massive skill in itself, and also doughnuts and some cakes helped, we always used to take that in, doughnuts and cakes and stuff. We tried to stay on the same level as the kids, we don’t want to be like, we are telling you what to do. We wanted to work with them and so be at their level, not only to make them understand things but also learn things from them, because that is really important” [ERsite3]*

It was reported that the embedded researchers know how to build relationships with the students involved in the school. For example, the embedded researchers offered the students light lunch to break barriers and to build relationships. This relationship-building facilitated working together to co-produce research with the students which contributed to the success of the embedded research project. This implies that a lack of relationship-building may serve as a barrier to co-production research between embedded researchers, and public health practitioners and other stakeholders as discussed in chapter one. Overall, participants agreed that being approachable helped the embedded researchers in building and maintaining relationships with the practitioners and other stakeholders.

The embedded researchers used diverse strategies to build and maintain relationships with practitioners and other stakeholders in their respective sites. The theme (role) was seen as crucial to the embedded research projects as it could be referred to as the foundation that other themes (roles) build on. Therefore, what follows is a series of discussions about how the embedded researchers work together to co-produce research with the practitioners and other stakeholders.

#### **4.5.2 Theme Two: Working Together to Produce Research (All sites)**

Results showed that the embedded researchers build and maintain relationships with the practitioners, and other stakeholders they work with in order to work together to produce research. This, therefore, facilitated the production and the use of the co-

produced research evidence at the embedded sites and helped close the gap between research evidence and its implementation as results were shared quickly with all those that were involved. All participants across the four case studies sites, irrespective of their age, years of experience, and education, agreed that this theme is one of the primary roles of an embedded researcher. Regarding this theme, the identified strategies used by the embedded researchers include:

- (1) providing research training and support,
- (2) co-producing research, and
- (3) building research capacity.

#### 4.5.2.1 Providing research training and support

The embedded researchers explained that they conducted training, and other developmental activities to help develop the practitioners' and other stakeholders' research skill-set.

*"I have done a kind of number of training sessions with staff and actually with volunteers that will want to get involved in collecting data [...] so I have run workshops, training workshop, so that means that when I go out there for collection the staff can come and do it with me" [ERsite4]*

*"[...] another element of my role is to deliver training to staff around the use of data around the benefits of collecting relevant information, how that information can be used to inform practice in decisions and planning and things like that, we just had a conference couple of weeks ago which was very much about kind of sharing the learning and then sort of getting people involved in the work that we do really, so they are my kind of key targets really" [ERsite1]*

Research-based training were offered by the embedded researchers in a variety of forms, such as using workshop training, one to one training and through seminars and conferences. For instance, an embedded researcher from the sports organisation reported that she taught the practitioners to collect data at a training workshop that she organised. She explained that this training assisted the embedded research project because it helped the practitioners to get involved in the data collection phase as they had the skills from the training. Similarly, another embedded researcher from LA1 reported that getting the practitioners involved in the embedded research work facilitated the sharing of learning, which was one of her main goals while working at

the LA. This particular researcher trained the public health practitioners to collect data and taught them how research evidence can inform practical decision making.

The public health practitioners across the sites reported similar experiences. They discussed how the embedded researchers conducted research training and support.

*“She provided some quick things for us [...] and it kind of validates the whole thing for us [...] I think that develops the capacity that we have and challenges our delivery and the reflection in terms of incorporating all of those elements into our daily work”*  
**[PHP4site2]**

*“The embedded researcher worked alongside us to be clear about what data, what information, be clear about the questions and how to shape some of those evaluations [...] to be really clear about the methodology [...] how to write protocol”*  
**[PHP2site1]**

One public health practitioner from LA2 confirmed that they had applied the training they had received into their everyday practice. Another practitioner at LA1 expatiated that the embedded researcher also provided ad-hoc research support by working with them. This helped in developing interview questions, methodology, and research protocols, thereby ensuring that the training and work enabled practitioners to develop their work going forward. This further indicates that, as discussed in chapter one, a lack of training or a failure to train practitioners may be one of the barriers to the practical implementation of research evidence.

Similarly in the school, the teachers and the students detailed how the embedded researchers worked with them and provided research training and support.

*“The researchers pointed and directed us in the right direction. Obviously, I have learnt how to work in a team and to conduct research, doing different roles some sort like that [...] It gave us some sort of developing teamwork skills. I think the researchers just sort of believed that we could do it, and so they just taught us how to do it. So, they gave us that support”*  
**[ST1site3 - Student]**

*“I think it was multitasked really, it was around helping the students to understand the role of research and how to research. It was about trying to expose them to some of the research [...] some of the techniques of the research and then helping them to draw their ideas together in order to try and make sense of the findings. So obviously the researchers brought in all of their knowledge about how to carry out research. The students were trained to understand the ethical considerations, just like you have done with me in all of this process [...] of interviewing people, going through it with them, and analysing the areas”*  
**[TR2site3 - Teacher]**



A student from the school stated that the embedded researchers had guided them through the research process thereby making the process easier and less intimidating. He also identified an additional advantage of working with the embedded researchers as being able to develop a team spirit. Similarly, a teacher from the school confirmed that the embedded researchers helped the students and teachers understand the importance of research and how to properly conduct research. By drawing from the training sessions and the researcher's wealth of knowledge, the students and their teachers learned to properly conduct research. This indicates that the embedded researchers helped integrate research activities and useful research findings into the daily practical functioning of the school.

Furthermore, the public health practitioners and other stakeholders acknowledged that their lack of research skills had made the embedded researchers quite valuable to the host organisations.

*"[...] particularly when we are looking at what we are gonna do, what we are gonna research, what is our search criteria, what we need to consider, and so she helped us with some of that evidence base and identifying that" [PHP1site2]*

*"Like I mentioned before, because of our lack of experience in that area, we couldn't have asked the right questions. [...] So we liaise with the researcher to develop that initial kind of overview of that population [...]. So, the embedded research role is really an advisory role, to begin with, and the researcher support us with the development of the initial questions, the questionnaire, and the initial research" [PHP1site4]*

*"Obviously, we don't actually know how to conduct research, and the researchers really sort of guide us through and obviously get us to understand research. Like going into what methods to use [...] and some stuff like that. So, the researchers gave us that support" [ST1site3 - Student]*

In all sites, it was found that practitioners and other stakeholders realised that their research skills are lacking. As such, they regularly sought the researchers' advice. It was evident that the embedded researchers frequently helped the practitioners and other stakeholders identify relevant research areas warranting further exploration, and they also provided research-related support that helped facilitate the co-production of research.

Participants agreed that the support the embedded researchers provide helps add depth and value to their work.

*“When the researcher came on board, the researcher has really put policies and procedures in place regarding how we structure our programs and projects as well as in terms of how we start looking at research and developing the tools to evaluate and assess it. So, it really was a more detailed and in-depth kind of input we received from the researcher - with the research and everything involved definitely. I don’t think we would be able to get the details and the valuable information that we get if at the end of the project we were doing it on our own. And again, that comes down to expertise, understanding what questions to ask, understanding the structure of questions and the best methods of evaluating and accessing information, and the best way of gathering that information whether it be from focus groups or services. The support has been brilliant” [PHP1site4]*

The embedded researcher’s assistance has influenced how the sports organisation structures its work programs and projects. The positive changes brought about by the guidance of the researcher would not have been possible if the sports organisation had had to rely on its own relatively unadvanced research skills.

It was evident that the embedded researchers adopted diverse strategies to introduce research to the practitioners and other stakeholders. The diversity of approaches encouraged practitioners and other stakeholders to participate in the co-production of research evidence at their respective organisations.

*“We did a lot of sort of interactive things with them. We did a lot of role-play. For the first phase, we did interviews, so teaching them interview skills, we did a lot of role-playing. It was not even just about the students, we researchers, we did role-play [...] we did a lot of training around different qual methods” [ERsite3]*

*“We practice for interviews, we practice for what we gonna ask, we practice for everything. To be honest, they have the experience, and so they guide us to what is right. When we were doing the interviews, they were in the room [...] they also help to organise everything [...] they made us like a checker to check those stuff [...] so we can build our questions to get the answer [...] it helps us gain experience in confidentiality, and I would do it again” [ST2site3 - Student]*

Results showed that apart from adopting interactive approaches, training also included role-playing, among other research methods. For example, a student from the school stated that before the actual data collection phase, the researcher conducted training on how to properly collect data from interview participants. He added that the researchers were always around to provide support, even during data collection. He confirmed that the researchers helped them develop the interview questions. They were involved in every stage of the research project and also gave training regarding confidentiality. The student’s willingness to conduct research again in the future indicates the positive results created by a collaborative approach to research.



Consequently, continuing to provide necessary research training and support can help the host organisations integrate research into their culture and sustain on-site research development.

However, it was noted that as the embedded researchers provided necessary research training and support to the public health practitioners and other stakeholders, they continued to attend relevant training designed to help them fulfil their role in their host organisations.

*Taking on the project I had to do quite a lot of training about how to speak to the young pupils, how to interview young pupils, and that kind of thing” [ERsite3]*

One embedded researcher from the school reported that to fit into her role perfectly, she was trained by the University on skills of working and speaking with young people before the project started. Consequently, this assisted the embedded researcher to successfully work with the teachers and the students to co-produce research.

It was quite evident that over the course of working with the embedded researchers, the participants recognised the importance of working with embedded researchers to co-produce research. All the participants across the four research sites acknowledged the research training and support offered by the embedded researchers. Another significant observation that kept appearing in the interview data was that the participants felt that the research training and support offered by the embedded researchers helped ensure research rigour.

*“It’s merely bringing somebody in who has that technical research knowhow and making sure that we have rigor about the research involved in public health practice. Then for us, it’s more about the outcome of that research being used to influence practice for quality improvement” [PHP1site1]*

*“It’s good to have somebody, a researcher, or somebody who is going to evaluate that, just to keep you on the right track. She did a lot of the literature review part, looking at the methodology and how their findings were transcribed, and then she kind of led on that. Then we worked together to pull all those key things out and then develop recommendations we could take forward. I think it’s really vital, actually because, without the support of having somebody there to help with the whole evaluation process, I don’t think it would have been done in a robust way” [PHP2site2]*

*“She was bringing her own fresh ideas and thoughts and things to the process” [PHP5site2]*

The public health practitioners from LA1 and LA2 shared similar experiences. They reported that the embedded researchers were employed because of their research skills, their ability to work with stakeholders, and their ability to ensure research rigour. It was clear that the embedded researchers worked with the practitioners, provided guidance on research activities, and helped develop recommendations that could be applied to practice. The researchers also provided support during the evaluation process, and they once again utilised and shared their research skills during the evaluation stage. The evidence and recommendations extrapolated from the high-quality research conducted at the sites were then used to inform on-site practices and improve the quality of services. By doing so, the researchers helped in utilising research evidence faster in the organisation and therefore worked to close the research evidence implementation gap. Indeed, the statements made by the practitioners indicate that it would have been difficult for them to conduct high-quality research if the embedded researchers had not been present on-site. This lack of research experience, which was remedied by the presence of the researchers, may be one of the barriers preventing the practical application of research evidence to organisational practices as discussed in chapter one.

Similarly, participants from the school reflected on how the researcher's skills contributed to the successful co-production of research. The embedded researcher from the school added that their role involves the coordination of the co-production research. Consequently, they used their research skills to ensure the rigour of the research conducted at the site.

*“You find a champion in a research setting that has an uncompromising belief in children, and for us, that was the researcher. So, I know that she will feel very humbled by me saying that. Having the researcher, somebody with massive credentials, she has lots of experience, she could be incredibly academic, but she clearly has a big heart and an understanding of what education can do for children”*  
**[TR1site3 - Teacher]**

*“We had to keep sort of making sure, things were getting done in a way they should be done. [...] I think a massive part of that is being able to see the value of the research”*  
**[ERsite3]**

*“[...] and I would do it again”*  
**[ST2site3 - Student]**

The participants from the school reported that they did not know how to conduct research prior to the co-production research project. To help overcome this deficiency, the researchers guided the participants through the research process and provided training that was age-relevant. This ensured that the co-produced research conducted on-site would be rigorous and credible. It appears that the research guidance provided by the researchers was effective because the students mentioned that they would be willing to engage in the co-production of research again in the future.

Overall, it was clear that the participants were aware of the importance of working together with embedded researchers, and the researchers were acknowledged for their ability to assist greatly with research-related training and support. It would have been difficult for these organisations to generate high-quality on-site research if the embedded researchers had not been present. Consequently, the embedded researchers helped work to close the research evidence implementation gap.

#### 4.5.2.2 Co-producing research

As discussed in chapter one, one of the fundamental roles of an embedded researcher is to co-produce research at the host organisation with the members of the host organisation as well as other stakeholders. The participants confirmed that they worked together to identify, plan, and conduct research intended to help the host organisations improve their services and meet the needs of the communities with which they work.

*“We liaise with the researcher to develop the initial kind of overview of that population [...] the researcher supports us in developing the initial questions, the questionnaire, and the initial research” [PHP1site4]*

*“[...] embedding research into the public health team. [...] then helping us to explore the questionnaires. The embedded researcher helps us with the development of that work including the formulae and evaluation for the intervention. We design and develop and embed and undertake the research together. She is very much a part of the team and a core within the team” [PHP4site2]*

For instance, a practitioner from the sports organisation reported that they worked with the embedded researcher to develop research questions and conduct research. Another practitioner from LA2 added that working with an embedded researcher helps the public health team integrate research into its practices quickly. The practitioner further expatiated that her team co-produced research with the embedded researcher

and was involved in every step of the research process. According to this participant, the embedded researcher was seen as a part of the public health team itself.

The participants acknowledged that working together to co-produce research with the embedded researchers encouraged adjustments to and engagement with research-related activities. Furthermore, embedded research was considered a cost-effective research approach.

*“I have been out in a couple of beneficiary interviews with the researcher. Certainly, I would not normally get involved with going out to see clients, but I have gone out a couple of times with the researcher, so that was interesting” [PHP5site2]*

*“[...] the embedded researcher worked alongside the public health practitioners [...] how to shape some of the evaluations, including how to be really clear about the methodology, the approach [...] And how to write protocol [...] So, I think that was the aim of it, it was to ensure that we have much more effective and cost-effective research” [PHP2site1]*

One public health practitioner reported that she participated in several research activities with the embedded researcher at LA2. She recognised that working with the researcher enabled her to do research work that she would not have ordinarily done. This suggests that not working together with practitioners to co-produce research may potentially prevent practitioners from being meaningfully involved in the research process. In such situations, the gap between the development and implementation of research evidence may actually become wider. One practitioner from LA1 explained that embedded research was adopted in the LA so that the authority could conduct cost-effective research. This only further indicates that having an embedded researcher on-site working collaboratively with practitioners and stakeholders to conduct cost-effective research can help bridge the research implementation gap.

The embedded researchers also talked about their experiences working with the practitioners and other stakeholders to co-produce research. Thus, they share the ownership of the research.

*“We actually asked the students to come up with an idea themselves, and we did not want to go into the school and say this is what you should do [...] We asked them what is the most important thing for them, we did that in both phases, and the topic that came up in the first phase was the changes to the GCSE [...] so we were looking at how these changes will affect young pupils in this scenario” [ERsite3]*

*“There is an ongoing thing which is about kind of improving data collection by working with the key stakeholders who can make those changes. We basically set*

*up a small working group where we just meet once a month and work through some things to try and get some of these improvements made” [ERsite1]*

*“[...] sometimes their staff will come out with me because they want to do some data collecting as well, so the practitioners are out there with me doing the interviews with folks and groups. [...] we developed a particular evaluation together” [ERsite2]*

One embedded researcher from the school recounted that they had worked with teachers and students to co-produce their research project. It was evident that the teachers and the students were involved in every stage of the research, including deciding which research areas to explore. Therefore, the research was jointly owned by the researchers and the school. Furthermore, since steps were taken to ensure that relevant research was conducted, the co-produced research generated useful outcomes for the school. Another embedded researcher from LA1 also recounted similar experiences. She reported that she had worked with key stakeholders to improve data collection, and a working group had been organised to facilitate this improvement, which further facilitated co-production. Yet another embedded researcher from LA2 stated that she worked closely with public health practitioners to develop an evaluation. This kind of close collaborative work can help organisations integrate research-related findings into their culture and their daily practices.

However, it was noted that the process of co-producing research between the embedded researchers and the public health practitioners and other stakeholders also facilitated shared learning.

*“Despite the fact that we went in obviously thinking of teaching them but the fact that we can learn from them about what was important to them, what was important to young pupils in schools, and how to speak to young pupils because that is schooling in itself. [...] and I think also you learn new skills [...] so I think you get sort of practical experience and learn new skills sort of more practical skills I suppose, not just research skills, so yeah that is why I think I say it’s the most important thing” [ERsite3]*

*“[...] and when I have been out with staff members, they will ask questions that I would never have thought of asking, because of their knowledge at work. [...] I have been learning a lot as well from the staff, and that shows the importance of doing it together” [ERsite2]*

One embedded researcher from the school reported that although their aim was to teach the students how to conduct research, they were able to learn what was important to the young people among other things from the students. Another embedded researcher from LA2 shared a similar experience and confirmed that during

the co-production work, the public health practitioners used their tacit knowledge of their field to ask relevant questions that had not occurred to her. Since the practitioners are more knowledgeable than the researcher regarding actual on-site practices, they added substantial value to the project. This indicates just how much learning is a two-way process, and demonstrates co-production of knowledge which involves the amalgamation of the practitioners' tacit knowledge and the researchers' explicit knowledge as detailed in chapter one.

It was felt that working together with embedded researchers provided the practitioners and other stakeholders with the opportunity to engage in co-production research.

*“Broadly I think we wanted to sort of help the students, like getting them to research because a lot of them have never heard of research before introducing them to research, getting them to learn new skills” [ERsite3]*

*“[...] and this allows the students to an extent to lead themselves as a group of researchers. So, I think this is really interesting in using this effectively with a group of disadvantaged students to really engage, with what research and learning look like in a professional research environment [...] never at any point did it become dry, or boring, or disengaging to the students” [TR1site3 - Teacher]*

*“[...] So, really it's about giving us the exposure to that sort of research. Well, honestly, I have learnt how to conduct research” [ST1site3 - Student]*

For example, the participants from the school agreed that the embedded researcher helped involve teachers and secondary school students who ordinarily would not be expected to engage in research to the research process and facilitated their participation in research activities. One teacher from the school noted that the embedded research project had helped expose disadvantaged students to the way that research is conducted in academia.

Furthermore, the teachers and students from the school stated that working with the embedded researchers had helped build their careers and the reputation of the school.

*“Yeah, the project without a doubt was one of my absolute professional privileges to be involved in. So, seeing research go from the design process to the implementation process to the fruit of the labour of a group of students publishing their own book with the University, I think it has to be one of my career highlights as an education leader. But seeing the researcher as a kind of leading female inspired the young females [...] I would say in the long term what we saw there were the aspirations of the school community raised as a result as well” [TR1site3 - Teacher]*



*“I think it sort of something you can put on the CV for a job prospect. It’s an added advantage to the school. I think it’s good, it also helps push people towards the highway of getting higher education” [ST1site3 - Student]*

*“First it took a group of pupils who were more ambivalent about their education and their connection with the school, and it really gave them an understanding and a voice, so they were understanding what was happening to them, and they did that, they subsequently have been able to help other students in the school, so actually that then led into them taking on a leadership role inside the school as mentor students. So, I think that really helped their understanding. I think it helped the school; I think it helped other students in the school. [...] I think it has really helped empower a set of young pupils” [TR2site3 - Teacher]*

One teacher from the school specifically mentioned that his involvement in the embedded research project was ‘one of his career highlights’. He said that the embedded researchers, as females and project leaders, encouraged the female teachers and students in the school, and challenged those who believe that only males can occupy leadership roles. This suggests that having embedded researchers in schools can help promote the aspirations of students and the confidence of teachers, especially female students and teachers seeking leadership roles. It was clear that the publication of a book chapter detailing the embedded research project (Hayden et al., 2019) improved the reputation of the school and inspired the students and staff who were not involved in the project.

One student from the school explained that being part of an embedded research project was something that they could add to their Curriculum vitae and that the project had inspired them to pursue higher education. The student described the project as a confidence-building experience that encouraged students to further their studies. A teacher from the school added that the embedded research project had had an empowering effect and had improved the confidence of the students who had been involved. These students developed the ability to assist other students in the school, and had taken advantage of opportunities to take leadership positions within the school. It was evident that the project made a significant difference in the school. Although the school has suffered from a bad reputation, its involvement in the project had improved the school’s reputation and boosted the morale of the students.

Teachers and students from the school discussed the findings noted above in greater detail than the participants at the other research sites. This may be because it is uncommon to conduct research with secondary school students. Consequently, the

project had been viewed as a unique experience whose impacts were thoroughly explored.

*“[...] it gave the school like an identity, that a University was working with it to create some kind of a book chapter on research. [...] that was beneficial. “Well, if not for the research, I will never have had the confidence to go into an interview properly”*  
**[ST2site3 - Student]**

*“What we saw was a group of students, many of which I would say good a kind of 80% of that group, let's say, I will say good kind of five of the eight actually would otherwise most likely disengage from school. I think they would have been what we class as posting learners, [...] but what we saw about this group of students is that they really engage in school”*  
**[TR1site3 - Teacher]**

*“It has also opened up the school's eyes to the fact there is high-quality research going on that really can help make a difference, but actually we can include the students in it, so we do these things together [...]”*  
**[TR2site3 - Teacher]**

It was acknowledged by the participants from the school that the involvement of the school with the co-production project gave the school an identity. One student from the school reported that the confidence he gained while working as part of the co-production research project had helped him to answer questions confidently during a job interview. Clearly, the project was an ‘eye-opener’ for the school. It helped the school realise that its students could be involved in high-quality useful research, and this gave the school a better idea of the true potential of both the school itself and the students. The project made the school understand the benefits of working with embedded researchers. It was clear that the embedded research project helped the students involved in the project engage more with the school.

Overall, it was evident that the researchers were recognised for their ability to co-produce research with the public health practitioners and other stakeholders. Thus, the co-produced research was jointly owned by those involved in the embedded research projects. As the research was co-produced with the intention to assist the organisations to improve the service they render to the public, thus, the embedded researchers' role assisted in facilitating the utilisation of research evidence. Also, the embedded research projects focused on meeting the needs of the host organisations, therefore, there were no instances where there were conflicts related to the research focus. The next section discusses how the embedded researchers assisted in building the research capacity of the public health practitioners and other stakeholders they worked with.



### 4.5.2.3 Building research capacity

The participants agreed that working together with the embedded researchers strengthened their ability to conduct high-quality research capable of benefiting their individual organisations.

*“It also allowed us to utilise and build the capacity of public health practitioners who would often not undertake any research for some time” [PHP2site1]*

*“So, it’s more like continuous professional development [...] So, the research skills are learnt such that at the end of the day, next time the research could be conducted independently, even if we didn’t have somebody coming from the outside. That’s the whole approach [...] is for developing public health practitioners to the extent that research can be conducted in a rigorous manner” [PHP1site1]*

*“I think probably when I attended two beneficiary interviews with her and just seeing how to speak to people when you are asking them questions so there is a way to ask the questions so that they understand, probably by listening to the researcher at that point I sort of learnt how” [PHP5site2]*

As the above suggests, it is evident that the embedded researchers encouraged some practitioners who would ordinarily not participate in research to engage in research activities. This suggests that working together with researchers may be a significant facilitator to building practitioners’ research capacity and closing the research implementation gap. The absence of an embedded researcher may even serve to widen the gap. Indeed, the public health practitioners observed that working with embedded researchers could eventually build their research capacity to independently conduct high-quality research in the future.

One public health practitioner from the sports organisation observed that working with the embedded researcher had built his confidence in his ability to conduct research. He described the process of becoming familiar with how to conduct research as a ‘big learning curve’.

*“I have learnt how to do research properly (laughs). Definitely, the structures in terms of knowing the audience, understanding how to research and how the methods change depending on the audience and the kind of structure and how those programs might look, how we go about evidencing [...] and that for me has been a big learning curve and from understanding what we do at the start of it and how to formulate what we do just to suit that group and that report from that has been really good” [PHP1site4]*

This shows that bringing researchers and practitioners to work together can improve practitioners' engagement with research activities, and ultimately, bridge the research implementation gap.

Overall, the participants agreed that their participation in the projects had built their research capacity regarding their present and future participation in research activities. The evidence suggests that irrespective of age, years of experience, and education level, working with an embedded researcher improves a person's capacity to co-produce research.

### 4.5.3 Theme Three: Informing and Developing Future Practice and Research (All sites)

Result showed that the embedded researchers built and maintained relationships with the practitioners and other stakeholders to work together with them to co-produce research. The participants from the four case studies sites reflected upon how the embedded researchers informed the sites of relevant research-based evidence, which helped in the development of future practice and research. By doing so, the embedded researchers bridged the gap between the discovery and implementation of research-based evidence. The results showed that all participants across all the four case studies sites, irrespective of age, years of experience, and education, agreed that the role of the embedded researchers includes this theme. The identified strategies adopted by the embedded researchers within this theme are:

- (1) identifying challenges in the host organisations,
- (2) utilising research experience,
- (3) implementing research evidence,
- (4) disseminating findings, identifying future research areas, and applying for funding,
- (5) presenting and publishing findings.

#### 4.5.3.1 Identifying challenges in the host organisation

Participants agreed that the research skills of the embedded researchers are essential to the process of identifying the practical challenges facing the research sites.

*"[...] the GSCE reforms of the time that was taking place, it was causing a significant amount of stress and pressure for the teachers. In the first instance, teachers were having to grasp new skills at work, they were having to understand the new*

*curriculum and subject knowledge. Some of the teachers weren't particularly strong, there was a level of undue pressure and stress being put on the students, so students were, pupils in the school were having to learn, and pupils nationally were having to learn lots of different contents, they were sort of taken away the security blankets of things like modular testing in course work and what that meant was that students will now have to recall so much more knowledge in exam conditions”*  
**[TR1site3 - Teacher]**

It was evident that the embedded researchers used their research skills to unravel the root cause of the challenges facing the school through a thorough investigation by co-developing and carrying out relevant research with the students and the teachers in the school. The research they carried out revealed that a lot of the schoolteachers were stressed and lacked confidence regarding what they were teaching in relation to the new GCSEs. The newness of the curriculum was causing both the teachers and students to lose confidence and experience stress. It was clear the lack of confidence experienced by the teachers impacted their own confidence level and the confidence of other students as well. By conducting research with the students and teachers, the embedded researchers identified that the students were expected to learn different contents which they need to know to pass GCSE exams. This also mounted an undue pressure on the students. Challenges relating to teachers' confidence and students' understandings of exam content were ongoing at the school well before the embedded research project began. However, these challenges seemed not identified nor addressed. This was particularly evident because none of the participants mentioned that these challenges were identified nor addressed before the outset of the research project. Following the identification of these challenges, research-based recommendations were offered through the co-production research. By using research evidence to help tackle the school's challenges, the researcher bridged the gap between the discovery and implementation of research-based evidence.

#### **4.5.3.2 Utilising research experience**

It is worth noting that the embedded researchers used their research experience to inform their host organisations of relevant existing and newly co-produced research evidence. The embedded researchers' research-related expertise and the time they spent searching for relevant evidence were both seen as useful to the public health practitioners and other stakeholders.

*“The beauty is that because it is their bread and butter, doing reviews and searching for evidence [...] one of the things the embedded researcher did to help me with it was to do that literature review [...] it would have taken me much longer [...], so that's the benefit of [...] it is their strength and their experience and skills which they have got and which we may not have and the time to do it which we may not also have because we are constantly under the treadmill” [PHP1site1]*

In fact, a public health practitioner from LA1 referred to searching for research evidence as researchers' 'bread and butter'. The public health practitioners agreed that the researchers were the most skilled in this area and that the embedded researchers made it easier to access research and use research to inform their practice. Thus, this closes the gap between research evidence and its implementation. In addition, by helping practitioners search for relevant research, the embedded researchers helped reduce the practitioners' workloads. It was evident that the practitioners' busy work schedules often restrict their ability to develop and implement their own research skills. Thankfully, the embedded researchers were able to assist the practitioners by using their research skills to overcome research-related challenges, and in the process taught them how to look for research evidence effectively. This, therefore, facilitates the implementation of evidence-based practice. The implication of this is that practitioners' lack of research skills and time would have served as a barrier for evidence-based practice in the research sites (as discussed in chapter one).

It was clear that the research-based evidence searched for, or co-produced by the embedded researchers and the public health practitioners including other stakeholders was used to inform practice and make positive changes. Evidence showed that the embedded researchers had informed the host organisations of relevant research evidence and had used their research experience and skills to make research-based recommendations. In other words, the embedded researchers made valuable research evidence, and knowledge accessible. As such, this brought about desirable changes that improved service and delivery in the research sites.

*“So the way this works with here is that you do the final report which has the recommendations in form of what we feel there should be changes to practice that goes to their public management team and then they will look at that” [ERsite2]*

Furthermore, the embedded researchers also discussed how they helped make positive on-site changes occur. For instance, an embedded researcher from LA2

reported that positive changes were made in practice after developing recommendations in the form of a report submitted for management's approval. It was clear that the practitioners take evidence-based advice from the embedded researcher to improve the quality of the services being offered to the public. Thus, this closes the gap between research evidence and its implementation.

#### 4.5.3.3 Implementing research evidence

The interviews inquired as to how research-based evidence was translated into practice at the four research sites. As the interview process continued, it became clear that desired changes and improvements were achieved through the on-site application of research-based evidence. As discussed in chapters one and two, the goal of evidence-based public health is to use research to improve the quality and delivery of public health services to the public and closes the gap between the development of research evidence and its application to public health practice. The results showed that across the four research sites, this process did indeed happen.

*“[...] as it is very much about kind of being a resource to implement the recommendations and embed kind of the key findings from the research, again I think my role is trying to get some of these things into practice really so its embedded research but the main one of the main things is around embedding the recommendations as well, so that's sort of work my role is around doing” [ERsite1]*

*“[...] at the same time, it also helps the researcher coming in to understand what goes on in practice so that you don't just go and conduct a piece of research that goes on the shelves. What you want is whatever product that you bring out should be utilised and put into practice. [...] So we would then need to weigh the evidence and the circumstances under which we are going to implement an intervention but we still take advice from the researcher on the evidence of what works. They could advise on what works [...] It's more about the outcome of research being used to influence practice for quality improvement” [PHP1site1]*

*“There are changes that are made with how they recruit their staff for the delivery staff [...] that changes were made and that was in practice, and they also kind of put it in a set of recommendations as to the ones to be delivered in schools” [ERsite4]*

Participants reported that the embedded researchers recommended existing research evidence, co-produced research evidence with the intent of informing practice, and also used relevant evidence to help improve service and delivery. For instance, an embedded researcher from LA1 stated that one of her key duties is helping the LA translate evidence into practice. A public health practitioner from LA1 added that it would not have been possible to translate research evidence into practical, real-world,

on-site changes if the researcher had not been embedded within the LA and therefore fully familiar with on-site contexts where the research evidence is to be utilised. This indicates that the relevance of research evidence itself is heavily dependent on the embedded researcher's familiarity with the public health practices of the host organisation to understand the context, and identify the needs of the host organisations. Thus, this facilitates such research evidence use to improve service and delivery. Participants from the sports organisation reported similar experiences. They acknowledged that the embedded researcher working within their organisation had brought about positive change. With the assistance of the embedded researcher, the sports organisation had made some research-informed changes to its staff recruiting processes. The positive changes that the researchers brought to the sports organisation would not have been possible if the researchers had not been embedded and present.

Furthermore, a teacher from the school stated that the evidence generated by the project was used to create positive change.

*One of the outcomes of the research is some of the children were feeling the pressure, some of the children were feeling stressed about this, so as a result we kind of increase the droppings the student could do with pastoral leaders, they can do a kind of counselling sessions as well. We have like a sort of exam kind of...like an extra sort of lesson after school where children add a drop in and ask questions from teachers about what they are struggling with and so on as well" [TR1site3 - Teacher]*

As explained earlier, the students at the school are considered to live in a deprived area and often do not have access to opportunities available at other UK schools. However, the embedded researchers and the other participants from the school were able to develop strategies that the school took forward to tackle challenges associated with recent changes to the GCSE examinations. An example of this was the school's increased number of meetings between students and pastoral leaders to support students. It also suggested that the school should provide extra lessons, and counselling sessions to students to discuss the challenges they were facing. The changes that were then brought about based on these findings constituted yet another closure of the research discovery and implementation gap. This implies without the assistance of the researchers, there is a possibility that the teachers would have had to continue teaching under pressure and stress and without confidence. This would



have been detrimental to the teachers' health, and the students would have continued to perform below expectations in GCSE since they are not confident in what they have been taught.

In other words, the role of embedded researchers provided accessibility to research-based evidence that was utilised to develop solutions to on-site challenges and create positive change.

#### 4.5.3.4 Disseminating findings, identifying future research areas, and applying for funding

The embedded researchers reported that having to present reports to diverse audiences prompted them to produce easily understandable, user-friendly reports that did not rely heavily on academic language.

*“[...] so I have quarterly reports that I have to produce which has to be user-friendly and appeal to a various range of agencies within the organisation [...] we had, basically we have had quite a few different presentations to different kind of groups or the senior management team and departmental teams and things which was about and sharing the results and recommendations, we have follow-ups sort of things from that” [ERsite1]*

*“[...] Yeah, just into writing report so she will do like verbal update or she provides like some blueprints in an email” [PHP5site2]*

The reports created by the embedded researchers avoided scientific terms that might be difficult for public health practitioners and other stakeholders to understand. Furthermore, practitioners and other stakeholders were informed of relevant research evidence in an unambiguous way. It is important to add that it would have been difficult for the embedded researchers to appropriately simplify their language if they had not had the opportunity to spend time on-site becoming familiar with the language used by the practitioners and stakeholders.

The participants also reported that the embedded research projects effectively discovered potential areas for future research. By making suggestions regarding future research, the embedded researchers furthered each host organisation's potential to engage in relevant, change-creating research.

*“[...] then the research outcomes, erm learning outcomes we used to inform the next phase, so obviously that was the first phase, erm which we felt was really successful*

*and worked really well, erm so then we took those sort of the things we learnt to the next phase” [ERsite3]*

For example, an embedded researcher from the school stated that the first phase of their embedded research project was such a success that the findings of the first phase informed the direction of the second phase, thereby ensuring continuous research activities in the school.

Furthermore, participants agreed that the outcomes of the embedded research projects assisted with the application for future funding.

*“[...] the results of the work that we did has been kind of used in terms of future funding opportunities, for providing data, providing kind of context information that was used in sort of proposals and in bids pushing and for applying for future funding” [ERsite1]*

*“[...] if they see more opportunities for funding to develop a project, they can also in their bid say we like to evaluate this because they have got somebody who can do it, so it means the work has rolled in and rolled in and rolled in” [ERsite2]*

*“We’ve actually increased our funding income as an organisation this year massively with probably total capacity of our funding this year and kind of support from the inside team and being able to support with kind of what we need to put in place. That support is been brilliant [...] what the researcher has done so far is being excellent and supportive from the application to program development. The researcher provides us with the information to start our program or the funding application and so the role is crucial at the beginning and definitely at the end as well” [PHP1site4]*

It was evident that the presence of the embedded researchers in their host organisations encouraged the push to apply for funding to develop projects. This, therefore, facilitates continuous engagement in research activities. The practitioners felt that the role of the embedded researchers is crucial to producing funding applications and program development.

#### 4.5.3.5 Presenting and Publishing Findings

Once embedded researchers succeeded at co-producing relevant on-site research evidence with practitioners and other stakeholders, and offering practical solutions to on-site challenges, it became clear that it would be necessary to present and publish the outcomes of the projects. As discussed in chapter one, one of the chief responsibilities of an academic is publishing findings. Consequently, embedded



researchers used their academic skills to publish the findings with practitioners and other stakeholders as co-authors. One of the benefits of publication is that published research can inform the host organisation, and other organisations facing similar challenges. Another significance of the role of embedded research pertaining to this, is that as the embedded research project is co-produced by both the embedded researcher and the host organisation, the findings from the research are jointly owned by both parties (as discussed in chapter one). This also assisted in integrating research into the host organisations culture.

*“We wrote a book chapter with their names on the published book chapter. We got all of them involved with the writing of the chapter [...] that makes a sort of massive difference” [ERsite3]*

*“We co-authored a chapter of a book. We used the findings to create a book chapter but all of us has input into it including the researchers” [ST2site3 - Student]*

For example, participants from the school reported that a book chapter based on co-produced research that they had worked on with their embedded researchers had been published (Hayden et al., 2019). Co-produced and co-published research evidence informs the school and research community of the institutional value of embedded research projects. The embedded researcher from the school added that the names of the students and staff involved in the research and writing processes were included in the book chapter. The book chapter was co-edited by both an academic and a public health consultant. This publication has made a tremendous positive difference to how a school labelled as ‘deprived’ views itself. Indeed, being involved in the co-production of valuable research has encouraged both students and teachers.

To further explore how embedded researchers can inform public health practice, the participants were asked whether any other evidence-sharing processes had been used by the embedded researchers. The embedded researchers in this study were connected to more than one organisation. Consequently, they have access to organisations with information that can benefit public health practitioners and other stakeholders. The participants felt that participating in other organisations helped the embedded researchers fulfil their role as the discoverers and sharers of information. The participants viewed this role of the embedded researcher in their sites important as it informs them of the latest research evidence and activities in the field. This could

also be seen as a way to sustain evidence-based practice in the sites. As the practitioners are regularly informed of the latest relevant evidence by attending research-based programmes, it facilitates the integration of research into the host organisations' culture.

*“When I see opportunities for conferences or local events, I will send an email or circulating them, there might be public health conference, it might be a Fuse conference that's linked in erm linked in heavily with the thing we have worked on and I circulate that to the staff member, to say here is an opportunity” [ERsite2]*

For instance, an embedded researcher from LA2 stated that she regularly informed the practitioners of programmes and events presenting research relevant to their practice. By attending such events, practitioners can stay informed and up to date and are more likely to make changes to their practice based on timely research evidence. Consequently, the findings of this study indicate that staying familiar with the latest relevant research is one of the ways to close the gap between the discovery and implementation of research-based evidence.

Overall, it was evident that the embedded researchers' ability to inform the organisations with relevant co-produced research evidence, and the ability to identify relevant information and opportunities and then circulate these to public health practitioners and stakeholders helped to inform the sites in creating relevant, research-based changes to benefit their public health practices. The positive outcomes they generated indicate that the role of embedded researchers can seriously contribute to closing the gap between the discovery and implementation of research-based evidence in the research sites.

#### **4.5.4 Theme Four: Keeping the Critical Reflection Trajectory (All sites)**

Twelve out of seventeen participants across the four sites mentioned this theme as part of the role of the embedded researcher in their respective organisations. Participants felt that critical reflection was an important process an embedded researcher must engage in throughout the 'journey' of becoming an agent of closing the gap between research evidence and its implementation in practice. The identified strategy adopted by the embedded researchers within this theme is (1) constant reflection. The findings associated with this theme are presented in detail below.

#### 4.5.4.1 Constant reflection

The participants agreed that constant reflection helps the embedded researchers evaluate their roles and their achievements. The participants also noted that reflection helps researchers meet target goals, celebrate their achievements, embrace new areas of research, and identify areas that need improvement. The participants stated that one of the duties of the embedded researchers was reflecting on their various roles in order to think of ways to apply acquired learning to daily on-site practices. Consequently, one of the embedded researchers – from LA2 reported that she spends quality time reflecting on her role.

*“I have to spend really more time reflecting” [ERsite2]*

Although the interview questions geared towards this theme were directed to the embedded researchers, some of the practitioners and other stakeholders commented on this theme.

*“So, I think she is constantly reviewing how she is working, what she is working on, and as a researcher, she is always looking at what is happening and how she can work differently or how she can influence how we work. So, in terms of her reflection, her review, I think that is constant and it circles between stages of her work. So, I think the researcher is constantly looking at how they can do things and I think the positive side is that because that is the case, there is a lot more information coming into our organisation through the researcher because the researcher is constantly looking at different elements all the times and asking have come across this with this project or have we thought about this in this project, it is really relevant to that work. It is constantly moving, it is constantly evolving” [PHP1site4]*

For instance, a public health practitioner from the sports organisation reported that the embedded researcher would regularly reflect because doing so helps the researcher identify areas of improvement and find ways to improve on-site practices. These observations indicate that reflection should become a part of each researcher's routine. The practitioners from the sports organisation added that it is clear that the researcher is reflecting on ways that her role can be improved as she is constantly sharing relevant information with the organisation. Constant reflection helps the researcher look at a project from different angles, and doing so improves the project as a whole. The absence of the embedded researcher could, therefore, negatively impact the scope of the knowledge available to the practitioners and other stakeholders. This could, in turn, affect the quality and delivery of the services the

organisation offers to the public. Furthermore, reflection helps the project constantly improve, adds value to the project, and ensures quality outcomes. Research generated from a project that has benefited from critical reflection is more likely to be used in practice. Therefore, making sure that research is relevant by constant reflection is one of the most effective ways to close the research implementation gap.

Furthermore, the comments made by the participants make it clear that constant reflection is one of the most important of an embedded researcher's duties.

*"I think it's always good to sort of like reflect on what we have done, how we do things I personally want to think about whether I could have done things better [...] so I think it's quite important to sort of reflect on how you have done things, and how you could do things in the future, like what lessons you have learnt, I think it's important to sort of reflect, to sort of think more about how you have done things and whether it could be practiced in the future" [ERsite3]*

*"I think reflection is needed to make sure that actually what is being provided is beneficial to the team and the person doing the work" [PHP4site2]*

*"I think they should be reflecting. Reflective thinking and reflective writing, they should be part of their supervision, as well as regular reflective notetaking, both about themselves, what they have learnt and how they are gonna apply that learning" [PHP2site1]*

One embedded researcher from the school noted that reflection helps her think about how she can improve the ways that she works with the research site. She added that being reflexive also informs how she will conduct her future work. Reflection, therefore, help her to constantly improve as an embedded researcher. This suggests that critical reflection helps her make sure that what she does with the school is relevant and valuable. Evidence showed that constant reflection assists embedded researchers assess how their role benefits the host organisations and themselves. A practitioner from LA1 further expatiated that she expected researchers to engage in both reflective thinking and writing, and suggested that the researchers' supervisors should include reflection in the researchers' duties. According to her, an embedded researcher should constantly keep reflective notes that document the details of their work, including what they are learning and how what they are learning can inform how they fulfil their role as an embedded researcher. Such reflective notetaking is essentially a self-evaluation that measures the embedded researcher's impact upon their host organisation.

One observation that was made repeatedly by the respondents was that reflection must be a continuous exercise practised throughout the duration of the embedded research project. Reflection should not be considered a one-time event. Rather, it should be done constantly and consistently.

*“It needs to be a continuous process, and as you work along you have to, every now and then sit back and reflect and see what impact am I having as part of the work that I am doing? It is similar for all of us as public health practitioners. You have to reflect constantly on your practice and that’s no different for the embedded researcher- to understand what impact you are having in whatever you are doing. So you couldn’t necessarily put a timescale on it. It needs to be part of your routine practice, that’s how it’s got to be yeah” [PHP1site1]*

*“[.] I am thinking how often do I reflect on my role everyday? Am I on the right track? Are we doing the right thing? What is going on right and what is not going on well? I think reflection should be a constant thing” [PHP2site2]*

One of the public health practitioners from LA2 used both herself and the other practitioners as examples. She said that they reflect on their practices constantly. Furthermore, she expects the embedded researchers to do so as well so that they can measure their impact on the host organisation. In other words, reflection must become part of each researcher’s routine. These observations suggest that constant reflection improves the quality of an embedded research project and creates research outcomes that are more likely to improve daily practices.

The embedded researchers confirmed that they constantly reflect on their actions. They described engaging in constant reflection in order to improve their research to produce high-quality outcomes and help close the research implementation gap.

*“[.] I always do it at the beginning of a new project, because I always want to know what I have learnt from the last project. This helps me in the next project? [..] maybe like halfway through the project, [..] at the end of the project. [..] I would say a couple of times just to sort of check to see whether things are going the way you would want them to go, whether we could do things better” [ERsite3]*

*“It might be while you drive home [..] might be in the shower [..] might be when I take the dog out for a walk and tea time to reflect because you do need time to reflect on your research, on your methodology [..] about what the findings need to show [..] at times my bag is full of paper everywhere, millions of notes in here and I have to open and jot down some questions so that I won’t forget them because they are so important” [ERsite4]*

*“I constantly reflect on my role to know what I am doing right, and what can be done differently” [ERsite1]*

An embedded researcher from the school stated that she usually reflects at the outset of any project with which she is involved to help her identify areas that can be illuminated by her experiences with previous projects and focus the direction of the current project. She reflects again when the project reaches the halfway point. She reflects yet again at the end of the project to assess the success of her work. Another embedded researcher from the sports organisation explained that she may reflect at any time. She said that reflection does not have to occur during office hours; she may reflect at any time during the day or even while taking a shower. For her, consistent reflection helps her think about crucial aspects of the project, including the methodology, methods, and expected outcomes. Much like the previously noted practitioner who had stated that reflection should be documented, she always writes down her reflections so that she does not forget them.

Overall, the participants agreed that reflection helps embedded researchers assess their roles and constantly improve their work. Therefore, reflection is crucial to successfully co-producing research and closing the research implementation gap.

## **4.6 Discussion**

This qualitative inquiry component of the PhD aimed to explore the themes that emerged from the systematic review on the role embedded researchers play in the co-production of public health knowledge in non-clinical settings and in the process of closing the research implementation gap. Qualitative fieldwork was conducted with four embedded researchers, nine public health practitioners, and four other stakeholders who are either working or have worked with embedded researchers across four sites. Four main themes relating to the roles played by embedded researchers emerged from the thematic analysis of the interview data:

- (1) building and maintaining relationships with practitioners and other stakeholders,
- (2) working together to produce research,
- (3) informing and developing future practice and research, and
- (4) keeping a critical reflection trajectory.

All the four embedded researchers are females, however, none of them mentioned that their gender posed any challenges to the delivery of their role in their respective case studies sites. It was found that embedded researchers build and maintain



relationships with practitioners and other stakeholders to work together to produce research. The evidence from the co-produced research is used to inform and develop future practice and research to improve service and delivery rendered to the public. Throughout this 'journey', embedded researchers keep a critical reflection trajectory to evaluate their role in their host organisations. The discussion of findings in relation to the relevant existing literature is detailed below.

### **Building and Maintaining Relationships with Practitioners and Other Stakeholders**

All participants, irrespective of their age, working experience, and education acknowledged that the relationships between the people involved in an embedded research project are crucial to the project's success. This conclusion is similar to those made in previous studies that have concluded that building and maintaining mutually beneficial relationships with practitioners and other stakeholders significantly helps embedded researchers co-produce public health knowledge in non-clinical settings (Langeveld et al., 2016; Lewis and Russell, 2011). The participants also recognised that the 'embeddedness' of the researchers, or the degree to which they become part of or spend time within the host organisation, is significant. A higher degree of embeddedness appears to lead to the development of beneficial relationships and also helps researchers develop a better understanding of organisational contexts, which in turn leads to the development of effective solutions and useful, co-produced research. Notably, becoming embedded to a significant degree helps others see the researchers as part of the team. Previous studies have also indicated it is the duty of the embedded researcher to become part of the host organisation by working collaboratively with practitioners and other stakeholders (Wong, 2009; Rowley, 2014). It was quite clear from the interview data gathered from all sites that the embedded researchers spent time with their host organisations and developed meaningful relationships. It is worth noting that the amount of time each researcher spent within their host organisation varied. The NIHR embedded research team reported similar findings and observed that the amount of time spent within an organisation can depend on the intensity of a project (Embedded research, no date).

Among other strategies, it was evident that engaging in informal conversations with the practitioners and other stakeholders also assisted the embedded researchers to

build relationships. This was confirmed only by the embedded researchers in case studies sites two and four who had worked in the host organisations for more than three years. This might be because the embedded researchers from LA2 and the sports organisation have worked and familiarised themselves with the members of the host organisation staff. Consequently, this could have made engaging in informal conversations easier, unlike the embedded researcher in site one who has just spent seven months in the site. This confirms what Vindrola-Padros et al. (2019) said that it takes time for embedded researchers to build trustworthy relationships in the host organisation and they recommend an 'introductory period' of a minimum of three months for familiarisation before an embedded research project starts. This was beneficial to the three case studies explored in Vindrola-Padros et al. (2019) as it allowed the embedded researchers to familiarise themselves with their host organisations and as well build relationships with the host organisations' staff. This also aligns with Lewis and Russell's (2011) view that an 'introductory period' is important before the commencement of an embedded research project. It is worth noting that the practicability of 'introductory period' might depend on the agreement between the parties involved.

Furthermore, embedded researchers must build relationships not only with practitioners and other stakeholders, but also with their academic supervisors. Having a successful relationship with one's academic supervisor can help a researcher overcome the challenges that arise as a consequence of having a dual affiliation and needing to manage diverse expectations and competing interests. The embedded researchers interviewed in this study had the support of their academic supervisors. Thanks to the vast experience of their supervisors, they are often excellent at mitigating unforeseen challenges. Indeed, Vindrola-Padros et al. (2019) have found that, among other factors, the success of an embedded researcher depends on the relationship between the researcher and his or her academic supervisor.

### **Working Together to Produce Research**

The interview participants recounted that it is important to work together to co-produce relevant research useful in the organisations. McGinity and Salokangas (2014) have similarly concluded that embedded researchers work with members of their host organisations to identify, plan, and conduct research that will meet the needs of the



organisation. By working collaboratively, researchers were able to train the practitioners and other stakeholders and improve their ability to help co-produce meaningful and valuable research that can be used to implement evidence-based adjustments to on-site practices.

The findings of this study indicate that working together produces meaningful research and also teaches practitioners and other stakeholders who assist embedded researchers how to conduct research. Wong (2009) similarly concluded that embedded researchers encourage practitioners and other stakeholders to participate in research activities and increase an organisation's capacity to conduct research. In other words, the collaborative work that accompanies embedded research helps close the research implementation gap. However, it was noted in this current qualitative inquiry that having the right researchers assisted in carrying out the projects successfully. This is similar to what Newbury-Birch and Allan (2019) said that having the right combination of researchers and practitioners in co-production is crucial to the success of such project. Also, Wong (2009) added that not all researchers have the relevant skills to conduct co-produced research. Therefore, it is essential to have the right combination of researchers, practitioners, and other stakeholders while working together to co-produce research to ensure its success.

### **Informing and Developing Future Practice and Research**

Based on the current qualitative inquiry, the role of the embedded researchers includes informing practice by making recommendations and positive changes that utilise both existing and newly co-produced research evidence. Doing so makes research evidence more accessible to public health practitioners and other stakeholders and ultimately improves service and delivery. Marshall et al. (2014) have similarly revealed that informing practice has been identified as a way by which embedded researchers communicate new and existing relevant research evidence and integrate research findings into practice.

As discussed in chapter one, two of the factors responsible for the gap between the discovery and implementation of research evidence are the disparity between the language spoken by the researchers and practitioners and the complexity of the language spoken by researchers, which is often focused on scientific methods. Such complex language can be ambiguous and difficult for practitioners to understand

(Friese and Bogenschneider, 2009). To discover whether language differences had been an issue in this study, the interviews included questions regarding how research evidence and recommendations were communicated to public health practitioners and other stakeholders. These questions were designed to create an understanding of how the embedded researchers had communicated. The information learned about the researchers' use of language informed the development of the proposed embedded research toolkit (as detailed in chapter six). The interviews revealed that the embedded researchers communicated research outcomes and recommendations effectively to the practitioners by using simple, unambiguous language. Using such language helped make research evidence more accessible to the practitioners.

Providing evidence for reports and future funding applications was identified as an important part of the embedded researchers' work within their host organisations (Jenness, 2008; Wong, 2009). The interview participants agreed that the researchers sometimes helped secure funds needed to conduct research at the host organisation. Doing so encouraged each host organisation's staff to participate in research that could prove useful to the organisation in the future.

### **Keeping Critical Reflection Trajectory**

Critical reflection helps embedded researchers evaluate the role they play within their host organisation and keep track of their progress (Duggan, 2014; Langeveld et al., 2016). In other words, reflection helps researchers identify and improve upon the areas that are not meeting expectations and discover what approaches are working successfully. This corresponds with the findings from this current qualitative inquiry. The interview participants acknowledged that the embedded researchers continuously reflect on their role and their work in order to identify what is and is not working. This assists embedded researchers to think of ways to apply acquired learning to daily on-site practice to improve their role in the co-production of research to bridge the gap between research evidence and its implementation in public health practice.

Overall, the success that the embedded researchers experienced including building relationships, co-producing research, translating research into practical changes, evaluating projects, and informing future public health practices as well as future research justifies increasing the amount of embedded research being conducted.

Embedded researchers also bring the tremendous benefit of strengthening the research capacities of public health practitioners and other stakeholders by providing research-based training and support. Such developments prove the value of embedded research projects. Finally, the relevant research-based recommendations made from the co-produced research guided by the embedded researchers are used to inform practices. The positive outcomes generated by the embedded research process indicate that embedded researchers can meaningfully contribute to closing the gap between the discovery and implementation of research evidence.

### **4.7 Chapter Summary**

Chapter four has presented the results of the thematic analysis of the qualitative fieldwork. The key findings are:

- Seventeen participants, four embedded researchers, nine public health practitioners, two teachers, and two students were interviewed across the four sites.
- Seven themes and twenty-eight codes/strategies emerged as the initial result of the thematic analysis.
- The initial results of the analysis were further analysed. Four themes and twelve codes/strategies emerged as the final results.
- All participants across the four sites confirmed that the role of embedded research includes 'building and maintaining relationships with practitioners and other stakeholders.
- 'Working together to produce research' was acknowledged by all the participants across the four sites as the role of embedded research.
- All participants across the four sites confirmed that the role of embedded research involves 'informing and developing future practice and research'.
- 'Keeping critical reflection trajectory' was confirmed by several participants across the four sites as one of the main roles of the embedded researchers.

The next chapter presents the results of the triangulation of findings of the systematic review (chapter three) and the current qualitative inquiry (chapter four). This informs the development of a toolkit on the role of embedded research in co-producing public

health knowledge in non-clinical settings to narrow the gap between research evidence and its implementation in public health practice (chapter six).

## CHAPTER FIVE

### TRIANGULATION FINDINGS

#### 5.0 Overview of the Chapter

This chapter presents the results of the triangulation of findings of the systematic review (chapter three) and the current qualitative inquiry (chapter four). First, the presentation of results, followed by the discussion of the overall findings and conclusions.

#### 5.1 Sorting

The results of the sorting of the categorisation of themes for each research approach showed that while six themes emerged from the systematic review, four themes emerged from the qualitative fieldwork (Table 19). The results showed that the four themes that emerged from the qualitative fieldwork covered all the six themes from the systematic review.

**Table 19: Sorting of the Themes from the Systematic Review (Chapter Three) and the Qualitative Study (Chapter Four)**

Systematic review	Qualitative fieldwork	Overall theme
1. Building mutually beneficial relationships	Building and maintaining relationships	Building mutually beneficial relationships
2. Becoming part of the organisation to co-produce research	Working together to produce research	Becoming part of the organisation to co-produce research
3. Building research capacity	*Building research capacity	Building research capacity
4. Informing practice	Informing and developing future practice and research	Informing and developing future practice and research
5. Managing funds allocated to the research and providing evidence for reports and future funding applications	*Providing evidence for reports and future funding applications	Managing funds and providing evidence for reports and future funding applications
6. Critical reflection	Keeping critical reflection trajectory	Keeping critical reflection trajectory

\*Not as a theme but a part of another theme.

The results of the sorting of the categorisation of the codes within each theme for the systematic review and the qualitative fieldwork are presented in table 20 below.

**Table 20: Sorting of Codes Within Each Theme from the Systematic Review (Chapter Three) and the Qualitative Fieldwork (Chapter Four)**

<b>EMBEDDED RESEARCH ROLE ONE: BUILDING MUTUALLY BENEFICIAL RELATIONSHIPS</b>		
<b>SYSTEMATIC REVIEW</b>	<b>QUALITATIVE FIELDWORK</b>	<b>OVERALL CODES</b>
<ul style="list-style-type: none"> <li>• Acting as an intermediary</li> <li>• Engaging in multi-stakeholder collaboration structure</li> <li>• Developing relationships with staff</li> <li>• Transdisciplinary</li> <li>• Engaging in formal and informal interactions</li> <li>• Networking</li> <li>• Regular contact with the host organisation’s staff</li> <li>• Developing trustworthy relationships with the host organisation’s staff</li> <li>• Building rapport</li> </ul>	<ul style="list-style-type: none"> <li>• Building internal and external relationships to share skills.</li> <li>• Developing relationships with staff</li> <li>• Regular contact</li> <li>• Attending formal meetings</li> <li>• Engaging in informal conversations</li> <li>• Building trustworthy relationships</li> <li>• Being approachable</li> </ul>	<ul style="list-style-type: none"> <li>• Connecting professionals, academics, and other stakeholders for collaborative work</li> <li>• Maintaining regular contacts with the stakeholders, and the academic supervisor</li> <li>• Attending formal meetings</li> <li>• Engaging in informal conversations</li> <li>• Building mutual trust</li> <li>• Being approachable</li> </ul>
<b>EMBEDDED RESEARCH ROLE TWO: BECOMING PART OF THE ORGANISATION TO CO-PRODUCE RESEARCH</b>		
<b>SYSTEMATIC REVIEW</b>	<b>QUALITATIVE FIELDWORK</b>	<b>OVERALL CODES</b>
<ul style="list-style-type: none"> <li>• Access and flexibility</li> <li>• Working closely with the practitioners</li> <li>• Embeddedness- being located at the host organisation</li> <li>• Dual affiliation</li> <li>• Co-production of knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Working together to produce research</li> <li>• Embeddedness</li> <li>• Dual affiliation</li> <li>• Providing the opportunity for different stakeholders to participate/engage in research activities</li> <li>• Managing large workload</li> <li>• Managing diverse expectations</li> <li>• Balancing competing interests</li> </ul>	<ul style="list-style-type: none"> <li>• Dual affiliation</li> <li>• Working together with the host organisation’s staff to conduct research.</li> <li>• Spending time in the host organisation</li> <li>• Providing the opportunity for stakeholders to participate in research activities.</li> <li>• Working closely with the host organisation’s staff to combine the tacit knowledge of the practitioners with the explicit knowledge from research</li> <li>• Balancing competing interests of the academic institution and the host organisation</li> <li>• Managing diverse expectations</li> </ul>

<b>EMBEDDED RESEARCH ROLE THREE: BUILDING RESEARCH CAPACITY</b>		
<b>SYSTEMATIC REVIEW</b>	<b>QUALITATIVE FIELDWORK</b>	<b>OVERALL CODES</b>
<ul style="list-style-type: none"> <li>• Providing training to staff</li> <li>• Presenting/Leading research</li> <li>• Engaging in and support research activities</li> <li>• Bringing research skill</li> <li>• To raise the profile of the host organisation in the community</li> </ul>	<ul style="list-style-type: none"> <li>• Providing research training and support to build practitioners and other stakeholders' confidence to conduct research</li> <li>• Ensure research rigour</li> <li>• Assisting stakeholders and the host organisation in building their career/reputation/aspiration/ morale</li> </ul>	<ul style="list-style-type: none"> <li>• Providing research training and support to practitioners and other stakeholders</li> <li>• Ensuring research rigour and bringing new skills into the host organisation</li> <li>• Building practitioners' and other stakeholders' confidence to conduct research</li> <li>• Assisting practitioners, other stakeholders, and the host organisation to build their career/reputation/morale</li> </ul>
<b>EMBEDDED RESEARCH ROLE FOUR: INFORMING AND DEVELOPING FUTURE PRACTICE AND RESEARCH</b>		
<b>SYSTEMATIC REVIEW</b>	<b>QUALITATIVE FIELDWORK</b>	<b>OVERALL CODES</b>
<ul style="list-style-type: none"> <li>• Catalyst for change and improvement in measuring effectiveness</li> <li>• A sounding board – recommending changes</li> <li>• Informing practice with relevant knowledge</li> <li>• Presenting and sharing of research findings.</li> <li>• Utilising and producing knowledge useful in practice/policy</li> </ul>	<ul style="list-style-type: none"> <li>• Utilising research experience.</li> <li>• Making recommendations and positive changes to proffer solutions to the host organisation's challenges</li> <li>• Assisting in searching for relevant research evidence</li> <li>• Identifying challenges in the host organisation</li> <li>• Disseminating findings, and identifying future research areas</li> <li>• Presenting and publishing findings.</li> <li>• Circulation of important opportunities</li> <li>• Implementation of research</li> </ul>	<ul style="list-style-type: none"> <li>• Making recommendations and positive changes to proffer solutions to the host organisation's challenges</li> <li>• Assisting in searching for relevant research evidence</li> <li>• Spending time on evaluation work.</li> <li>• Assisting in identifying the challenges facing the host organisation</li> <li>• Assisting in identifying future research areas</li> <li>• Assisting in publishing research findings</li> <li>• Writing and presenting reports unambiguously</li> <li>• Circulation of important opportunities</li> <li>• Assisting in translating research evidence to practice</li> </ul>
<b>EMBEDDED RESEARCH ROLE FIVE: MANAGING FUNDS, AND PROVIDING EVIDENCE FOR REPORTS AND FUTURE FUNDING APPLICATIONS</b>		
<b>SYSTEMATIC REVIEW</b>	<b>QUALITATIVE FIELDWORK</b>	<b>OVERALL CODES</b>
<ul style="list-style-type: none"> <li>• Managing research funds</li> <li>• Providing evidence for reports and future funding applications</li> </ul>	<ul style="list-style-type: none"> <li>• Assisting with future funding applications</li> </ul>	<ul style="list-style-type: none"> <li>• Supervising research funds</li> <li>• Providing reports for future funding</li> </ul>



		<ul style="list-style-type: none"> <li>• Providing advice on proposals, and funding applications</li> </ul>
<b>EMBEDDED RESEARCH ROLE SIX: KEEPING A CRITICAL REFLECTION TRAJECTORY</b>		
<b>SYSTEMATIC REVIEW</b>	<b>QUALITATIVE FIELDWORK</b>	<b>OVERALL CODES</b>
<ul style="list-style-type: none"> <li>• Critical reflection</li> <li>• Intentional reflection</li> </ul>	<ul style="list-style-type: none"> <li>• Constant reflection</li> </ul>	<ul style="list-style-type: none"> <li>• Constant reflection</li> </ul>

## 5.2 Convergence Coding

Table 21 presents the summary of the key themes and codes identified in the systematic review and the qualitative fieldwork. The six key themes were:

- (1) building mutually beneficial relationships,
- (2) becoming part of the organisation,
- (3) building research capacity,
- (4) informing and developing future practice and research,
- (5) managing funds and providing evidence for reports and future funding applications,  
and
- (6) keeping critical reflection trajectory.

The qualitative fieldwork was split into three parts: findings from:

- (1) embedded researchers,
- (2) public health practitioners, and
- (3) other stakeholders/teachers/students.

While the symbol √ indicates the identification of a theme or code in the research element, - signifies silence and x means disagreement or dissonance.

**Table 21: Summary of Themes Identified in the Research, with the Agreement Between Research Components Identified**

Themes/Codes	Systematic review	Qualitative fieldwork: embedded researchers	Qualitative fieldwork: public health practitioners	Qualitative fieldwork: other stakeholders (teachers and students)
<b>Building mutually beneficial relationships</b>	√	√	√	√
Connecting professionals, academics, and other stakeholders for collaborative work	√	√	√	√
Maintaining regular contacts with the practitioners, other stakeholders, and the academic supervisor	√	√	√	-
Attending formal meetings	√	√	√	-
Engaging in informal conversations	√	√	√	-
Being approachable	√	√	√	√
Building mutual trust	√	-	√	-
<b>Becoming part of the organisation to co-produce research</b>	√	√	√	√
Dual affiliation	√	√	√	√
Working with the host organisation's staff to conduct research	√	√	√	√
Spending time in the host organisation	√	√	√	√
Providing the opportunity for stakeholders to participate in research activities	√	√	√	√
Working closely with the host organisation's staff to combine the tacit knowledge of the practitioners with the explicit knowledge from research	√	√	√	-
Managing diverse expectations	-	√	√	-
Balancing competing interests	-	√	√	-
<b>Building research capacity</b>	√	√	√	√
Providing research training and support to stakeholders	√	√	√	√

Ensuring research rigour and bringing new skills into the host organisation	√	√	√	√
Building stakeholders' confidence to conduct research	√	√	√	√
Assisting stakeholders and the host organisation to build their career/reputation/morale	√	√	-	√
<b>Informing and developing future practice and research</b>	√	√	√	√
Writing and presenting reports in a simple way	√	√	√	-
Spending time on evaluation work	√	√	-	-
Making recommendations and positive changes to proffer solutions to the host organisation's challenges	√	√	√	√
Assisting in identifying the challenges facing the host organisation	√	√	-	√
Assisting in identifying future research areas	-	√	√	√
Assisting in publishing research findings	-	√	-	√
Assisting in searching for relevant research evidence	√	-	√	-
Assisting in translating research evidence to practice	√	√	√	√
Circulation of important opportunities	√	√	-	-
<b>Managing funds allocated to the research and providing evidence for reports and future funding applications</b>	√	√	√	-
Supervising research funds	√	-	-	-
Providing reports for future funding	√	√	√	-
Providing advice on proposals, and funding applications	√	√	√	-
<b>Keeping critical reflection trajectory</b>	√	√	√	√
Constant reflection	√	√	√	√

Furthermore, as site triangulation was also adopted, table 22 presents the summary of the key themes identified in the research, with the agreement between the four case studies sites. While the symbol √ indicates the identification of a theme in the case study site, - signifies silence and x means disagreement or dissonance.

**Table 22: Summary of Themes Identified Across the Four Case Studies Sites**

Themes	Case Study- LA1 (Site One)	Case Study- LA2 (Site Two)	Case Study- School (Site Three)	Case Study- Sports Organisation (Site Four)
Building mutually beneficial relationships	√	√	√	√
Becoming part of the organisation to co-produce research	√	√	√	√
Building research capacity	√	√	√	√
Informing and developing future practice and research	√	√	√	√
Managing funds allocated to the research and providing evidence for reports and future funding applications	√	√	-	√
Keeping Critical Reflection Trajectory	√	√	√	√

The results showed that the systematic review, and the qualitative fieldwork in all the four case studies sites agreed that the role of embedded research entails ‘building mutually beneficial relationships’, ‘becoming part of the organisation to co-produce research’, ‘building the capacity of the practitioners towards conducting research’, ‘informing and developing future practice and research’, and ‘keeping a critical reflection trajectory’ (Tables 21 and 22).

Three case studies sites (one, two, and four) and the systematic review agreed that the role of embedded research includes ‘managing funds and providing evidence for reports and future funding applications’. Except that the ‘managing funds’ element of the theme was not mentioned in the qualitative fieldwork components (case studies sites one, two, and four). There was silence, not disagreement regarding this theme from case study site three (school). This could be because site three is a secondary school, therefore, not so many research activities were going on there.

### 5.3 Convergence Assessment

When drawing together the results from the systematic review and the qualitative fieldwork six themes were identified to be important:

- (1) building mutually beneficial relationships,
- (2) becoming part of the organisation to co-produce research,
- (3) building research capacity,
- (4) Informing and developing future practice and research,
- (5) keeping critical reflection trajectory, and
- (6) managing funds, and providing evidence for reports and future funding applications (Tables 21 and 22).

### 5.4 Completeness Assessment

As different research approaches (methodological triangulation) and data sources (data triangulation) were adopted in this piece of work, each one contributed to the answering of the research questions by converging relevant data to increase the trustworthiness (validity) of the overall outcome. As such, they all contributed to a thorough analysis and deeper understanding of the role of embedded research in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice.

### 5.5 Discussion

The overall results of the triangulation of the findings from the systematic review and the qualitative fieldwork are discussed below.

#### 5.5.1 Building mutually beneficial relationships

The first role identified by the systematic review and the qualitative fieldwork in the four case studies sites was 'building mutually beneficial relationships'. This finding is similar to Eyre et al. (2015) that building relationships between researchers and other stakeholders including practitioners could lead to an increase in research impact to bring about positive change in the host organisation.

#### 5.5.2 Becoming part of the organisation to co-produce research

This second role was confirmed in the systematic review and the qualitative fieldwork in the four case studies sites. As discussed in chapter one, the separation between

the process involved in the creation of research evidence and where it is to be utilised is one of the major factors responsible for the gap between knowledge and its utilisation in practice (Walshe and Davies, 2013). Therefore, it was recommended that knowledge should be created where it is to be utilised to bridge this gap. This role assists embedded researchers to build relationships, understand the context and needs of the host organisation (Vindrola-Padros et al., 2017). Consequently, embedded researchers could channel effort into co-producing research that could meet the needs of the host organisation. Thereby, this could facilitate the use of such co-produced research evidence in practice.

### 5.5.3 Building research capacity

The third identified role of embedded research which could assist in closing the gap between research evidence and its implementation in public health practice was 'building research capacity'. The systematic review and the qualitative fieldwork in the four case studies sites confirmed this role. As earlier discussed in chapter one, lack of research skills and the disparity in the terminologies used by the researchers and practitioners could contribute to the 'research evidence-implementation' gap (Friese and Bogenschneider, 2009). As such, Wong (2009) and McGinity and Salokangas (2014) said that practitioners could learn new skills relating to research including research terminologies from embedded researchers.

### 5.5.4 Informing and developing future practice and research

The above was identified as one of the key roles of embedded research in co-producing public health knowledge in non-clinical settings to facilitate the use of research evidence in public health practice. Thus, this brings about improvement in the quality of public health service and delivery to the public. Embedded researchers can inform practice by 'assisting in identifying the challenges facing the host organisation' and 'assisting in identifying future research areas'. These strategies could enable embedded researchers to be informed about the practical problems facing the host organisation and channelling research towards solving them. Hence, this could facilitate the use of research evidence in public health practice. This is similar to earlier studies in that the essence of identifying the practical problems in the host organisation is to be able to target research in proffering a solution to the problem (Lewis and Russell, 2011; Rycroft-Malone, 2014; McGinity and Salokangas, 2014). As

explained in chapter one, one of the barriers to utilisation of research evidence in practice is the lack of understanding of the problems facing the context in which research evidence is to be utilised. Hence, there should be a two-way type of information, that is, as research informs practice, so also practice should inform research (Sullivan and O'Neill, 2019). Thus, embedded research assists in identifying future research areas. As a result, the research conducted could be relevant to the context it is to be utilised. The relevancy of the research evidence to the host organisation would, therefore, facilitate the utilisation of research evidence in practice, hence, bridging the 'research evidence-implementation' gap.

### **5.5.5 Managing funds and providing evidence for reports and future funding applications**

The fifth identified role of embedded research was 'managing funds and providing evidence for reports and future funding applications'. To carry out this role in non-clinical settings, 'supervising research funds', 'providing reports for future funding', and 'providing advice on proposals and funding applications' were identified as strategies that embedded researchers could adopt. This agrees with previous studies that embedded researchers could use these strategies in the host organisation (Jenness, 2008; Wong, 2009). Hence, this could encourage public health practitioners to engage in research activities that could facilitate research evidence use in practice.

### **5.5.6 Keeping critical reflection trajectory**

The sixth identified role of embedded research in non-clinical settings to improve service and delivery through co-produced research was 'keeping a critical reflection trajectory'. This role was confirmed in the systematic review and the qualitative fieldwork in the four case studies sites. This role enables an embedded researcher to engage in personal evaluation of his or her role in the host organisation. This finding from this PhD agrees with the previous studies that embedded researchers should be able to reflect on their role to identify what works well and what does not, and therefore, make improvements to their role in practice (Wong, 2009; Lewis and Russell, 2011; Rowley, 2014).

Overall, although a systematic review and a qualitative fieldwork using four case studies sites and three categories of participants were explored on the topic, there was concurrence across them except that the 'managing funds' element of the theme



'managing funds and providing evidence for reports and future funding applications' was not mentioned in the qualitative fieldwork. Also, there was concurrence in almost all the themes across the four case studies sites and between participants. Except that 'managing funds and providing evidence for reports and future funding applications' was not mentioned in case study site three. This confirms the NIHR embedded research project team findings that there are variations in the types of embedded research initiatives based on intent, structure, and the processes within the initiative (Embedded research, no date; Ward et al., 2021). As such, this might be responsible for the slight variation across the four case studies sites, and the experience of the participants. Overall, the six themes informed the development of a toolkit on the role of embedded research in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice (chapter six).

## 5.6 Conclusion

This chapter has detailed the methods and the process of triangulating the findings of the systematic review and the qualitative fieldwork, using Farmer et al.'s (2006) triangulation protocol. Adopting more than one type of triangulation (method, data from people and sites) have provided a more robust and thorough investigation of the role of embedded research in co-producing public health knowledge in non-clinical settings which could bridge the gap between the research evidence and its implementation in public health practice. Furthermore, the agreement between the findings from different sources explored has provided more confidence and credibility in the overall outcomes on the topic. This echoed Rothbauer (2008) that one of the most important advantages of triangulation is when different methods yield similar results regarding a phenomenon of interest, it provides confidence in such an outcome. Furthermore, the use of different research approaches served a complementary purpose as some of the codes (strategies to deliver the role) that were not mentioned in the systematic review were picked by the qualitative fieldwork and vice versa. This is similar to what Noble and Heale (2019) said that adopting triangulation in a study could reduce biases as the methods used could complement each other. As such, the limitation of one method could be addressed or balanced by the strength of the other methods used in the triangulation.

Overall, the explorative nature of the qualitative approach assisted in the provision of more in-depth information while the exhaustive and rigorous nature of the systematic review assisted in providing relevant available evidence on the topic to strengthen the overall results. This confirmed what Farmer et al. (2006) pointed out, that the strength of triangulation depends on the research's underpinned theory, methodology, analysis, and the investigator's abilities and skills.

## 5.7 Chapter Summary

This chapter has provided results on the triangulation of findings that was undertaken. The following are the outline of the summary:

- The four themes from the qualitative fieldwork: (1) building and maintaining relationships with practitioners and other stakeholders, (2) working together to produce research, (3) informing and developing future practice and research, and (4) keeping a critical reflection trajectory, covered all the six themes from the systematic review: (1) building mutually beneficial relationships, (2) becoming part of the organisation to co-produce research, (3) building research capacity, (4) informing practice, (5) managing funds allocated to the research and providing evidence for reports and future funding applications, and (6) critical reflection. Thus, the sorting of the themes from the systematic review and the qualitative inquiry was used to form the basis for the triangulation.
- The overall results of the triangulation yielded six themes (1) building mutually beneficial relationships, (2) becoming part of the organisation to co-produce research, (3) building research capacity, (4) informing and developing future practice and research, (5) managing funds allocated to the research, providing evidence for reports and future funding applications, and (6) keeping a critical reflection trajectory.
- There were agreements in all the themes from the systematic review and the qualitative fieldwork, except that the 'managing funds' element of 'managing funds allocated to the research and providing evidence for reports and future funding applications' was not mentioned in the qualitative fieldwork.
- There were agreements in all the four case studies sites in almost all the six themes on the topic.

- There were agreements in all the three categories of participants in almost all the six themes.

The next chapter presents the development of the embedded research toolkit on the role of embedded research in co-producing public health knowledge to bridge the gap between research evidence and its implementation in public health practice.

## CHAPTER SIX

### DEVELOPMENT OF AN EMBEDDED RESEARCH TOOLKIT

#### 6.0 Overview of the Chapter

Having triangulated the findings from the systematic review and the qualitative fieldwork (chapter five), this chapter presents the development of an embedded research toolkit. The toolkit provides the role of embedded research in co-producing public health knowledge in non-clinical settings which when utilised can bridge the gap between research evidence and its implementation in public health practice. Firstly, the methods adopted in the embedded research toolkit development are introduced. Following these are results including the results of the exploration of related existing models, and how they are linked with the development of the embedded research toolkit. Then, the embedded research toolkit is presented including the participants' initial and final views on the usefulness and the relevance of the embedded research toolkit in public health practice. This is followed by the comparison of the role of embedded research in non-clinical settings with the NIHR work on the role of embedded research in clinical settings (NHS) (Embedded research, no date). Finally, the overview of how each phase of the PhD informed the development of the embedded research toolkit, the strengths, and the limitations of the embedded research toolkit, and how the toolkit could be informed and developed later in the future are presented.

#### 6.1 Introduction to Embedded Research Toolkit Development

A toolkit is a set of tools kept together in a certain place for a specific purpose (Soanes et al., 2006). The embedded research toolkit was proposed to serve as a tool or a guide in providing public health practitioners and researchers the role of embedded research in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice. The use of the toolkit can therefore assist in the improvement of the quality of the service and delivery offered to the public as a result of rapid and timely utilisation of research evidence in public health practice.

## 6.2 Aims and Objectives of the Chapter

### 6.2.1 Aims

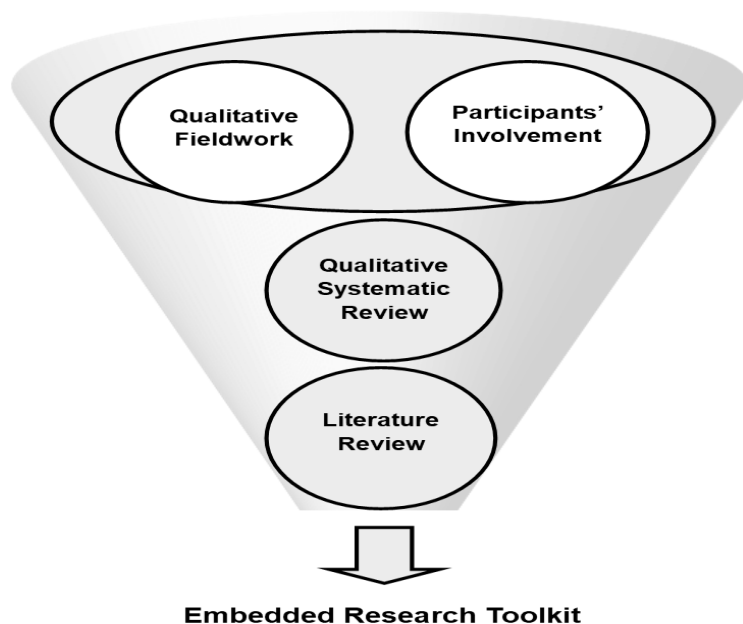
The aim of this component of the PhD was to develop a toolkit on the role of embedded research in the co-production of public health knowledge in non-clinical settings which could bridge the gap between research evidence and its implementation in public health practice.

### 6.2.2 Objectives:

- To explore relevant existing models and toolkits on bridging the gap between research evidence and its implementation in public health practice, to examine their strengths and limitations.
- To explore the responses of the participants who participated in the qualitative inquiry regarding their thoughts on the development of an embedded research toolkit useful in public health practice.
- To use the result of the triangulation of findings (chapter five) to develop a toolkit on the topic.
- To cross-check the usefulness and the relevance of the embedded research toolkit with participants.
- To compare and contrast the role of embedded research in non-clinical settings with the role of embedded research in clinical settings (NHS).
- To inform future postdoctoral research on the role of embedded research in bridging the gap between research evidence and its implementation in public health practice.

## 6.3 Methods

As detailed in previous chapters, it was essential to develop a toolkit on the role of embedded research which could be used in public health practice to bridge the gap between research evidence and its implementation. Thus, this PhD aims to develop an accessible toolkit on the topic available for both public health embedded researchers and public health practitioners to improve service and delivery for the public. Figure 7 shows the research elements that informed the development of the embedded research toolkit. The following sub-sections detail the contribution of each research element to the development of the novel toolkit.



**Figure 3: Development Process**

### 6.3.1 Literature Review

To be informed of the existing literature and identify the gap in the literature around the role of embedded research in co-producing public health knowledge in non-clinical settings, a literature review was conducted (chapter one). Although literature reviews are not as rigorous and thorough as systematic reviews (Grant and Booth, 2009), they are beneficial in providing an overview of a research topic to assess the extent of knowledge on a specific topic (Snyder, 2019). In addition, literature reviews offer the basis by which a novel conceptual theory or model can be built (Torraco, 2005). To this end, a literature review was conducted to have an overview of existing evidence on the topic and to examine if there was any existing embedded research toolkit on the topic. Also, the literature review served as a basis and guide for the embedded research toolkit development. As such, relevant databases such as Google Scholar, Cinahl, and NIHR embedded research's website were searched for relevant literature on the topic. Vindrola-Padros et al.'s (2017) narrative review was used as a starting point. The papers reviewed in the narrative review and their reference list were explored to gain knowledge about the topic.

### 6.3.2 Systematic Review

To synthesise qualitative findings from relevant studies on the role of embedded research in co-producing public health knowledge in non-clinical settings, a systematic review was conducted. As detailed in chapter two, JBI methodology was adopted to systematically review relevant literature to inform the development of an embedded research toolkit on the topic.

### 6.3.3 Qualitative Fieldwork

Qualitative fieldwork was conducted to explore the themes that emerged from the systematic review. Semi-structured interviews were carried out with 17 participants to inform the development of the embedded research toolkit. To investigate the views of the participants about the development of an embedded research toolkit, the final question on the interview schedules asked if participants think that the development of an embedded research toolkit would be needed, and useful in public health practice. Participants were asked: *“Do you think the development of a toolkit on the role of embedded research in bridging the gap between research evidence and its implementation in public health practice would be useful? If yes, Why and how do you think it could be used in public health practice?”* This was to answer the fifth objective of the qualitative fieldwork as outlined in chapter two – to inform the development of the proposed embedded research role toolkit.

### 6.3.4 Participants' / Stakeholders' Involvement

Stakeholders are defined as *“individuals, organizations or communities that have a direct interest in the process and outcomes of a project, research or policy endeavor”* (Deverka et al., 2012, p.5). As the gap between the production of research-based evidence and its implementation has been identified as a major problem for the health research system, stakeholder involvement or engagement is encouraged by health-based organisations, including researchers, as an important means to attaining impact (Kok et al., 2016). Similarly, involving the views of available key stakeholders has great advantages. Such as, improving the usability and relevance of research evidence, and thus, offer useful knowledge to improve practice (Centre for Medical Technology Policy, 2021). Therefore, participants/stakeholders were involved in the development of the embedded research toolkit to improve the toolkit's usability and relevance in public health practice.

Four embedded researchers, each from the four embedded research sites, and one teacher from the school (site three) were asked to provide feedback and discussion on the relevance and usefulness of the embedded research toolkit in practice. There was a plan to recruit more participants/stakeholders for this phase, but COVID-19 made this impossible. The embedded research toolkit provided an overview of how it was developed, the PhD aims and objectives including the expected outcomes of this PhD. Following the diagram that presents the role of embedded research, are the colour-coded text boxes of how the roles could be carried out in public health practice, and a glossary of terms to define terminologies. A feedback sheet was attached to the embedded research toolkit to guide the participants through the feedback process. The feedback sheet contained questions around the usability, structure, applicability, accessibility, and content of the embedded research toolkit. The feedback of the five participants was collated and the results are presented in section 6.4.5.

## 6.4 Results of the Toolkit Development Stages

### 6.4.1 Embedded Research Toolkit Development: A Literature Review

The literature review showed that there was no embedded research toolkit on the topic in non-clinical settings, but there was a similar NIHR work on embedded research in clinical settings (Embedded research, no date). Hence, the NIHR embedded research team's papers, website, webinars, and other resources including an embedded research model in clinical settings, informed the development of the embedded research toolkit in non-clinical settings.

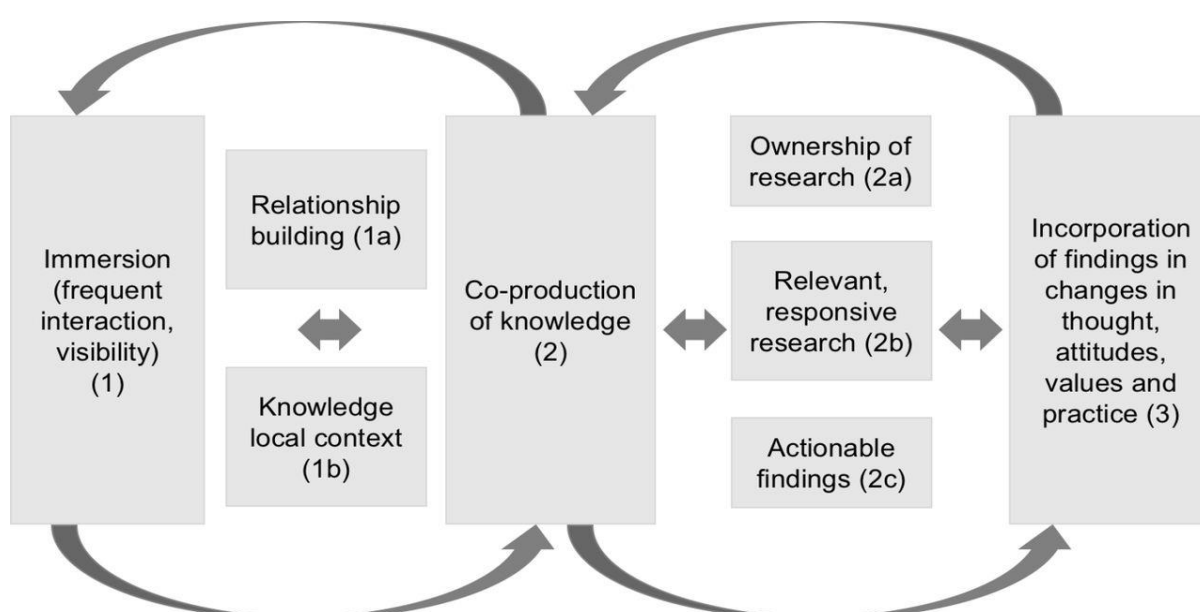
Furthermore, the NIHR embedded research project in clinical settings (NHS) (Embedded research, no date) informed the method used in this piece of work. Although the NIHR embedded research work focused on clinical settings, it was found that the development of the role of embedded research toolkit in non-clinical settings complements the NIHR embedded research work. As detailed in chapter one, the NIHR embedded research project explored four workstreams. The findings were used to produce a model and guidance on the role of embedded researchers such as job specifications, training among others, in clinical settings (Embedded research, no date; Vindrola-Padros et al., 2019). Therefore, as the NIHR work on embedded research in clinical settings (NHS) seemed to be the only most closely related work to produce a model and guidelines on the role of embedded research though, in clinical



settings, the development of this current embedded research toolkit in non-clinical settings adopted the NIHR embedded research methods. To increase rigour, apart from adopting the methods used by the NIHR embedded research team, that is, a literature review, the identification of embedded research initiatives, case studies, and the dissemination of findings, this current PhD also conducted a systematic review on the topic. Also, the usefulness and relevance of the embedded research toolkit in public health practice was cross-checked with four embedded researchers and one other stakeholder to increase the rigour of this PhD study.

#### 6.4.1.1 Key insights from existing models on embedded research from existing literature

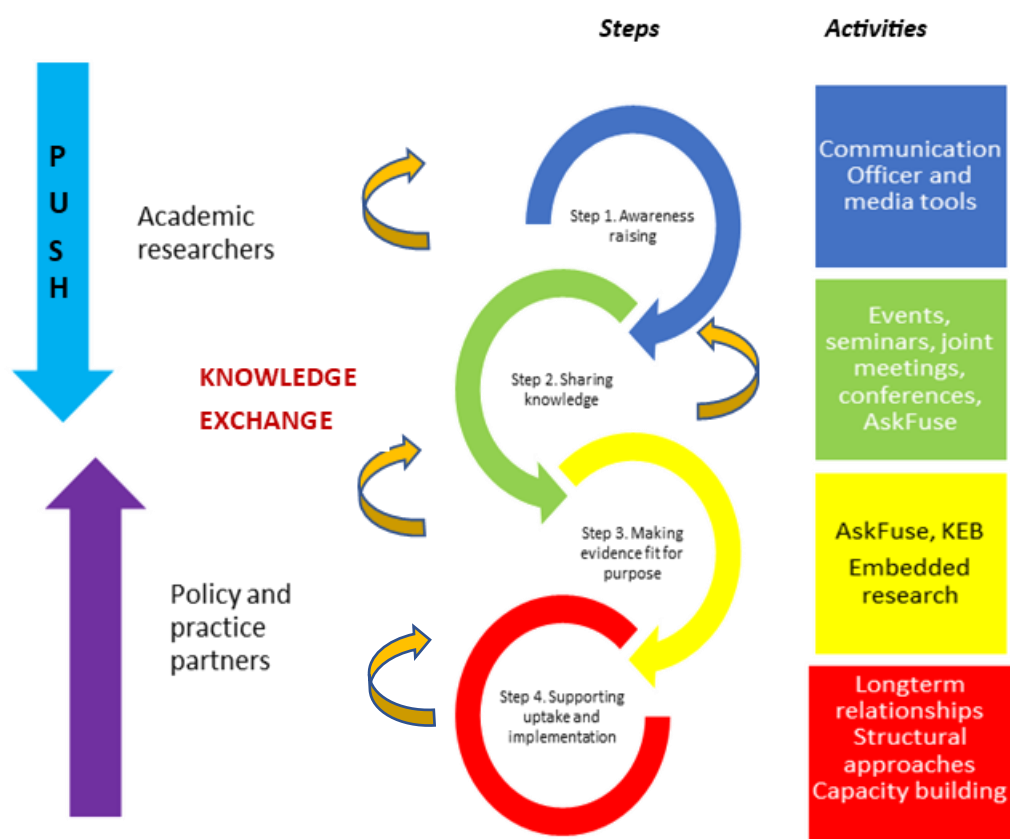
As discussed in chapters one and two, different terminologies are used for embedded research. In clinical settings, embedded research is popularly referred to as “researcher-in-residence” (Marshall et al., 2014; Marshall et al., 2016). The NIHR embedded research team in their paper “*Addressing the challenges of knowledge co-production in quality improvement: learning from the implementation of the researcher-in-residence model*” (Vindrola-Padros et al., 2019) presented a researcher-in-residence model (Figure 8). Although the model was based on clinical settings, it was relevant to the development of the current embedded research toolkit in non-clinical settings. Figure 8 presents the researcher-in-residence model in clinical settings by Vindrola-Padros et al. (2019).



**Figure 4: Researcher-in-Residence Model (Vindrola-Padros et al., 2019)**

The model provides some roles of an embedded researcher or researcher-in-residence to make research more relevant to meet the needs of the host organisation. Thus, it makes research evidence more usable in the host organisation, and therefore, it could bring about positive changes in the host organisation. These could be achieved by being part of the host organisation through relationship building, and understanding the local context which could facilitate the co-production of knowledge. The role of embedded research presented in Vindrola-Padros et al.'s (2019) researcher-in-residence model (Figure 8) seems similar to the role identified in this current work. However, when considering the researcher-in-residence model above, it was difficult to know how an embedded researcher (researcher-in-residence) could carry out each role to meet expectations. As such, this inadequacy could serve as a barrier to the use of the model in practice. Although the authors present the model in a short, and easy-to-follow way, the role of embedded research needs to be expanded upon to reveal more roles that could make it easier for users to identify and adapt in practice. Participants from the current qualitative fieldwork mentioned some characteristics that could facilitate the use of a toolkit in public health practice such as being easy-to-follow, 'self-serve', and concise.

Another model that is related and considered in this piece of work was the Fuse knowledge exchange model (Figure 9). The model features embedded research amongst others, as a way to make research relevant to meet the need in practice. Figure 9 presents the Fuse model by Van der Graaf et al. (2019).



**Figure 5: Fuse Knowledge Exchange Model**

Obtained from Van der Graaf et al. (2019)

The Fuse model (Figure 9) focused on knowledge exchange wherein an embedded research approach was one of the activities to facilitate knowledge exchange. The model appears to be clear, simple, and easy to read. Also, the use of infographics and colour coding would make the model attractive and easy to follow for users. As such, this could facilitate its use in practice. However, the role of embedded research and how it can be delivered to achieve the expected outcomes need to be expanded upon to inform practice. Therefore, it was essential that the embedded research toolkit developed from this PhD clearly outlines the role of embedded research as well as how the role could be carried out to bridge the gap between research evidence and its implementation in public health practice. Apart from the literature review, a systematic review, qualitative fieldwork, and participants'/stakeholders' involvement informed the development of the current embedded research toolkit.

### 6.4.2 Embedded Research Toolkit Development: A Systematic Review

The six themes that emerged from the systematic review (chapter three) which informed the development of the embedded research toolkit were:

- (1) Building mutually beneficial relationships,
- (2) Becoming part of the organisation to co-produce research,
- (3) Building research capacity,
- (4) Informing practice,
- (5) Managing funds allocated to the research and providing evidence for reports and future funding applications, and
- (6) Critical reflection

### 6.4.3 Embedded Research Toolkit Development: A Qualitative Fieldwork

The four themes that emerged from the qualitative fieldwork (chapter four) which informed the development of the toolkit were:

- 1) building and maintaining relationships with practitioners and other stakeholders,
- (2) working together to produce research,
- (3) informing and developing future practice and research, and
- (4) keeping a critical reflection trajectory

#### 6.4.3.1 *Participants' views on toolkit development*

Following the presentation of the qualitative fieldwork results detailed in chapter four, this section presents the results of the interview participants' views and perspectives on the development of an embedded research toolkit. All the interview participants except the two secondary school students who might find the following questions difficult to answer, contributed to this phase. Participants were asked: *“Do you think the development of a toolkit on the role of embedded research in bridging the gap between research evidence and its implementation in public health practice would be useful? If yes, Why and how do you think it could be used in public health practice? If no, why do you think the development of the toolkit would not be useful?”* Below are the aspects the participants mentioned regarding the development of the toolkit. Their responses informed the development of the embedded research toolkit.

### 6.4.3.1.1 Needfulness

Interview participants were asked whether there was a need for the development of a toolkit on the role of embedded research which could bridge the gap between research evidence and its implementation in public health practice. They thought as there was not much guidance on the role of embedded research, it would be essential to develop a toolkit on the topic as a guide for practice.

*“Yeah, I think, there is not much guidance, at this minute, I feel there is something that is really lacking when I sort of went about coproduction things before. When you look, when you sort of google coproduction and things come up but there is not any sort of like a toolkit, there isn’t any way of doing it. And I think at the minute people do things very differently and I think it’s always good to have a sort of guide or like gold standard to follow”*

**[ERsite3, Female, Embedded Researcher]**

*“If I actually drive in or came into an organisation and I did not know what an embedded research role was, I probably will need a long chat with an embedded researcher, so to have it handy from you will really be helpful”*

**[PHP6site2, Male, Public Health Practitioner]**

### 6.4.3.1.2 Usefulness

The participants stated that the development of an embedded research toolkit would be useful in practice. As such, they were asked to further explain their responses.

*“I tell you what, I am not sure everyone knows what embedded research involves. I do think the toolkit will probably give people a little more knowledge about what is happening, where the professional boundaries are, where the ethics lie, how you build relationships”*

**[PHP6site2, Male, Public Health Practitioner]**

The public health practitioners believed that having a toolkit will enable them to know the role of the embedded researcher they are working with. Therefore, the toolkit will provide the opportunity to know where to seek support when needed.

*“Yeah, definitely, based on my own experience [...] sometimes it can be an opportunity when you know that you can get that additional help and support. If you knew that you are having that kind of information about what the role and function is, that will really be helpful, definitely”*

**[PHP2site2, Female, Public Health Practitioner]**

An embedded researcher emphasised that the toolkit would serve as a guide to follow when carrying out embedded research projects.

*“Of course, if you have a sort of standard or guidelines to follow, just thinking of what I want to do like a systematic review, other pieces of research will always have a guideline to follow and it makes the process easier. You can see the steps that need to be taken or things you need to consider. I think this is something that will be important if you are doing this kind of research, I think it will really be helpful”*

**[ERsite3, Female, Embedded Researcher]**

The participants mentioned that an embedded research toolkit would bring clarity to the role of an embedded researcher especially, it would be useful for induction processes.

*“Absolutely, again is much better when the role you hold is clear when you began. Yeah, it's kind of giving clarity of role and function and purpose. That will be beneficial”*

**[PHP3site2, Male, Public Health Practitioner]**

The participants' views were also used to inform the development of the embedded research toolkit to ensure that the toolkit is clear enough to outline the role of embedded research. This, therefore, will enhance the toolkit's usability and accessibility in diverse public health settings.

#### **6.4.3.1.3 Format**

Participants were also asked about their views on how an embedded research toolkit should be presented to enhance its usability. The participants agreed that the embedded research should be comprehensive enough to accommodate all the essential roles of embedded research. However, they added that the toolkit should not be lengthy, or else it will not be read.

*“[...] It will be beneficial as long as it's not too big, otherwise it won't be read”*

**[PHP3site2, Male, Public Health Practitioner]**

*“[...] I am not talking of a Wikipedia because nobody will read it. I am talking of a miniature description I suppose, of what the service offers [...] just to give people an idea”*

**[PHP6site2, Male, Public Health Practitioner]**

Therefore, it was ensured that the embedded research toolkit was concise to facilitate its usability and accessibility in practice.

#### **6.4.3.1.4 Limitations or challenges**

Participants reflected upon the limitations or challenges that could be encountered in the process of the development of an embedded research toolkit. An embedded researcher discussed that as public health projects could be different, it might be difficult to develop a standardised or universal embedded research toolkit. Hence, the embedded research toolkit should be flexible to allow being used for different public health embedded research projects.

*“The one thing I would say is that it would be quite hard to make, erm to standardise it because it would obviously depend on the project as there are different co-production projects unless you must have something that is quite flexible, yeah that is quite flexible. You would not have to use every element inside it, say there are 20 items on it, you would not necessarily need to use all 20, but 10 of them might be great to know what I need to do. So, having something that will be quite flexible and quite adaptable as well”*

**[ERsite3, Female, Embedded Researcher]**

*“you know there are some lessons learnt from researches out there because the setting is different and don't assume that you go into one organisation and then it will behave exactly the same as somebody in embedded research somewhere else”*

**[PHP2site1, Female, Public Health Practitioner]**

*“I think it will be very helpful. [...] looking at how that toolkit might be and how you can develop where the flexibility will lie within this [...] you know that will certainly be very interesting. [...] erm yes, I think it will be very helpful and good luck.”*

**[ERsite2, Female, Embedded Researcher]**

It was clear that the proposed embedded research toolkit must be flexible to maximise its usefulness in diverse non-clinical public health settings. More so, public health teams work with partners across LAs and various non-clinical settings such as schools (Segrott and Roberts, 2019; Hayden et al., 2019), and criminal justice (Ferguson et al., 2019; Newbury-Birch et al., 2019), to actualise their goals. Therefore, the embedded research toolkit was developed in a way to enhance the flexibility of its use across diverse non-clinical public health settings.



#### 6.4.4 Embedded Research Toolkit Development: Triangulation of Findings

The findings from the systematic review (chapter three) and the qualitative fieldwork (chapter four) were triangulated (chapter five) in relation to the development of an embedded research toolkit. The results showed an overall of six themes which were:

- (1) building mutually beneficial relationships,
- (2) becoming part of the organisation to co-produce research,
- (3) building research capacity,
- (4) Informing and developing future practice and research,
- (5) keeping critical reflection trajectory,
- (6) managing funds, and providing evidence for reports and future funding applications.

#### 6.4.5 Results of Stakeholders'/Participants' Involvement

Following the development of the embedded research toolkit, it was cross-checked with some of the participants for its usefulness and relevance in public health practice. Although it was proposed that all the participants including the embedded researchers, public health practitioners, and other stakeholders were to be asked to provide feedback on the embedded research toolkit, this was not achievable due to the COVID-19 pandemic. Hence, only the four embedded researchers, one each from the four embedded research sites, and one other stakeholder were asked to provide feedback on the toolkit. This feedback from the five participants was used to modify the initial embedded research toolkit to develop the current toolkit (version 1.0, Fig 10). Table 23 presents the compilation of the feedback from the participants.



**Table 23: Compilation of Feedback from the Participants on the Toolkit**

Question	Feedback
1. Would you find this toolkit useful to know the role of embedded research in bridging the gap between research evidence and its implementation in your organisation?	<ul style="list-style-type: none"> <li>• Yes, the toolkit sums up the key features of the role of embedded research/co-production working well and is a good way to introduce the way of working to individuals with no previous experience or who are unsure of the benefits, etc.</li> <li>• This would have been very helpful when I started out five years ago.</li> </ul>
2. Would this toolkit be appropriate or acceptable and feasible for use by you, or within your organisation? Would you find it simple and easy to follow?	<ul style="list-style-type: none"> <li>• Yes, the toolkit is very clear, easy to read, simple, and easy to follow. I like the colour coding and text boxes as it breaks up the information in a clear and appealing way. It is four pages long. Do not want anything too onerous, but this gives you the right amount of detail.</li> <li>• I think it would be useful to share with partner organisations to communicate what embedded research can offer and an outline of what it may involve. It is also really useful to provide a glossary of terms for those who may be new to co-production research, so it is great this is included.</li> <li>• The visual aspects make it accessible.</li> </ul>
3. Would this help if you were to recruit embedded researchers in your organisation? As an embedded researcher, does the toolkit include all your role/activities in the host organisation?	<ul style="list-style-type: none"> <li>• Yes, the toolkit covers the roles/activities of an embedded researcher comprehensively.</li> <li>• This could be used to help structure recruitment (e.g. person specification) and could be used with interview formats. The toolkit could then be used as part of a successful applicants' induction process.</li> </ul>
4. What are the facilitators and barriers to using this toolkit?	<ul style="list-style-type: none"> <li>• <b>Facilitators-</b> Knowing how to use the tool effectively, how it can be used, and to what benefit/advantage, etc. If it can be disseminated/ communicated to those who will find it valuable successfully, it will be a great asset.</li> <li>• Ensuring people can access the toolkit and are aware that it is available.</li> <li>• <b>Barriers-</b> Some of the languages may need to be simplified if trying to appeal to a wider audience. I felt like some of the terms used in the glossary are overly complex. The glossary should be as simple as possible when explaining terminology.</li> <li>• Informing practice picture on the infographic- bit difficult to interpret. Although appreciate that this is a difficult concept to put across in a picture!</li> </ul>

<p><b>5. How best do you think this toolkit can be disseminated to public health researchers and practitioners?</b></p>	<ul style="list-style-type: none"> <li>• PHE conference would be a good starting point. Using the likes of social media (Twitter) and tweeting Directors of Public Health! Fuse would also be another good place to present at, one of the QRM's, as that links in the North East academics/practitioners.</li> <li>• Perhaps there's a way to raise awareness through NIHR or other funding bodies, local Health and Wellbeing Boards, and health forums.</li> <li>• Some FREE CPD that also features a visual or written case study outlining how it has worked previously and the key benefits to public health organisations.</li> </ul>
<p><b>6. Which elements of this toolkit do you like?</b></p>	<ul style="list-style-type: none"> <li>• I really like the layout and colour coding and how it has been broken up into the important factors. It feels easy to read, accessible and there are not large amounts of overwhelming text which can be a drawback of other models.</li> <li>• It was set out clearly, the diagram provided a clear visualisation. I like how there is an infographic, but then more detail, and examples of how each of the toolkit themes can be delivered.</li> <li>• All aspects are helpful, but it is especially useful in that it is summative and not too long-winded. Thus, accessible for busy practitioners.</li> <li>• The toolkit looks flexible. It could be adapted in other fields apart from public health.</li> </ul>
<p><b>7. Which elements do you think could be improved?</b></p>	<ul style="list-style-type: none"> <li>• Some of the bullet points could be expanded upon for clarity as it may not always be clear to a reader what they are referring to - e.g. circulation of important opportunities- what kind of opportunities, how to circulate etc. Most of them do read well and are clear, just feel like there's a couple I'm not sure what they are referring to and if I'm not sure, someone new to co-production research would likely find these difficult to understand.</li> </ul>
<p><b>8. Anything else you want to say?</b></p>	<p>The embedded research role toolkit looks great. Excellent work Abi!</p>

Participants were very pleased to contribute to the development of the embedded research toolkit. Therefore, when they were asked to provide feedback on the embedded research toolkit, they were so happy to do so. The participants mentioned how good they felt to see the final product of the PhD work. The participants provided detailed comments used to modify the toolkit to develop the embedded research toolkit version 1.0. It was quite clear that the toolkit is needed and essential in practice. In fact, one of the embedded researchers specifically said:

*“This would have been very helpful when I started out five years ago”*

***[ERsite2, Female, Embedded Researcher]***

The result from the stakeholders' / participants' involvement confirms the result of the literature review that there seems to be no existing embedded research toolkit on the topic, apart from the one provided by the NIHR embedded research team in clinical settings (Vindrola-Padros et al., 2019). Thus, there is a gap in literature being filled by the development of the current embedded research role toolkit.

The participants agreed that the toolkit appeared comprehensive- that is, the toolkit is detailed and includes all aspects of what they believe to be the embedded research er role, and at the same time was presented in a concise, informative, easy to follow way to facilitate its use in practice. Participants commented that the toolkit clearly provides the role of embedded research in practice in a simple way. Also, that the toolkit looks flexible which means it could be applied in diverse public health non-clinical settings as well as other fields apart from public health. However, participants added that a video presentation of the toolkit could also be developed to make the toolkit more accessible to diverse audiences. The response from the stakeholders'/participants' involvement corresponds with the results from the qualitative fieldwork that the embedded research must have the right detail but must be short, otherwise, it will not be read. As summarised in table 23, participants suggested how awareness and dissemination of the embedded research role toolkit could be made to facilitate its use in public health practice.

#### **6.4.6 Embedded Research version 1.0**

Figure 10 presents the embedded research toolkit developed as the overall outcome of this PhD.

##### **6.4.6.1 Content of the embedded research toolkit**

As discussed earlier, the triangulation of the findings from the systematic review and the qualitative fieldwork yielded six themes on the role of embedded research in co-producing public health knowledge in non-clinical settings.

The roles are:

(1) building mutually beneficial relationships,

- (2) becoming part of the organisation to co-produce research,
- (3) building research capacity,
- (4) informing and developing future practice and research,
- (5) managing funds, providing evidence for reports and future funding applications,
- (6) keeping critical reflection trajectory.

The toolkit includes six areas as informed by the triangulation of findings. An infographic presentation of the themes was done to make the toolkit easy to follow, and attractive. Six colour-coded text boxes were used to provide strategies of how each role could be carried out by embedded researchers in public health practice. The strategies were the overall codes derived from the triangulation of the systematic review and the qualitative fieldwork (Table 20). To ensure that the toolkit is simple and easy to read, simple words were used without ambiguity. Also, a box was used to provide a glossary of terms to define terminologies for users.

#### ***6.4.6.2 Use of the embedded research toolkit***

The use of a diagram (infographic) and text boxes to present the embedded research toolkit would make the toolkit usable for users. The toolkit would serve as a guide for users not only to identify the role of embedded research but also to know the strategies of how each role could be carried out to bridge the gap between research evidence and its implementation in public health practice. The expected outcomes are:

- That the public health practitioners in non-healthcare settings use the toolkit as a guide to improve service and delivery.
- That more public health practitioners and academics would be informed of the potential of embedded research in bridging the gap between research evidence and its implementation in practice.
- That more organisations and more researchers would consider adopting an embedded research approach.
- That the toolkit would serve as a guide for public health practitioners/practice on job specifications when recruiting embedded researchers.

The embedded research toolkit is designed to be flexible. As such, the embedded research toolkit could be used in diverse non-clinical settings where embedded research is adopted.

***6.4.6.3 Appearance and format of the embedded research toolkit***

To ensure that the embedded research toolkit is attractive, simple, easy to read, and accessible, it is four pages long. Also, the texts were in Arial font, size 11 to ensure it is clear, large, and readable for users. Infographics, text boxes, colour-coding, and bullet points were adopted to make the toolkit attractive and easy to understand for users. These, therefore, should facilitate its use in practice. Furthermore, the same colour was assigned to each role and its corresponding text box on how the role could be carried out. For example, colour green was assigned to 'building mutually beneficial relationships' on the diagram and in the text box. This would make the embedded research toolkit appealing to users by making it easy for them to follow. Figure 10 presents the embedded research toolkit developed as the overall outcome of this PhD.

## Embedded Research Role Toolkit

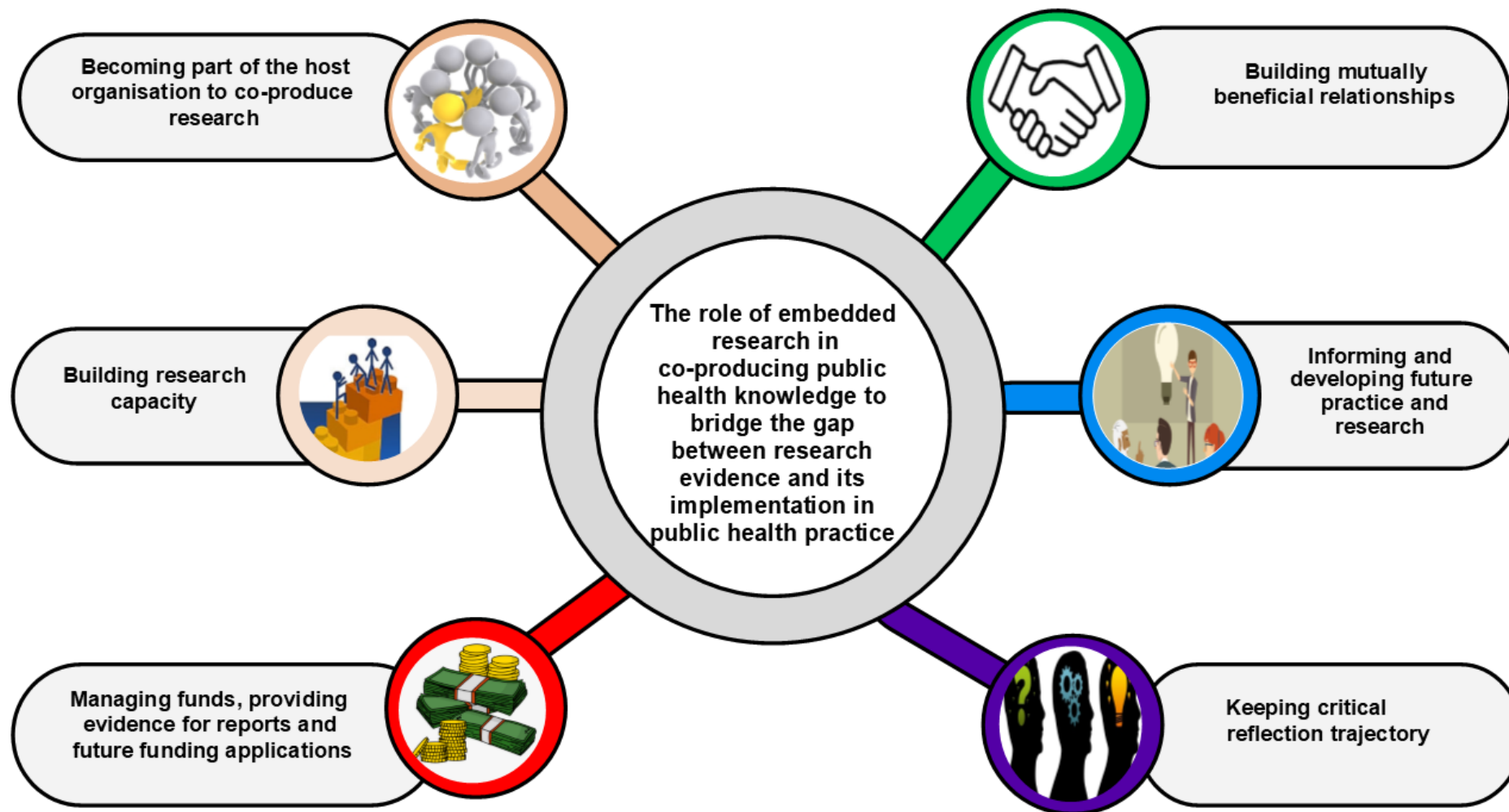


Figure 6: The Embedded Research Role Toolkit Version 1.0

## The Role of Embedded Research in Public Health Practice

### 1. Building mutually beneficial relationships

- Maintaining regular contacts with the stakeholders, and the academic supervisor
- Connecting practitioners, academics, and other stakeholders for collaborative work
- Attending formal meetings with practitioners
- Engaging in informal conversations with the practitioners and other stakeholders
- Being friendly and approachable to the practitioners and other stakeholders
- Building mutual trust

### 2. Becoming part of the host organisation to co-produce research

- Having an affiliation with an academic institution and a host organisation
- Working with the host organisation's staff to conduct relevant research
- Spending time in the host organisation to understand the context of the host organisation
- Providing the opportunity for stakeholders to participate in research activities
- Working closely with the host organisation's staff to combine the tacit knowledge of the practitioners with the explicit knowledge from research.
- Managing diverse expectations
- Balancing competing interests of the academic institution and the host organisation

### 3. Building research capacity

- Providing research training and support to practitioners and other stakeholders
- Ensuring high quality research and bringing research skills, while learning new skills in the host organisation
- Building stakeholders' confidence to conduct research
- Assisting stakeholders and the host organisation to build their career/reputation/morale by their involvement in research

**4. Informing and developing future practice and research**

- Writing and presenting reports unambiguously
- Spending time on evaluation work
- Making recommendations and positive changes to proffer solution to the host organisation's challenges
- Assisting in identifying the needs/challenges facing the host organisation.
- Assisting in identifying future research areas
- Assisting in publishing research findings
- Assisting in searching for relevant research evidence
- Assisting in translating/implementing research evidence to practice
- Circulation of relevant opportunities such as information regarding research conferences, and seminars

**5. Managing funds, providing evidence for reports and future funding application**

- Supervising research funds
- Providing reports for future funding
- Providing advice on proposals, and funding applications

**6. Keeping critical reflection trajectory**

- Constant reflection to evaluate the role of embedded research in the host organisation



### Glossary of Terms

**Embedded research:** is a research conducted by an individual who has a dual affiliation with a host organisation and an academic institution with the aim of carrying out research agenda while maintaining mutually beneficial relationships.

**Collaboration:** the act of working with an individual/s to produce something.

**Stakeholders:** is a group of people that has an interest in an organisation and can either influence or be affected by the activities of the organisation.

**Dual affiliation:** is the act of associating with two different organisations.

## 6.5 Comparison of the Findings to the NIHR Work in Clinical Settings

As mentioned in previous chapters, the NIHR embedded research team developed similar research in clinical settings (NHS). (Embedded research, no date). The NIHR embedded research project team used their findings to develop a range of resources including an embedded research model (Vindrola-Padros et al., 2019), and a job description document useful in recruiting embedded researchers (Embedded research, no date). The roles specified in the embedded research job description in clinical settings (NHS) were extracted (Embedded research, no date) and compared to the six roles of embedded research and how they could be delivered in non-clinical settings. Table 24 presents the comparison between the role of embedded researchers in clinical settings (NHS) and in non-clinical settings. (\* indicates the difference between the role of embedded research in both settings).

**Table 24: Comparison Between the Role of Embedded Research in Non-clinical Settings and Clinical Settings (NHS)**

Embedded Research Role	Non-clinical Settings	Clinical Settings (Embedded research, no date)	Comments
<p><b>Building Mutually Beneficial Relationships</b></p>	<ul style="list-style-type: none"> <li>• Maintaining regular contacts with the stakeholders, and the academic supervisor</li> <li>• Attending formal meetings with practitioners</li> <li>• Engaging in informal conversations with the practitioners and other stakeholders</li> <li>• Being friendly and approachable to the practitioners and other stakeholders</li> <li>• Connecting practitioners, academics, and other stakeholders for collaborative work</li> <li>• Building mutual trust</li> </ul>	<ul style="list-style-type: none"> <li>• Assisting in building relationships within the host organisation, and between organisations including the affiliated University, and promote co-production between relevant stakeholders to improve the service and delivery.</li> <li>• Maintaining regular contact with the academic supervisor to monitor progress.</li> <li>• Promote working together between the members of the host organisation, and the academics.</li> </ul>	<p><b>‘Building Mutually Beneficial Relationships’ is identified as one of the roles of embedded research in both settings.</b></p>
<p><b>Becoming Part of the Organisation to Co-produce Research</b></p>	<ul style="list-style-type: none"> <li>• Having an affiliation with an academic institution and a host organisation</li> <li>• Working with the host organisation’s staff to conduct relevant research</li> <li>• Spending time in the host organisation to understand the context of the host organisation</li> <li>• Providing the opportunity for stakeholders to participate in research activities</li> <li>• Working closely with the host organisation’s staff to combine the tacit knowledge of the practitioners with the explicit knowledge from research.</li> <li>• Managing Diverse Expectations</li> <li>• Balancing competing interests of the academic institution and the host organisation</li> </ul>	<ul style="list-style-type: none"> <li>• Dual affiliation- which involves having desks and responsibilities in both affiliated organisations.</li> <li>• Working together with members of staff in the University, and as well carrying out relevant co-produced research with the staff of the host organisation to improve service and delivery in the host organisation.</li> <li>• Develop research agenda with the support of academic supervisor and the supervisor in the host organisation.</li> <li>• Understanding the host organisation work in the context of the research project, and gaining understanding and knowledge from the host organisation.</li> <li>• Maintaining confidentiality involved in the role.</li> </ul>	<p><b>‘Becoming Part of the Organisation to Co-produce Research’ is identified as one of the roles of embedded research in both settings.</b></p>

		<ul style="list-style-type: none"> <li>• Balancing responsibilities in both affiliated organisations.</li> <li>• Co-ordinating the research project</li> <li>• Working closely with related agencies to enhance the research process and strategy.</li> </ul>	
<b>Building Research Capacity</b>	<ul style="list-style-type: none"> <li>• Providing research training and support to practitioners and other stakeholders</li> <li>• Ensuring high-quality research and bringing new/research skills into the host organisation</li> <li>• Building stakeholders' confidence to conduct research</li> <li>• Assisting stakeholders and the host organisation to build their career/reputation/morale by their involvement in research</li> </ul>	<ul style="list-style-type: none"> <li>• Providing advice by sharing academic knowledge and supporting the members of the host organisation in the research process.</li> <li>• Attending relevant conferences and seminars to build the embedded researcher's and other's skills.</li> <li>• Improving the reputation of the host organisation by improving service through research impact.</li> <li>• Assisting in building the staff's and other stakeholders' career development.</li> </ul>	<b>'Building Research Capacity' is identified as one of the roles of embedded research in both settings.</b>
<b>Informing and Developing Future Practice and Research</b>	<ul style="list-style-type: none"> <li>• Writing and presenting reports in a simple way</li> <li>• Spending time on evaluation work</li> <li>• Making recommendations and positive changes to proffer solutions to the host organisation's challenges</li> <li>• Assisting in identifying the needs/challenges facing the host organisation.</li> <li>• Assisting in identifying future research areas</li> <li>• Assisting in publishing research findings</li> <li>• Assisting in searching for relevant research evidence</li> <li>• Assisting in translating/implementing research evidence to practice</li> </ul>	<ul style="list-style-type: none"> <li>• Identifying, contextualising, and address issues around service delivery.</li> <li>• Being an agent of change through the use of research evidence in the host organisation</li> <li>• Circulating research results, and presentation of research findings to diverse audiences</li> <li>• Identifying relevant research needed in the host organisation, and producing knowledge.</li> <li>• Reviewing relevant literature, and assisting in the process of publication activities.</li> <li>• Engaging in service evaluation and quality improvement activities.</li> <li>• Assisting to draft progress reports.</li> </ul>	<b>'Informing and Developing Future Practice and Research' is identified as one of the roles of embedded research in both settings.</b>

	<ul style="list-style-type: none"> <li>• Circulation of relevant opportunities such as information regarding research conferences, and seminars.</li> </ul>		
<p><b>Managing Funds Allocated to Research and Providing Evidence for Reports and Future Funding Applications</b></p>	<ul style="list-style-type: none"> <li>• Supervising research funds.</li> <li>• Providing reports for future funding.</li> <li>• Providing advice on proposals, and funding applications.</li> </ul>	<ul style="list-style-type: none"> <li>• Assisting in the development of proposals for research grant funding.</li> </ul>	<p><b>*‘Managing Funds Allocated to Research’ is identified as part of the role of embedded research only in non-clinical settings.</b></p> <p>However, both clinical and non-clinical settings identified ‘Providing Evidence for Reports and Future Funding Applications’ as part of the roles of embedded research.</p>
<p><b>Keeping a Critical Reflection Trajectory</b></p>	<ul style="list-style-type: none"> <li>• Constant reflection to evaluate the role of embedded research in the host organisation</li> </ul>	<ul style="list-style-type: none"> <li>• Reflection to shape their future practice.</li> </ul>	<p><b>‘Keeping a Critical Reflection Trajectory’ is identified as one of the roles of embedded research in both settings.</b></p>

*\* indicates the difference between the role of embedded research in both settings.*

The comparison between the role of embedded research in non-clinical settings and the clinical settings showed that there were lots of similarities between the role of embedded research irrespective of the setting. The six identified roles of embedded research in non-clinical settings confirmed from this PhD were almost the same as the role of embedded researcher outlined in the NIHR embedded researcher job description (Embedded research, no date). The slight difference was that the 'managing funds allocated to research' element of the role 'managing funds allocated to the research and providing evidence for reports and future funding applications' was not included in the NIHR embedded researcher job description in clinical settings. 'Managing funds allocated to research' was mentioned only by one article in the systematic review (Jenness, 2008), it was not mentioned by the qualitative fieldwork participants. However, as Jenness (2008) has the 'highest' methodological quality among the included studies in the systematic review, this element was added to the role of embedded research (managing funds allocated to the research and providing evidence for reports and future funding applications). Therefore, as discussed in chapter one, this explains why the NIHR embedded research project team conducted a study on "a framework of design options for embedded researcher initiatives' (Embedded research, no date). They found that there are different varieties of embedded research initiatives based on intent, structure, and the processes in the initiative. Hence, this shows that while some embedded research initiatives might involve 'managing funds allocated to the research' like Jenness (2008), some embedded research initiatives might not include this element. Apart from this element - 'managing funds allocated to research', there was no difference between the six identified roles of embedded research (themes) and the strategies to deliver them (codes) in both non-clinical settings and clinical settings.

The slight disparity was not based on settings but was due to the fact that while the NIHR embedded research team used a literature review, and case studies, this PhD explored a literature review, a systematic review, a qualitative fieldwork, and stakeholders' involvement. Hence, this informs how the researcher's choice of methodology as detailed in the reflexivity section – 2.4, was able to pick 'managing funds' as part of the role 'managing funds allocated to the research and providing evidence for reports and future funding applications'.

## **6.6 Discussion**

### **6.6.1 Summary of How this PhD Study Components Informed the Toolkit Development**

Table 25 presents the summary of the main findings from each component of this PhD work, and how each component has informed the development of the embedded research toolkit.

**Table 25: Summary Table of How the Research Components Informed the Development of the Embedded Research Role Toolkit**

PhD Study Components	Key Findings	Contribution to Embedded Research Role Toolkit
<b>Literature Review/Introduction</b>  Chapter One	The potential of embedded research to bridge the gap between research evidence and its implementation in public health practice sits in its role.	This informed the investigation of the role of embedded research and how each role can be delivered by conducting a systematic review and a qualitative fieldwork.
	There seemed to be no existing toolkit on the role of embedded research in non-clinical settings, apart from the NIHR embedded research team's model in clinical settings.	The existence of the NIHR embedded research model in clinical settings creates the opportunity to discuss the similarities and the difference between the role of embedded research in clinical settings and non-clinical settings. Also, the NIHR embedded research work in clinical settings (NHS) provides insights for the research approach adopted, and the development of the current toolkit in this PhD.
	There was no systematic review on the topic to inform the development of the embedded research toolkit, and public health practice of the potential of embedded research in bridging 'research evidence-implementation' gap.	This informed the conduction of a systematic review to fill the gap in the literature by synthesising available evidence useful to inform public health practice, and the development of the embedded research role toolkit.
	There was a need for consistent terminology for embedded research to enhance its use.	There was a consistent use of the term 'embedded research' throughout this study, and also a glossary of terms was attached to the embedded research role toolkit to provide meaning to terms.
<b>Systematic Review</b>  Chapter Two	Key roles of embedded researchers in co-producing public health knowledge in non-clinical settings were 1) informing practice, 2) building mutually beneficial relationships, 3) building capacity, 4) becoming part of the organisation, 5) critical reflection, and 6) managing funds allocated to the research and providing evidence for reports and future funding applications.	The roles that emerged from the systematic review were explored by conducting a qualitative fieldwork. Hence, the roles that emerged from the systematic review informed the development of the interview schedule for the qualitative fieldwork participants.
	The critical appraisal showed that the majority of the included studies are of high to moderate quality.	This informed how the embedded research toolkit was written up to ensure it is of high quality by providing the right amount of detail.
<b>Qualitative Fieldwork</b>	The role of embedded research in co-producing public health knowledge in non-clinical settings were 1) building and	The roles from the qualitative fieldwork were triangulated with the role from the systematic review to



<p>Chapters Three, and Four</p>	<p>maintaining relationships with practitioners and other stakeholders, 2) working together to produce research, 3) informing and developing future practice and research, and 4) keeping critical reflection trajectory.</p>	<p>inform the development of the embedded research toolkit.</p>
	<p>Interview participants emphasised the need to develop an embedded research role toolkit in non-clinical settings. Participants provided some criteria which could facilitate the use of the toolkit in public health practice.</p>	<p>The development of the embedded research toolkit followed the criteria suggested by interview participants to enhance its use in public health practice.</p>
<p><b>Triangulation and Discussion of Findings</b></p> <p>Chapter Five</p>	<p>The role of embedded research in co-producing public health in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice were 1) building mutually beneficial relationships, 2) becoming part of the organisation to co-produce research, 3) building research capacity, 4) informing and developing future practice and research, 5) managing funds and providing evidence for reports and future funding applications, and 6) keeping a critical reflection trajectory.</p>	<p>The six themes were presented in the embedded research toolkit as the role of embedded research. The codes under each theme were strategies of how each role could be delivered in public health practice.</p>
<p><b>Review of Existing Related Embedded Research Models</b></p> <p>Chapter Six</p>	<p>The existing embedded research model in clinical settings (NIHR embedded research project) and the fuse knowledge exchange model needed to unpack the tools needed to successfully carry out embedded research.</p>	<p>The embedded research toolkit detailed the role of embedded research using a diagram and colour coding for clarity.</p>
	<p>The existing embedded research model in clinical settings (NIHR embedded research project) and the fuse knowledge exchange model were not detailed enough to outline how each role of embedded research could be carried out.</p>	<p>The current embedded research toolkit clearly and comprehensively outlined how each role of embedded research could be delivered to bridge the gap between research evidence and its implementation in public health practice.</p>
<p><b>Stakeholders'/Participants' Involvement</b></p> <p>Chapter Six</p>	<p>Participants confirmed that the embedded research toolkit is needed in practice. Also, that the embedded research toolkit is clear, simple, flexible, and easy to follow.</p>	<p>The embedded research toolkit was made as clear and flexible as possible to enhance its use in various non-clinical public health practices.</p>
	<p>Participants emphasised that the toolkit captured the role of embedded research and how each role could be delivered in practice.</p>	<p>The toolkit development was informed by diverse research components to provide a comprehensive and robust outcome.</p>
	<p>It was advised that if the embedded research toolkit could be disseminated/ communicated to those who will find it valuable successfully, it will be a great asset.</p>	<p>The embedded research toolkit will be disseminated in diverse public health conferences and seminars to create awareness and enhance its use in practice.</p>

### 6.6.2 Discussion of the Toolkit Development Results

Although there is an embedded research model from the NIHR embedded research project in clinical settings (NHS) (Vindrola-Padros et al., 2019; Embedded research, no date), and a knowledge exchange model from Fuse-the centre for translational research in public health (Van der Graaf et al., 2019), to date there was not a toolkit for non-clinical settings which was the aim of this current work. This PhD adopted necessary insights in the development of the current embedded research toolkit so that users could find the toolkit useful to bridge the gap between research evidence and its implementation in public health practice.

The interview participants suggested that as public health operates in diverse non-clinical settings, the embedded research toolkit must be flexible enough to enhance its use. Being flexible indicates that not necessarily all, but some of the roles and how they could be delivered could be successfully adapted in diverse non-clinical public health settings. Thus, the current embedded research toolkit was made flexible to increase its usability in diverse non-clinical settings. Also, the current embedded research role toolkit will be tested in diverse non-clinical public health settings, and the evaluation of its effectiveness would be measured and explored in the future postdoctoral study.

### 6.6.3 Comparison Between the Role of Embedded Research in Non-clinical, and Clinical Settings.

The six identified roles of embedded research in non-clinical settings were almost the same as the role of embedded research identified in clinical settings (NHS). The one difference was one element in the role 'managing funds allocated to the research and providing evidence for reports and future funding applications', which was 'managing funds allocated to research' that was not included in the clinical setting as detailed in section 6.5. Overall, although the operations in the clinical and non-clinical settings differ as discussed in chapter one, there appears to be only a slight difference in the embedded research role irrespective of the setting. This might be because the major role of the embedded researchers is to carry out research agenda to facilitate the use of research evidence to improve the quality of service and delivery in the host organisation (McGinity and Salokangas, 2014; Vindrola-Padros et al., 2017). As such, there might not be a large disparity in their role irrespective of the setting.

#### 6.6.4 Strengths and Limitations of the Embedded Research Toolkit Development

One of the main strengths of the embedded research role toolkit is that it was developed from the triangulation of different research components. As detailed in chapter two, the advantages of adopting triangulation include, to reduce bias (Jonsen and Jehn, 2009; Denzin, 2009); to improve the analysis of data and the interpretation of results, and expand the knowledge of different issues around a topic of interest (Abir and Jaclene, 2012); to increase the validity of results and assisting in achieving saturation (Farmer et al., 2009). To maximise the advantages of triangulation, the embedded research role toolkit was developed based on the triangulation of findings of a systematic review and qualitative fieldwork.

The participants'/stakeholders' involvement is another strong aspect of the embedded research role toolkit development. The cross-checking of the usefulness and relevance of the embedded research role toolkit with some of the participants provided the feedback that was used to modify the toolkit before the final presentation of the toolkit (version 1.0). Although having to ask feedback from five participants (four embedded researchers, and one other stakeholder) rather than all the participants due to the COVID-19 pandemic could have been seen as a limitation, this was noted as an area to explore in the future study.

As this work was carried out in the UK, it could be that the use of the embedded research role toolkit might be limited to the UK. Although the systematic review findings involve findings from diverse countries, the qualitative fieldwork was solely conducted in the UK. Nevertheless, this limitation might be regarded as an opportunity to explore the role of embedded research in other countries and conduct a comparative study on its relevance and usefulness in the future postdoctoral study. Another limitation of the development of the embedded research role toolkit is that there are limited related models or toolkits on embedded research role and how the role could be delivered in public health practice. This poses a level of limitation in the comparison of the current toolkit with the existing ones. Nevertheless, this novel toolkit will serve as a starting point for postdoctoral exploration in the future to test the toolkit in diverse non-clinical public health settings and modify the toolkit if necessary. Also, the toolkit (version 1.0) can be adapted to suit various non-clinical settings, as such, users can take what they need from it and add to it if needed.

### 6.6.5 Dissemination and Future Plans for the Embedded Research Role Toolkit

The participants'/stakeholders' results provided ideas of platforms where the current embedded research role toolkit could be disseminated. The poster presentation of the systematic review findings was presented at the postgraduate research conference at Teesside University (Akintola et al., 2019; Appendix 12). To disseminate the toolkit to the target population or audience, apart from publishing it in relevant academic journals as soon as possible, different platforms will be used. It will be sent to the four embedded research sites explored in this PhD, and it will be made available online through PURE – Teesside University's Research Information System. PHE conferences, Fuse conferences, local Health and Wellbeing Boards, health forums, Twitter among other relevant platforms will also be used to disseminate the toolkit. As such, these will create and increase the awareness and accessibility of the toolkit in public health practice.

In the postdoctoral study in the future, an implementation study will be conducted to test the toolkit in a couple of case studies sites. This would be to evaluate and explore the effectiveness and usefulness of the toolkit in public health practice. Therefore, in the future, not only the toolkit will be presented but with case studies showing examples of where the toolkit has been successfully implemented. This would add more validity to the quality of the embedded research toolkit.

## 6.7 Chapter Summary

This chapter details the process involved in the development of the current embedded research role toolkit to fulfil the fourth, fifth and sixth objectives of this PhD. The development of the current toolkit was based on different views and approaches to enhance its quality and trustworthiness. As such, it was informed by various research components such as literature review along with the review of existing related embedded research models, the triangulation of findings of the systematic review and qualitative fieldwork, as well as participants'/stakeholders' involvement. The main findings are:

- No embedded research toolkit useful in non-clinical settings were found prior to this PhD study.

- The existing embedded research model in the clinical setting and the fuse knowledge exchange model needed more information to unpack the role of embedded research and how the role could be delivered in practice.
- The involvement of participants'/ stakeholders' in the development process of the embedded research toolkit was useful and helpful as the feedback was used to modify the embedded research toolkit before its final presentation (version 1.0).
- All the results from the participants'/stakeholders' involvement were positive; stating that the embedded research role toolkit was concise, easy to follow, and covered all the roles of embedded research. Also, that as there was a need for the development of the toolkit, it would be a great asset in public health practice.
- The embedded research role toolkit was developed and presented in section 6.4.6.
- A colour-coded diagram was used to present the six main roles of embedded research in co-producing public health knowledge in non-clinical settings which could bridge the gap between research evidence and its implementation in public health practice.
- Six text boxes were used to outline how each role could be delivered to bridge the gap between research evidence and its implementation in public health practice.
- The six identified roles of embedded research in non-clinical settings are similar to the role of embedded research in clinical settings (NIHR) only with one difference in one of the themes.
- This chapter has fulfilled one of the main aims of this PhD work which was to use different sources of evidence to develop a toolkit on the topic. Nevertheless, the current toolkit will be modified further in the postdoctoral study if necessary.

## CHAPTER SEVEN

### GENERAL DISCUSSION

#### 7.0 Overview of the Chapter

This chapter presents the contribution of this PhD to the body of knowledge in public health. Then, the strengths and limitations of this work are discussed. Finally, recommendations for practice and future research are presented.

#### 7.1 Summary of this PhD Study

The overall aims of this PhD were:

- 1) to provide evidence of the potential of embedded research in bridging the gap between research evidence and its implementation in public health practice.
- 2) to develop a toolkit on the role of embedded research in the co-production of public health knowledge in non-clinical settings to facilitate the utilisation of research evidence in public health practice.

The gap between research-based evidence and its implementation in public health practice is globally recognised (Nutbeam, 1996; Di Ruggiero et al., 2017). This gap can cause the resources invested in public health research to be wasted. It can also have a negative impact on the quality of public health services and the health and well-being of the population (Macintyre, 2003). Research has identified that embedded research has the potential to bridge the ‘research-based evidence implementation gap’ (Vindrola-Padros et al., 2017). However, prior to this PhD work, there was no embedded research toolkit to inform public health practice of the role of embedded research which could bridge the ‘research-based evidence implementation gap’ to improve services and delivery to the public in non-clinical settings.

To achieve the overall aims, the following research components were explored:

- A literature review was undertaken to be informed of the existing literature and identify the gap in the literature around the role of embedded research in co-producing public health knowledge in non-clinical settings (chapter one).

- A systematic review identified and synthesised available qualitative evidence on the topic (chapters two and three).
- Semi-structured interviews were conducted with embedded researchers, public health practitioners, and other stakeholders to explore the themes that emerged from the systematic review on the topic (chapters two and four).
- The triangulation of findings informed the development of an embedded research toolkit on the topic (chapters two, five and six).
- The embedded research toolkit was cross-checked with four embedded researchers, and one other stakeholder to explore its relevance and usefulness in public health practice (chapter six).
- The overall outcome of this PhD was compared to the NIHR work in clinical settings to investigate the similarities and differences in the role of embedded research in clinical settings and non-clinical settings (chapter six).
- Recommendations for practice and future research were provided (chapter seven).

## 7.2. Main Findings and Contribution to the body of knowledge in Public Health

### 7.2.1 Main Findings

Chapter one introduced the concept of public health, and clearly distinguished clinical settings from non-clinical public health settings, followed by the gap between research evidence and its implementation in public health. One of the key findings from chapter one was the necessity to close the gap between research evidence and its implementation in public health practice to improve service and delivery. Embedded research, a type of co-production where the researcher has a dual affiliation with an academic institution and a host organisation with the aim of carrying out research agenda, while maintaining mutually beneficial relationships, has been identified with the potential to bridge the 'research evidence-implementation' gap (Vindrola-Padros et al., 2017; McGinity and Salokangas, 2014). There was an NIHR work on embedded research in clinical settings (NHS), but as public health operates outside clinical settings, it was essential to investigate the role of embedded research in non-clinical settings. More so, there was no systematic review to inform public health practice of the role of embedded research in co-producing public health knowledge in non-clinical settings which could bridge the gap between research evidence and its

implementation in practice. Different terminologies are used to describe embedded research, as such, there was a need to compile the terminologies to enhance embedded research use.

Chapters two and three systematically reviewed the role of embedded research in co-producing public health knowledge in non-clinical settings, using JBI methodology (JBI, 2020). Sixteen articles were included in the systematic review. The role of embedded research identified were:

- (1) informing practice,
- (2) building mutually beneficial relationships,
- (3) building capacity,
- (4) becoming part of the organisation,
- (5) critical reflection, and
- (6) managing funds allocated to the research and providing evidence for reports and future funding applications.

The findings were similar to the findings of a narrative review by Vindrola-Padros et al. (2017) on the topic. The systematic review also showed that the critical appraisal of the majority of the included studies was of high to moderate quality. However, the three included commentaries were of lower methodological quality. This implies that including commentaries in a systematic review could reduce the quality of the outcome from such review. This was also evidenced with the ConQual results that showed that the assessment of certainty in the majority of the synthesised findings were 'moderate' when the three commentaries were excluded rather than 'very low' when they were included. The systematic review also identified the need to explore the time spent by embedded researchers in their host organisation. As such, the results prompted a qualitative fieldwork to explore the themes that emerged from the systematic review in order to increase the confidence in the findings.

The qualitative fieldwork (chapters two and four) further informed the development of the toolkit useful to inform practice on the role of embedded research in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice (chapter six). Following the



analysis of the interview data from embedded researchers, public health practitioners, and other stakeholders, four themes were identified:

- (1) building and maintaining relationships with practitioners and other stakeholders,
- (2) working together to produce research,
- (3) informing and developing future practice and research, and
- (4) keeping a critical reflection trajectory.

Chapter five triangulated the findings from the systematic review and the qualitative fieldwork. The overall findings yielded six overarching themes (roles) and thirty codes (strategies to deliver the roles) (table 21; Fig 10), this informed the development of the embedded research toolkit. It was found that embedded researchers build mutually beneficial relationships with the members of the host organisations, other stakeholders, and their academic supervisors. Among other strategies, 'engaging in informal conversations with the practitioners and other stakeholders' was identified as a strategy that can be used by embedded researchers to build relationships. This agrees with earlier studies that building relationships is one of the important roles of an embedded researcher in the host organisation (Langeveld et al., 2016; Cheetham et al., 2017; Lewis and Russell, 2011; Smith and Wilkins, 2018; Steen et al., 2018; McGinity and Salokangas, 2014; Duggan, 2014; Hope, 2016; Jenness, 2008; Yost et al., 2014; Miszczak and Patel, 2018; Rowley, 2014). Building mutually beneficial relationships assist an embedded researcher to understand the context and the practical problems facing the host organisation (Newbury-Birch and Allan, 2019; Vindrola-Padros et al., 2019), and as such, proffer solution through research.

The second identified role was 'becoming part of the organisation to co-produce research'. This is similar to McGinity and Salokangas (2014) that one of the main roles of embedded research in the host organisation is to conduct relevant research to meet the needs of the host organisation. As explained in chapter one, successful collaborative working between embedded researchers and the staff of the host organisation facilitates the utilisation of research evidence in practice, and research impact which brings about positive changes in the host organisation (Eyre et al., 2015; Marshall, 2014).

The third identified role on the topic was 'building research capacity'. Embedded researchers provide research training and support to practitioners and other

stakeholders which in turn builds their research capacity. Thereby this assists them to participate in research activities in the future. However, the learning or the capacity building might be a two-way process rather than one way. This agrees with what Allen et al. (2014) pointed out that increasing connectivity between researchers and practitioners could enhance shared learning.

The fourth identified role was 'informing and developing future practice and research'. This confirms earlier work on the topic that one of the aims of embedded research in the host organisation is to inform practice with relevant research evidence which is utilised to improve service and delivery rendered to the public (Marshall et al., 2014; Vindrola-Padros et al., 2017). One of the identified strategies by which embedded researchers could use to inform practice is by 'making positive changes and research-informed recommendations'. As discussed in chapter one, some scholars mentioned that lack of access to research evidence could contribute to the gap between research evidence and its utilisation in practice (Albert et al., 2007; Armstrong et al., 2006; Bunn, 2011). This implies that 'research evidence-implementation' gap could be bridged if practitioners have more access to relevant research evidence through research-informed recommendations by embedded researchers to bring about positive changes in the host organisation.

The fifth identified role was 'managing funds and providing evidence for reports and future funding applications'. This corresponds with earlier studies that embedded researchers' role involves the above in the host organisation (Jenness, 2008; Wong, 2009). Therefore, this could encourage practitioners to engage in research activities that could facilitate the use of research evidence in practice. The sixth identified role of embedded research was 'keeping a critical reflection trajectory'. This is similar to other relevant studies that embedded researchers evaluate their role in their host organisation to make improvement their role (Lewis and Russell, 2011; Wong, 2009). Nevertheless, it is worth noting that the role of embedded research could be flexible across diverse non-clinical settings.

The findings from the triangulation as detailed above informed the development of the embedded research toolkit. The developed toolkit from non-clinical settings was compared to the NIHR work in clinical settings (chapter six). Even though there are differences between how non-clinical settings and clinical settings operate, as

discussed in chapter one, there was only a slight difference in the role of embedded research in these settings (chapter six). This might be because the major role of an embedded researcher in the host organisation is to conduct research (Vindrola-Padros et al., 2017; McGinity and Salokangas, 2014). As such, there might not be a major difference apart from the difference that could be specifically due to the intent, structure, and processes within the initiatives as explained by the NIHR embedded research project team in clinical settings (Embedded research, no date). Although these have not been proven in non-clinical settings as ways to distinguish embedded research initiatives, these would likely be applicable in non-clinical settings.

The overall findings of this PhD in non-clinical settings agree with the NIHR embedded research project team's findings in clinical settings except for a slight difference, that is, the 'managing funds' element of 'managing funds and providing evidence for reports and future funding applications' role was not included in the role of embedded research in clinical settings. Indeed, 'managing funds' was only reported by one study in the systematic review (Jenness, 2008), but it was not experienced by the participants in the qualitative fieldwork. However, this element was added to the role of embedded research "managing funds and providing evidence for reports and future funding applications" because the paper it was extracted from was of 'high' methodological quality (Jenness, 2008) (Table six). This suggests there might not be a 'one size fit all' toolkit for the embedded research role, but a toolkit that is flexible and adaptable to diverse non-clinical public health settings. This also informs the flexibility of the toolkit developed from this PhD to allow its usefulness in diverse non-clinical public health settings.

### 7.2.2 Contribution to the Body of Knowledge in Public Health

This PhD contributes to the existing knowledge in public health by filling the identified gap in the literature. The phases and the achieved aims are the following:

**Phase one:** This phase reviewed the role of embedded research in the co-production of public health knowledge in non-clinical settings (chapter two). Although, there was a narrative review on the topic (Vindrola-Padros et al., 2017), there was no systematic review on the topic to inform public health practice. Hence, this phase assessed available relevant qualitative studies on the topic using the JBI approach. There is a

similar NIHR work, but in clinical settings (NHS) (Embedded research, no date), as such, it was important to investigate the topic in non-clinical settings as public health operates outside clinical settings. Also, as different terminologies are used for embedded research, there was a need to compile the terminologies to enhance its use. Therefore, a systematic review was conducted on the topic to fill the gap in the literature to contribute to the knowledge base in public health (chapters two and three). Also, a compilation of different terminologies used for embedded research was carried out (Appendix five).

**Phase two:** This phase explored the themes that emerged from the systematic review (chapters two, and four). These were explored by conducting semi-structured interviews with embedded researchers, public health practitioners, and other stakeholders in four case studies sites. This is a significant achievement in the field, as prior to this PhD, no studies have explored the topic using diverse methods adopted in this PhD.

**Phase three:** In this phase, the findings of the qualitative fieldwork were triangulated with the findings of the systematic review (chapters two and five). The results of the triangulation were used to develop a toolkit useful to inform public health practice of the role of embedded research in bridging the gap between research evidence and its implementation in practice. This is novel in public health, as prior to this study, there was no embedded research toolkit useful in non-clinical settings. The embedded research toolkit was cross-checked with some participants to know its relevance and usefulness in public health practice. The embedded research toolkit useful in non-clinical settings developed from this PhD clearly outlines the role of embedded research in the co-production of public health knowledge. Also, the embedded research toolkit provides strategies of how each role could be delivered in non-clinical settings. The structure, format, and contents of the embedded research toolkit are simplified to enhance its usefulness and relevance in public health practice. Moreover, the embedded research toolkit is flexible to facilitate its use in diverse public health sites. Thus, all the six roles and 30 strategies might not be applicable in all public health settings because of diversity in the settings where public health operates.

The toolkit is anticipated to be used as follow:

- That public health practitioners in non-clinical settings use the toolkit as a guide to improve service and delivery.
- That more public health practitioners and academics would be informed of the potential and benefits of embedded research in bridging the gap between research evidence and its implementation in practice.
- That more organisations and more researchers would consider adopting an embedded research approach.
- That the toolkit would serve as a guide for organisations including public health practice when developing job specifications for embedded researchers.

The embedded research toolkit could make a huge contribution to the knowledge base in public health as it provides the role of embedded research in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice. This in turn could assist in the improvement of quality public health service and delivery offered to the public. However, the toolkit needs to be tested practically in public health practice.

**Phase four:** The similarities and differences in the role of embedded research in non-clinical settings and clinical settings were explored (chapter six). This was to investigate the extent to which the identified roles and strategies of embedded research in clinical settings differ from non-clinical settings. This phase of the current work demonstrated the achievement, and contribution of this work to the body of knowledge in public health. This PhD provides an original contribution to the knowledge base in public health as it generates knowledge on how research evidence could be implemented faster in public health to ensure improved quality service and delivery by providing a toolkit on the role of embedded research in non-clinical settings to co-produce knowledge. This new, original, and significant research is being driven by gaps in the existing literature. Therefore, this PhD outcome should prompt and help public health embedded researchers and public health practitioners to engage more in the co-production of knowledge which would facilitate the use of research evidence in practice in order to improve public health and wellbeing through rapid improved quality health delivery.

### 7.3 Strengths and Limitations of this Work

The following sub-sections summarise the strengths and the limitations of this piece of work.

#### 7.3.1 Strengths

The major strength of this PhD was that it thoroughly investigated and explored the potential of the role of embedded research in the co-production of public health knowledge which could bridge the gap between research evidence and its implementation in non-clinical public health settings. This PhD work did not rely on one method but used different research methods to investigate and explore the topic, hence improving the confidence in the outcome of this work. This is similar to what Rothbauer (2008) said about the benefits of employing triangulation. Also, the use of different methods served a complementary purpose (Noble and Heale (2019), that is, the weakness or flaw of one method was addressed by the strength of other methods used in the PhD work. To this end, the use of triangulation in this PhD strengthened the confidence in the outcome which was used to develop an embedded research toolkit on the topic.

Another strength of this PhD work was that every method used has its own research protocol, hence, the research components followed guidelines (JBI, 2020; Farmer et al., 2006). For instance, the systematic review protocol was reviewed and published on PROSPERO as stated in chapter two (Akintola et al., 2019). This also ensures that the protocol was reviewed before the systematic review was carried out. This demonstrated that each stage of this PhD was carefully considered and planned to achieve the overall aim of this piece of work. Furthermore, a comprehensive reflexive account of the whole research process of this PhD, starting from the inception to the writing up stage was provided. This provides the transparency and accountability of the effect or the influence that the research has on the researcher and vice versa (Edge, 2011; Attia and Edge, 2017; Lietz et al., 2006). To this end, this increases the quality of this PhD by ensuring richness, clarity, accountability, trustworthiness, personal development, and ethics (Barbara, 2015).

There was no systematic review found on the topic before this current work. Thus, a systematic review was conducted to inform public health practice of the potential of the role of embedded research in bridging the gap between research evidence and its

implementation in practice. The synthesised evidence was not only from the studies conducted in the UK, but relevant evidence from international studies was also included. Furthermore, there was no restriction on the type of qualitative work included so as to include all available relevant evidence on the topic. To ensure this, the search process included electronic databases as well as the reference list of the included studies (Horsley et al., 2011). In addition, two independent reviewers (AA and OI) reviewed the systematic review to ensure that relevant studies were not missed (Stoll et al., 2019). Furthermore, the search was not limited to any specific language or country, as this was to broaden the opportunity to include all relevant international studies on the topic.

The qualitative fieldwork in this PhD explored not only embedded researchers' views on the themes that emerged from the systematic review but also the views of public health practitioners and other stakeholders were sought to increase the credibility of this work. The findings confirmed previous qualitative studies on the topic (Cheetham et al., 2017; Rowley, 2014; Yost et al., 2014; Dungan, 2014; Wong, 2009; Jenness, 2008). Furthermore, the case studies explored different four embedded research sites to capture all the roles of embedded research in various non-clinical settings. A further investigation was conducted to know the similarities and differences between the role of embedded research across various non-clinical settings (chapters two, four and five). This also increases the transferability of the qualitative fieldwork to similar non-clinical settings (Yin, 1981; Herriott and Firestone, 1983). The triangulation of findings of the systematic review and the qualitative fieldwork informed the development of the novel embedded research toolkit useful in non-clinical settings. This demonstrates the major strength of this body of work as its outcome could be used to improve quality public health service and delivery to the public.

The embedded research toolkit developed from this PhD was a novel one as there was none found prior to this PhD. The developed embedded research toolkit does not only provide the roles needed of embedded research in non-clinical settings, but also provides strategies by which each identified role could be delivered successfully to bridge the gap between research evidence and its implementation in public health practice (Table 21; Fig 10). Furthermore, as discussed in chapter six, the flexibility of the embedded research toolkit would allow its use in diverse non-clinical settings. This is important because public health operates in diverse non-clinical settings (Buck and



Gregory, 2013; The King's fund, 2015; Milne, 2018). More so, the embedded research toolkit was developed from the results collected from diverse research methods and from exploring the views of three categories of participants in four different case studies sites. As such, the embedded research toolkit could be adopted in local authorities, schools, and in other non-clinical organisations. These could be considered as one of the strengths of this piece of work. Hence, the originality of this PhD.

A further strength of this PhD is the involvement of the participants in the development of the embedded research toolkit. This increases the credibility of the outcome of this PhD as feedback was sought from the participants on the relevance and the usefulness of the toolkit in public health practice. Therefore, this increases the usability of the toolkit to improve practice (Centre for Medical Technology Policy, 2021). Furthermore, the outcome of this PhD was compared with the NIHR embedded research work in clinical settings. The results were almost the same. Therefore, the embedded research toolkit could be used to develop a more detailed embedded research job description document useful in the process of recruitment and induction in public health practice.

This PhD identified the gap in the literature and was able to fill the gap by providing evidence through the exploration of diverse methods. The evidence was used to develop a novel embedded research toolkit useful in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice. Thus, assisting in the improvement of quality public health service and delivery to the public. In addition, this PhD has been able to identify how the outcome from this PhD could be developed further in the postdoctoral study in the future. This will be discussed in section 7.4.2.

### **7.3.2 Limitations**

As the strength of this PhD has been summarised, the limitations of this PhD will be summarised as follow.

#### **7.3.2.1 COVID-19**

A part of the data collection phase to the submission of this PhD was carried out during the COVID-19 pandemic, thus, this had a negative impact on this PhD. For instance,



it was planned that at least four participants would be recruited from each of the four case studies sites, however, this was not achieved at two sites due to the COVID-19 pandemic. Most of the potential participants were front-line workers in the COVID-19 pandemic, hence, it would be unreasonable to ask them to participate in a study during the challenging time.

Furthermore, it was planned to use both semi-structured interviews and focus groups to collect data for the qualitative phase of this PhD to increase the credibility of the findings. However, the focus group element was cancelled due to the COVID-19 pandemic as explained in chapter two. As a result of this, the participants were unable to interact with each other, however they may have been more likely to provide more honest information with the one-to-one semi structured interviews (Straus, 2010). Therefore, the developed embedded research toolkit was cross-checked for its relevance and usefulness with participants to increase the confidence and credibility in the outcome of this PhD. It was planned that the toolkit would be cross-checked with the four embedded researchers, nine public health practitioners, and four stakeholders. However, due to COVID-19, the toolkit was only cross-checked with the four embedded researchers and one stakeholder as detailed in chapters two and six. To this end, it is proposed that future research will be needed to test the embedded research toolkit practically in public health practice.

### **7.3.2.2 Other Limitations**

Although different terms were used for embedded research in the systematic review to capture all available relevant papers, there is a possibility that some papers would be missed because of the different terminologies used by different authors. Also, as it has been noted in chapters one and two, there were no quantitative studies on the topic explored in this PhD. This would have provided an opportunity to conduct a mixed-methods systematic review which is a review that combines synthesised findings from both qualitative and quantitative studies (Harden, 2010) on the topic. Therefore, this would have increased the applicability of the systematic review findings in non-clinical settings including public health practice.

As this piece of work is a part of PhD work, the qualitative fieldwork including the collection, transcription, analysis, and presentation of data was solely conducted by

the researcher (AA). As such, this was time-consuming. Nevertheless, to tackle this challenge, nine months were allocated to the qualitative fieldwork. Although the systematic review synthesised evidence from studies within and outside the UK, the qualitative fieldwork was solely conducted in the UK. This area could be explored in the future by conducting qualitative studies in other countries such as Nigeria and then compare the result to the outcome of this PhD.

Another limitation of the second phase of this piece of work, being qualitative research, was subjectivity. The information provided by the participants was based on their point of view. Hence, it might be difficult to verify the qualitative information provided to ensure that accurate information was provided by the participant regarding the phenomenon of interest. Nevertheless, some practical measures were undertaken to ensure the credibility of this work. As earlier discussed in chapter two, data triangulation and site triangulation according to Denzin (1978) were adopted in the qualitative study. These were done to increase the confidence in the outcome of the qualitative research phase regarding the themes that emerged from the systematic review on the role of embedded research in co-producing public health knowledge in non-clinical settings.

As noted by Hennink et al. (2011), one of the shortcomings of snowball sampling is that it is based on social networks or referrals. In such situations, it is possible that the majority of the participants may come from the same social network. To overcome this shortcoming, four different case studies sites were explored in the qualitative study to widen the range of recruitable participants. Hennink et al. (2011) have noted that using snowball sampling as a recruitment strategy in qualitative research can be a slow process, as it is based on referrals, which means that potential participants are identified one after the other. Nevertheless, as semi-structured interviews allow the analysis of interview data before interviewing the next participant (DiCicco and Crabtree, 2006), in the qualitative study, interviews were transcribed while waiting for a referral for a new potential participant. Additionally, although adopting snowball sampling involves investing time in waiting for a response from those that are referred, the snowball sampling adopted in this study ensures the accuracy in recruiting those who can provide adequate information (Lawrence et al., 2015; Yin, 2011) regarding the topic.

Also, as this piece of work is a part of PhD work, the development, and the cross-checking of the embedded research toolkit to know its relevance and usefulness in public health practice with some interview participants was solely conducted by the researcher (AA). Hence, this can also be considered as one of the limitations of this work as it might be difficult to verify if the participants were being honest with their responses.

## 7.4 Recommendations for Practice and Future Research

### 7.4.1 Recommendations for Practice

Based on the findings from this PhD, embedded research as a model of co-production is feasible to improve quality service and delivery in public health practice. The adoption of embedded research and the newly developed toolkit on its role in public health settings would assist in channelling the limited resources to conduct relevant research that is useful in the local context. Besides, it would prevent the wastefulness of limited resources caused by numerous conductions of public health research that are not relevant to practice or context where there are to be utilised. As a result, most research that has been hugely invested in is wasted, as it takes an average of 17 years before research evidence is utilised in practice (Morris et al cited in Sullivan and O'Neill, 2019). However, a researcher who aspires to become an embedded researcher must possess some qualities, such as, the ability to adapt, flexibility, and integrity (McGinity and Salokangas, 2014).

In addition, this PhD has shown how beneficial embedded research is in bridging the gap between research evidence and its implementation in public health practice. By sharing the knowledge and findings including the embedded research toolkit, it will be useful for researchers and public health practitioners to use. More so, based on the findings from this PhD, and other scholars, embedded research is a way to increase research impact (Eyre et al., 2015; Marshall et al., 2014; Groundwater-Smith and Mockler, 2002). Thus, by sharing the findings including the embedded research toolkit at conferences, making the toolkit available online, and writing papers will increase the knowledge of researchers and practitioners of the potential of embedded research in public health practice.

Based on the findings from this PhD, embedded research is acceptable and effective in the host organisations. Embedded research focuses on solving practical problems facing the host organisation through the use of research evidence (McGinity and Salokangas, 2014). Nevertheless, there are some areas of considerations that need to be considered, such as the parties involved must reach an agreement on the role of the embedded researcher, including the sharing of information between the embedded researcher and the host organisation's staff before embarking on an embedded research project (Vindrola-Padros et al., 2019; Brewster et al., 2015; Marshall et al., 2016; Sullivan and O'Neill, 2019). These ascertain the feasibility, appropriateness, meaningfulness, and effectiveness of embedded research for practice.

The overarching recommendation for public health practice is to test the novel embedded research toolkit developed from this body of work. Developed from the combination of diverse research components, the embedded research toolkit could provide an opportunity to bridge the gap between research evidence and its implementation in practice, and thereby facilitate the improvement of quality service and delivery offered to the public. The dissemination of the embedded research toolkit could prompt more organisations and more researchers to consider adopting an embedded research approach. In addition, the embedded research toolkit would serve as a guide for organisations including public health practice on job specifications when recruiting embedded researchers.

## **7.4.2 Future Research Recommendations and Final Conclusions**

### **7.4.2.1 Systematic review**

This PhD synthesised available qualitative evidence on the topic. It would be advantageous to update the systematic review regularly (every three years) to ensure it is kept up to date. Although a compilation of all available terminologies used for embedded research was carried out in this piece of work (Appendix 5), it would be beneficial to update the review regularly. Thus, this would provide up to date information.

### **7.4.2.2 Qualitative fieldwork**

This PhD explored the topic in four different case studies sites: two local authorities, one secondary school, and one sports organisation. More work is needed in other non-

clinical settings such as non-governmental organisations, to explore embedded research. In addition, as the potential of embedded research has been confirmed, it would be worth exploring how embedded research could be sustained in public health non-clinical settings. As such, it would provide strategies on how embedded research could be maintained in public health to ensure the continuity of improved quality service and delivery.

#### ***7.4.2.3 Embedded research toolkit development***

Evidence from the systematic review and the qualitative fieldwork was used to develop the embedded research toolkit which was cross-checked with some of the participants for its relevance and usefulness in public health practice. However, it would be important to carry out a future implementation study by using the toolkit practically in practice in a variety of settings and getting further feedback. According to Glasgow et al. (2003) implementation study started due to the recognition of the significance of the gap between research and practice. Therefore, implementation science is widely recognised as a study of methods to adopt and utilise evidence-based interventions in specific locations or settings to improve the health of the population (Lobb and Colditz, 2013). Therefore, the implementation study could be proposed as a postdoctoral study where the researcher will work with embedded researchers and public health practitioners in practice to use the embedded research toolkit to achieve all its expected outcomes as outlined in section 7.2.2. The case study might adopt a mixed-method approach, where the embedded research toolkit will be evaluated after one or two years in a variety of settings. A qualitative study will be conducted to explore the usefulness of the embedded research toolkit, and a quantitative study will examine the effectiveness of the embedded research toolkit in practice. The summary of the evaluation result from the case study could be attached to the embedded research toolkit to inform prospective users of its successful use and applicability in public health practice. As such, this would increase the confidence in the embedded research toolkit, as well as its usability in practice.

In conclusion, this PhD work used in-depth methods to explore the role of embedded research in co-producing public health knowledge in non-clinical settings to bridge the gap between research evidence and its implementation in public health practice. The aims were to provide evidence of the potential of embedded research in bridging the

gap between research evidence and its implementation in public health practice, and to develop a toolkit on the topic. These, therefore, provide basis for making recommendations to assist in making embedded research part of the process in public health practice. The embedded research toolkit presents the role of embedded research and how the roles can be delivered in public health practice to improve the service and delivery offered to the public. In view of this, the knowledge generated from this PhD should increase the adoption of embedded research and the newly developed toolkit in public health practice to help public health practitioners achieve their goals.

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## APPENDICES

Appendix 1: Table Showing an Example of the Search Terms Used in Cinahl

Database	Types of participants	Phenomena of interest	Context
Cinahl  Via EBSCO host	Embed* research* OR	Co-produc* OR	Non-clinical* OR
	Researchers-in-residence* OR	Coproduc* OR	Nonclinical* OR
	Researcher-in-residence* OR	Collaborat* work* OR	Public health OR
	Knowledge spanner* OR	Collaborat* research* OR	Local authorit* OR
	Knowledge broker* OR	Co-creat* OR	Voluntary organisation* OR
	Engaged scholar* OR	Cocreat* OR	Health and well-being service* OR
	Boundary spanner* OR Embed*	Partnership* OR	Health and wellbeing service* OR
	Scholar* OR Transient	Critical friendship* OR	Third sector* OR
	Government official* OR	Participat* research*	Non-government* OR
	Embed* scientist* OR		Nongovernment* OR
	Knowledge facilitator* OR		Government* OR
	Knowledge mobilis* OR		Local council* OR
	Knowledge exchange professional* OR		Municipalit* OR
	Knowledge exchange* OR		Charit* OR
	Knowledge transfer* OR		Ministry of health OR
	Knowledge translat*		Council OR
			Voluntary sector* OR
		Local government OR	
		Department of health and social care OR	
		Public sector* OR	
		Public service	
		Community*	



**Appendix 2: JBI Critical Appraisal Checklist for Qualitative Research (JBI, 2014)**

**JBI Critical Appraisal Checklist for Qualitative Research**

Reviewer \_\_\_\_\_ Date \_\_\_\_\_

Author \_\_\_\_\_ Year \_\_\_\_\_ Record Number \_\_\_\_\_

	Yes	No	Unclear	Not applicable
1. Is there congruity between the stated philosophical perspective and the research methodology?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Is there congruity between the research methodology and the research question or objectives?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Is there congruity between the research methodology and the methods used to collect data?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is there congruity between the research methodology and the representation and analysis of data?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Is there congruity between the research methodology and the interpretation of results?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Is there a statement locating the researcher culturally or theoretically?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Is the influence of the researcher on the research, and vice-versa, addressed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Are participants, and their voices, adequately represented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal:      Include       Exclude       Seek further info

Comments (Including reason for exclusion)

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**Appendix 3: JBI Qari Data Extraction Tool for Qualitative Research (JBI, 2014)**

**JBI QARI Data Extraction Tool for Qualitative Research**

Reviewer \_\_\_\_\_ Date \_\_\_\_\_

Author \_\_\_\_\_ Year \_\_\_\_\_

Journal \_\_\_\_\_ Record Number \_\_\_\_\_

**Study Description**

Methodology|

\_\_\_\_\_

\_\_\_\_\_

Method

\_\_\_\_\_

\_\_\_\_\_

Phenomena of interest

\_\_\_\_\_

\_\_\_\_\_

Setting

\_\_\_\_\_

\_\_\_\_\_

Geographical

\_\_\_\_\_

\_\_\_\_\_

Cultural

\_\_\_\_\_

\_\_\_\_\_

Participants

\_\_\_\_\_

\_\_\_\_\_

Data analysis

\_\_\_\_\_

\_\_\_\_\_

Authors conclusions

\_\_\_\_\_

\_\_\_\_\_

Comments

\_\_\_\_\_

\_\_\_\_\_

Complete

Yes

No



## Appendix 4: Summary of Included Studies

Study Characteristics	Brannick and Coghlan (2007)	Cheetham et al. (2017)	Duggan, J. R. (2014)	Hope, A. (2016)	Jenness, V. (2008)
<b>Setting/Country</b>	Ireland	Local authority/ UK	Local authority/ UK	local authority/ UK	California prison/USA
<b>Methodology/methods</b>	Commentary	Action research/ Interviews, focus groups and observations	Case study/ Interviews and observations	Case study/ Interviews, meeting minutes, board papers and reports	Autoethnography/ Interviews
<b>Phenomena of interest</b>	The authors revisited some of the established paradigms to see what position they might have on insider researcher. Also, explored the dynamics of insider research under the headings of access, preunderstanding, role duality and managing organisational politics.	An embedded researcher 'report what was, and was not, achievable through an embedded research approach and the extent to which the choice to adopt this approach impacted on the knowledge created, how it was shared and used to influence decision-making	"The article engages with the opportunities and constraints raised by embedded research during times of rapid and extensive organisational change"	"To examine the use of the Knowledge Transfer Partnership as a means for Universities to generate and exchange knowledge to foster sustainable cities and societies"	Experience of an embedded researcher in California prison.
<b>Characteristics of the embedded researcher</b>	To be part of the organisation. Reflexivity on the effect of 'preunderstanding' on the research. Ability to manage preunderstanding, role duality and organisational politics.	Having a desk and sitting with PH team members. The embedded researcher ... were navigating. The embedded researcher is immersion ... usefulness to policy and practice partners.	Becoming part of the organisation, Developing relationship with staff and Critical reflection	Interaction of the KTPs with the non-academic environment, participation in some of the housing design meetings, training staff on key aspects of sustainable housing, networking ... host organisation.	Worked as 'a public servant.' Carried out in-depth fieldwork with inmates and wardens in the California prison system
<b>Participant/ Demographics/days spent in the host organisation</b>	-	N=1 embedded researcher/Public health embedded researcher/3 days/week	1 PhD student/ 1 University of Manchester PhD student/Not stated	3 KTPs/ knowledge transfer associates/ /Not stated	N=1 embedded researcher/ an independent researcher working for

					the University of California/Not stated
<b>Benefits</b>	Enhance gaining primary access to the organisation. Being close to data- as ER is part of the organisation	Enabled trusting relationships to develop and impromptu conversations and informal exchanges to occur. This facilitated... emerged. Provided knowledge... facilitate change. These conversations ... staff support and training. Observations, ... opportunities for influence.	The embedded researcher gained knowledge of the daily practice of the professionals and gained understanding of different collaborative relationships.	Sharing of both explicit and tacit knowledge. It helps in building capacity of stakeholders. The development of useful tool.	A good way to get a unique perspective, insight and data.
<b>Aims of the initiative</b>	-	"To evaluate an integrated wellness model commissioned by a local authority in north east England"	aimed to increase collaboration in children's services.	To develop a project tasked with improving and increasing its social housing stock as a means to reduce the vulnerability of its tenants from fuel poverty and climate change.	To study coercive sex among inmates incarcerated in male prisons in California
<b>Types of actors</b>	-	Public health practitioners, managers, commissioners and academic partners.	Professionals	Academics, non-academics, tenants and other stakeholders	Inmates and wardens
<b>Types of knowledge created/used</b>	-	Both explicit and tacit knowledge	Explicit and tacit	Explicit and tacit knowledge	Explicit and tacit knowledge
<b>Data analysis</b>	-	-	-	The cases are analysed using the conceptual framework derived from the literature	Not stated
<b>Author's conclusion</b>	"Insider research is not only valid and useful	"The paper shows the possibilities and	Researching an initiative that finished	It demonstrates that a KTP can be an	My experience has taught me that being

	but also it provides important knowledge about what organisations are really like, which traditional approaches may not be able to uncover”	challenges of ER, by illustrating that at different stages, the embedded researcher acted as sounding board, ... barriers to research use	before my fieldwork started was stressful but ultimately beneficial to ... services. My status as an embedded researcher, ... collaboration.	effective in exchanging knowledge between universities, ... formal and Informal interactions and networked.	embedded as a researcher is a fantastic way to get unique perspective, insight, and data, but only if one can be more like a cat than a dog
<b>Reviewer’s comments</b>	The commentary paper aims to revisit and explore what have been done on the topic. The conclusion of the commentary was drawn from the collection of papers	Congruity between the methods and methodology. Conclusions drawn from the results relate to the aim of the study. There were clear themes from the analysis to inform the conclusion	Congruity between the methods and methodology, and the conclusion were drawn from the results however, the ethical approval for the study was unclear.	Congruity between the methods and methodology, and the conclusion were drawn from the results however, the ethical approval for the study was unclear	There is congruity between the philosophical perspective, methodology and methods. There is a statement locating the researcher culturally or theoretically, and the conclusions drawn from the results relate to the aim of the study

<b>Study Characteristics</b>	<b>Langeveld et al. (2016)</b>	<b>Lewis and Russell (2011)</b>	<b>McGinity and Salokangas (2014)</b>	<b>Miszczak and Patel (2018)</b>	<b>Murdock et al. (2013)</b>
<b>Setting</b>	Amsterdam city district/ Holland	North East, England/UK	University of Manchester, School of Education/UK	Cape town, South Africa	Three different third sector settings in the UK
<b>Methodology/methods</b>	Action research/ Participant observation/ field notes	Ethnography/ Ethnographic- Observations, semi-structured interviews and document analysis	Commentary/ Not applicable	Case study/semi-structured interviews, document analysis and participant observation	Case study/ Not stated
<b>Phenomena of interest</b>	To gain in-depth understanding of how this knowledge broker approach works.	To identify the key elements of embedded research, whilst arguing that its fundamental value still derives from the	To highlight the challenges and implications embedded research has for policy,	To better understand how knowledge partnerships are formed, sustained and the (perceived)	To consider the different approaches to ... from three practitioner perspectives

		'traditional' principles of participant observation and ethnographic fieldwork	practice and educational research	benefits of such knowledge configurations	
<b>Characteristics of the embedded researcher</b>	Like all city district employees, she was given an access account (providing her with an internal email address, a key to all doors and access to the intranet), and she signed the Formal Secrecy Act, binding her to secrecy. She .... network	Researcher acts as 'some kind of team member.' Researcher maintains a collaborative relationship with co-workers. Researcher uses traditional principles of ethnographic fieldwork.	Embedded research builds 'a mutually beneficially relationship' between the host organisation and academic institution. The embedded researcher is embedded in the host organisation.	the KTP provided an opportunity for researchers to engage with and be informed about the context in which they work and thus, produce work which is more grounded and relevant	In effect the academic on placement can become a de facto part of the organisation with an implicit role and responsibilities
<b>Participant/ Demographics/days spent in the host organisation</b>	N-1 Knowledge broker/ a postdoctoral anthropologist with 3 years' work experience / Half time in the Uni/Half in the host organisation	Embedded researchers, non-academics and stakeholders/ Embedded researchers, non-academics and stakeholders/ Not stated	N- 3 doctoral students (embedded research/ University of Manchester doctoral students/Not applicable	//Not stated	Not stated
<b>Benefits</b>	This positioning gave her access to significant stakeholders and policy-related and contextual information. To support .... scientific perspective.	Enables researchers to respond to collaborators' needs and expectations	The relationship... such institutional apparatuses.	The unprecedented access to data and knowledge and the inner workings of each institution that is not normally... and practitioners	The third sector organisation can derive .. challenges facing the organisation.
<b>Aims of the initiative</b>	To create healthy public policies by setting the agenda for health and by	To control tobacco in the North east of England. to describe and analyse the fluid and negotiated	-	to respond to the changing nature of urban and environmental change.	To present three case studies of different mechanisms for knowledge exchange

	specifying evidence-informed policy alternative	relationships .... to solving a public health problem			activity and analyses the implications for the types of impact generated.
<b>Types of actors</b>	Policy makers, civil servants	Embedded researchers, non-academics and stakeholders	-	Practitioners	Researchers and third sector
<b>Types of knowledge created/used</b>	Explicit and tacit knowledge	Both explicit and tacit knowledge	-	Both explicit and tacit knowledge	Both explicit and tacit knowledge
<b>Data analysis</b>	Iterative processing of field notes	Not stated	-	Not stated	Not stated
<b>Author's conclusion</b>	The employment of a knowledge broker who works simultaneously on agenda-setting for health and the specification of health-promoting policy alternatives seems a promising first step in establishing local healthy public policies	For us, embeddedness enables us to respond to our collaborators and ethnography's needs and expectations while allowing us simultaneously... and corporations from the inside	We consider that a platform for discussion on approaches to embedded research is not only... may take place	Using qualitative research methods, it is argued that more engaged interactions, including knowledge co-production .... embedded research were found to be significant.	These different approaches to knowledge exchange .... stages of the knowledge exchange activity
<b>Reviewer's comments</b>	Congruity between the methods and methodology. Conclusions drawn from the results relate to the aim of the study. However, the influence of the researcher on the research, and vice-versa, was not clear	Congruity between the methods and methodology. Conclusions drawn from the results relate to the aim of the study. However, the influence of the researcher on the research, and vice-versa, was not clear	As a commentary, the conclusion of the commentary was drawn from the collection of qualitative studies	Congruity between the methods and methodology. Conclusions drawn from the results relate to the aim of the study. However, the influence of the researcher on the research, and vice-versa, was not clear. Also, the ethical	Congruity between methodology and research objectives. However, the congruity between research methodology and methods is unclear. Also, the ethical approval is unclear



				approval for the study was not stated	
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Study Characteristics	Rowley, H. (2014)	Scott and Bell (2013)	Smith and Wilkins (2018)	Steens et al. (2018)	Wong, S. (2009)	Yost et al. (2014)
<b>Setting</b>	Weston Academy, a newly established secondary school	Blyth Valley Borough Council (BVBC) was a small district council on the North East coast of England	N/A	The organisation for child and family social work in Flander / Belgium	SDN Children's Services, an Australian not-for-profit provider of services for children, families and communities/Australia	Three Canadian public health departments/ Canada
<b>Methodology/methods</b>	Ethnography/ interviews, document analysis and participant observations.	Ethnography/ semi-structured interviews, focus groups, participant observations and document analysis.	Commentary	Case study/ Participant observation, in-depth interviews and case-file analyses	Ethnography/ interviews, participant observation and survey.	Case study/ Interviews and reflective journals
<b>Phenomena of interest</b>	Author's experiences of gaining ethical approval for my doctorate as an embedded researcher	This paper reports on a three-year ethnographic study ... to analysing indicator development.	To describe the concepts of scholar-practitioner ... practitioner model.	To elaborate experience of the authors in building an academic collaborative centre	This paper highlights the innovative nature of the approach by positioning the role of the embedded researcher ... collaborative investigation of their work.	To provides an overview of tools used in three Canadian public health departments involved in a study to develop capacity for evidence-informed decision making.
<b>Characteristics of the embedded researcher</b>	Carried out quantitative and qualitative research to inform future practice.	The researcher (Scott) had the twin objectives of assisting in the practical development of local	Through this work, they operate as boundary spanners* who act in	The science practitioner/researcher divided her time between the organisation for child and family social work	Worked alongside, shared office space and socialised with practitioners. Embedded researchers	Provided workshop training for all staff; Provided one-on-one consulting; Mentored staff....

	Performed informal tasks to develop trusting relationships. Attended and participated in steering board meetings. Developed reports sharing research findings.	QLIs for Blyth Valley and ... entries and meeting notes.	partnership with both academics and practitioners and move back and forth between these 2 domains	and the ... collaboration structure.	participated in six studies focused ... engagement with research.	Evidence-Informed Decision Making.
<b>Participant/ Demographics/days spent in the host organisation</b>	1 Embedded researcher / PhD student of University of Manchester, UK / Not stated	N=1 embedded researcher/ PhD Student/ Part time	N/A	N=1 science practitioner/ A science practitioner with experience in both social work research and practice/ Not stated	N-1 Embedded researcher/ an early career researcher, and also a qualified early childhood educator/Not stated	N- 1 Knowledge broker/ Knowledge broker/ 2 days/week
<b>Benefits</b>	The researcher has access to a wide range of people and informal practices, increasing the depth and diversity of collected data. The research ... organisation.	This enabled the various shifts in discursive positioning to be witnessed.	The scholar-practitioners' commitment.. benefit public health.	Connecting with the different stakeholders, ... critical question.	Increased local staff members' capacity to conduct research. Contributed ... to inform policy and practice	-
<b>Aims of the initiative</b>	The research team aimed to track the development of the initiative through various research	The original aim of the project was to develop indicators in a collaborative way using local understandings of well-being.	N/A	To link an organisation for child and family ... science and practice.	The aim of the research project was to inform SDN's future decision-making relating to research and evaluation.	To provide an overview of tools used in three Canadian public health departments involved in a

	activities, the results of which were fed back to the executive board in an effort to inform future practice.					study to develop capacity for evidence-informed decision making.
<b>Types of actors</b>	Families, executive board, members of Weston Academy and the team of academics from the University of Manchester	key policy actors	N/A	Members of the management of the organisation for child and family social work, representative of the social work practitioners and researchers.	The research team and program managers and staff	Senior management and public health professionals
<b>Types of knowledge created/used</b>	Explicit	Explicit	Explicit	Both explicit and tacit knowledge	Explicit	Explicit
<b>Data analysis</b>	Thematically	Thematically	N/A	Not stated	Data from the surveys were analysed using grounded theory techniques where responses were coded and then developed into categories which became the ‘themes’ reported here	Qualitative data analysis
<b>Author’s conclusion</b>	Finally, in light of the potential for embedded research to be an increasingly popular way to fund doctoral research, I recognise...	Policy makers and scholars should therefore place more focus on... policy making.	The cultivation of scholar-practitioners and AR approaches in public health .... research and practice.	We conclude by identifying three important aspects to implementing a research–practice .... differences can safely exist and negation can take place.	The employment of an embedded researcher can have positive benefits both for the organisation and the practitioners—but who the researchers are really matters	Using a KTE intervention delivered by a KB, this study demonstrated that the KB facilitated the sharing ... Ontario health departments.

	position may bring.					
<b>Reviewer's comments</b>	Congruity between the methods and methodology. Conclusions drawn from the results relate to the aim of the study	Congruity between the methods and methodology, and the conclusion were drawn from the results however, the ethical approval for the study was unclear	As a commentary, the conclusion of the commentary was drawn from the collection of qualitative studies	Congruity between the methods and methodology, and the conclusion were drawn from the results however, the ethical approval for the study was unclear	Congruity between the methods and methodology. Conclusions drawn from the results relate to the aim of the study	Congruity between the methods and methodology. Conclusions drawn from the results relate to the aim of the study

**Appendix 5:** Included Studies, Synthesized Findings and their Terminology for Embedded Research (Systematic review)

Articles	Terminology for embedded research	Synthesized Findings
Cheetham et al. (2017)	Embedded researcher	1,2,3
McGinity and Salokangas (2014)	Embedded researcher	2
Brannick and Coghlan (2007)	Insider research	1, 4
Duggan (2014)	Embedded researcher	2,4,5
Hope (2016)	knowledge transfer associates	2, 3,4
Jenness (2008)	Embedded researcher	2, 3,4 ,6
Langeveld et al. (2016)	Knowledge broker	1, 2, 4, 5
Lewis and Russell (2011)	Embedded researcher	2, 4
Miszczak and Patel (2018)	Academic embedded researcher	2, 3, 4
Rowley (2014)	Embedded researcher	1, 2, 3, 4
Scott and Bell (2013)	Embedded researcher	3
Smith and Wilkins (2018)	Scholar-practitioner	1, 2, 3, 5
Steens et al. (2018)	Science-practitioner	2, 4
Wong (2009)	Embedded researcher	3, 4, 6
Yost et al. (2014)	Knowledge broker	1, 2,3
Murdock et al. (2013)	Academic on placement; Knowledge broker	4

**Appendix 6: Study Findings and Illustrations**

1. Cheetham, M., Wiseman, A., Khazaeli, B., Gibson, E., Gray, P., Van der Graaf, P. & Rushmer, R. 2017. Embedded Research: A Promising Way to Create Evidence Informed Impact in Public Health? *Journal of Public Health*,40, i64-i70.

Finding	Illustrations from study	Evidence
A sounding board	“The embedded researcher was able to recommend changes to the assessment process for users of the integrated wellbeing service, to reflect its core aims and address the social determinants of health” (p3)	Unequivocal
A catalyst for change and timely improvements in delivery	“The embedded researcher’s immersion in the organisation, provided knowledge of relevant managers with the required decision-making powers, and the ability to flag issues, to create linkages and facilitate change” (p3)	Unequivocal
Acknowledging achievements in targeting inequalities	“The embedded researcher was able to emphasize the value of service users’ stories and feedback in shaping services” (p3)	Unequivocal
Building research capacity	“The embedded researcher encouraged Local authority and public health colleagues to be involved in the research process, including applying for ethical approval, co-facilitating focus groups with service users and assisting with data analysis” (p3)	Unequivocal
Catalyst for change and improvement in measuring effectiveness	“The embedded researcher facilitated discussions with commissioners and providers of the integrated wellbeing services to amend the performance monitoring framework” (p3)	Unequivocal
Knowledge broker	“The embedded researcher acted as a knowledge broker, feeding in research findings and bringing different stakeholders together at the right time to co-produce research, enhance its local relevance and usefulness to policy and practice partners” (p4)	Unequivocal

2. McGinity, R. & Salokangas, M. 2014. Introduction: ‘Embedded Research’ As an Approach into Academia for Emerging Researchers. *Management in Education*, 28,1, 3-5.

Finding	Illustrations from study	Evidence
Building mutually beneficial relationship	The relationship typically provides the researcher with greater access to the host organization with benefits for collecting data and research funding. For the host organisation the relationship provides a bridge to academia and academic knowledge, networks and critical approaches to developing organizational pol-icies and practices. (p3)	Unequivocal
“Embeddedness”- being located at the host organisation.	The embeddedness allows researchers to get “under the skin” of these organizations and ask difficult ques-tions, granting access to see multiple perspectives as they traverse the hierarchies inevitable within such institutional apparatuses. (p4)	Unequivocal

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3. Brannick, T. & Coghlan, D. 2007. In Defense of Being “Native”: The Case for Insider Academic Research. *Organizational Research Methods*, 10, 1, 59-74.

Finding		Illustrations from study	Evidence
Managing Organisational Politics		“Balancing the organisational’s formal justification of what it wants in the project with their own tacit personal justification for political activity”. (p71)	Credible
Access		“Negotiating access with superiors” (p 68)	Credible

4. Duggan, J. R. 2014. Critical Friendship and Critical Orphanhood: Embedded Research of an English Local Authority Initiative. *Management in Education*, 28, 1, 12-18.

Finding		Illustrations from study	Evidence
Mutually beneficial relationship		“An equal and mutually beneficial relationship between the academic and non-academic partners is a foundational theme in embedded research” (p16)	Unequivocal
Becoming part of the organisation		“Furthermore, I was given a desk in the ‘admin pool’. Sitting with the administrators was an excellent vantage point to learn about the organisation... ”(p13)	Unequivocal
Developing relationship with staff		“Critical friendship- seemed to speak to the situation I found myself in, and what I hoped to achieve by working with professionals in children’s services” (p13)	Unequivocal
Critical reflection		“On a more positive note, the extensive access I secured through my embedded position and the opportunity to actually do collaborative working provoked me to reflect on the adequacy of the existing approaches to conceptualising collaboration” (p15)	Unequivocal

5. Hope, A. 2015. Creating Sustainable Cities Through Knowledge Exchange A Case Study of Knowledge Transfer Partnerships. *International Journal of Sustainability in Higher Education*, 17, 6, 796-811.

Finding		Illustrations from study	Evidence
Transdisciplinary		“The transdisciplinary approach was further demonstrated through the interaction of the KTPs with the non- academic environment”. (p 804)	Unequivocal



Participatory	“A similar approach was adopted on KTP1 and KTP2 where a tenant’s user group was established with members invited to participate in some of the housing design meetings to ensure that their needs were being met”.(p 804)	Unequivocal
Problem-oriented knowledge	“One of the key aims of all three KTPs was to build skills and capacity within the local authority with respect to designing and specifying sustainable housing and service delivery. KTP1 achieved this formally by training staff on key aspects of sustainable housing policy whilst KTP2 developed an architectural design handbook for local authority staff. KTP1 also offered building developers a chance to gain expertise in specifying and operating sustainable technologies and therefore gain commercial advantage and begin the process of developing environmental capacity within their own businesses (Hope and O’Brien, 2010). KTP3 helped to integrate and join up different types of services to provide housing tenants with greater opportunity to participate in leisure and social activities that can impact positively on their physical and psychological wellbeing” (p 804)	Unequivocal
Assist in developing useful tools/services	<p>“KTP1 combined academic theory with practical industry and community experience to develop the ‘PFI Sustainability Evaluation Tool’ a multivariate methodology for evaluating and comparing sustainability within developments procured through PFI procurement”.</p> <p>“KTP2 developed an Architectural Design Evaluation Tool that set out a clear process of assessment criteria enabling the evaluation of proposed building designs and the extent to which the housing would meet key health and wellbeing criteria”.</p> <p>“KTP3 led to the development of new community- based services that deliver nutritional support for healthy eating, direct access to specialist nurses and multidisciplinary healthcare teams, and the development of dementia friendly environments” (p 805)</p>	Unequivocal
Formal and Informal interactions	“Knowledge was created and exchanged through the full range of mechanisms e.g participation in conferences, mobility of people, publication and sharing of facilities”. (p 805)	Unequivocal
Networked	“All three KTPs resulted in the formation of professional and social relationships and networks that have endured post project completion” (p 805)	Unequivocal
Located in the host organisation	“Each project involved an associate employed by the university but embedded within the specific authority project team. The associates were recent graduates who were each supported by two senior academics with experience working in relevant academic and professional fields”.(p 803)	Unequivocal

6. Jenness, V. 2008. Pluto, Prisons, and Plaintiffs: Notes on Systematic Back-translation from an Embedded Researcher. *Social problems*, 55, 1, 1-22.

Finding	Illustrations from study	Evidence
Managing funds	"I was also overwhelmed by the thought of managing over \$400,000 in funding, securing approval from the University of California Institutional Review Board (IRB) to interview inmates about sexual assault and consensual sex, work with and for what is routinely called a "dysfunctional organization," and put together a research team that could accomplish the victimization study being called for." (p9)	Unequivocal
Capacity building	"To do so, we trained a team of interviewers to travel up and down the state of California to interview a random sample of inmates in six prisons and a purposive sample of transgender inmates in one prison." (p11)	Unequivocal
Embeddedness	"for over two years I worked closely with CDCR officials to develop a research design and logistics protocol that that would direct our efforts" (p12)  "In this pool of telling commentary, one of the most revealing comments came when I was told that after the Q & A one warden said to another, in a seemingly casual and confidential moment: "She's one of us." (p12)	Unequivocal
Presentation/ lead research	"I presented a working plan for the research design and logistics protocols at a wardens' meeting." (p 12)	Unequivocal
Co-production of knowledge	"While we determined site selection and sample selection procedures, corrections personnel determined the conditions under which we could enter prisons, interview inmates, and otherwise collect data." (p12)	Unequivocal

7. Langeveld, K., Stronks, K. & Harting, J. 2016. Use of a Knowledge Broker to Establish Healthy Public Policies in a City District: A Developmental Evaluation. *BMC Public Health*,16.

Finding	Illustrations from study	Evidence
Critical reflection	"The fact that she was also employed by the university gave her the opportunity to critically reflect on the knowledge broker role from a scientific perspective".(p3)	Unequivocal
Building relationship	"The civil servant did share critical reflections on the city district's procedures with the knowledge broker, demonstrating that initial rapport had been built" (p5)	Unequivocal
Embeddedness	"Like all city district employees, she was given an access account (providing her with an internal email address, a key to all doors and access to the intranet), and she signed the Formal Secrecy Act, binding her to secrecy. She attended regular meetings, took part in corridor chats, and shared a room with a senior civil servant who introduced her to his network. This positioning gave her access to significant stakeholders and policy-related and contextual information" (p3)	Unequivocal

Knowledge brokering	“To support her knowledge brokering activities (as mentioned above in the Introduction), she could consult public health scientists at both universities as well as public health specialists from the PHS” (p3)	Unequivocal
Agent of change	“As health was already on the agenda, in her meetings with the civil servant the knowledge broker endeavored to strengthen this awareness and to extend this agenda, in the hope that this would have an impact on the local poverty policy with regard to health” (p5)	Unequivocal
Inform practice/policy-science gap	“other policy alternatives specified by the health scientists consulted were considered to be too scientific (Table 1c): they were too abstract, did not suit policy practice and came from too great a distance. However, such distance was not referred to in relation to the knowledge broker. She mostly closed the gap between science and policy by providing the civil servant with specific policy measures that matched the content of the policy document so that they could immediately be integrated” (p6)  “In a one-to-one meeting, the knowledge broker further explained how environmental and socioeconomic determinants affect LGBT health. She also commented on non-health-related issues in the LGBT policy document as well as on the budget available” (p5).	Unequivocal
Knowledge spanner	“The knowledge broker was also able to bridge the gap because of her role as a boundary spanner, which meant that she could involve experts from the university and the PHS” (p6)	Unequivocal
Catalyst for change and suggestions of alternatives	“Almost all alternatives specified by the knowledge broker were integrated into the policy document” (p8)	Unequivocal

8. Lewis, S. J. & Russell, A. 2011. Being Embedded: A Way Forward for Ethnographic Research. *Ethnography*, 12, 3, 398-416.

Finding	Illustrations from study	Evidence
Embeddedness	“Not only was the organization embedded in the process of study design, and the researcher then embedded within the organizational network in order to conduct the research, but the research project came to be embedded into the organization’s own systems” (p404)  “Embedded research allows the researcher to experience the ‘worldview’ of the organization, its members and their partners (and is akin, therefore, to immersion fieldwork), but also requires the researcher to assess that experience in the light of academic knowledge and give the resulting insights back to the organization critically and formatively (as with forms of action research or process evaluations), so that they can make operational use of those insights” (p410)	Unequivocal
Collaboration	“Length of engagement and ensuring that the researcher shared in partners’ experiences at all levels of the regional tobacco control programme was significant in ensuring that those outside the Fresh team felt that they too were part of, could engage with and have ownership of the research process” (p 405)	Unequivocal

	“Working together, the principal researcher and a member of the Fresh team developed the Alliance Toolkit” (p406)	
Knowledge broker	“In sharing difficult situations and joyous celebrations, and in the demonstration of confidences maintained, trust grew and the researcher was able thus to operate ‘in-between’ the Fresh team and the various partners, to be embedded in the whole process rather than simply within the team, and to provide critical feedback to all parties.”(p405)	Unequivocal

9. Miszczak, S. M. & Patel, Z. 2018. The Role of Engaged Scholarship and Co-production to Address Urban Challenges: A Case Study of the Cape Town Knowledge Transfer Programme. *South African Geographical Journal*, 100, 2, 233-248.

Finding	Illustrations from study	Evidence
Embeddedness	“The researchers were embedded in the policy space, working alongside City Officials for seven months a year over three years.” (p 238)  “Being embedded in the City was shown to be a useful way of developing ideas together.” (p 240)	Unequivocal
Capacity building	“Informally, weekly coffee meetings held with embedded researchers provided opportunities for peer support,” (p 242)	Unequivocal
Co-production of knowledge	“knowledges produced in the course of the programme were ‘more layered and have more depth’ because it brings together the different knowledge types of the researchers and practitioners” (243)	Unequivocal
Building relationship	“By working in a more connected way, a stronger relationship between the institutions has been built through mutual trust.” (p 242)	Unequivocal

10. Rowley, H. 2014. Going Beyond Procedure: Engaging with the Ethical Complexities of Being an Embedded Researcher. *Management in Education*, 28, 1, 19-24.

Finding	Illustrations from study	Evidence
Embeddedness	“I was ‘embedded’ within the organisation and worked closely with both the executive board, members of Weston Academy and the team of academics from the University of Manchester” (p19)  “One of main benefits to such arrangements is the intimate knowledge of the organisation that the insider possesses, meaning that the research can be tailored to meet the needs of the organisation” (p22)	Unequivocal
Conduct research	“During the three-year partnership, various qualitative and quantitative data collection activities were completed” (p20)	Unequivocal

Informing practice	“Presentations and progress reports detailing the research findings were also shared and discussed. In this capacity, the research team acted as critical friends to the executive board from the perspective of informed outsiders who were able to stimulate critical reflection through questioning, use of theory and examples from other research projects” (p20)	Unequivocal
Access and flexibility	“one of the main advantages of being embedded within an organisation is the flexibility and access the researcher has to the field, enabling them to respond in an ad-hoc way to data-collection opportunities” (p21)	Unequivocal
Capacity building	“This is advantageous not only for how such relationships may positively impact the data-collection process, but also for how they may help participants to gain new knowledge and skills about how to conduct research” (p 22)  “In this sense, participation in the research process also has the potential to be affirming and empowering (Compton et al., 2002) while also increasing the likelihood that the findings will be useful to the organisation.” (p 22)	Unequivocal
Relationship building	“Furthermore, the closeness of the proximity in which the researcher works with their subjects also means that there is potential for strong and trusting relationships to be developed” (p22)  “I invested a great deal of time in negotiating access, building trust and listening to their stories” (p23)	Unequivocal

11. Scott, K. & Bell, D. 2013. Trying to Measure Local Well-being: Indicator Development as a Site of Discursive Struggles. *Environment and Planning C-Government and Policy*, 31, 3, 522-539.

Finding	Illustrations from study	Evidence
Assist in development	“The researcher (Scott) had the twin objectives of assisting in the practical development of local QLIs for Blyth Valley and studying the process of their development (as a participant observer).” (p 527)	Unequivocal
Data collecting	“This included consulting with the LSP and local communities (through consultation events around the borough and focus groups). The process of this work—which included formal meetings, day-to-day practice, and informal discussions—was documented through research diary entries and meeting notes.” (p 526)	Unequivocal

12. Smith, L. S. & Wilkins, N. 2018. Mind the Gap: Approaches to Addressing the Research-to-Practice, Practice-to-Research Chasm. *Journal of Public Health Management and Practice*, 24, S6-S11.

Findings	Illustrations from study	Evidence
Intermediary	“Through this work, they operate as boundary spanners* who act in partnership with both academics and practitioners and move back and forth between these 2 domains” (p s7)	Credible

Reflection	"The scholar-practitioners' commitment to rigorous and intentional reflection on their practice, and its effectiveness, can benefit public health." (p s8)	Credible
Inform practice	"Scholar-practitioners value both theory and practical application. They use theory and research to inform their practice and use their practice as a source for new learning and insights to develop new theories and models. (p s7)	Credible
conduct research	"They also conduct research (usually in practice settings) and disseminate their findings to both researcher and practitioner audiences" (p s7)	Credible

13. Steens, R., Regenmortel, Tine V., Hermans, K. 2018. Beyond the Research–Practice Gap: The Development of an Academic Collaborative Centre for Child and Family Social Work. *British Journal of Social Work*, 48, 6, 1611-1626.

Finding	Illustrations from study	Evidence
Dual affiliation	"The science practitioner/researcher divided her time between the organisation for child and family social work and the research institutes" (p 1618)	Credible
Knowledge broker	"She was able to maintain informal contacts with all stakeholders, to sense problems and to raise these problems for discussion through the multi-stakeholder collaboration structure" (P 1618)	Credible

14. Wong, S. 2009. Tales from the Frontline: The Experiences of Early Childhood Practitioners Working with an 'Embedded' Research Team. *Evaluation and Program Planning*, 32, 2, 99-108.

Finding	Illustrations from study	Evidence
Embeddedness/ building relationships	"The RA, and later the SPR, worked alongside, shared office space and socialised with the program practitioners" (p101)	Unequivocal
Bringing new skill	"There were number of potential benefits for SDN of employing an embedded researcher. First and foremost, the employment of dedicated personnel with research skills, knowledge, understandings should ensure that the research was credible" (p102)	Unequivocal
To conduct and support research within the organisation.	"Help establish and support implementation of research for different programs." (p103) "Provide support to existing programs to set up evaluation systems." (p103)	Unequivocal
To evaluate programs to support on-going development.	"Formally evaluate existing programs to determine outcomes and effectiveness of program." (p103)	Unequivocal
To provide evidence for reports and future funding applications.	"To research the various program to see how they run, evaluate their effectiveness and value to the community and to gather stats for SDN to use for further funding proposals as well as reporting purposes." (p103)	Unequivocal

To disseminate findings.	"To write a report about our work and present the findings at conferences and in journals." (p103)	Unequivocal
To raise the profile of SDN in the community.	"To raise the profile of the work SDN is doing to the community and with the organization." (p103)	Unequivocal

15. Yost, J., Dobbins, M., Traynor, R., DeCorby, K., Workentine, S. & Greco, L. 2014. Tools to Support Evidence-informed Public Health Decision Making. *BMC Public Health*, 14.

Finding	Illustrations from study	Evidence
Capacity building	"Provided workshop training for all staff" (p 3)  "Provided one-on-one consulting" (P3)  "Mentored staff teams through rapid evidence reviews;" (P 3)  "Advised Research Knowledge & Exchange Committee on creation of EIDM guidebook;" (P3)	Unequivocal
Relationship building	"Regularly met with and presented to senior management" (P3)	Unequivocal
Agent of change	"Advocated for staff time to be allocated to Evidence-Informed Decision Making." (p3)	Unequivocal

16. Murdock, A., Shariff, R. & Wilding, K. 2013. Knowledge Exchange between Academia and the Third Sector. *Evidence & Policy: A Journal of Research, Debate and Practice*, 9, 419-430.

Finding	Illustrations from study	Evidence
Part of the organisation	"In effect the academic on placement can become <i>a de facto</i> part of the organisation with an implicit role and responsibilities" (p 422)	Credible

Appendix 7: Meta-aggregative Flowchart (JBI, 2014)





Appendix 8: Results of Meta-synthesis

Meta-aggregation 1

Findings	Categories	Synthesized finding	
<p><b>A sounding board:</b> “The embedded researcher was able to recommend changes to the assessment process for users of the integrated wellbeing service, to reflect its core aims and address the social determinants of health”.</p> <p><b>A catalyst for change and timely improvements in delivery:</b> “The embedded researcher ‘provided knowledge of relevant managers with the required decision-making powers, and the ability to flag issues, to create linkages and facilitate change”.</p> <p><b>Catalyst for change and improvement in measuring effectiveness:</b> “The embedded researcher facilitated discussions with commissioners and providers of the integrated wellbeing services to amend the performance monitoring framework”.</p> <p><b>Catalyst for change and suggestions of alternatives:</b> Almost all alternatives specified by the knowledge broker were integrated into the policy document”.</p> <p><b>Agent of change:</b> “As health was already on the agenda, in her meetings with the civil servant the knowledge broker endeavoured to strengthen this awareness and to extend this agenda, in the hope that this would have an impact on the local poverty policy with regard to health”.</p> <p><b>Catalyst for change:</b> “Advocated for staff time to be allocated to Evidence-Informed Decision Making.”</p> <p><b>Managing Organisational politics:</b> “Balancing the organisational’s formal justification of what it wants in the project with their own tacit personal justification for political activity”.</p>	<p>Serving as an agent of change by making positive impacts in the host organisation</p>	<p>Informing practice with relevant information to make positive changes. Embedded researchers provide alternative suggestions to tackle issues in the host organisation, these can bring about change.</p>	
<p><b>Closing practice/policy-science gap:</b> “other policy alternatives specified by the health scientists consulted were considered to be too scientific (Table 1c): they were too abstract, did not suit policy practice and came from too great a distance. However, such distance was not referred to in relation to the knowledge broker. She mostly closed the gap between science and policy by providing the civil servant with specific policy measures that matched the content of the policy document so that they could immediately be integrated...in a one-to-one meeting, the knowledge broker further explained how environmental and socioeconomic determinants affect LGBT health. She also commented on non-health-related issues in the LGBT policy document as well as on the budget available”.</p>			<p>Informing practice with relevant knowledge useful in practice which could bring about its utilisation.</p>
<p><b>Informing practice with relevant knowledge:</b> “Presentations and progress reports detailing the research findings were also shared and discussed. In this capacity, the research team acted as critical friends to the executive board from the perspective of informed outsiders who were able to stimulate critical reflection through questioning, use of theory and examples from other research projects”.</p>			

<p><b>Utilising and producing knowledge useful in practice/policy:</b> “Scholar-practitioners value both theory and practical application. They use theory and research to inform their practice and use their practice as a source for new learning and insights to develop new theories and models”.</p>		
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**Meta-aggregation 2**

Findings	Categories	Synthesized finding
<p><b>Acting as a knowledge broker:</b> “The embedded researcher acted as a knowledge broker, feeding in research findings and bringing different stakeholders together at the right time to co-produce research, enhance its local relevance and usefulness to policy and practice partners”.</p>	<p>Connecting professionals, academics and other stakeholders for collaborative work</p>	<p>Building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working. Connecting and bringing relevant stakeholders together enhance the building of relationships which facilitate co-production of knowledge. This combines the explicit knowledge of the researchers and the tacit or</p>
<p><b>Supporting knowledge brokering activities:</b> “To support her knowledge brokering activities (as mentioned above in the Introduction), she could consult public health scientists at both universities as well as public health specialists from the PHS”.</p>		
<p><b>Knowledge spanner:</b> “The knowledge broker was also able to bridge the gap because of her role as a boundary spanner, which meant that she could involve experts from the university and the PHS”.</p>		
<p><b>In-betweenness role between different parties:</b> “In sharing difficult situations and joyous celebrations, and in the demonstration of confidences maintained, trust grew and the researcher was able thus to operate ‘in-between’ the Fresh team and the various partners, to be embedded in the whole process rather than simply within the team, and to provide critical feedback to all parties”.</p>		
<p><b>Acting as an intermediary:</b> “Through this work, they operate as boundary spanners who act in partnership with both academics and practitioners and move back and forth between these 2 domains”.</p>		
<p><b>Engaging in multi-stakeholder collaboration structure:</b> “She was able to maintain informal contacts with all stakeholders, to sense problems and to raise these problems for discussion through the multi-stakeholder collaboration structure”.</p>		
<p><b>Building mutually beneficial relationship:</b> “The relationship typically provides the researcher with greater access to the host organization with benefits for collecting data and research funding. For the host organisation the relationship provides a bridge to academia and academic knowledge, networks and critical approaches to developing organizational policies and practices”.</p>	<p>Building mutually beneficial relationships with practitioners to facilitate co-production of knowledge.</p>	
<p><b>Establishing mutually beneficial relationship:</b> “An equal and mutually beneficial relationship between the academic and non-academic partners is a foundational theme in embedded research”.</p>		
<p><b>Developing relationship with staff:</b> “Critical friendship- seemed to speak to the situation I found myself in, and what I hoped to achieve by working with professionals in children’s services”.</p>		
<p><b>Transdisciplinary:</b> “The transdisciplinary approach was further demonstrated through the interaction of the KTPs with the non- academic environment”.</p>		

<b>Engaging in formal and informal interactions:</b> “Knowledge was created and exchanged through the full range of mechanisms e.g participation in conferences, mobility of people, publication and sharing of facilities”.		experience of the practitioners and other stakeholders.
<b>Networking:</b> “All three KTPs resulted in the formation of professional and social relationships and networks that have endured post project completion”.		
<b>Embeddedness:</b> “For over two years I worked closely with CDCR officials to develop a research design and logistics protocol that that would direct our efforts... in this pool of telling commentary, one of the most revealing comments came when I was told that after the Q & A one warden said to another, in a seemingly casual and confidential moment..she’s one of us”.		
<b>Building rapport:</b> “The civil servant did share critical reflections on the city district’s procedures with the knowledge broker, demonstrating that initial rapport had been built”.		
<b>Regular contact with the host organisation’s staff:</b> “Regularly met with and presented to senior management”.		
<b>Building mutual trust:</b> “By working in a more connected way, a stronger relationship between the institutions has been built through mutual trust”.		
<b>Developing trustworthy relationship with the host organisation’s staff:</b> “Furthermore, the closeness of the proximity in which the researcher works with their subjects also means that there is potential for strong and trusting relationships to be developed....I invested a great deal of time in negotiating access, building trust and listening to their stories”.		

**Meta-aggregation 3**

Findings	Categories	Synthesized findings
<b>Building research capacity:</b> “The embedded researcher encouraged Local authority and public health colleagues to be involved in the research process, including applying for ethical approval, co-facilitating focus groups with service users and assisting with data analysis”.	Developing the skills of practitioners towards conducting research.	Building capacity of the practitioners and other stakeholders towards conducting research. Supporting practitioners and other stakeholders through research
<b>Problem-oriented knowledge:</b> “One of the key aims of all three KTPs was to build skills and capacity within the local authority with respect to designing and specifying sustainable housing and service delivery. KTP1 achieved this formally by training staff on key aspects of sustainable housing policy whilst KTP2 developed an architectural design handbook for local authority staff. KTP1 also offered building developers a chance to gain expertise in specifying and operating sustainable technologies and therefore gain commercial advantage and begin the process of developing environmental capacity within their own businesses (Hope and O’Brien, 2010). KTP3 helped to integrate and join up different types of services to provide housing tenants with greater opportunity to participate in leisure and social activities that can impact positively on their physical and psychological wellbeing”.		
<b>Capacity building:</b> “To do so, we trained a team of interviewers to travel up and down the state of California to interview a random sample of inmates in six prisons and a purposive sample of transgender inmates in one prison”.		

<p><b>Peer support:</b> “Informally, weekly coffee meetings held with embedded researchers provided opportunities for peer support”.</p>		
<p><b>Facilitating the acquiring of research skills:</b> “This is advantageous not only for how such relationships may positively impact the data-collection process, but also for how they may help participants to gain new knowledge and skills about how to conduct research”.</p>		
<p><b>Providing training to staff:</b> “Provided workshop training for all staff...provided one-on-one consulting. Mentored staff teams through rapid evidence reviews; advised research knowledge &amp; exchange committee on creation of EIDM guidebook”.</p>		
<p><b>Presenting/Leading research:</b> “I presented a working plan for the research design and logistics protocols at a wardens’ meeting”.</p>	<p>Facilitating and giving support through research process to encourage participation.</p>	
<p><b>To conduct research:</b> “During the three-year partnership, various qualitative and quantitative data collection activities were completed”.</p>		
<p><b>Data collecting:</b> “This included consulting with the LSP and local communities (through consultation events around the borough and focus groups). The process of this work—which included formal meetings, day-to-day practice, and informal discussions—was documented through research diary entries and meeting notes”.</p>		
<p><b>To engage in research activities:</b> “They also conduct research (usually in practice settings) and disseminate their findings to both researcher and practitioner audiences”.</p>		
<p><b>To conduct and support research within the organisation:</b> “Help establish and support implementation of research for different program...provide support to existing programs to set up evaluation systems”.</p>		
<p><b>To disseminate research findings:</b> “To write a report about our work and present the findings at conferences and in journals”.</p>		
<p><b>Bringing new skill:</b> “There were number of potential benefits for SDN of employing an embedded researcher. First and foremost, the employment of dedicated personnel with research skills, knowledge, understandings should ensure that the research was credible”.</p>		
<p><b>Acknowledging achievements in targeting inequalities:</b> “The embedded researcher was able to emphasize the value of service users’ stories and feedback in shaping services”.</p>	<p>Giving support and assisting in developing relevant tools, services and programmes useful in practice.</p>	
<p><b>Assist in developing useful tools/services:</b> “KTP1 combined academic theory with practical industry and community experience to develop the ‘PFI Sustainability Evaluation Tool’ a multivariate methodology for evaluating and comparing sustainability within developments procured through PFI procurement. KTP2 developed an Architectural Design Evaluation Tool that set out a clear process of assessment criteria enabling the evaluation of proposed building designs and the extent to which the housing would meet key health and wellbeing criteria. KTP3 led to the development of new community- based services that deliver nutritional support for healthy eating, direct access to specialist nurses and multidisciplinary healthcare teams, and the development of dementia friendly environments”.</p>		

<b>Providing support in the process of development:</b> “The researcher (Scott) had the twin objectives of assisting in the practical development of local QLIs for Blyth Valley and studying the process of their development (as a participant observer)”.		
<b>To evaluate programs to support on-going development.:</b> “Formally evaluate existing programs to determine outcomes and effectiveness of program”.		
<b>To raise the profile of the host organisation in the community:</b> “To raise the profile of the work SDN is doing to the community and with the organization”.		

**Meta-aggregation 4**

Findings	Categories	Synthesized finding
<b>Embeddedness:</b> “The RA, and later the SPR, worked alongside, shared office space and socialised with the program practitioners”.	Becoming part of the host organisation	Becoming part of the organisation to collaboratively work with practitioners and other stakeholders. Being “embedded” in the host organisation gives an embedded researcher the opportunity to identify issues, and thereby targeting the research agenda towards tackling the problems through collaborative
<b>Access and flexibility:</b> “One of the main advantages of being embedded within an organisation is the flexibility and access the researcher has to the field, enabling them to respond in an ad-hoc way to data-collection opportunities”.		
<b>Working closely with the professionals:</b> “I was ‘embedded’ within the organisation and worked closely with both the executive board, members of Weston Academy and the team of academics from the University of Manchester. One of main benefits to such arrangements is the intimate knowledge of the organisation that the insider possesses, meaning that the research can be tailored to meet the needs of the organisation”.		
<b>Working alongside the professionals:</b> “The researchers were embedded in the policy space, working alongside City Officials for seven months a year over three years. Being embedded in the city was shown to be a useful way of developing ideas together”.		
<b>Being seen as a member of the organisation:</b> “Not only was the organization embedded in the process of study design, and the researcher then embedded within the organizational network in order to conduct the research, but the research project came to be embedded into the organization’s own systems. Embedded research allows the researcher to experience the ‘worldview’ of the organization, its members and their partners (and is akin, therefore, to immersion fieldwork), but also requires the researcher to assess that experience in the light of academic knowledge and give the resulting insights back to the organization critically and formatively (as with forms of action research or process evaluations), so that they can make operational use of those insights”.		
<b>Being regarded as a part of the organisation:</b> “Like all city district employees, she was given an access account (providing her with an internal email address, a key to all doors and access to the intranet), and she signed the Formal Secrecy Act, binding her to secrecy. She attended regular meetings, took part in corridor chats, and shared a room with a senior civil servant who introduced her to his network. This positioning gave her access to significant stakeholders and policy-related and contextual information”.		

<p><b>Part of the organisation:</b> “In effect the academic on placement can become a de facto part of the organisation with an implicit role and responsibilities”.</p>		<p>working with practitioners and other stakeholders.</p>
<p><b>Embeddedness- being located at the host organisation:</b> “The embeddedness allows researchers to get “under the skin” of these organizations and ask difficult questions, granting access to see multiple perspectives as they traverse the hierarchies inevitable within such institutional apparatuses”.</p>		
<p><b>Becoming part of the organisation:</b> “Furthermore, I was given a desk in the ‘admin pool’. Sitting with the administrators was an excellent vantage point to learn about the organisation”.</p>		
<p><b>Located in the host organisation:</b> “Each project involved an associate employed by the university but embedded within the specific authority project team. The associates were recent graduates who were each supported by two senior academics with experience working in relevant academic and professional fields”.</p>		
<p><b>Dual affiliation:</b> “The science practitioner/researcher divided her time between the organisation for child and family social work and the research institutes”.</p>		
<p><b>Access:</b> “Negotiating access with superiors”.</p>		
<p><b>Participatory:</b> “A similar approach was adopted on KTP1 and KTP2 where a tenant's user group was established with members invited to participate in some of the housing design meetings to ensure that their needs were being met”.</p>	<p>Working together to combine the tacit knowledge of the practitioners with the explicit knowledge of the embedded researcher.</p>	
<p><b>Co-production of knowledge:</b> “While we determined site selection and sample selection procedures, corrections personnel determined the conditions under which we could enter prisons, interview inmates, and otherwise collect data”.</p>		
<p><b>Collaboration:</b> “Length of engagement and ensuring that the researcher shared in partners’ experiences at all levels of the regional tobacco control programme was significant in ensuring that those outside the Fresh team felt that they too were part of, could engage with and have ownership of the research process. Working together, the principal researcher and a member of the Fresh team developed the Alliance Toolkit”.</p>		
<p><b>Bringing together different knowledge:</b> “knowledges produced in the course of the programme were ‘more layered and have more depth’ because it brings together the different knowledge types of the researchers and practitioners”.</p>		

**Meta-aggregation 5**

Findings	Categories	Synthesized finding
<p><b>Reflection:</b> “On a more positive note, the extensive access I secured through my embedded position and the opportunity to actually do collaborative working provoked me to reflect on the adequacy of the existing approaches to conceptualising collaboration”.</p>	<p>Reflecting on the embedded researcher’s role can</p>	<p>Critical reflection on the embedded researcher’s role enables the researcher to</p>
<p><b>Critical reflection:</b> “The fact that she was also employed by the university gave her the opportunity to critically reflect on the knowledge broker role from a scientific perspective”.</p>		

<p><b>Intentional reflection:</b> “The scholar-practitioners’ commitment to rigorous and intentional reflection on their practice, and its effectiveness, can benefit public health”.</p>	<p>benefit practice.</p>	<p>evaluate his/her role in the host organisation. This assists in to identify what works and what doesn’t in order to make adjustments, improvements or recommendations when possible.</p>
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***Meta-aggregation 6***

Findings	Categories	Synthesized finding
<p><b>Managing funds:</b> “I was also overwhelmed by the thought of managing over \$400,000 in funding, securing approval from the University of California Institutional Review Board (IRB) to interview inmates about sexual assault and consensual sex, work with and for what is routinely called a “dysfunctional organization,” and put together a research team that could accomplish the victimization study being called for”.</p>	<p>Supervising research funds, keeping records and providing support for future funding applications.</p>	<p>Managing funds allocated to the research and providing evidence for reports and future funding applications.</p>
<p><b>To provide evidence for reports and future funding applications:</b> “To research the various program to see how they run, evaluate their effectiveness and value to the community and to gather stats for SDN to use for further funding proposals as well as reporting purposes”.</p>		

Appendix 9: ConQual Score Table

Synthesised finding	Type of research	Dependability	Credibility	ConQual score
Synthesised finding	Qualitative <b>HIGH</b>	All articles only 'yes' for 4-5 dependability questions. So the paper remains unchanged (High) <b>HIGH</b>	All unequivocal –remains unchanged (High) <b>HIGH</b>	<b>HIGH</b>
Synthesised finding	Qualitative <b>HIGH</b>	At least 1 article only 'yes' for 2-3 dependability questions, so downgrade 1 level (-1) <b>DG 1 LEVEL</b>	All unequivocal –remains unchanged (High) <b>HIGH</b>	<b>MODERATE</b>
Synthesised finding	Qualitative <b>HIGH</b>	At least 1 article only 'yes' for 2-3 dependability questions, so downgrade 1 level (-1) <b>DG 1 LEVEL</b>	Mix of unequivocal / credible, so downgrade 1 level (-1) <b>DG 1 LEVEL</b>	<b>LOW</b>
Synthesised finding	Qualitative <b>HIGH</b>	At least 1 article only 'yes' for 0-1 dependability Qs, so downgrade 2 levels (-2) <b>DG 2 LEVEL</b>	Mix of unequivocal / credible, so downgrade 1 level (-1) <b>DG 1 LEVEL</b>	<b>VERY LOW</b>

Produced with reference to Lloyd (2018)



**Appendix 10:** Results of the Dependability Grade for Each Synthesised Finding Based on the Studies They Were Meta-aggregated From (Without Commentaries)

Synthesised finding	Studies	Comment	Overall dependability
1. Informing practice with relevant information to make positive changes.	Cheetham et al. (2017); Langeveld et al. (2016); Yost et al. (2014); Rowley (2014)	At least 1 article only 'yes' for 2-3 dependability questions, so downgrade 1 level (-1)  (Yost et al. (2014) only 'yes' to 3 dependability questions)	downgrade 1 level
2. Building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working.	Cheetham et al. (2017); Langeveld et al. (2016); Lewis and Russell (2011); Duggan (2014); Hope (2016); Jenness (2008); Yost et al. (2014); Miszczak and Patel (2018); Rowley (2014); Steen et al. (2018)	At least 1 article only 'yes' for 2-3 dependability questions, so downgrade 1 level (-1)  (Langeveld et al. (2016); Lewis and Russell (2011); Yost et al. (2014); Miszczak and Patel (2018) and Steen et al. (2018) only 'yes' to 3 dependability questions)	Downgrade 1 level
3. Building capacity of the practitioners and other stakeholders towards conducting research.	Cheetham et al. (2017); Hope (2016); Jenness (2008); Miszczak and Patel (2018); Rowley (2014); Yost et al. (2014); Scott and Bell (2013); Wong (2009)	At least 1 article only 'yes' for 2-3 dependability questions, so downgrade 1 level (-1)  (Yost et al. (2014); Miszczak and Patel (2018) and Scott and Bell (2013) only 'yes' to 3 dependability questions)	Downgrade 1 level
4. Becoming part of the organisation to collaboratively work with practitioners and other stakeholders	Wong (2009); Rowley (2014); Miszczak and Patel (2018); Lewis and Russell (2011); Langeveld et al. (2016); Duggan (2014); Hope (2016); Jenness (2008); Murdock et al. (2013); Steen et al. (2018)	At least 1 article only 'yes' for 2-3 dependability questions, so downgrade 1 level (-1)  (Murdock et al. (2013) only 'yes' to 3 dependability questions)	Downgrade 1 level
5. Critical reflection on the embedded researcher's role	Duggan (2014); Langeveld et al. (2016)	At least 1 article only 'yes' for 2-3 dependability questions, so downgrade 1 level (-1)	Downgrade 1 level

enables the researcher to evaluate his/her role in the host organisation		(Langeveld et al. (2016) only 'yes' to 3 dependability questions)	
6. Managing funds allocated to the research...applications	Jeness (2008); Wong (2009)	All articles only 'yes' for 4-5 dependability questions. So the paper remains unchanged (High)	High

**Appendix 11:** Results of the Credibility Grade of Each Synthesised Finding Based on the Credibility of the Individual Findings They Were Meta-aggregated From (Without Commentaries)

Synthesized findings	Studies	Comments	Credibility
1. Informing practice with relevant information to make positive changes.	<b>Unequivocal-</b> Cheetham et al. (2017) (3x); Langeveld et al. (2016) (3x); Yost et al. (2014) and Rowley (2014)	<b>8 Unequivocal</b>	All unequivocal – remains unchanged. <b>High</b>
2. Building mutually beneficial relationships with the professionals and other stakeholders to enable collaborative working.	<b>Unequivocal-</b> Cheetham et al. (2017); Langeveld et al. (2016) (3x); Lewis and Russell (2011); Duggan (2014) (2x); Hope (2016) (3x); Jenness (2008); Yost et al. (2014); Miszczak and Patel (2018) and Rowley (2014)  <b>Credible-</b> Steen et al. (2018)	<b>14 Unequivocal + 1 Credible</b>	Mix of unequivocal / credible.  <b>Downgraded one (-1)</b>
3. Building capacity of the practitioners and other stakeholders towards conducting research.	<b>Unequivocal-</b> Cheetham et al. (2017) (2x); Hope (2016) (2x); Jenness (2008) (2x); Miszczak and Patel (2018); Rowley (2014) (2x); Yost et al. (2014); Scott and Bell (2013) (2x) and Wong (2009) (5x)	<b>17 Unequivocal</b>	All unequivocal – remains unchanged.  <b>High</b>
4. Becoming part of the organisation to collaboratively work with practitioners and other stakeholders	<b>Unequivocal-</b> Wong (2009); Rowley (2014) (2x); Miszczak and Patel (2018) (2x); Lewis and Russell (2011) (2x); Langeveld et al. (2016); Duggan (2014); Hope (2016) (2x) and Jenness (2008)  <b>Credible-</b> Murdock et al. (2013) and Steen et al. (2018)	<b>12 Unequivocal + 2 Credible</b>	Mix of unequivocal / credible.  <b>Downgraded one (-1)</b>
5. Critical reflection on the embedded researcher's role enables the researcher to evaluate his/her role in the host organisation	<b>Unequivocal-</b> Duggan (2014) and Langeveld et al. (2016)	<b>2 Unequivocal</b>	All unequivocal – remains unchanged.  <b>High</b>
6. Managing funds allocated to the research and providing evidence for reports and future funding applications	<b>Unequivocal-</b> Jenness (2008) and Wong (2009)	<b>2 Unequivocal</b>	All unequivocal – remains unchanged.  <b>High</b>

X – the number of individual finding from the article. For example, 2x means two individual findings, and 3x means three individual findings.

Appendix 12: Poster Presentation of the Systematic Review Findings

Presenter:  
Abisope Akintola



Can embedded research build bridges and break barriers between public health academe and practice? a systematic review  
Abisope Akintola<sup>1</sup>, Prof. Louisa Ells, Prof. Dorothy Newbury-Birch<sup>2</sup>, Dr Mandy Cheetham<sup>1</sup> and Dr Oladipo Idowu<sup>1</sup>.  
School of Health and Social Care, Teesside University<sup>1</sup> School of Social Science, Humanities and Law, Teesside University<sup>2</sup> | Email: A.Akintola@tees.ac.uk

Introduction

The gap between knowledge and practice in public health is globally recognised (Di Ruggiero *et al.*, 2017). Embedded research is an approach adopted by researchers to co-produce knowledge with the professionals, which involves working and building relationships between professionals across academia and policy/practice (McGinity and Salokangas, 2014). Embedded research is beneficial as there is evidence to demonstrate its role in facilitating research evidence utilisation (Eyre *et al.*, 2015), and facilitation of new knowledge production through collaborative working (Marshall, 2014). However, there is no systematic review on the role of embedded research in bridging the knowledge-practice gap.

Review question/objective

What is the role of embedded researchers in co-producing public health knowledge in non-clinical settings?

Methods

We accessed CINAHL Medline, AMED, Web of Science, PsycINFO, Psychology and behavioural science collection, PsycARTICLES, ASSIA, Embase and Scopus, Google Scholar, Open Grey, Google, and organisational websites for search terms that included embedded research, researcher-in-residence, knowledge broker and knowledge spanner.

Articles were reviewed by two independent reviewers

Studies were included if they: (1) were qualitative studies, including commentaries (2) investigated or reported the role of embedded researcher, (3) were conducted in the non-clinical setting, and (4) involved an embedded researcher.

Data were independently extracted by two independent reviewers. JBI SUMARI using the meta-aggregation approach will be used to pool qualitative data.

Assessing certainty in the synthesized findings was conducted using JBI conQual approach.

Results

A total of 16 studies were included in the review (fig. 1). There were 13 qualitative studies and 3 commentaries.

Figure 1 Flow Diagram of the Systematic Review Method

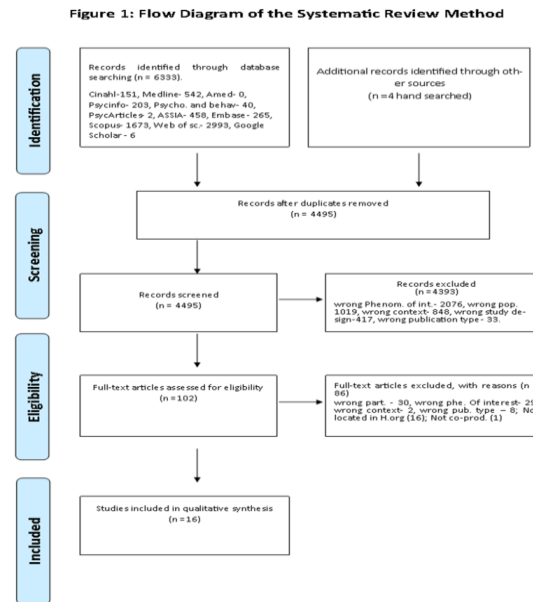


Figure 2 Diagram of the synthesized findings

From the 16 included studies, 66 findings were extracted through JBI SUMARI. The 6 synthesized findings were:



Conclusion

The systematic review results of our 16 included studies suggest that the role of an embedded researcher could bridge the knowledge-practice gap by co-producing relevant knowledge where it is to be utilised with those to utilise it (public health practitioners).

Selected references

Di Ruggiero, E., Viehbeck, S., Greyson, D. (2017) *Knowledge Utilization and Exchange*. Oxford: Oxford University Press—Oxford Bibliographies in Public Health.

Eyre, L., George, B. and Marshall, M. (2015) Protocol for a process-oriented qualitative evaluation of the Waltham Forest and East London Collaborative (WELC) integrated care pioneer programme using the Researcher-in-Residence model. *British Medical Journal*, 5.

Marshall, M. N (2014) Bridging the ivory towers and the swampy lowlands; increasing the impact of health services research on quality improvement. *International Journal for Quality in Health Care*, Vol.26, pp.1–5.

McGinity R. and Salokangas M. (2014) Introduction: “Embedded research” as an approach into academia for emerging researchers. *Management in Education*, Vol. 28, pp.3-5.

## Appendix 13: The Ethics Application Form

**REQUEST FOR ETHICAL APPROVAL  
EthApp V 9.0 2019 - CONFIDENTIAL**

*Please fully answer every Section as the SRESC may not be able to review any incomplete forms.*

The academic supervisor (or the Chief Investigator for non-student projects) submits by emailing the completed form and any supplementary documents, to [sohsc-ethics@tees.ac.uk](mailto:sohsc-ethics@tees.ac.uk).

**Before submitting this form:**

Please read the TU 'Policy Procedures and Guidelines for Research Ethics' and ensure the proposed research complies with the University's six Principles for Research Ethics. The ethical issues underlying these principles are laid out in detail in the Guidelines section.

If this project will require Health Research Authority Approval after TU Ethical Clearance has been confirmed then do not complete this form. You must apply for TU Ethical Clearance by submitting a form generated through the Integrated Research Application System (IRAS <https://www.myresearchproject.org.uk/>).

You must not apply for HRA review, nor any other external approvals or permissions, until after TU Ethical Clearance has been confirmed.

*If you are in any doubt about which Approvals/Permissions your project requires use please contact the Chair of SRESC before applying.*

**SECTION A: To be completed by the Chief Investigator (CI)**  
NB – for student projects the Academic Supervisor is the CI

**1) Project title:**

The role of embedded researchers in co-producing public health knowledge in non-clinical settings.

**2a) Name, job title and address\* of the Chief Investigator:**

Prof. Louisa Ells, Professor in Public Health and Obesity  
Specialist Advisor to PHE

**2b) Name, job title, employer and address of all other people involved with this project other than student(s) or researcher(s):**

Prof. Dorothy Newbury-Birch, Professor of Alcohol and Public Health Research.

Dr. Mandy Cheetham, Fuse Post doctoral Research Associate.

*\* For TU employees do not give address*

**3a) Name(s) of researcher(s)/student(s) working on this project:**

Abisope Rhoda Akintola

**3b) Please initial below to indicate which category of project this is:**

Taught Postgraduate	PG Research Student	L E	Staff - higher degree	Staff - other research	Final Year Undergrad Student
<p>4) <b>Expected duration of this project: From:</b> As soon as ethical approval is granted  <b>To:</b> 30/07/2020</p>					
<p>5) <b>Research Question(s), Aim(s) and/or any Hypotheses being tested:</b></p> <p>What is the role of embedded researchers in co-producing public health knowledge in non-clinical settings?</p>					
<p>6) <b>Please give full details of who the participants in this project will be (i.e. what are the things which make a person eligible to take part in this project)*:</b></p> <p>Potential participants for this study are:</p> <ul style="list-style-type: none"> <li>• Embedded researchers working in public health. There are criteria to differentiate embedded researchers from other types of researchers. These criteria require the researcher to be located in the host organisation, to bring new skills to the host organisation, and to be involved in the negotiation of knowledge (<a href="http://www.embeddedresearch.org">http://www.embeddedresearch.org</a>). To be eligible to participate in this study, the embedded researcher must be working in a non-clinical setting such as a local authority, school or voluntary and community organisations excluding Gateshead Council as one of the researcher's supervisors is currently working there as an embedded researcher and this could raise further ethical implications. Also, the embedded researcher must be involved in the co-production of public health knowledge with public health practitioners.</li> <li>• Public health practitioners who are working/have worked with an embedded researcher to co-produce public health knowledge in non-clinical settings. This non-clinical setting can include local authorities, schools and non-governmental organisations. To be eligible to participate in this study, the public health practitioner must be working in a non-clinical setting, excluding Gateshead Council as one of the researcher's supervisors is currently working there as an embedded researcher and this could raise further ethical implications. Also, the public health practitioner must be involved in the co-production of public health knowledge with an embedded researcher(s).</li> </ul> <p><i>*Please note - If you plan to recruit Teesside University staff in this project please refer to TU's Policy, Procedures, and Guidelines for Research Ethics</i></p>					
<p>7) <b>Please give full details of how you will recruit the participants: Please state who will identify the potential participants (i.e. the people who can take part), how they will know a person is eligible and how they will obtain the potential participants' contact details? Please ensure all processes are compliant with the General Data Protection Regulations (GDPR) and the Data Protection Act (DPA) (2018).</b></p> <p>The details of this research will be circulated to potential participants through relevant professional contacts and networks, including those identified by my supervisors, the team members of embedded research project funded by the Health</p>					

Services and Delivery Research Programme of the National Institute of Health Research (<http://www.embeddedresearch.org>), the Knowledge Mobilisation Network, PHE, Fuse, the Centre for Translational Research in Public Health and the School for Public health research. The eligibility criteria are included in the Participant Information Sheet and also the eligibility criteria will be made clear in all the information that will be sent out. Potential participants will then contact the researcher directly by email if they are interested in taking part. The researcher will then arrange to make contact with the person by email, to answer any questions they may have regarding the research and make practical arrangements for the interview at a convenient time and place to suit them. If the required number of participants is not met, we will contact individuals who meet the eligibility criteria until we reach our target for recruitment. If too many participants are recruited, we will politely inform people we have reached our recruitment target and thank them for their interest in the project.

***How and by whom will the potential participants first be contacted and find out that this project is running, that they are eligible and that they are invited to consider taking part?***

Potential participants will receive information about this research through their contacts and networks. They will be able know if they are eligible to participate in this research by reading the Participant Information Sheet. Any eligible individual who is interested in participating in this research will then contact the researcher working on this study directly by email.

***Who will potential participants be able to contact to ask any questions they may have before they decide whether or not they wish to take part?***

The invitation letter will include the contact details of the researcher working on this project, one of her supervisors' contact details and Dr Darren Flynn's (the ethics chair) contact details therefore, the potential participants will be able to contact the researcher working on this project if there are any questions regarding the research.

***How many participants do you hope to recruit and how did you decide on that number?***

Qualitative research does not seek to generalise findings to larger population but rather to seek an in-depth understanding of phenomenon (Brannen, 2005). Therefore, qualitative research uses smaller samples to obtain rich data. This qualitative research will use one-to-one semi-structured in-depth interviews as data collection method. A minimum of 5 embedded researchers and 8 public health practitioners will be recruited depending on the number of embedded researchers and public health practitioners that are available and are willing to take part in this study. Ultimately, the required number of participants will depend on when saturation is reached, that is interviewing will continue until nothing new comes from the data.

***How many people will you contact and invite to take part?***

The details of this research will be circulated to approximately 40 people through relevant professional contacts and networks. This means, approximately 10 embedded researchers and 30 public health practitioners will be invited to take part in the study. If the required number is not met, more individuals will be sent information.

***How long will the potential participants have to decide whether or not they wish to take part?***

The potential participants will be given up to two weeks to decide if they want to take part or not.

***How will a potential participant indicate that they would like to take part?***

The potential participants will indicate their interest to participate in this research by contacting the researcher working on this study by email.

***When and how will you obtain and document the participant's Informed Consent/Consent & Assent\* to take part?***

Potential participants will have the opportunity to ask questions before they agree to take part. The consent form will be completed by the participant immediately before the interview. A copy will be given to the participant. The consent form will be held securely in a locked cabinet at Teesside University and only be accessible to the research team.

***\*If young person's under the age of 16 are eligible how will the Informed Consent of their parents/guardians (Informed Consent for their child to be asked if they would like to take part and to take part if they wish to) be obtained and documented?***

**N/A**

***\*How will the young person's Assent be obtained and documented after parents/guardians Informed Consent is confirmed? If the young person's Assent will not be obtained and documented then please justify this choice.***

**N/A**

***Will participants be given any monetary or other inducements to/rewards for taking part?***

***NO*** (delete as appropriate)

***If YES, please detail the inducement/incentive/reward and how and when participants will receive this:***



**8) Please give full details of the methods; please detail all the procedures, activities and equipment involved in the proposed project from when Informed Consent is obtained and documented (i.e. where Section 7 stops) through to the end of the project and the destruction (or archiving) of the data collected. Please include copies of all materials or documents you will use (e.g. Invitation Letter/email, Participant Information Sheet, Consent/Assent Form, Questionnaire, Interview Schedule, Focus Group topic guide etc) as cross-referenced appendices.**

See research protocol (Appendix 1) and attached documentation, including participant information sheet, , consent form and interview schedule.

**9a) What (if any) risks do you feel there will be to anyone who decides to take part in the research as a result of their choice?**

As qualitative research involves the collection of in-depth data from the participants, these might provoke anxiety and distress. For instance, public health professionals or embedded researchers might feel their practice is under scrutiny. Participation in the research could affect their job, the reputation of the host organisation and future funding. To mitigate this risk, consent will be gained from the participants at the beginning of the study. The Participation Information Sheet will detail the purpose and the scope of the study, the types of questions which are likely to be asked, the method of anonymisation and the extent to which participants' words will be used. The Participant Information Sheet will also state that all data will be anonymised and no personal details will be included in any published reports. The participants will be assured that every document will be given a code number rather than in their names, and stored securely. With permission, the interview will be audio-recorded and transcribed verbatim. Also, the Participant Information Sheet will state that participants are free to withdraw from the interview at any time.

Participants in a qualitative study might feel pressurised to participate in research, therefore participants will be given enough time to consider their participation and to ask questions regarding the research before the interviews.

, In-depth interviews could involve the participants travelling to a convenient location away from their place of work for an interview if they chose to do so. Also participating in in-depth interviews requires the participants to create time to attend the interviews. As both embedded researchers and public health practitioners are busy, this risk of inconvenience will be mitigated by making effort to accommodate the time and place of participants' choice. Also, participants would be offered to answer the interview questions over the phone if they cannot attend a face-to-face interview. This is to reduce the risk of inconvenience. In a situation where a participant prefers to be interviewed by telephone rather than face-to-face, the researcher will email the consent form and ask for it to be returned by email before the interview. The interview will go ahead on receipt of a signed consent form.

To reduce the risk associated with confidentiality, the participants' names will not be identifiable on the recordings. They will be assigned an individual code number which would not be known or accessible by anyone except the research team. These will be held securely in a locked cabinet at Teesside University.

**9b) What (if any) risks do you feel there will be to the people who are involved in running the project and/or the University?**

Participants will be given the opportunity to be interviewed somewhere away from work if they wish. The researcher working on this study will offer to book rooms at the University or another place if participants prefer not to be interviewed at their place of work to ensure confidentiality.

The participant information sheet will make it clear that participants are not allowed to name any specific people nor give any information that could render anyone identifiable and if they do all data collected from them will be destroyed and are ineligible.

. Any potential critical findings will be managed with sensitivity and discretion to minimise the risk of damage to participating organisations. In a situation where unprofessional conduct such as safeguarding concerns are disclosed, the researcher will stop the interview and there will be a breach of confidentiality. The researcher's Director of Studies will be informed.

For personal safety, the researcher working on this study will adhere to Teesside University's lone worker policy. The researcher will inform her Director of Studies before leaving the University, before and after the interview. The researcher will carry a fully charged mobile phone and for easy access, the contact number of her Director of Studies and other emergency numbers will be programmed in.

**10): Will participants be allowed to withdraw their data after it has been collected?**

**YES** (delete as appropriate)

**If NO, why have you chosen not to allow this?**

**If YES,**

**Why have you chosen to allow this?**

The participants will be able to withdraw their data up to 2 weeks after the interview.

**How will this be made possible** (i.e. will the data be person identifiable or pseudonymised [link-anonymised] during the period when withdrawal of data is allowed)?

The participants will be informed they can withdraw their data up to 2 weeks after the interview as interviews have not been transcribed. However, after 2 weeks, the interviews will be transcribed, and the transcripts will be anonymised by assigning a code to the transcripts which will not be known to anyone except the researcher and the research team. This code will be stored separately and destroyed after 2 weeks. Therefore, it will not be possible for participants to withdraw their data at this point.

***What (if any) time limit will be set on the period when withdrawal of data is allowed?***

2 weeks

***If any time limit will be set on how long people have to withdraw their data how will the data be rendered non-person identifiable after that point in time has passed? (i.e. how will the linkage of the data be broken and the data rendered non-identifiable - or - if that will not occur will the data then be destroyed or retained, if retained for how long, where and in what format will it be retained e.g. non or person identifiable, pseudonamysed [link anonymised], as electronic files or hard copies etc and why)***

The data will be coded and only the research team will be able to identify this, therefore, no one apart from the research team will be able to identify the participants.

After the interviews, all electronic and hard documents including the transcripts, the audio recording, notes taken will be stored securely in locked filing cabinets at Teesside University for the period of this study. After the final submission of this work, the data will be archived for ten years and then destroyed.

***11a) What steps and procedures will be taken to preserve the confidentiality and privacy of any people and/or organisations involved in, and/or data or information collected as part of this project?***

No names, personally identifiable information about individuals or the names of their employing organisation will be included in written documents. All electronic and hard documents including the transcripts, the audio recording, notes taken will be stored securely in locked filing cabinets at Teesside University for the period of this study. These will not be accessible to anyone except to the research team. After the final submission of this work, the data will be archived for ten years and then destroyed.

***11b) Please detail what, where and in what format people's data will be stored from the point at which is collected to when it is destroyed or archived.***

All digital recordings and transcripts will be stored securely on a Password Protected Teesside University Server, or password protected University laptops and /or in locked filing cabinets in key coded or locked offices. Hard documents including the transcripts, the audio recording, notes taken will be stored securely in locked filing cabinets at Teesside University for the period of this study. These will not be accessible to anyone except to the research team. After the final submission of this work, the data will be archived for ten years and then destroyed.

**11c) Do you foresee any circumstances under which that confidentiality and privacy may need to be breached?** (For example - what actions (if any) would be taken if any previously unknown factors become known during the course of the research which may require disclosure (e.g. medical or health problem(s), criminal confession or intention to commit crime, abusive or unprofessional behaviours or actions by any person etc).

**YES** (delete as appropriate)

**If YES, please detail and justify these circumstances and explain what will happen?**

Any potential critical findings will be managed with sensitivity and discretion to minimise the risk of damage to participating organisations. In a situation where unprofessional conduct such as safeguarding concerns are disclosed, the researcher will stop the interview and confidentiality will be broken. The researcher will inform her Director of Studies in any instance in which an interview has to be stopped.

**12) Will any secondary analysis of data occur during the project** (i.e. will you be using any data which was collected separately from this project)?

**NO** (delete as appropriate)

**If YES – Please either:**

**Submit a separate Release Form application that details the Secondary Analysis which will occur,**

**- or -**

**Refer to the Release Form and give both:**

- 1. Full details of how the use of that data complies with the requirements of the GDPR and DPA (2018) ( in particular the derogations contained in Article 89 of the GDPR and Section 19 of the DPA) and any other relevant legislation,**

**- and -**

- 2. Include verification of the statements, required on the Release From, here.**

**13) Will the research involve the use of any of the following:**

**13a) Human Tissue of any kind** (e.g.) blood, semen, saliva, urine, bodily fluids etc ?

**NO** (delete as appropriate)

**If YES, please give a full explanation of how the research is compliant with the requirements of the Human Tissue Act 2004 and why HRA Approval is not required.** (See page 46 of 'Policy Procedures and Guidelines for Research Ethics')

**13b) Radioactive materials?****NO** (delete as appropriate)

If **YES**, please give a full explanation of how the research is compliant with the requirements of the relevant legislation regulating radioactive materials and why HRA Approval is not required.

**13c) Any other potentially dangerous or hazardous materials, such as chemicals or other agents?****NO** (delete as appropriate)

If **YES**, please give a full explanation of how the research is compliant with the requirements of any relevant legislation (e.g. COSHH, BioCOSHH etc).

**14) Will the project receive financial support from outside Teesside University?****NO** (delete as appropriate)If **YES**,

Please detail the nature and source of the support:

Have any restrictions/conditions been imposed upon the conduct of research?

**NO** (delete as appropriate)

If **YES**, please detail the nature of, and reason for, these restrictions/conditions:

**15) Will any restrictions been placed on the dissemination, or use of the results and/or findings?****NO** (delete as appropriate)

If **YES**, please state the nature of, and reason for, these restrictions:

<p><b>16) Does the project require any external approvals or permissions after TU ethical clearance has been granted?</b></p> <p style="text-align: center;"><b>NO</b></p> <p><i>If YES, please state what these are and include any required documentation as cross-referenced appendices.</i></p>	
<p><b>17) Is there anything which has not already been included on this form, or in any supporting documents that you would like SRESC members to be aware of when reviewing this application?</b></p> <p style="text-align: center;"><b>NONE</b></p>	
<p><b>18) I confirm that have read the University's 'Policy Procedures and Guidelines for Research Ethics', and confirm that my project will conform to the University's six Principles for Research Ethics contained therein. I am aware of University procedures on Health &amp; Safety. I understand that the ethical propriety of this project may be monitored by the School's Research Ethics sub-Committee and that my project may be audited by the University Research Ethics and Integrity Committee at any time during the course of the project or after it is completed.</b></p>	
<p><i>(Please complete the following as appropriate by putting your initials or explanatory text in the boxes)</i></p>	
<p>▪ <b>I have appropriate experience of the research area of the project</b></p>	
<p>▪ <b>I have undertaken any research ethics training required by my School.</b> <i>Note: having undertaken training is not a condition of application for ethical Approval unless a School requires that training be completed.</i></p>	
<p>▪ <b>I confirm that as Supervisor I will monitor progress of the project.</b></p>	
<p>• <b>I confirm that the project complies with the Code of Practice of the following Professional Body (state N/A, if this is not applicable):</b></p>	
<p><b>19:</b></p> <p>Signature of Staff Researcher: _____ Date: _____</p> <p><b>OR:</b> For any student projects Signature of Academic Supervisor or Director of Studies _____ Date: _____</p>	

**Appendix 14: Participant Information Sheet****The role of embedded researchers in co-producing public health knowledge in non-clinical settings****What is the purpose of this research?**

This research aims to understand the role of embedded researchers in non-clinical settings.

**Why have I been contacted?**

You have been invited to participate in this research because you are an embedded researcher/ public health practitioner working in a non-clinical setting such as a local authority, school, or third sector organisation. We are interested in hearing about your experiences as you are involved in embedded research.

**What will happen to me if I choose to take part in your research?****The events that will happen to you have been described below:**

1. You will be asked to take part in a one-to-one interview with the researcher, which will take no more than an hour to discuss research and evidence use in your organisation.
2. We will ask for your permission to contact you again to talk about the toolkit that we plan to develop.
3. We will ask you to complete a demographic data collection form after the interview. This is to ensure we capture a range of different views and experiences.
4. We will ask you about your role and collect basic information about your gender and educational background.

**Where will the research take place?**

If you are happy to take part, you will reply by email to the researcher. The researcher will contact you to arrange a one-to-one interview with you in your office or at a convenient place at a time that suits you. The researcher can book a room at the University or somewhere away from work if you prefer not to be interviewed at your place of work.

**What happens to the information I give? Will it be kept confidential?**

With your permission, the interview will be recorded so that the researcher can capture everything that is said. You will not be identified by name on this recording. All data will be anonymised, you will be assigned an individual code number which will not be known or accessible by anyone except the research team. No personal details (name, place of work etc) will be included in the PhD thesis, reports or publications we write, but we may use quotes from you to illustrate points made. You will be free to withdraw from the interview at any time. If any abusive or unprofessional actions are disclosed during the interview, then confidentiality will have to be breached.

All digital recordings and transcripts will be stored securely on a Password Protected Teesside University Server, or password protected University laptops and /or in locked filing cabinets in key coded or locked offices. Hard documents including the transcripts, the audio recording, notes taken will be stored securely in locked filing cabinets at Teesside University for the period of this study in accord with the Data Protection Act (1998). These will not be accessible to anyone except to the research team. After the final submission of this work, the data will be archived for ten years and then destroyed.

**Do I have to take part?**

No, you are not obliged to take part. Participating in this research is voluntary. You will be asked to sign a consent form to show that you have agreed to take part. It will be possible to withdraw your data up to two weeks after the interview, without giving a reason. To withdraw from the study, you can simply call the researcher (Abi Akintola-contact details shown below) and give your name and state that you would like to withdraw your information.

**Who is organising the project?**

This study is being undertaken as part of a doctoral research study. This is supervised within the School of Health and Life Sciences at Teesside University.

**What will happen to the results of this research?**

The results will be analysed and presented in a full report. A short summary of the findings will be given to participants who took part in this study. The information may



also be published in a scientific journal. All data will be anonymous, and no names or personal information will be used in any of the published articles or in the thesis.

**Has the project been independently reviewed?**

YES. Ethical approval has been granted by the Teesside University School of Health and Life Sciences Research Governance and Ethics Sub-Committee.

**What if there is a problem?**

If you have concerns about any aspect of this study, please speak to the researcher in the first instance who will do her best to respond. If you have any concerns about the study, you can contact Dr Darren Flynn, at Teesside University, who knows about, but is not involved in the study.

**What shall I do next if I wish to take part?**

If you would like to take part, please email the researcher

If you require any further information or would like to ask any questions relating to this project, please do not hesitate to contact:

Abisope Akintola  
Email: [A.Akintola@tees.ac.uk](mailto:A.Akintola@tees.ac.uk)  
Tel: 01642342778

Professor Louisa Ells  
Email: [L.Ells@tees.ac.uk](mailto:L.Ells@tees.ac.uk)  
Tel: 01642342936

Dr Darren Flynn  
Chair of School of Health and Life Sciences Research Governance and Ethics Committee. Teesside University, Middlesbrough, Tees Valley, TS1 3BX  
Email: [d.flynn@tees.ac.uk](mailto:d.flynn@tees.ac.uk)  
01642342749

**Thank you for reading this information.**



**Appendix 16: Demographic Sheet for Participants**

**The role of embedded researchers in co-producing public health knowledge in non-clinical settings**

**Please complete the blank spaces and tick as appropriate**

1. What is your gender?

Male

Female

2. How old are you?

Below 21 years	
21- 30 years	
31- 40 years	
41- 50 years	
51- 60 years	
61+	

3. What is your highest level of education?.....

4. How many years have you worked as an embedded researcher/ public health practitioner?.....

**Appendix 17: Ethical Approval Email**

**From:** Atkinson, Greg <Greg.Atkinson@tees.ac.uk>

**Sent:** 24 October 2019 08:11

**To:** Newbury-Birch, Dorothy <D.Newbury-Birch@tees.ac.uk>; Flynn, Darren <D.Flynn@tees.ac.uk>

**Cc:** Akintola, Abisope <A.Akintola@tees.ac.uk>; Ells, Louisa <L.Ells@tees.ac.uk>

**Subject:** RE: Abi Akintola's revised ethics documents

Hi Dot,

Many thanks for submitting the revised documents and summary of responses. After reading these, I am happy to approve this study in Darren's absence as Vice Chair of the committee.

Many thanks and good luck with the study,

Greg

Greg Atkinson BSc(Hons), PhD  
Professor of Health Sciences and Biostatistics Research  
School of Health and Life Sciences  
Teesside University  
[Greg.atkinson@tees.ac.uk](mailto:Greg.atkinson@tees.ac.uk)  
@GregTees  
<https://research.tees.ac.uk/en/persons/greg-atkinson>

**Appendix 18: Expression of Interest Email**

Hello,

**Expressions of interest: Co-production/Embedded research project**

I am a PhD student undertaking research at Teesside University and I am writing to ask if you would consider taking part in my research project. I am seeking to interview public health embedded researchers and public health practitioners who are working/ have worked with an embedded researcher about their views and experiences about embedded research.

Participation involves taking part in a one-to-one interview, which will take no more than an hour to discuss co-production/embedded research and evidence use in your organisation. You will be asked to complete a consent form to indicate your willingness to take part in this research and the interview will be recorded. The interview will take place at a convenient place at a time that suits you. Attached to this email is a Participant Information Sheet which explains the study in more detail.

Participation in this study is entirely voluntary.

If you would like to register your interest in this study or ask any questions, please feel free to contact Abi Akintola (PhD Researcher) at Teesside University on [A.Akintola@tees.ac.uk](mailto:A.Akintola@tees.ac.uk) or 01642 342778.

Kind regards  
Abi Akintola

**Appendix 19: Reminder Email****Reminder email**

We recently contacted you about taking part in a PhD research project, which has been designed to explore the role of embedded research in co-producing public health knowledge in non-clinical settings. If you received the previous email and you are not interested in taking part in this project, please accept our apologies and ignore this follow up email. However, if you would be interested in taking part please read the email and the attachments below:

**Expressions of interest: Co-production/Embedded research project**

I am a PhD student undertaking research at Teesside University and I am writing to ask if you would consider taking part in my research project. I am seeking to interview public health embedded researchers and public health practitioners who are working/ have worked with an embedded researcher about their views and experiences about embedded research.

Participation involves taking part in a one-to-one interview, which will take no more than an hour to discuss co-production/embedded research and evidence use in your organisation. You will be asked to complete a consent form to indicate your willingness to take part in this research and the interview will be recorded. The interview will take place at a convenient place at a time that suits you. Attached to this email is a Participant Information Sheet which explains the study in more detail.

Participation in this study is entirely voluntary.

If you would like to register your interest in this study or ask any questions, please feel free to contact Abi Akintola (PhD Researcher) at Teesside University on [A.Akintola@tees.ac.uk](mailto:A.Akintola@tees.ac.uk) or 01642 342778.

Kind regards  
Abi Akintola

**Appendix 20: Interview Schedules for Participants**

**The role of embedded researchers in co-producing public health knowledge in non-clinical settings**

(Participants - Embedded researchers)

**Exploring participants' experiences, views and perceptions of embedded research**

**Interview schedule for embedded researchers**

**Introduction**

- (i) Check interviewee is happy to go ahead with interview
- (ii) Ensure consent form and demographic form have been signed
- (iii) Recording of interview- check interviewee is happy to have the interview recorded
- (iv) Briefly mention that all responses will remain confidential and will be anonymised
- (v) Ensure no further questions or concerns before commencing.

**Role identification and background information about the embedded research initiative**

1. What is your role in your organisation? **Prompt-** Job title, Daily task, Responsibilities. B) How long have you been in this role? C) Can you tell me about your background and what you do? **Prompt** -The journey so far- How do you get to where you are now? D) As an embedded researcher where is your academic affiliation?
2. How long has your embedded research initiative been going on in your organisation? B) Do you know the rationale for employing an embedded researcher in your organisation? C) Who funds your project? D)What is the management arrangement?

**Moving on to look at the embedded research initiative more specifically**

3. What is the aim of the embedded research project you are involved in? B) How many hours/days do you spend in your host organisation in a week, and in the academic institution? C) Why? D) How often do you contact your academic supervisor?
4. How has embedded research gone so far in your organisation? B) How many people are involved in the co-production/embedded research you are involved in? or who do you work with? C) How many embedded researchers are involved in the project? **Prompt** - How many professionals/stakeholders?

5. What are your views and experience of embedded research?

**Prompt**- what have you learnt? What, if anything, has helped? (Why do you say that?) What, if anything, has been more difficult or challenging? (Why do you say that)? What difference has embedded research made in your organisation? (so if embedded research has been useful, why and how?)

**Looking more specifically at the role of the embedded researcher in the organisation**

6. Can you think of any changes in practice/policy as a result of research evidence being used? **Prompt** – What role did you play? Who was involved? What changed? How? For who? How do you inform practice with research evidence?
7. Tell me what you think are the benefits of working as an embedded researcher? Why do you say that? B) How do you manage the dual affiliation? **Prompt**-what are the benefits (What has helped?) and also what are the challenges?
8. Tell me what you think are the challenges of working as an embedded researcher? **Prompt** - Why do you say that? B) What are the barriers to data sharing, if any?
9. Do you think building mutually beneficial relationships with the host organisation staff is important to the success of an embedded research project? If yes, Why? B) How do you build relationships with the host organisation's staff?



10. Can you cite an example of where you have built practitioners and other stakeholders' confidence in conducting their own research? B) What is your role, as an embedded researcher in bridging the gap between research evidence and its implementation in practice? C) Does your role require managing research funds? If yes, how do you manage this?
11. How often do you reflect on your role? **Prompt-** To know what works and what needs to be improved?
12. Do you think the development of a toolkit on the role of embedded research in bridging the gap between research evidence and its implementation in public health practice would be useful? If yes, Why and how do you think it could be used in practice?"
13. Any top tips for other researchers considering embedded research?
14. Please don't mention names, but can you think of any potential participants- people you are working with or have worked with that you can pass on the details of this research? B) Would you be happy to be contacted afterward to circulate details of this research to those you have identified, to see if they will be willing to participate in this research?

**Appendix 21: Interview Schedules for Participants**

**The role of embedded researchers in co-producing public health knowledge in non-clinical settings**

(Participants - public health practitioners)

**Exploring participants' experiences, views and perceptions of embedded research**

**Interview schedule for public health practitioners**

**Introduction**

- (i) Check interviewee is happy to go ahead with interview
- (ii) Ensure consent form and demographic form have been signed
- (iii) Recording of interview- check interviewee is happy to have the interview recorded
- (iv) Briefly mention that all responses will remain confidential and will be anonymised
- (v) Ensure no further questions or concerns before commencing.

**Role identification and background information about the embedded research initiative**

1. What is your role in this organisation? B) How long have you been in this role? C) Can you tell me about your background and what you do? **Prompt-** The journey so far- How do you get to where you are now?
2. How long has your embedded research initiative been going on in your organisation? B) Do you know the rationale for employing an embedded researcher in your organisation? C) Who funds your project?

**Moving on to look at the embedded research initiative more specifically**

3. What is the aim of the embedded research you are involved in? What problem is your embedded research initiative trying to solve?

4. How has embedded research gone so far in your organisation? B) How many people are involved in the co-production/embedded research you are involved in? **Prompt-** who do you work with? How many embedded researchers are involved in the project? How many professionals/stakeholders are involved?

**Looking more specifically at the role of the embedded researcher in the organisation**

5. What is the role of the embedded researcher you are working with in your organisation? **Prompt-** how does the embedded researcher carry out his/her work?) C) Do you think building mutually beneficial relationships with the host organisation staff is important to the success of an embedded research project? If yes, Why? D) How does the embedded researcher in your organisation build relationships with the host organisation's staff?
6. As a public health practitioner, what is your experience of working with an embedded researcher? **Prompt-** What lessons have you learnt from your experience of working with an embedded researcher? B) What benefit or what difference has the embedded research post made? **Prompt-** so if embedded research has been useful, why and how? What has helped?
7. Can you cite an example of where the embedded researcher has built your confidence in conducting your own research? B) Does embedded researcher role involve managing research funds? If yes, how is this managed? C) How often should an embedded researcher reflect on his/her role? **Prompt-** Why is this important?
8. Do you use research evidence in practice/policy? **Prompt-** If not, why not? If yes, how often do you use research evidence in practice or policy?
9. How do you get informed with relevant research evidence in practice? B) What role does an embedded researcher play in informing you with relevant research evidence? C) How has the role of embedded research bridge the gap between research evidence and its implementation in your organisation?

10. Can you give an example of where you used research evidence in practice/policy?  
**Prompt-** What happened? What role did you play? Who else was involved? What role did other people that are involved play? What changed? How? For who?
11. Apart from research evidence, what other evidence do professionals use? **Prompt-** Why?
12. Do you think the development of a toolkit on the role of embedded research in bridging the gap between research evidence and its implementation in public health practice would be useful? If yes, Why and how do you think it could be used in practice
13. Any top tips for other organisations considering employing an embedded researcher?
14. Please don't mention names, but can you think of any potential participants- people you are working with or have worked with that you can pass on the details of this research? B) Would you be happy to be contacted afterward to circulate details of this research to those you have identified, to see if they will be willing to participate in this research?

**Appendix 22: Interview Schedules for Participants**

**The role of embedded researchers in co-producing public health knowledge in non-clinical settings**

(Participants – Other stakeholders- teachers and students)

**Exploring participants' experiences, views and perceptions of embedded research**

**Interview schedule for other stakeholders (service users/providers)**

**Introduction**

- (i) Check interviewee is happy to go ahead with the interview
- (ii) Ensure consent form and demographic form have been signed
- (iii) Recording of the interview- check interviewee is happy to have the interview recorded
- (iv) Briefly mention that all responses will remain confidential and will be anonymised
- (v) Ensure no further questions or concerns before commencing.

**Role identification and background information about the embedded research initiative**

1. What is your role in your school? **Prompt-** what do you do? B) How long have you been in this role/school? C) Can you tell me about your background and what you do? **Prompt-** The journey so far- How do you get to where you are now?
2. How long has co-production research been going on in your school? B) How were you informed of the co-production research? C) Do you know the importance or benefits of co-production research to your school?

**Moving on to look at the embedded research initiative more specifically**

3. What is the aim of the co-production research you are involved in? B) What problem is the co-production research trying to solve?
4. What can you say about the co-production research? B) How many people are involved in the co-production/embedded research you are involved in? **Prompt-** who do you work with? How many researchers are involved in the project? How many students and teachers are involved?

**Looking more specifically at the role of the embedded researcher in the organisation**

5. What is the role of the researcher/s working within your school? **Prompt-** how does the embedded researcher carry out his/her work?) C) How does the researcher in your organisation build relationships with you and other people that are involved in the co-production research?
6. As a student, what is your experience of working with researchers? **Prompt-** What lessons have you learnt from your experience of working with researchers? B) What benefit or what difference has co-production research made in your school? **Prompt-** so if co-production research has been useful, why and how? What has helped?
7. Can you cite an example of where the researcher has built your confidence in conducting your own research in the future? B) How often should a researcher reflect on his/her role? **Prompt-** To know what works and what needs to be improved? **Prompt-** Why is this important?
8. Do you use research findings in the co-production research you are involved in? **Prompt-** If not, why not? If yes, how often do you use research findings in the co-production research you are involved in?

9. How do you get informed with relevant research findings in the co-production research you are involved in? B) What role does the researchers play in informing you of relevant research findings? **Prompt-** Does the research discuss research findings with you and other members of your team? C) How has the role of the researcher assists in using research findings in your school?
10. Can you give an example of where you used research findings in your school? **Prompt-** What happened? What role did you play? Who else was involved? What role did other people that are involved play? What changed? How? For who?
11. What is your view about the co-production research you are involved in? **Prompt-** What do you think about it? Why?
12. Any top tips for other schools considering co-production research? Any advice for other students about the co-production research team?
13. Please don't mention names, but can you think of any potential participants- people you are working with or have worked with that you can pass on the details of this research? B) Would you be happy to be contacted afterward to circulate details of this research to those you have identified, to see if they will be willing to participate in this research?

**Appendix 23:** COREQ (Consolidated criteria for Reporting Qualitative Research) Checklist (Tong et al., 2007)

A checklist of items that should be included in reports of qualitative research.

Topic	Item No	Guide questions/ Description	Reported on page number
<b>Domain 1: Research team and reflexivity</b>			
<b>Personal characteristics</b>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<b>Relationship with participants</b>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
<b>Domain 2: Study design</b>			
<b>Theoretical framework</b>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory,	



		discourse analysis, ethnography, phenomenology, content analysis	
<b>Participant selection</b>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<b>Setting</b>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of nonparticipants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<b>Data collection</b>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or	

		after the interview or focus group?	
Duration	21	What was the duration of the interviews or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or correction?	
<b>Domain 3: analysis and findings</b>			
<b>Data analysis</b>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	26 Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<b>Reporting</b>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Appendix 24: Table Showing an Example of the Qualitative Data Analysis

Theme Four: Keeping a Critical Reflection Trajectory	
<p><i>“I constantly reflect on my role to know what I am doing right, and what can be done differently”</i> <b>[ERsite1, Female, Embedded researcher]</b></p> <p><i>“I think they should be reflecting, reflective thinking and reflective writing, that should be part of their supervision, as well as regular reflective notes, both about themselves, what they have learnt and how they are gonna apply that learning”</i> <b>[PHP2site1, Female, Public Health Practitioner]</b></p> <p><i>“It needs to be a continuous process, and as you work along you have to, every now and then sit back and reflect and see what impact am I having as part of the work that I am doing? It is similar for all of us as public health practitioners. You have to reflect constantly on your practice and that’s no different for the embedded researcher- to understand what impact you are having in whatever you are doing. So you couldn’t necessarily put a timescale on it. It needs to be part of your routine practice, that’s how it’s got to be yeah”</i> <b>[PHP1site1, Female, Public Health Practitioner]</b></p> <p><i>“I think reflection is needed to make sure that actually what is being provided is beneficial to the team and person doing the work”</i> <b>[PHP4site2, Female, Public Health Practitioner]</b></p> <p><i>“I have to spend really more time reflecting”</i> <b>[ERsite2, Female, Embedded researcher]</b></p> <p><i>“[...] am thinking how often do I reflect on my role everyday. Am I on the right track? Are we doing the right thing? What is going on right and what is not going on well? I think reflection should be a constant thing”</i> <b>[PHP2site2, Female, Public Health Practitioner]</b></p> <p><i>“I don’t know how embedded research reflect on their role...I’m sure they share plenty frustrations with all their partners or with this organisation so they should be reflecting [...] but I don’t know how often they reflect..may be monthly”</i> <b>[PHP3site2, Male, Public health Practitioner]</b></p>	<p><b>Constant Reflection</b></p>

*“I think it’s always good to sort of like reflect on what we have done, how we do things erm I personally want to think about whether I could have done things better [...] so I think it’s quite important to sort of reflect on how you have done things, and how you could do things in the future, like what lessons you have learnt, I think it’s important to sort of reflect, to sort of think more about how you have done things and whether it could be practiced in the future [...] I always do it at the beginning of a new project, because I always want to know what I have learnt from the last project. Erm will this help me in the next project? [...] maybe like halfway through the project, [...] at the end of the project. [...] I would say a couple of times just to sort of checking to see whether things are going the way you would want them to go, whether we could do things better” [ERsite3, Female, Embedded researcher]*

*“I think there is definitely something about being reflective, to make sure that while this work is going on, something is continually communicated back, erm to make sure we understand whether there is any problem going on, or if there is something we need to do differently [...] erm because there need to be someone who can identify that there is a problem going on and resolve them as quickly as possible. Reflection should be continuous” [ST4site3, Male, Teacher/Stakeholder].*

*Reflection should be part of the day to day practice and I’m sure the researchers reflect on their role regularly, on the co-production work in the school, to know what and when to do things differently so that we can achieve our aims [ST3site3, Male, Teacher/Stakeholder].*

*“It might be while you drive home [...] might be in the shower [...] might be when I take the dog out for a walk and tea time to reflect because you do need time to reflect on your research, on your methodology ..about what the findings need to show [...] at times my bag is full of paper everywhere, millions of notes in here and I have to open and jot down some questions so that I won't forget it because they are so important” [ERsite4, Female, Embedded researcher]*

*“So, I think she is constantly reviewing how she is working, what she is working on, and as a researcher, she is always looking at what is happening and how she can work differently or how she can influence how we work. So, in terms of her reflection, her review, I think that is constant and circle between stages of her work. So, I think the researcher constantly looking at how they can*

<p><i>do things and I think the positive side is that because that is the case, there is a lot more information coming into our organisation through the researcher because the researcher constantly looking at different elements all the times, have come across this with this project or have we taught about this in this project, it is really relevant to that work. It is constantly moving, it is constantly evolving”</i></p> <p><b>[PHP1site4, Male, Public health practitioner]</b></p>	
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Appendix 25: Initial Seven Themes and Twenty-eight Codes of Findings from Qualitative Work

