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Assessment of Local Networking Strategies to Enhance Clinical Research Capacity in Zambia

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Abstract

Well conducted clinical research leading to the generation of evidence based guidelines, in low- and middle-income countries has been viewed as the means of making significant improvements to global health. This is because these are the regions that bear the highest burden of disease and premature death. Several efforts over the past two decades have therefore focused on research capacity strengthening initiatives as a way of increasing the amount of clinical research conducted in these regions. The aim of this study was to evaluate if setting up a local online network and holding a skills sharing workshop would raise the knowledge and confidence of researchers in Zambia and enhance their capacity to conduct independent clinical research. This was a before and after study that involved open discussions about clinical research in Zambia through a local online platform (the Zambian Clinical Research Forum), on the Global Health Network. A total of 19 members took part in the study, 12 of whom were emerging researchers and 7 established researchers. In addition to the discussions, a one-day research skills sharing workshop was conducted after the period of the discussions that brought together those who were interested in the conduct of clinical research in Zambia. Structured questionnaires were used as the assessment tool and administered before and after the online discussions and at the workshop. The Zambian Clinical Research Forum stimulated discussions between emerging and established researchers on the conduct of clinical research in Zambia and resulted in an increase in the research self-confidence of the emerging researchers as opposed to that of the established researchers. The conduct of the one-day skills sharing workshop also enabled the sharing of information, skills and experiences based on the conduct of clinical research in Zambia. Participation in the online discussions however did not illicit a demonstrable change in the reported

behaviour of the members in conducting clinical research related tasks. Furthermore, the discussions and interactions on the online platform were not continued beyond the study period. These findings indicate that the development of future network-based capacity building initiatives in Zambia should be underpinned by clear and achievable objectives that could drive the participation of those involved. There could also be a need to incorporate capacity building initiatives such as online platforms within the regular conduct of clinical research rather than as isolated ventures. This could be considered in Zambia by embedding such an online platform in institutions that can support this initiative and stimulate participation amongst their members.

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Table of Contents

List of Tables

List of Figures

Acronyms

CIDRZ – Centre for Infectious Diseases Research In Zambia

EDCTP – European and Developing-Countries Clinical Trials Partnership

GHT – Global Health Trials

HICs – High Income Countries

HIFA – Health Information for All

INDOX – INDia-Oxford

LMICs – Low and Middle Income Countries

MIM – Malaria Institute at Macha

MSc – Master of Science

NHRAC – National Health Research Advisory Committee

NSTC – National Science and Technology Council

OXTREC – Oxford Tropical Research Ethics Committee

RSES – Research Self-Efficacy Scale

SOC – Stages of Change

TDR – Tropical Diseases Research

TDRC – Tropical Diseases Research Centre

TGHN – The Global Health Network

UNZABREC – University of Zambia Biomedical Research Ethics Committee

UTH – University Teaching Hospital

WHO – World Health Organisation

ZCAHRD – Zambia Centre for Applied Health Research and Development

1 Introduction

One cannot talk about the achievement of good health without mentioning evidence based guidelines. These in turn cannot be detached from the conduct of clinical research. The importance of clinical research in generating the evidence required to improve health has been discussed widely in literature and Lang et al. (1) particularly state that “clinical trials establish the evidence base for the prevention and treatment of disease”. They go on to say that clinical trials are more likely to be of benefit in low- and middle-income countries (LMICs) due to the high disease burden and the lower percentage of global clinical research conducted in these countries (1,2). According to the World Health Organisation (WHO), 70% of the world’s population in the least well off regions of sub-Saharan Africa, Asia and Latin America have the highest burden of disease; premature death and unfortunately also the lowest percentage of global research (3). This may be due to the lack of capacity for independent clinical research in these low- and middle-income countries, which lags behind that of high-income countries (HICs). The World Health Organisation further reports that the achievements of health research, such as reduced burden of disease, improved quality of life and increased life expectancy have so far only been realised in the high-income countries that make up for only 30% of the world’s population (3). It is therefore important for global clinical research to involve the participation of all countries in order to improve the current state of the world’s health. The World Health Report of 2013 emphasises that, “because local problems require local solutions, each country should be a producer as well as a consumer of research” (4). It is even more critical to encourage more clinical research in the areas where it is most needed and especially that conducted by local researchers who understand the unique research needs and priorities of these areas.

The conduct of clinical research in low- and middle-income countries would particularly be enhanced if the researchers in these countries worked together to ensure that this becomes a reality. The world today revolves on networking, be it social networks, professional networks or skills networks among others. However, areas that stand to benefit most from networking are lacking such vital networks and one such area is clinical research in low- and middle-income countries. To echo this need, the Zambia National Health Research Strategic Plan of 2008 – 2011 described health research in Zambia as being “fragmented, ineffectively coordinated and inadequately monitored” (5). In addition to focusing on conducting research, low- and middle-income countries researchers should hence make it a priority to be connected to each other in order to share ideas and integrate research programmes. Rather than work in isolation, they should come together regardless of the area of expertise to jointly tackle the challenges common to them. This could be done through the sharing of knowledge, data and open access resources through digital technologies (2). Adopting the most reliable form of digital communication such as mobile networks in resource limited areas could enhance collaborative research even in remote areas. This may promote the creation of local research networks and strengthen the research environment as well as overcome the challenges that prevent researchers in different locations from getting together physically. However, before the initiative of sharing data digitally among researchers is implemented, challenges such as unreliable electricity supply, inadequate computers, lack of maintenance and IT skills should be carefully considered. In addition, factors that can discourage data sharing such as ethical considerations, arising from sensitive or confidential information and the highly competitive nature of research should be well balanced against the benefits of collaboration (2).

This study aims to evaluate if setting up a local research online network and holding a skills sharing workshop would influence the capacity of clinical researchers in Zambia and enable the sharing of experiences, knowledge and methodology. This is based on the realisation that clinical researchers in Zambia rarely communicate among themselves to share skills and information, thus impacting negatively on their overall capacity to conduct independent clinical research. An online network was chosen over face to face meetings due to the perceived difficulties in getting researchers together for face to face meetings. This is from the background that such meetings are usually successful in Zambia when held as part of professional and work programmes rather than as an external isolated venture as could have been regarded for this study.

1.0 Background

The conduct of clinical research in low- and middle income countries has been increasing steadily over the years. However, most of these studies are designed and led by organisations in Europe and the United States of America. In addition this has not been substantial as there are still too few studies and hardly any that are designed and led by local researchers. This is especially so in the countries that stand to gain the most from the evidence generated through clinical research (6). On examination of the clinical trials registered on ClinicalTrials.gov for instance, less than one sixth of the trials registered for Zambia are conducted wholly by local principal investigators (7). Therefore, there is an unmet need to encourage more locally-led research despite the challenges facing the conduct of clinical research in low- and middle-income countries. Perceived barriers to clinical trial conduct in low- and middle-income countries have been described widely in literature and include inadequate funding, lack of human and material capacity, cultural, regulatory and organisational challenges

(6,8–10). Suggestions to help address these challenges have also been put forward, mainly focusing on community engagement; institutional strengthening and capacity building encompassing training, knowledge sharing and collaboration (8,11). Such suggestions targeted specifically at strengthening clinical research capacity among local researchers in these regions, could go a long way in increasing the amount of clinical research conducted in low- and middle-income countries.

1.1 Study Justification

The rationale for this study was based on the findings that emerged from a Masters dissertation on 'a qualitative assessment of the challenges encountered by research workers in the conduct of clinical trials in developing countries' (12). Rather than just challenges to clinical trials, a number of facilitating factors were proposed and networking was one of the key factors. Similarly, key enablers of knowledge sharing and experience exchange emerged from a qualitative study aimed at understanding the investigators in Ethiopia (8). This study used the findings generated to support the plan of setting up an online network and holding a skill-sharing workshop. The data from these previous studies were also used to develop discussion points to inform the running of an online network focused on bringing local researchers together. A collaborative programme aimed at addressing issues concerning clinical research conduct in low- and middle-income countries and targeted at local researchers could benefit them by providing the support needed to conduct research. This could be in form of an interactive platform that allows the sharing of experiences, skills and methodology (1). Sharing methods could also minimise duplication of studies and hence speed up research (11). The idea behind the development of a network of local researchers came from the realisation of several efforts being put into north-south and

south-south collaborations and not many calls for in-country collaborations (13). Bringing researchers together was hoped to stimulate open discussions on clinical research and enable the sharing of knowledge and experiences to create mutual support and encouragement.

By making it a priority to be connected to each other, low- and middle-income countries researchers would strengthen research, build a supportive environment and create communities of practice for sharing knowledge across different institutions (14). These communities could be subject or discipline specific; could be a great platform for the implementation of training and mentoring schemes; and enable better integration of research programmes (14). This could encourage local researchers to take on the responsibility of developing and strengthening capacity for research directed to their local research environment. The advantage of an online network is that it can address the challenges of distance, location and time that prevent people from coming together (2) and has the potential to be more sustainable beyond this study. The advancement of digital technology has been said to have enabled many more people to make use of online resources and methods of communication. The Global Health Network (TGHN) is one such platform that has over 300 thousand users making use of its resources. The Global Health Network is a collection of interlinked websites, each being a separate subject-specific entity with specialised goals and objectives aimed at building open collaborations to facilitate global health research (15). Global Health Trials (GHT) for example, is one of the communities on The Global Health Network, designed specifically to support low- and middle-income countries-based trials. This is through the provision of research guidance, tools, resources, training and professional membership schemes (16). In addition, Global Health Trials regularly joins up with

local clinical research facilities and universities to offer free, one-day research skills sharing workshops across the globe. These workshop days offer cross-cutting talks about clinical research and are suitable for the whole research team (16). Such communities bringing together researchers from across the globe could be a source of motivation for researchers within regions or countries to come together with the aim of strengthening their regional networks.

1.2 Goal

The goal of this study was to work with local researchers to evaluate practical and sustainable strategies for enhancing the knowledge and confidence to undertake their own locally-led research and assess whether these could be impactful.

1.3 Aim

The aim of this study was to assess if setting up a local online network and holding a skills sharing workshop would raise the knowledge and confidence of researchers in Zambia and enable the sharing of experiences, knowledge and methodology.

1.4 Objectives

1. To identify emerging and established researchers in Zambia and to assess their conduct of clinical research;
2. To assess whether it is possible to establish a sustainable online network between these groups to share experiences, knowledge and best practice;
3. To hold a workshop on clinical research in Zambia in order to discuss the barriers and enablers to local investigators conducting research within Zambia;

4. To assess whether the online network and the workshop had any impact on the knowledge and confidence of both the emerging and established researchers in conducting their own research and to make the necessary recommendations.

1.5 Research Questions

1. How can the interaction of local researchers through an online platform enhance the existing capacity to conduct independent clinical research?
2. How will open discussions between established and emerging researchers contribute to strengthening research networks?

2 Literature Review

This review of literature sought to identify studies relating to the importance of conducting clinical research in low- and middle-income countries; the barriers to conducting clinical research; the strategies that have been employed to address them and enhance clinical research capacity and the role of networking on clinical research capacity development. I searched the following electronic databases PubMed, Global Health Library and Google Scholar using keywords such as “clinical research capacity”, “networking”, “collaboration”, “strategies”, “developing countries” and “Zambia”, to mention just a few. I retrieved the full text of previous studies, reports and opinion documents relevant to the various aspects of this study. Alternative words describing the keywords were used to make the literature search all inclusive to avoid missing out on key information. Most of the literature included in this study were accessed through Google Scholar which was used to complement the PubMed and Global Health Library databases as these only brought out few studies. The literature search was not limited to a particular time period, however the literature accessed mainly extended over the previous two decades.

2.1 Significance of Clinical Research Conduct and Barriers

Clinical research in low- and middle income countries is not a new topic in the literature and the importance of conducting clinical research in such areas that stand to benefit the most from it, cannot be over-emphasised. It has been stated that, “inequalities in health research contribute to inequalities in health” (17). In order to improve the overall health of the world, all countries must make it a priority to get involved in the conduct of clinical research (4). As Jaffar et al. (18) state from their study on research in Africa, the highest disease burden experienced in sub-Saharan Africa can be addressed by

conducting more programme-based health services research. They go on to stress that for this to be achieved there is an urgent need to scale up the impact of health interventions by investing more funds in research and enhancing research capacity and training (18). In addition to reducing the disease burden and improving health, it has been noted that the conduct of research in low- and middle-income countries also increases familiarity with research methodology principles and stimulates critical thinking (6). To maximise the benefits of clinical research conduct Yusuf (6) evaluated the hindrances that make such areas lag behind the rest of the world in the conduct of research and described a number of barriers to clinical trial conduct in these countries. These included, lack of training; inadequate funding for research; participant recruitment and retention challenges; lack of data management facilities; inaccuracy and lack of adherence to study protocols; cultural and organisational challenges (6). Moreover factors such as illiteracy, poverty and fragmented healthcare systems have been known to make populations vulnerable and in turn contribute to the challenges of clinical trial conduct (10). Franzen et al. (8) also went on to add to the barriers to investigator-initiated clinical trials in Ethiopia and these included lack of human and material capacity; regulatory and administrative hurdles; operational challenges and the lack of confidence, motivation and awareness. This was in an effort to increase investigator-initiated trials for the purpose of generating evidence that could be applicable to improving the health of the local population.

Generally a lack of capacity for independent clinical research seems to be the overriding challenge. Clinical research capacity is claimed to be widely inadequate across several low- and middle-income countries (19) and is described as “comprising the institutional and regulatory frameworks, infrastructure, investment and sufficiently

skilled people to conduct and publish research" (17). These and other studies seeking to understand the dearth of clinical research in the least well-off regions of the world give us a picture of the emphasis that is placed on clinical research for the improvement of health in these countries. The understanding of hindrances to research in these regions would however be futile without accompanying suggestions to address them. Although there is a large literature on barriers to clinical research in low- and middle-income countries, few strategies to enhance clinical research capacity in these countries have been adequately evaluated, less so implemented.

2.2 Strategies Enhancing Clinical Research

The approaches to enhance clinical research and clinical trials in regions such as Africa, Asia and Latin America have focused mainly on capacity building. Different definitions of research capacity building have been employed based on the particular strategies and processes used to build research capacity. The definition of research capacity building has also been said to be dependent on whether capacity building is considered as a means to an end or as a goal in its own right (20). When considered as a means to an end, research capacity building has been defined as referring to the skills and infrastructure which allow for research to be conducted leading to the generation and dissemination of knowledge for the improvement of health and to lobby for more research funds (21). Though considered difficult to define, most definitions of research capacity building have ultimately focused on the improvement of health which should be sustainable (22). This is an important factor in adopting the right approaches for research capacity building. Nchinda (19) emphasises that "building research capacity in the south is too important to be left to chance" and that assessing the priority research needs and the available human resources for health research is a

vital step in the capacity building process. He further states additional components of research capacity building which include research training and institutional strengthening, which must be sustained and have long term goals (19).

Other authors have also argued that research capacity strengthening is “one of the most powerful, cost-effective and sustainable means of advancing health and development” (23). It has further been suggested that research capacity building should be based on certain principles in order to have a positive influence on health care and for the purpose of measuring this influence. “These principles are that research capacity building should: develop skills and confidence, support linkages and partnerships, ensure the research is 'close to practice', develop appropriate dissemination, invest in infrastructure, and build elements of sustainability and continuity” (24). Among these principles, the idea of networking and partnerships has been stated as being integral to capacity building as it enhances the ability to do research through the building of relationships and the sharing of knowledge (25).

Additionally, Lang (2) has proposed that rather than working in isolation to enhance clinical research capacity, researchers in low- and middle-income countries should come together regardless of their specialist areas to cooperatively find ways of addressing common problems. Strategies based on the networking of local researchers incorporating training, knowledge sharing, experience exchange and collaboration have also been suggested as a means of strengthening their clinical research capacity (8). Emphasis has also been placed on the need for such researchers to take on the responsibility of increasing capacity for research and directing it to their local context. Some other approaches to research capacity building include, enhancing existing research activities for more established institutions and

investing in basic infrastructural components such as buying computers and hiring staff for the less established research institutions (21). Generally most approaches though different are directed at individual, institutional and societal levels.

Due to the numerous definitions and resultant approaches employed for research capacity building, it is difficult to have a uniform evaluation technique. It may therefore be more appropriate to evaluate the implementation of capacity building processes and the resultant impacts (20). Successes of capacity building initiatives in some cases have been described as the achievement of sustainable capacity. This is however not an easy target to achieve as it is constantly affected by high turnover of staff, challenges in integrating new activities into existing systems, securing funding and influencing policy changes (22).

2.3 Collaboration to Strengthen Clinical Research Capacity

The World Health Organisation states that collaboration between experienced and inexperienced individuals can be seen as a way of increasing confidence and contributing to the success of capacity building (3). Research collaboration whether between institutions, within countries and across national borders increases the flow of knowledge and provides access to external resources thereby strengthening the capacity to conduct research (3). Most of these approaches to strengthening research capacity and increasing the conduct of clinical research are focused on networks of capacity, with researchers coming together and working on collaborative projects. Other strategies to increase the conduct of clinical research in low- and middle-income countries have focused on institutional rather than individual collaborations and more so with institutions or organisations in high-income countries. These collaborations have resulted in centres of excellence based in institutions in low- and middle-income

countries, usually specialised in particular research fields and have been known to make a tremendous contribution to the conduct of clinical research.

Collaborative research, the force behind most of the studies being conducted in low- and middle-income countries is the main reason for the steady increase in clinical research that has been observed over the past two decades (26). With several research collaborations having been developed between the north and south countries, researchers in the south countries have acquired skills for independent clinical research and their research capacity has been enhanced. This has been done through research organisations such as the Wellcome Trust, the World Health Organisation - Tropical Diseases Research (TDR) and the European and Developing-Countries Clinical Trials Partnership (EDCTP) that have all invested in networks (13). The EDCTP with the aim of creating a sustainable environment for conducting high-quality medical research in sub-Saharan African countries, offers larger grants that focus on clinical trials as the basis and provide opportunities for networking and capacity development (13). To encourage south-south linkages in addition to those with the north, the EDCTP has created regional networks of excellence comprising research institutions with complementary research expertise. These provide training to less endowed centres in their region to strengthen their capacity to participate in multicentre trials (27,28). These networks of excellence have also been envisaged to promote strong collaboration, resource sharing and cross mentorship which will enable the south countries to participate actively and own the means for solving their own health problems (29,30). The INDia-Oxford (INDOX) Cancer Research Network is another example of a partnership that facilitates the capacity building of the Indian investigators through training to enable them design and conduct their own studies

(31). These north-south collaborations have been viewed as the solution to the need to scale up the conduct of clinical research in the countries of the south (32). Conversely rather than focusing on the benefits and advantages of these partnerships, it is paramount to also evaluate any weaknesses of such collaborations to which several authors have made reference.

Volmink & Dare (17) agree with the notion that collaboration in research may be one vehicle for strengthening clinical research capacity in less privileged countries. They however go on to state that because collaborations with the north are more preferred by African researchers compared to those within their countries or region, it is vital to set clear guidelines for north-south collaborations to avoid scientific colonialism (17,33). This can lead to inequalities in research partnerships were less privileged countries are merely used for research rather than benefiting from the research to enhance their own capabilities. In agreement with this, Zumla and Costello (34) state that some forms of north-south research interactions may not focus much on ownership, sustainability and the development of national research capacity. Though they do not entirely oppose partnerships with the north, they propose that these should be cooperative and guided by principles such as ownership and the development of the research capacity of the south countries (34). Edejer (35) further reiterates the importance of having principles to guide north-south research partnerships which include monitoring and evaluation of research collaborations and focusing on increasing research capacity. Such principles are viewed as creating partnerships that are mutually beneficial to both parties involved, as the focus will not only be on generating scientific results. Lansang & Dennis (26), however argue that though these partnerships provide several research benefits and seem to be sustainable, mutually

beneficial partnerships are often difficult to maintain as they come with their own costs. These include “loss of autonomy, financial costs associated with organisational functions of the partnerships and most importantly, the increased time and effort needed to build trust, create feelings of ownership, share decision-making, promote transparency and sustain indigenous research capacity” (26). North-south collaborations can therefore be deemed to be beneficial to low- and middle-income countries when such costs are considered, the partnerships are transparent and are guided by the overall aim of enhancing clinical research capacity in these countries. Learning from the successes and shortcomings of such networks, there are now several calls for in country collaborations to advance the strengthening of local research capacity and prevent the over reliance on foreign based solutions to address indigenous challenges. With the sustainability of north-south collaborations regularly being in question, it would therefore be important to explore how researchers in the south countries can collaborate among themselves to further enhance their capacity to conduct locally initiated clinical research.

Collaborations within countries of the south are unfortunately quite minimal and in some regions non-existent due to the lack of co-ordination of the researchers in these regions (36). Due to the scarcity of dialogue within the African research environment Harle (14) emphasises the need for African researchers to be connected to each other and for networking between them to be made a priority. It has widely been observed that African researchers communicate more with European, North American and Asian researchers than they do with colleagues within their countries or regions. Though he does not discourage connections among the global research community, he stresses that local networking should be more encouraged as this will in turn strengthen

international collaborations (14). Many research networks have been known to exist in low- and middle-income countries but have struggled to maintain significant activity and ended up becoming dormant (14). To promote sustainability of these networks, they should be underpinned by clear agendas and objectives and the target group should be well defined for the purpose of building a network that will motivate researchers to take part. Harle (14) further argues that networks should aim towards developing communities of excellence as opposed to the centres of excellence that have been the common trend. Communities of excellence encourage communication among researchers based in different institutions and hence foster inter-institutional collaborations that contribute to institutional capacity development and link researchers across various institutions. Institutional capacity development also encourages integration and sustainability and offers greater opportunities for recognition and support by governments (29,37).

To support the need for collaboration among institutions within low- and middle-income countries and to foster increased networking Ghaffar et al. (38) propose that a change in mind-set is needed to overcome the isolation that results from the view that research should be competitive. They go on to stress that researchers should understand that collaboration is critical for facilitating larger and better funded research projects, that have the ability to contribute more substantively to informing health policy (38). Such a change in mind-set has the impetus to improve the effectiveness of local collaborations in strengthening research capacity. An example of a growing interest in networking can be seen within the Zambian context where several institutions have recognised the importance of connecting with like-minded institutions for the achievement of their research objectives and avoiding duplication of studies. This has

been done through the Ministry of Health that has established the National Health Research Advisory Committee (NHRAC), a network of individuals across multiple disciplines who work together to advance solutions in health research (39). In addition the Zambia Forum for Health Research (ZAMFOHR), a non-governmental organisation launched in 2005 is another strategy aimed at promoting research networking. It is particularly focused on bringing researchers, research users and health-equity institutions together to engage the government on research issues (40). These networking efforts are steadily building the spirit of networking in Zambia which is still in its infancy. In order to gain the most from local networking, it is important to realise that it is no simple task and adequate thought, consideration and planning should be put into its development. Whether targeted to a particular discipline or interdisciplinary, networks should offer opportunities to keep people involved. The type of networks that would work best for a particular area should also be well examined as well as the best means of communication.

2.4 Open Access Online Communication Platforms

Online platforms of communication have recently been taking precedence over face to face means of sharing information (2), especially since they are said to overcome the challenge of getting individuals from different locations together in person. Additionally, the innovative use of digital technology has been viewed as stimulating important changes in global health research. These technologies used in combination with open access resources sharing and knowledge exchange could have the stimulus to enhance clinical research capacity in low- and middle-income countries (2). The Global Health Network is one such platform making use of digital technology. It was created to enable the formation of communities of practice to develop protocols,

exchange research instruments and share skills (11). Since 2011, the project has been used by more than 60 000 researchers, nurses, technicians and scientists from several low- and middle-income countries to share research methods, knowledge and processes (11). Health Information For All by 2015 (HIFA2015) is another great example of an online network that provides a platform for people to connect around a shared goal, to create a world where people are no longer dying for lack of basic health care knowledge (41). However, before digital technological approaches are implemented the challenges associated with their use need to be addressed and these include unreliable electricity supply, lack of or inadequate computers and lack of IT skills. In addition, there should be a willingness among the research community to engage in such data sharing activities despite the competitive view of research conduct (2). Online approaches like these could overcome the barriers encountered in getting researchers from various locations together for research meetings or discussions. Nonetheless rather than moving away from face to face meetings entirely, these can still be held every now and then within institutions to enable researchers to meet and engage in discussions as a way of sustaining online networks (14). Such meetings being within institutions can complement online networks by bringing individuals with different disciplines together and can also form the basis for inter-institutional collaborations. Based on the successes of the existing online platforms in achieving their goals of sharing information and resources, online methods of collaboration that are free, open access and encourage data sharing and knowledge exchange could be envisaged to make a significant contribution to research capacity strengthening. However how such online initiatives can be targeted to strengthening the capacity of individual local research environments within low- and middle-income countries has not been adequately addressed. This is because most of the successes

of online platforms have mainly focused on the statistics of the number of visits and the overall use of the available resources rather than on the evaluation of the actual individuals who use these platforms. Additionally the assessments of such initiatives for their outputs of enhancing clinical research capacity particularly in areas where the need is greatest, has not been clearly described.

This study aimed to fill this knowledge gap by building on such networking efforts for the enhancement of clinical research capacity in Zambia. This was done by bringing both emerging and established researchers together on an online platform to enable the sharing of research knowledge, methods and experience. This was using an open access approach to stimulate open discussions and a sense of belonging among each of the members. To complement the online network, a one-day skills sharing workshop was also conducted with the sole involvement of the Zambian local research community. An assessment of the influence of these activities on the research confidence and behaviour of both the emerging and established researchers in performing certain research related tasks was also conducted. This was used as a marker for assessing the effect of the networking activities on clinical research capacity strengthening.

3 Methodology

This chapter sets to describe how this study was conducted and outlines the study design that was used; the location of the study; the data generated and how it was collected; the assessment tool and the method of data analysis. I am a Zambian Pharmacist with a biomedical background and limited experience of social science research methods. However, having pursued a taught masters in Global Health Science prior to this study provided me with training in qualitative research methods for the conduct of a qualitative study leading up to a masters dissertation. My previous experience and training in social science methods therefore equipped me to conduct this study with a refinement of my qualitative research skills throughout the process. My position as a Zambian Pharmacist with a biomedical background had an important influence on my choice of research area, my ability to conduct the study and the approach used to conduct the analysis.

3.1 Study Design

This was a before and after study that involved open discussions about clinical research in Zambia through a local online forum on the Global Health Network. This design was chosen for the purpose of assessing the influence of practical strategies on the local clinical research capacity. Structured questionnaires were used as the assessment tool. A pre-discussion questionnaire was administered prior to the commencement of the online discussions and a post-discussion questionnaire at the end of the discussion period. In addition a one day research skills sharing workshop was conducted after the period of the discussions that brought together those who were conducting, or were interested in conducting clinical research in Zambia. A feedback questionnaire aiming to assess the influence of the workshop on the sharing

of knowledge, skills and experiences was administered at the beginning and at the end of the workshop.

3.2 Location

The study was conducted in Zambia, a lower- middle-income country located in sub-Saharan Africa. With health research in Zambia being described as not very well coordinated in the National Health Research Strategic Plan of 2008 -2011 (5), this was a viable location for the engagement of researchers in networking strategies. Moreover, my background of working in Zambia as a Pharmacist meant that I had prior knowledge of the needs and challenges within this setting. The specific target sites were the University Teaching Hospital (UTH), the Ministry of Health, Ministry of Community Development Mother and Child Health and the various independent research organisations such as the Centre for Infectious Diseases Research in Zambia (CIDRZ) and the Zambia Centre for Applied Health Research and Development (ZCAHRD). The University Teaching Hospital is the country's only tertiary hospital and being a teaching hospital, it was viewed as having a diverse range of health workers and academicians who could provide a variety of views and experiences on the research topic. The Ministry of Health and the Ministry of Community Development Mother and Child Health being government structures were vital for identifying researchers involved in public-sector research and providing information for clinical research in Zambia. The independent research organisations on the other hand provided opportunities to identify and engage with researchers involved in independent health research projects. All of these target sites are based in Lusaka the capital city of Zambia. The other relevant public and private research organisations such as the Tropical Diseases Research Centre (TDRC) in Ndola on the

Copperbelt Province and the Malaria Institute at Macha (MIM) in Monze in the Southern Province, being located outside the capital city were not included in the study due to the limited study time.

3.3 Members

The individuals approached to be part of this study were referred to as members rather than participants as the study involved joining an online platform and engaging in discussions about clinical research in Zambia. The target group included established independent clinical researchers and emerging researchers mainly comprised of health workers and academicians interested in conducting clinical research but were not yet doing so. The projected sample size was 10 for the established researchers and this was arrived at based on the number of local investigators identified on the clinical trials registry platforms, for studies registered under Zambia. Less than 16% of the studies registered under Zambia were conducted wholly by local researchers hence the small sample size. The anticipated number of emerging researchers to be recruited for the study was 20. This was based on the recruitment method which was purposive seeking to identify individuals with an interest in research to best inform the study topic. The sample size was regarded as sufficient for the purpose of having a reasonable number of members engaging in discussions on the online platform. The recruitment was also flexible, as varied methods of recruitment were employed such as local introductions and referrals. The recruitment process involved approaching the prospective members and explaining the study by talking them through the information sheet that was provided (Appendix section 8.1) and thereafter establishing their interest to be part of the study. This was affirmed by the signing and dating of the information sheet by the members.

I identified the established independent local researchers through clinical trials registry platforms namely ClinicalTrials.gov and the World Health Organisation, International Clinical Trials Registry Platform (7,42), prior to the beginning of the recruitment process. In order for the identification of the established researchers to be thorough and all inclusive, I also obtained a database of approved studies of health research in Zambia from the Directorate of Public Health and Research at the Ministry of Health. This database was used to identify additional established researchers who were not on the clinical trial registry platforms and also to retrieve contact details of those initially identified. The final list of researchers to approach was arrived at by excluding those who were not based in the capital city and those who were in top positions at the public sector level, such as Permanent Secretaries and Deputy Ministers as these would have been difficult to approach. I was put in touch with the majority of these researchers through a respected researcher in Zambia, who being an established researcher himself was in contact with most of the other researchers. He served as my first local point of contact for the conduct of this study and provided the guidance I needed on how to proceed through the stages of conducting this study in Zambia. I personally made follow-ups on the established researchers who could not be reached by phone and those who were not known by my local advisor. This was done by visiting each of the institutions or organisations they were affiliated to and making appointments to see them.

The established researchers approached were based at Non-Governmental research organisations, research collaborative departments at the University Teaching Hospital, the University of Zambia School of Medicine departments and some clinical departments at the University Teaching Hospital. Based on a subjective affirmative

response as to whether the approached researchers had been or were principal investigators on previous or current studies, they were asked to take part in the study. Being a Zambian, I understood the local way of communicating and was able to raise support for the initiatives of this study. The overall response was favourable with the majority of researchers taking a keen interest and agreeing to take part in the study from the onset. Working commitments prevented three of the established researchers who were interested in the study from taking part, while one researcher could not be reached altogether and was therefore not included. By the end of the recruitment period, which took approximately three weeks, 10 established researchers agreed to take part in the study by signing and dating the information sheet that was provided. The job titles of the established researchers included Clinical Specialists, Consultants, Investigators, Lecturers, Student-Research Supervisors and Heads of Departments.

The emerging researchers who were mostly health workers and academicians interested in conducting clinical research were recruited by snowball sampling and direct introductions through word of mouth. Snowball or chain sampling "may be defined as a technique for gathering research subjects through the identification of an initial subject who is used to provide the names of other actors*"* (43). This method of recruiting emerging researchers was chosen based on the premise that it would have been difficult to identify such individuals without the help of those who had similar interests. The individuals initially identified through direct introductions were asked to identify other colleagues or workmates who they knew would be interested in conducting research and these were the ones approached for the study. This however meant that individuals interested in conducting independent clinical research in Zambia but not known by the members already recruited, were left out as no other

means of identifying them were employed. The recruitment was limited to the University Teaching Hospital because being a public sector institution, it was easier to access the relevant contact persons to assist in identifying emerging researchers. My previous experience of working in a public sector institution in Zambia also provided me with the knowledge of which avenues to take in identifying who to approach for the study. This was in comparison to private sector institutions where a point of contact was needed to gain access. In addition to being a teaching hospital, it provided an opportunity to recruit emerging researchers with varied expertise ranging from health workers to academicians.

Different departments at the University Teaching Hospital such as the Pharmacy, Medicine, Biomedical and Post Basic Nursing departments were targeted for the identification of emerging researchers. I accessed these departments through the Heads of Department in some cases and through initial contact persons in other cases. This was for the purpose of having a systematic method of approaching emerging researchers as one contact in each department linked me to another through the method of chain sampling. The approached individuals were asked if they had an interest in conducting independent research and based on a subjective affirmative response, were asked to take part in the study. Similar to the established researchers, the majority of the emerging researchers approached, agreed to take part in the study. Two of the emerging researchers approached, declined to take part due to professional commitments and time constraints and an additional two others who were proposed by their colleagues could not be reached. After the three week recruitment period, a total of 18 emerging researchers were recruited to take part in the study after they signed and dated the information sheet provided. Their job titles included

Clinicians, Lecturers, Pharmacists and Biomedical Scientists. This brought the number of both established and emerging researchers who agreed to be part of the study to 28.

3.4 Operational Plan

During the recruitment process, the stages of the study were clearly defined and both the emerging and established researchers were required to complete a structured questionnaire at the onset and then take part in online discussions for a period of approximately 5 weeks. They were then required to complete another questionnaire at the end of the discussion period. Following on from this, a one day skills sharing workshop on the conduct of clinical research in Zambia was conducted and this was open to the wider research community in Zambia in addition to those who took part in the study. A feedback questionnaire was administered at the workshop and it was composed of two parts, the attendees were asked to complete the first part at the start of the workshop and the second part at the end of the workshop.

3.4.1 Online Network

I developed the network as a space on the existing Global Health Network (https://tghn.org/) within the Global Health Trials area (https://globalhealthtrials.tghn.org/community/groups/group/zambian_clin_res/). I named it the Zambian Clinical Research Forum for the purpose of stimulating a sense of ownership among the members. A brief description of what the group was all about and what was required of each member of the group was also added to provide guidance. All of the members who were recruited were asked to join the online local network and engage in discussions about the conduct of clinical research in Zambia. The Zambian Clinical Research Forum was created as an open access group and the

only requirement for joining the group was registering to be part of the Global Health Network, which is a simple sign up process requiring individuals to input their name, email address and job title. The open access nature of the group was hoped to instil a sense of belonging among all the members by avoiding the process of waiting to be granted access. This was also in order to facilitate the sharing of knowledge, methods, experiences and concerns freely. It was also hoped that participation in the group discussions would make the members more informed about the roles and needs of each other in relation to research. In order to encourage participation in the online discussions each member was informed during the recruitment process that they were obliged to contribute to the discussions at least once every week. This was done in order to avoid overwhelming the members based on the knowledge that they already had work commitments. In view of this, I only posted one discussion topic to the group every week.

The discussions were driven by topics generated from the findings of my previous Master of Science (MSc) in Global Health Science project entitled: 'A qualitative assessment of the challenges encountered by research workers in the conduct of clinical trials in developing countries' (12). This formed the project component of my taught MSc, which I also completed while based at the Global Health Network. The aim of this previous project was to better understand the experiences that research workers had, while conducting clinical trials in Nigeria, Uganda, Tanzania, Malawi and India. The findings revealed both barriers that they encountered and facilitating factors on how to improve clinical trial conduct. On further evaluation of the findings, a number of questions were generated, mainly linked to the role of local researchers in conducting clinical trials; the communication system among them; and how the

barriers can be addressed in the planning stages of research. A list of the discussion topics developed from these questions is provided (Appendix section 8.2). I went to efforts to promote a sense of belonging within the Zambian Clinical Research Forum by discussing issues that I knew were relevant to the Zambian clinical research setting and through encouraging a participatory approach regardless of discipline, job title or research level. I maintained the discussions for five weeks with one discussion topic posted at the beginning of each week. I also sent out email notifications at the beginning of each week to every member to notify them of the new discussion topic. This was followed up by a reminder mid-way through the week encouraging members to contribute to the discussions or sign-up to join the group if they had not already done so.

3.4.2 Structured Questionnaire

The assessment tool for this study was a structured questionnaire modified from a Research Self-Efficacy Scale (RSES) and a Stages of Change (SOC) tool. The original RSES and SOC statements are provided (Appendix section 8.3 and 8.4). These were used respectively to assess research self-confidence and progress in changing members' attitudes, intentions and actions in relation to the conduct of research. A copy of the questionnaire is provided (Appendix section 8.5). The questionnaire was adapted from previously validated standardised questionnaires based on the Research Self-Efficacy Scale and the Stages of Change tool (44–46). According to Unrau and Beck (44) the Research Self-Efficacy Scale had good internal consistency when used at pre-test and post-test for their studies. They went on to state that though designed to test research self-confidence among social work students, it also had face validity for use in other professional programmes (44,45).

The items of the Research Self-Efficacy Scale used for this study were modified so that they could correspond to the discussion topics used for the online forum. Minimal changes to the items were made but the nature of the questioning was maintained in order to assess how confident individuals were in performing research tasks relevant to the planned discussion topics. Most of the changes to the tasks involved incorporating research tasks linked to interactive activities, such as individuals approaching others to obtain help in conducting research. The members rated their confidence on performing each of the 10 research tasks using a 10 point Likert scale that ranged from 1 (=not very confident) to 10 (=very confident). The Research Self-Efficacy Scale being known to over-estimate respondent's confidence, was complemented by the Stages of Change tool which, it was hoped would capture more subtle effects of the online networking strategy (45,46). The Stages of Change tool asked members to state whether they 'strongly agreed', 'generally agreed', 'generally disagreed' or 'strongly disagreed' to 14 statements relating to members' attitudes, intentions and actions towards research. The discussion topics developed for the online forum were used to focus the statements of the Stages of Change tool to suit the local context. The questionnaire was self-administered and completed in supervised settings so that any questions from the members could be clarified and no sections left unanswered. This study was also used to pilot the adapted questionnaires as this could not be done before data collection due to limited time and also because the anticipated sample size could have been compromised if prospective members were to be involved in the pilot phase. The questionnaire was administered during recruitment before the start of the online discussions to those members who agreed to take part in the study. This was immediately following my explanation of the details of the study to them and the presentation of the information sheet which provided more

details of the study. The members were free to seek clarification on any section of the questionnaire as I was present when they completed the pre-discussion questionnaire. At the end of the discussion period, the members completed the post-discussion questionnaire but not all members were able to complete the questionnaire in my presence at that stage. I therefore left the questionnaires in some cases and made follow ups to pick them up once completed. No further discussion topics were posted to the forum after the administration of the post-discussion questionnaire. The members were however, still advised to continue the discussions by posting their own discussion topics, questions or any resource that would be beneficial to the conduct of clinical research in Zambia.

3.4.3 One-Day Skills Sharing Workshop

This workshop was conducted as a means of complementing the online discussion forum, to further enhance the sharing of knowledge, skills and experiences based on clinical research conduct in Zambia. In addition to the members of the Zambian Clinical Research Forum, the workshop was open to anyone interested in clinical research in Zambia. I organised this workshop with the help of my local advisor in Zambia and the team at Global Health Trials who regularly team up with local research facilities in low- and middle-income countries to facilitate the holding of one-day research skills sharing workshops. The costs of booking the venue and meals for the workshop were therefore covered by Global Health Trials. Preparations for the workshop began during the period of the online discussions and with the help of my local advisor, local speakers who had expertise in different areas of clinical research were identified. I made appointments with each of the local speakers over the phone and on meeting them, gave a brief description of the workshop and invited them to give presentations.

The presentation topics for the workshop were developed based on the online discussions in which members were engaged on the Zambian Clinical Research Forum. This was in order to tailor the workshop to the clinical research environment in Zambia as much as possible.

The responses received from each of the local research experts who were approached to give presentations at the workshop were very accommodating and affirmative. Those who were not able to get involved for one reason or another always gave alternative options by offering suggestions of other suitable individuals or sending representatives from within their organisations. All the speakers approached to take part in the workshop were in attendance at the workshop and gave 20 minute presentations on their different areas of expertise with a focus on the clinical research setting in Zambia. The speakers then addressed related questions from the rest of the workshop attendees. In addition, presentations on the online platform and the activities of the Global Health Network were also given. I gave a presentation on the Zambian Clinical Research Forum as a way of introducing the online platform where the discussions and interactions had been ongoing for five weeks at the time that the workshop was held. Another representative from the Global Health Network was also in attendance and delivered a presentation on the work of the Global Health Network. A copy of the workshop agenda outlining the topics and speakers is provided (Appendix section 8.6). The workshop was open to the whole research community in the capital city of Zambia and was advertised on Global Health Trials. I also distributed workshop flyers and invitation letters to the University Teaching Hospital departments, Non-Governmental research organisations and the public sector institutions including the Ministry of Health and the National Science and Technology Council of Zambia.

The members of the online discussion forum were also reminded to attend the workshop having been initially informed about it during the recruitment period. Those interested in attending had to sign up through Global Health Trials. The targeted number of attendees for the workshop was 70 as this was the number of individuals that the workshop venue could accommodate. The workshop was also viewed as a good platform to introduce the Zambian Clinical Research Forum to the wider research community with the aim of generating interest and making the online network a more sustainable resource.

A feedback questionnaire was administered at the beginning and end of the workshop to better understand the impact of the workshop and seek feedback in order to guide improvements for future workshops. A copy of the workshop questionnaire is provided (Appendix section 8.7). The questionnaire was developed by the workshop coordinating team at Global Health Trials. It included both closed and open ended questions. The closed ended questions sought to capture the job roles of the attendees, their motivation for attending the workshop, the fulfilment of their aims and the influence of the workshop on their confidence in conducting certain aspects of clinical trials. The open ended questions alternatively sought to capture specific areas that the attendees were keen to learn about, any parts of the workshop that they found particularly useful and any suggestions or comments for improvement. The completion of the questionnaire was voluntary and the attendees were asked to complete the first part of the questionnaire at the beginning of the workshop before the presentations began and the second part at the end of the workshop. This resulted in some questionnaires being incompletely filled in, as some attendees only attended the morning session of the workshop and left after lunch. It was therefore not feasible to

conduct an analysis of the influence of the workshop on the confidence of the attendees in conducting certain aspects of clinical trials due incomplete data. A narrative description of mostly the open ended questionnaire responses and some of the closed ended responses was therefore conducted. This was done with the aim of gaining a better understanding of the knowledge, skills and experience exchange that took place amongst the different individuals who are conducting or are interested in getting involved in the conduct of clinical research in Zambia.

3.5 Qualitative Data Analysis

The data from the online discussions were analysed by thematic content analysis and this was facilitated by NVivo version 10, a type of qualitative data analysis software developed by QSR international (47). I selected thematic analysis as the method of analysis in order to assess the progress of the online discussions between the emerging and established researchers and also how the interactions and content of the contributions varied between the two groups. Braun and Clarke (48) have described thematic content analysis as a method that minimally organises and describes a data set in rich detail and is used to identify, analyse and report themes within data. Data analysis of other online discussion forums have employed mixed method approaches using qualitative coding methods to capture impressions and trends and further analysis of the coded results quantitatively (49, 50). Qualitative analysis of online discussion forums has only recently been employed. Analysis of most of these forums were mainly limited to frequency counts that could easily be done but did not necessarily give an indication of the quality of the content of the postings (51).

The data content of the online discussions on the Zambian Clinical Research Forum were imported into NVivo using NCapture. This is a free web browser extension that gathers web pages and imports them into NVivo as PDF sources. I identified repeated patterns of meaning in the data using an inductive approach so that the themes identified were data driven, rather than based on an existing conceptual framework. The first stage of the analysis involved a familiarisation process in which I read and re-read the data and noted down any initial ideas. This allowed for the generation of initial parent nodes with a series of related child nodes. I focused only on the responses given by the members on the discussion forum to avoid developing themes based entirely on the discussion topics. Continual reading of the data led to the generation of initial codes in a systematic fashion across the entire content of the discussions and the gathering of data relevant to each code. I did this iteratively until no new codes emerged. Illustrative extracts that were clear and captivating were also taken note of during the coding process. Collation of the free nodes resulted in the development of possible themes that were reviewed to ensure that they were adequately linked to the coded extracts and the entire data set. This process resulted in the generation of a thematic map to which ongoing analysis was performed to refine the specifics of each theme and make inferences about the linkages between themes. In addition, the various themes generated were compared using matrix queries, which allowed me to chart the different issues according to whether they were raised by the emerging researchers or established researchers. Ongoing definitions and naming of the themes was also done in order to relate the narrative analysis of the network discussions to the research questions.

3.6 Quantitative Data Analysis

The data arising from the structured questionnaire were analysed using SPSS statistical software version 22. The aim of the analysis using SPSS was to determine if there was a change in research confidence and in the reported behaviour of members in relation to the conduct of clinical research, after taking part in the online discussions. This was determined using the scores of the Research Self-Efficacy Scale and the Stages of Change tool. I sought the help of a statistician in ensuring that the data were analysed correctly using the relevant statistical methods.

3.6.1 Assessment of the Research Self-Efficacy Scale Data

The total mean scores for all the statements on the Research Self-Efficacy Scale were calculated for each member. The 10 point scale ranged from 1 (=not very confident) to 10 (=very confident), therefore, higher scores were indicative of a greater amount of confidence in performing the 10 research tasks on the Research Self-Efficacy Scale. To assess whether the mean difference in the scores between the pre-discussion questionnaire and the post-discussion questionnaire, were significantly different from zero, a paired samples t-test was performed. The assessment was conducted among the emerging and established researchers separately. The paired samples t-test was used after the data were assessed as having met all the four assumptions of the test (52). Among the assumptions were that the data had one dependent variable being the change in mean scores before the discussions and after the discussions; the data had one independent variable being time-point, which had two levels namely pre-discussion and post-discussion. The other two assumptions were tested for using SPSS and these were that, there should not be significant outliers in the differences between the two related groups and the distribution of the differences of the dependent

variable between the two related groups should be approximately normally distributed (52). Two outliers were detected that were more than 1.5 box-lengths from the edge of the box in a boxplot for the emerging researchers' scores. Inspection of their values did not reveal them to be extreme and they were kept in the analysis. The established researchers' scores did not reveal any outliers. The assumption of normality was not violated across both levels of analysis, as assessed by Shapiro-Wilk's test ($p = 0.30$ for the emerging researchers' scores and $p = 0.64$ for the established researchers' scores). The box plots and the outputs for the tests of normality are provided (Appendix section 8.8). An independent-samples t-test was also performed to determine if there was a significant difference between the change in means of the emerging and established researchers before and after taking part in the discussions. In addition to the assumptions of the paired samples t-test, the data met two additional assumptions in order for the independent-samples t-test to be conducted (53). These being that there were different members in each group of emerging and established researchers and that the data had homogeneity of variances. Levene's test for equality of variances was used in SPSS to test homogeneity of variances ($p = 0.65$).

3.6.2 Assessment of the Stages of Change Tool Data

The scores for the Stages of Change tool were computed by assigning scores to each of the 4 categories on the Likert scale. 'Strongly agree' (=4), 'generally agree' (=3), 'generally disagree' (=2) and 'strongly disagree' (=1). Higher scores were therefore indicative of increasing levels of agreement to each of the statements of the Stages of Change tool. Thinking in retrospect, the action statements would have been better assessed using a binary 'Yes' or 'No' response to determine if the action had occurred, as action either happens or does not happen. However, since the categorical Likert

scale was also applied to the action statements during data collection, the data were analysed as such. The total mean scores for each category of statements (i.e. attitudes, intentions and actions) were calculated for each of the members. The Wilcoxon signed-rank test was used to determine whether there was a median difference between the pre-discussion responses and the post discussion responses. This nonparametric test was chosen over the parametric paired sample t-test because the data from the Stages of Change tool did not meet the assumptions for the t-test. The data did however meet the assumptions of the Wilcoxon signed-rank test and these included the data having one dependent continuous variable being the change in mean scores before and after the discussions and one independent categorical variable which was the time-point (i.e. pre-discussion and post-discussion). The third assumption of the Wilcoxon signed-rank test which is that the distribution of the differences between the two related groups should be symmetrical in shape (54) was only met for the combined data of the Stages of Change tool scores (i.e. the emerging and established researchers' scores combined). The assessment was therefore not conducted among the emerging and established researchers separately. The Mann-Whitney U test, a non-parametric test was however used to determine if there were differences between the changes in mean scores for the emerging and established researchers before and after taking part in the discussions. This was done for each category of the statements of the Stages of Change tool (i.e. attitudes, intentions and actions). The data in addition to the meeting the assumptions of the Wilcoxon signed-rank test also met one of the two assumptions of the Mann-Whitney U test (55) which was that the data had independence of observations, as different members were in each of the emerging and established researchers groups. The other assumption was violated as the distribution of the scores for both groups was determined to have a

different shape. However this only affected the interpretation of the results of the Mann-Whitney U test, in that the mean rank was used to determine the difference in the dependent variable rather than the median values.

3.7 Ethical Considerations

This was a minimal risk student study that involved the administration of questionnaires, online discussions and face to face discussions at a one-day skills sharing workshop. Application for ethical review and clearance was done and obtained through the University of Oxford Tropical Research Ethics Committee (OXTREC). The study was conducted in Zambia therefore an application for a waiver from the full ethical review process was made to the University of Zambia Biomedical Research Ethics Committee (UNZABREC). This was on the basis of the study being minimal risk and having obtained ethical approval from OXTREC. The application for a waiver was done through my local advisor. This was in form of a request letter accompanied by the OXTREC approval letter and addressed to the chairperson of the research ethics committee in Zambia. The application was successful and UNZABREC issued a waiver from the full ethical review process for this study and gave permission for the study to be conducted in Zambia. No interventions or procedures were done, rather this was an assessment of possible mechanisms to support researchers. The public were not involved in any way.

4 Results

4.1 The Zambian Clinical Research Forum Members

Of the 28 members approached to take part in the study, 19 joined the Zambian Clinical Research Forum and participated in the online discussions. Of these, 12 were emerging researchers and 7 were established researchers. A minimum of one post for each member throughout the entire duration of the discussions was enough for one to be regarded as having participated. This meant that even members who posted only once in the five weeks that the discussions were held were also included in the assessment. This was with the view that having joined the online forum and made a contribution, may indicate that they also read some contributions posted by other members. A total of nine members did not join the online forum and therefore, did not take part in the online discussions. These included six emerging researchers and three established researchers. On enquiry as to the reasons for non-participation, almost all of the established researchers alluded to very busy work schedules while the emerging researchers, in addition to busy schedules cited difficulties in getting internet access or the inability to contribute to the discussions using their mobile devices.

4.2 Motivation and Nature of Contributions

Constant reminders through email and text messages were the driving force behind most of the contributions to the online discussions. At the beginning of every week during the discussion period, a discussion topic was posted to the online platform and every member was sent an email with the hyperlink of the discussion topic. The email also included information on how to sign up to the online platform to remind those who had not yet signed up to do so. I was concerned when there was a low level of contributions to the discussions and sent out another reminder email mid-way through

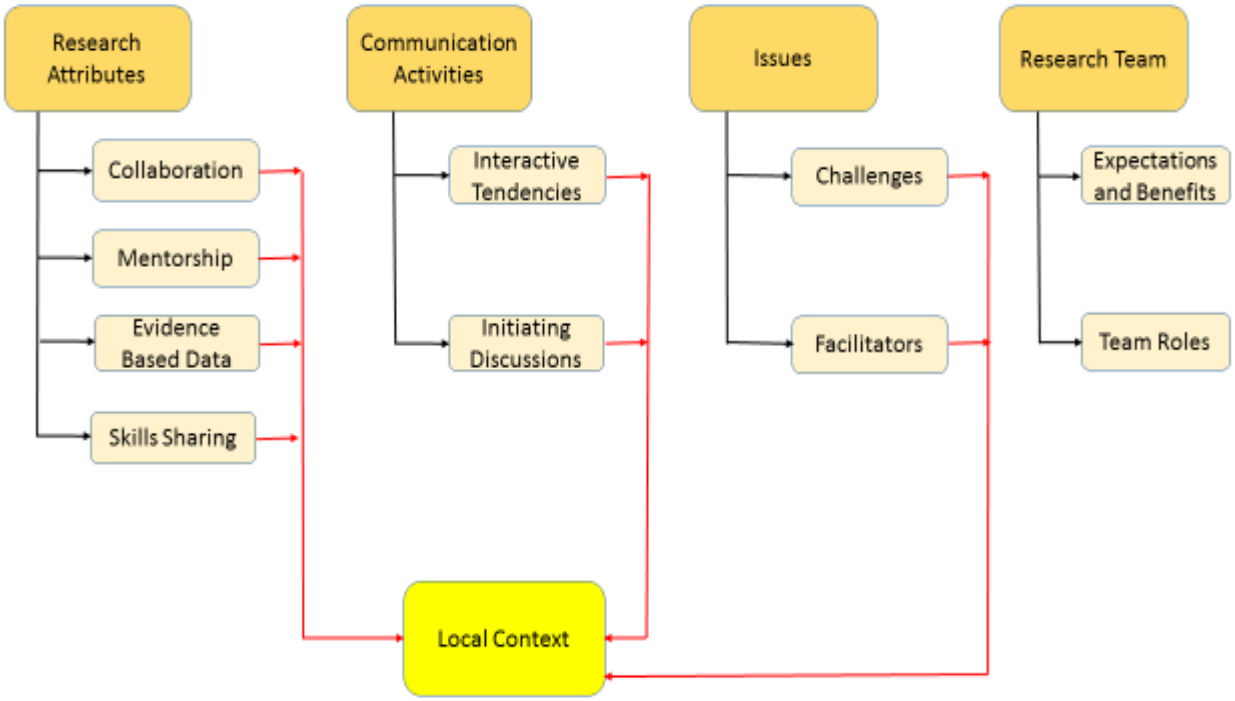
the week and at the end of the week depending on the response. This included information on how the topic of the particular week was progressing and how more contributions would result in a richer and more informative discussion. The reminder email was accompanied by a text message prompting the members to check their emails if they had not done so. This was a way of notifying the members of a new discussion topic at the beginning of the week or encouraging them to contribute to an already existing topic mid-way through the week. As the discussions progressed, prompts linked to the topic of the week were added for the purpose of encouraging more contributions on the particular topic. The prompts included, questions on specific aspects of the discussion topic or simply asking the members to elaborate on their posts.

It was observed that the established researchers only contributed to the discussion topics that related to the actual conduct of clinical research in Zambia. These topics included the challenges and expectations of working in a research team and the issues associated with conducting clinical research such as recruitment of study participants, obtaining funding and data management. The emerging researchers on the other hand, in addition to contributing to the above topics also contributed to the topics relating to the general aspects of clinical research. These included how individuals with different skills and experiences could contribute to the conduct of clinical research in Zambia; the opportunities that were available within professional jobs for identifying areas of clinical research and the career progression options available for different members of the research team.

4.3 Thematic Analysis of Online Discussions

The contributions on the discussion topics were all included in the analysis of the online discussions regardless of the level or frequency of posts. This is because rather than focusing on the quantity, the quality and content of the posts were more important for the assessment of how an open access platform could stimulate information exchange and experience sharing between emerging and established researchers. Thematic content analysis facilitated by NVivo 10, was used to link the discussions into an overall story that told of the interactions of the researchers on the online local network. The research level of the members of the online network as either emerging or established researchers guided the analysis. The emerging researchers were those who had an interest in clinical research but had not yet conducted their own studies, while those who were or had been principal investigators on current or previous studies made up the established researchers. Thematic analysis of the online discussions generated five major themes namely communication activities, research attributes, issues raised, research teams and local context. Each of these themes apart from local context were further subdivided into subthemes. This is because most of the themes that emerged from the online discussions were based within the local context of the Zambian research setting. The relationships of these themes and subthemes are displayed in the thematic map below (Figure 1).

Figure 1: Thematic map of the online discussions



4.3.1 Communication Activities

This theme focuses on how the online discussion platform in addition to being a networking platform in its own right, stimulated a number of activities related to communication which is a vital component of networking. The observation that the members exhibited communication tendencies while taking part in this interactive platform points to the capability for such a platform to encourage networking and associations among those involved. This theme was subdivided into two subthemes namely interactive tendencies and initiating discussions.

4.3.1.1 Interactive Tendencies

This subtheme describes the types and behaviour of the interactions exhibited through the numerous discussions on the online network. The types of interactions included

contributions based on experience and responses specific to particular professional fields. Most of the experience based posts were from the established researchers who contributed based on actual experiences that they had in leading studies. This provided insight into some of the perceived issues affecting the conduct of clinical research. For instance, the motivation to conduct research among various professional fields, was said to range from promotion for academics to informing practice through evidence -based data for clinicians. Speaking from experience, a number of members were also able to share some challenges they encountered in conducting research and also how they had overcome them. As an example an established researcher shared one of the ways he deals with challenges of participant recruitment and retention.

> *"…I think planning ahead including being realistic about cases would help in reaching targets in time. I basically estimate loss-to-follow-up of upto 10% for a trial with a 24 month follow-up."* (Established Researcher)

The emerging researchers also shared their experiences from the point of view of being part of a study. This gives insight into how different individuals involved in clinical research, could all make vital contributions regardless of their research level. It was also noticed among the discussions that some members made contributions that were field specific, this was observed mainly among emerging researchers particularly Pharmacists who gave their views based on their expertise as drug managers.

> *"For example, in my practice, I noted there is an overwhelming number of patients presenting with relapse of Cryptococcal Meningitis after standard treatment. This as simple as it may seem, may require a study to investigate the cause of this trend, so that we avoid a pitfall of assuming poor compliance in all patients with a relapse."* (Emerging researcher)

Field specific responses were also seen as providing several opportunities for identifying areas of research particularly for scenarios lacking clinical guidelines. The members also exhibited interactive behaviours such as making contributions in response to other members' posts. Exploration of these behaviours revealed that most of the responses were affirmations, additions and insights on what had been contributed by other members. A practical example of an insightful response was a post revealing how one established researcher had recently acquired funding for his research from a local organisation in Zambia. This was following several contributions that had expressed lack of knowledge of the availability of any local funds for research or even where to obtain such funds.

> *"I am not aware of where to locally source for funds to conduct meaningful research. All large research projects that I know of in Zambia are externally funded."* (Established Researcher)

4.3.1.2 Initiating Discussions

The members exhibited networking behaviours through the discussions and these involved members posting their own discussion topics or questions, in addition to commenting on the topics already posted. This was done by both an established and emerging researcher. The discussions initiated were in form of a general clinical research topic posted by an established researcher and a field specific question posted by an emerging researcher. This points to the realisation that the members viewed the Zambian Clinical Research Forum as a platform that could be used to gain information from other members especially that none of the ones who initiated discussions contributed on their own topics.

4.3.2 Research Attributes

The discussions on the Zambian Clinical Research Forum, led to the mention of attributes linked to research such as skills sharing, collaboration, mentorship and the generation of evidence based data. The online discussion platform therefore, provided an opportunity for members to relate on aspects that are vital to the conduct of research. As most of these attributes are related to researchers coming together, it could be seen that the online group enthused discussions that involved topics related to working together with the view of encouraging the conduct of more research.

4.3.2.1 Skills Sharing

The discussions around skills sharing focused on how the integration of skills and experiences of individual researchers could greatly improve the quality of research conducted in Zambia and could further enhance the research platform. This view was mainly shared by the emerging researchers.

> *"As a young researcher in my field, I strongly feel I do benefit more in strengthening my research skills by tapping into the skills, knowledge and experience of different 'seasoned' researchers in the field of interest*." (Emerging Researcher)

It was further noted that different skilled individuals could help to add credibility to clinical research findings to aid in the development of clinical guidelines to be used in practice. The benefits of skills sharing were also highlighted as work being simplified and easier, leading to quality results for the whole research team, particularly when skills were utilised to the maximum. In a nutshell, the discussions emphasised that different skills when combined are strengthened.

4.3.2.2 Collaboration

The mention of collaboration emphasised the importance of working together and it was regarded as a key ingredient in building capacity for research by both emerging and established researchers and more so by the former.

> *"…collaborative approaches are exactly one approach we are seeking to engage our Faculty at the School of Medicine to adopt for internal capacity building in research."* (Emerging Researcher)

The discussions encouraged collaboration between different professional levels such as the academia and clinical practice and also among the research community. Such collaborative efforts both at a local and international level were even viewed as a means of lobbying for more funds for research in addition to moving science forward through research. A researcher's knowledge of a subject was said to be limited without collaboration and this was regarded as the reason behind the lack of depth observed in most research conducted in Zambia.

4.3.2.3 Mentorship

The mentorship attribute was closely linked to getting connected and it was stressed as an avenue through which skills transfer takes effect. It was also regarded as being very critical as expressed especially by the established researchers, some of whom were of the opinion that every principal investigator should be a mentor. The mentor was expected to understand the protocol very well and more than other research team members in order to be well respected and considered a real mentor. With mentorship defined as being between two parties, the discussions also highlighted the mentee's role in identifying a suitable mentor.

> *"One of the roles of the mentee is to identify mentors who are available and interested in mentoring. Sometimes, those mentors may be outside the research team."* (Established Researcher)

The importance of mentorship as brought out by the established researchers could have been an indication of the benefits they derived from their own mentors.

4.3.2.4 Evidence-Based Data

The generation of evidence-based data was linked to conducting clinical research in Zambia and how this could improve the quality of healthcare. It was highlighted in the discussions that clinical research conducted in the local population would provide evidence applicable to the unique population rather than relying on empirical data.

> *"…clinical research in Zambia would help us manage patients based on our local findings as opposed to managing them based on evidence from elsewhere as we know that research outcomes may be influenced by a lot of factors such as race, ethnicity etc. Therefore, clinical research in Zambia would promote evidence-based practice enhancing specificity, rationality and economical approach to practice."* (Emerging Researcher)

Evidence-based data could be considered as one of the most important attributes of clinical research and the Zambian Clinical Research Forum by stimulating discussions on this and other research attributes could hence be regarded as a means of enhancing clinical research capacity.

4.3.3 Issues Raised

This theme focuses on how the online discussions brought out a number of issues to do with conducting research. These were divided into challenges and facilitators of

clinical research in Zambia. The discussions around the issues related to the conduct of clinical research in Zambia were noted as having the most contributions from almost all members compared to the other discussions.

4.3.3.1 Challenges of Clinical Research

The discussions brought out a number of challenges linked to the conduct of clinical research in Zambia most of them being from emerging researchers. These were mainly based on challenges related to the conduct of research such as participant recruitment, funding and data management and also challenges related to research teams such as the costs incurred. The difficulties noted in participant recruitment and retention were in some cases linked to over optimistic estimation of cases especially in multicentre trials as expressed by one of the established researchers. This was said to be the case mostly for therapeutic and health system trials and also for trials with longer durations and numerous visits. Sensitive studies such as those involving disclosure of personal health information and involving sensitive screening or specimen, were also viewed as facing challenges in recruiting participants as was noted by some emerging researchers. One of the established researchers further noted that studies requiring second or third party approval also posed challenges to recruitment.

> *"A study that requires approval from a spouse, e.g. vaginal microbicide trials, involving under aged children or HIV discordant couples may be challenging to recruit participants".* (Established researcher)

The challenges encountered in participant recruitment were also said to lead to research being restricted to areas where community members were likely to co-

operate rather than where the research was really needed. One emerging researcher stated that this was especially true when participants demanded incentives before they could take part in studies.

The other challenge discussed included the lack of local funding sources for research with almost all research studies being externally funded. This was viewed by most emerging researchers, as one of the major issues affecting the conduct of clinical research in Zambia. A few established researchers also had this point view, some of whom regarded the lack of funds as being *"the biggest bottleneck".* Some of the reasons behind this were that research may seem as a luxury for government in the face of so many competing priorities resulting in inadequate or no funds allocated for research. More discussions revealed that even when funds were available from external or local sources, they were mostly tied to specific areas of interest, usually in line with the funding organisation's objectives. On the other hand, some members, particularly emerging researchers stated that they were unable to access research funds as they had limited knowledge of grant writing or how to locate key funders. The neglect of certain vital components of research such as data management was noted as another challenge affecting the conduct of clinical research in Zambia. The fact that not much emphasis is placed on the aspect of data management was viewed as one of the reasons behind poor quality research.

The conduct of research was also said to be hindered by the lack of collaboration and lack of support for research progression in some professions as opposed to others. For instance, research progression when working as a clinician was said to be less supported than when working as an academician. At other times research progression was not possible due to high workloads which resulted in limited time dedicated to

research. It was further noted that even when the challenges were overcome and research was conducted, the challenge of not using the results sometimes arose.

> *"One thing that discourages people is the way the results have been used especially here in Zambia. Research should be able to direct clinical practice and not just being piled on the shelves."* (Emerging Researcher)

Apart from challenges related to the conduct of research, the difficulties encountered when working in a research team were also discussed. These included costs of running a research team such as members' remuneration and other logistics for the research programme. It was also discussed that poor management of resources such as finances, time and human resources, by top officers in the team for instance, affected the output of the whole team. Other challenges stressed were conflicts arising from lack of discipline, lack of understanding of the roles played by other members and forgetting the responsibility of being accountable to the research activity.

The challenges of clinical research discussed on the online platform as encountered by different researchers brought out the aspect of identifying common difficulties that researchers face that can in turn stimulate more discussions on strategies for addressing them.

4.3.3.2 Facilitators of Clinical Research

The discussions apart from bringing out challenges to clinical research in Zambia highlighted a number of facilitating factors too. The facilitating factors were mostly discussed concurrently and could thus be looked at as strategies to overcome the challenges stated. These were contributed by both emerging and established

researchers and most of the strategies brought out by the established researchers were based on their experiences in handling challenges that they faced while conducting studies. Despite the challenges mentioned above, it was felt that several great opportunities exist in clinical research and all that was needed from individuals seeking to conduct studies was passion and creativity. In addition, some academic institutions were seen as providing support for research progression through the existence of research unions.

> *"…For instance, the University of Zambia has the union for research which helps individuals to progress in research."* (Emerging Researcher)

Moreover, an established researcher pointed out that one of the driving factors to managing or coordinating research projects along with other duties such as teaching, was the fact that research was one of the requirements for promotion in the academia. Alternatively, in clinical practice having the knowledge of research informing practice and the emphasis on evidence-based clinical practice was viewed as enough impetus to conduct research. The discussions also brought out the aspect of being focused and knowing how to manage time in order to pursue a research career alongside official employment. In order to tackle the participant recruitment and retention challenges that were brought out, a number of approaches were proposed. These included planning ahead, being realistic about recruitment numbers, having competent staff and implementing an elaborate recruitment and retention strategy. Furthermore, participants should also be involved early on in the study through community engagement which as was underscored by one established researcher, is crucial at the various levels of stakeholder involvement.

> *"A full involvement of participants at the very inception of the study in issues that concern them and allow them to participate in decision making can be one strategy that may enhance the recruitment and retention rate."* (Emerging Researcher)

The discussions also provided a number of ways by which the scarcity of research funds could be addressed, especially that funding was stated as one of the major challenges of clinical research.

> *"One way that can assist in acquisition of funding is through collaboration with other researchers and also to ensure that your research will provide viable solutions to current problems."* (Emerging Researcher)

Encouragingly, one of the established researchers went on to share how he had obtained local research funds through the National Science and Technology Council of Zambia (NSTC).

> *"….who I informed about a small grant of 25000 USD which I was recently awarded by National Science and Technology Council of Zambia. Yes there is funding through NSTC council, and there is a call at least once a year. Of all the grants I have had in the last 5 years ranging from hundreds of thousands to millions of euros or dollars ... The USD 25000 is the most cherished.....because it gives me hope that one day we shall have adequate funding from our local agencies."* (Established Researcher)

This was a great example particularly because most of the challenges involving research funds pointed to a lack of local funding sources. Following on from this, more collaboration and concerted lobbying was suggested as a means of getting adequate budgetary support. It was also proposed that every team member should be engaged

in the process of grant writing in order to be prepared to apply for funds when they became available.

Strategies for dealing with the challenges of data management were also discussed and these included having the appropriate hardware and software which were viewed as vital components. More importantly having qualified personnel was deemed as essential not just for data management but also for the achievement of all the other strategies.

4.3.4 Research Team

The discussions on research teams focused on two main areas. Expectations and benefits of working in a research team and the roles of different members of the research team.

4.3.4.1 Expectations and Benefits

The expectations and benefits of working in a research team as highlighted by both the emerging and established researchers were focused on working together. The common expectations as underlined in the discussions were to gain new knowledge, sharpen skills and identify additional possible research questions. Among other benefits were the ability to share work and ideas and come up with the best solution to a problem before it was considered for a result. Research teams were also viewed as a means of building capacity for research.

> *"Working in a research team helps in building capacity of not only the individual members but also the whole team. We all have different skills and these are strengthened when they are combined. Team work most times leads to better outputs, and of course, sharing responsibilities mean increased efficiency."* (Established Researcher)

For the benefits of research teams to be realised, it was discussed that from the onset, the agenda and objectives should be laid out and clearly understood by all team members. For instance, one of the emerging researchers put it as "*house rules should be clearly set*."

4.3.4.2 Team Roles

For research teams to function well and achieve their objections, many members stated that it was important for the roles of each team member to be clearly defined and that these should point towards a common goal.

> *"It is important to clearly document what each member should expect from others and vice versa right from the start, regarding things like work schedule, remuneration, reports, etc."* (Emerging Researcher)

Apart from being conversant with the expectations and objectives of research teams, the aspect of having a structural hierarchy was also noted as being important.

> *"I expect that the structural organisation of the research team should be clearly defined. By this I mean there should be a research team leader and the hierarchy should be well established."* (Emerging researcher)

In addition each member should be respectful to other members, should be disciplined and the team should have a well outlined way of resolving conflicts. Just as any team is usually made up of members from various disciplines, research teams should be no

different. As was emphasised through the discussions, the best research teams are often those which are multidisciplinary.

4.3.5 Local Context

This theme points to the fact that most of the discussions focused on the conduct of clinical research within the local context. For example, both the quality of healthcare and the management of patients in Zambia were linked to the conduct of clinical research. This is another strength of the online network as encouraging discussions tailored to a local context have the potential to give members a sense of ownership and fulfilment that local issues are being addressed. This may be the case when problems related to their environments are solved as a result of their interactions. Conducting clinical research in Zambia was seen as a means of generating evidence-based data which is one of the research attributes that were alluded to earlier. This would in turn aid in the development of clinical guidelines on diagnosis and treatment of diseases applicable to Zambia's unique population.

> *"Clinical research can improve quality of healthcare in Zambia by helping us develop evidence-based clinical guidelines on diagnosis and treatment of diseases, use of scarce resources in health care etc. Unlike merely adapting guidelines based on studies in different populations, clinical research conducted in our local population would provide evidence applicable to our unique population."* (Emerging Researcher)

Similarly, the other discussions ranging from the experiences of different professionals in research, to field specific responses and the discussion topics initiated, all had an inclination to the Zambian research environment. This was also seen for most of the discussion areas under the themes of research attributes and issues raised as

members mainly focused on relating them to conducting research within the local context.

4.4 Structured Questionnaire Data

The questionnaires administered before and after the online discussions sought to assess the influence of the online platform on the research self-confidence and reported behaviour of the members in conducting clinical research in Zambia. The 19 members of the Zambian Clinical Research Forum made up of 12 emerging and 7 established researchers and having participated in the online discussions, were included in the analysis of the structured questionnaire data. The nine members that did not participate in the online discussions were excluded from the analysis as the study was comparing the change in mean scores for both the Research Self-Efficacy Scale and the Stages of Change tool after participation in the online discussions. The analysis was done using the relevant statistical tests, by research level i.e. emerging and established researchers, where the assumptions for the tests were met and by combining the two groups where the assumptions were violated.

4.4.1 Research Self-Efficacy Scale

This scale was used to assess the gain in research self-confidence of members after taking part in online discussions involving topics related the conduct of clinical research in Zambia. This was in relation to the performance of a number of research tasks. The total and mean scores for all the statements of the scale were calculated for each individual. These were then used to determine if there was a significant difference between the pre-discussion and post-discussion mean scores for the both the emerging and established researchers using a paired samples t-test. The analysis was done separately for the emerging and established researchers in order to compare the gains between the two groups. Data are mean ± standard deviation, unless otherwise stated. The 12 emerging researchers who participated in the online

discussions, had higher mean scores (7.32 ± 1.22) on the Research Self-Efficacy Scale after the discussions compared to before the discussions (6.57 ± 1.30) as displayed in table 1. This portrays an increase in their confidence to carry out the research tasks outlined on the Research Self-Efficacy Scale (Appendix 8.5 for the scale items). Table 2 further illustrates that the emerging researchers increased their confidence score by 0.75 and that this increase is statistically significant (p = 0.03, 95% CI, 0.10 to 1.40). The increase in research confidence though slight, compared to the difference between each of the scale points (=1.00) is still indicative of an influence of the online discussions on the research confidence of the emerging researchers.

Table 1: Mean Research Self-Efficacy Scale (RSES) scores for emerging researchers before and after participating in the online discussions

	Mean	N	Std. Deviation	Std. Error Mean
Mean RSES responses for post-discussion questionnaire	7.32	12	1.22	.35
Mean RSES responses for pre-discussion questionnaire	6.57	12	1.30	.37

Table 2: Paired samples t-test for the mean difference of the emerging researchers' Research Self-Efficacy Scale (RSES) scores before and after participating in the online discussions

	Paired Differences					Sig. (2-tailed)
	Mean Difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Mean RSES responses for post-discussion questionnaire – Mean RSES responses for pre-discussion questionnaire	.75	1.03	.30	.10	1.40	.03

The 7 established researchers who took part in the online discussions, also had higher post-discussion Research Self-Efficacy Scale scores (8.76 ± 1.07) compared to pre-discussion (8.44 ± 1.42) as outlined in table 3. The increase of 0.31 as displayed in table 4, was however not statistically significant (p = 0.30, 95% CI, -0.37 to 1.00). The confidence of established researchers in performing a number of research tasks was therefore, not influenced by their participation in the online discussions.

Table 3: Mean Research Self-Efficacy Scale (RSES) scores for established researchers before and after participation in the online discussions

	Mean	N	Std. Deviation	Std. Error Mean
Mean RSES responses for post-discussion questionnaire	8.76	7	1.07	.40
Mean RSES responses for pre-discussion questionnaire	8.44	7	1.42	.54

Table 4: Paired samples t-test for the mean difference of the established researchers' Research Self-Efficacy Scale (RSES) scores before and after the online discussions

	Paired Differences					
	Mean Difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		Sig. (2-tailed)
				Lower	Upper	
Mean RSES responses for post-discussion questionnaire – Mean RSES responses for pre-discussion questionnaire	.31	.74	.28	-.37	1.00	.30

To determine if a difference existed between the change in Research Self-Efficacy Scale mean scores of the emerging and established researchers, an independent-samples t-test was performed and the output is displayed in table 5 below. There was homogeneity of variances for research self-confidence scores for emerging and established researchers as assessed by Levene's test for equality of variances (p = 0.65). The emerging researchers' mean research confidence score was 0.44 (CI, -0.50 to 1.38) higher than the established researchers' mean research confidence score. This increase was however, not statistically significant (p = 0.34) therefore, there was no difference in the change in mean research confidence scores between emerging and established researchers after taking part in the online discussions.

Table 5: Independent samples t-test for the difference in the change in Research Self-Efficacy Scale (RSES) mean scores between emerging and established researchers

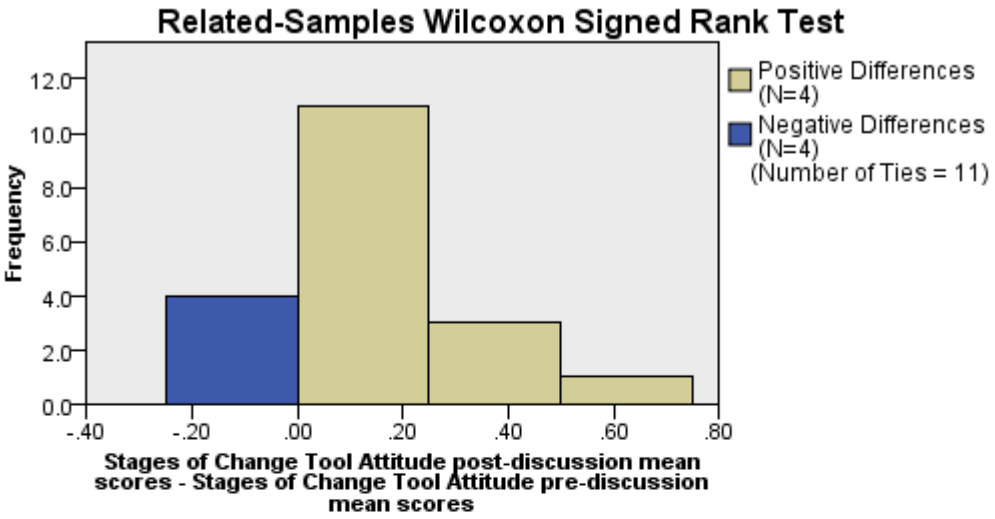
	Levene's Test for Equality of Variances		t-test for Equality of Means				
						95% Confidence Interval of the Difference	
	F	Sig.	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Differences between pre- and post-discussion RSES mean scores	.22	.65	.34	.44	.45	-.50	1.38

4.5 Stages of Change Tool

The Stages of Change tool was used to assess progress in changing members' attitudes, intentions and actions in relation to the conduct of clinical research in Zambia after participating in the online discussions. The total mean scores for each category of statements (i.e. attitudes, intentions and actions) were calculated for each of the members. These results were used to determine if there was a significant median difference between the pre-discussion and post-discussion Stages of Change tool scores, for both the emerging and established researchers using a Wilcoxon signed-rank test. The analysis was done for the emerging and established researchers as a combined group rather than separately because the data did not meet the assumptions of the test when analysed separately. The analysis was however still conducted according to the different categories of the Stages of Change tool statements, these being attitudes, intentions and actions.

Of the 19 members who participated in the online discussions, 4 of them elicited an improvement in their attitudes to the performance of certain research tasks after the discussions compared to before the discussions, whereas 15 members saw no improvement as displayed in figure 2. The improvement observed was not statistically significant ($p = 0.76$), therefore participation in the online discussions did not influence the attitudes of the members to the conduct of research related tasks such as learning research skills and doing more research as an individual among others (Appendix section 8.5 for the different tasks).

Figure 2: Related-samples Wilcoxon signed rank test for the median difference of the members' attitude scores before and after participating in the online discussions

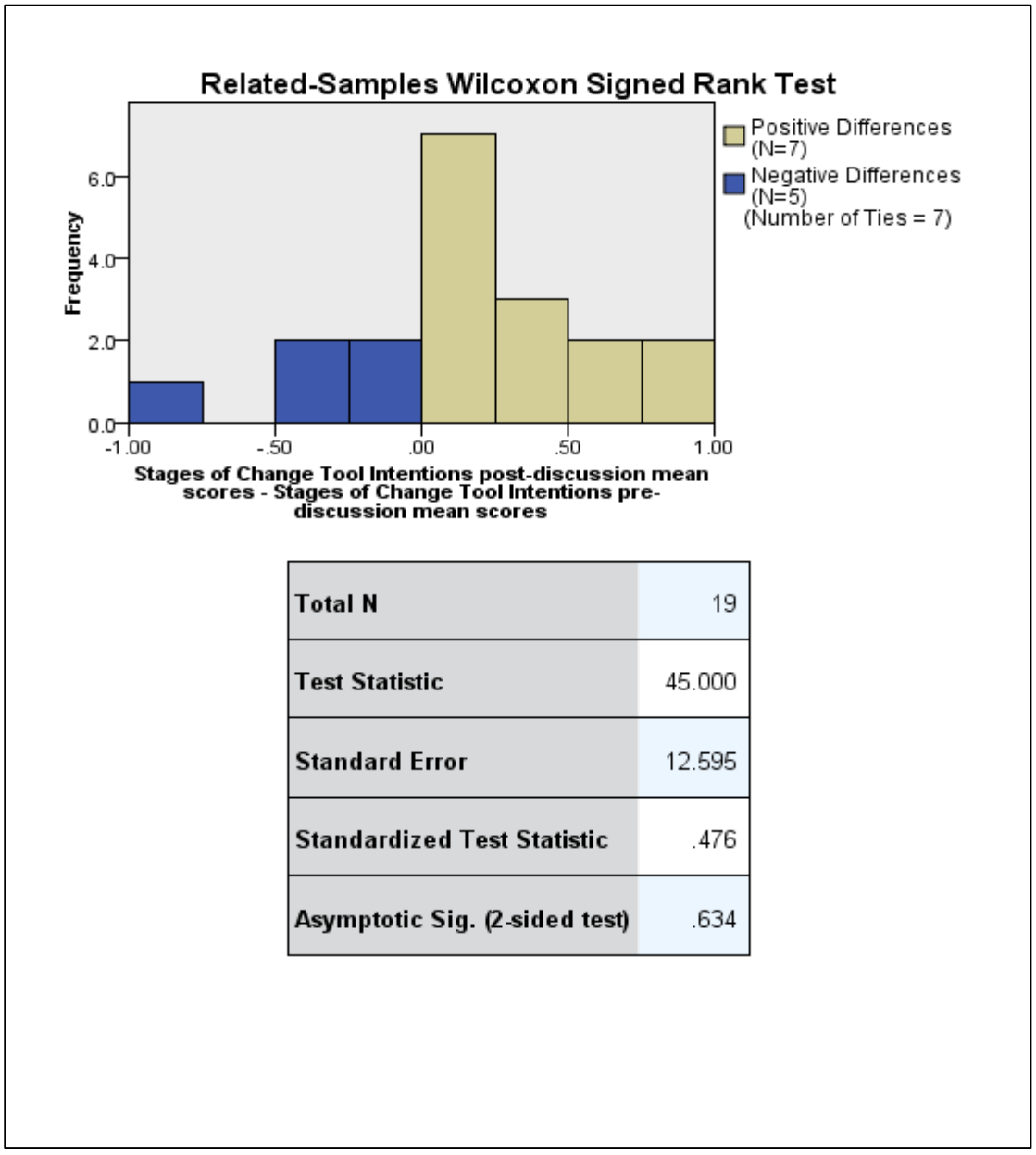


Total N	19
Test Statistic	20.000
Standard Error	6.633
Standardized Test Statistic	.302
Asymptotic Sig. (2-sided test)	.763

For the intentions category of the Stages of Change tool, 7 of the members elicited an improvement in their intentions to the performance of certain research tasks after the discussions compared to before the discussions, whereas 12 members saw no improvement as displayed in figure 3. The improvement observed was not statistically

significant (p = 0.63), therefore participation in the online discussions did not influence the intentions of the members to the conduct of research-related tasks.

Figure 3: Related-samples Wilcoxon signed rank test for the median difference of the members' intention scores before and after participating in the online discussions

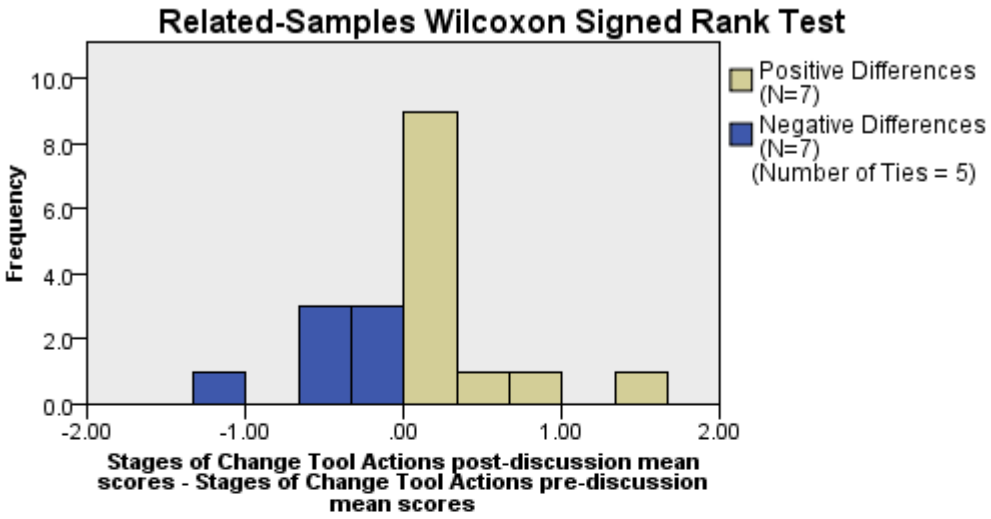


Total N	19
Test Statistic	45.000
Standard Error	12.595
Standardized Test Statistic	.476
Asymptotic Sig. (2-sided test)	.634

The action category also showed an improvement in 7 of the members, in their actions to conduct certain research tasks after the discussions compared to before the discussions as portrayed in figure 4. This improvement as with the attitudes and

intentions categories was however not statistically significant (p = 0.80). The online discussions therefore did not stimulate progress in changing members' attitudes, intentions and actions in relation to the conduct of clinical research in Zambia.

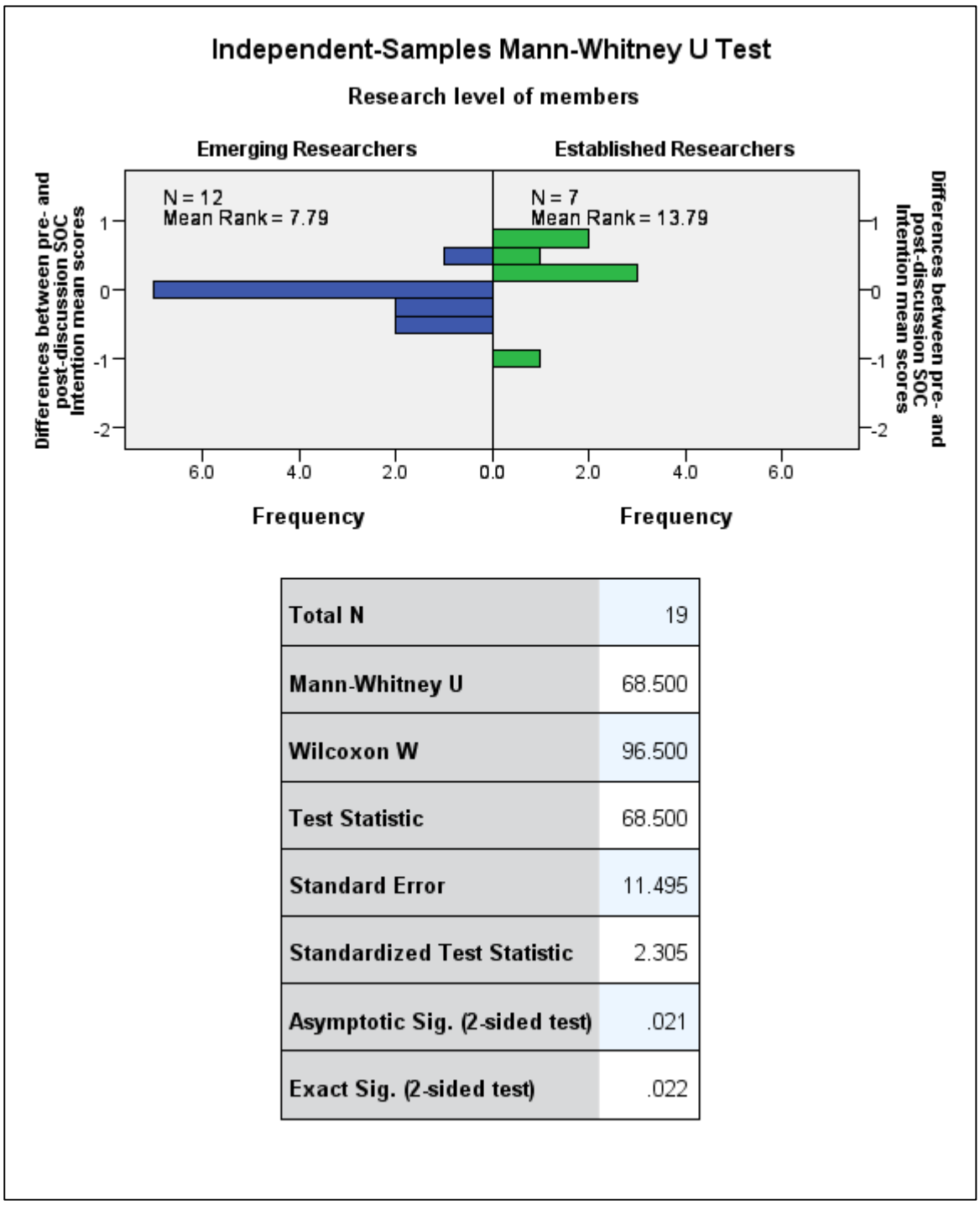
Figure 4: Related-samples Wilcoxon signed rank test for the median difference of the members' action scores before and after participating in the online discussions



Total N	19
Test Statistic	48.500
Standard Error	15.859
Standardized Test Statistic	-.252
Asymptotic Sig. (2-sided test)	.801

Despite the non-significant improvement in the member's attitudes, intentions and actions in conducting activities related to clinical research in Zambia, a Mann-Whitney U test was performed on the Stages of Change tool mean change scores. This was to determine if a difference existed between the change in mean scores of the emerging and established researchers. The difference between the emerging and established researchers was found to be statistically significantly different only for the intentions category and not for the attitudes or actions categories. Therefore, only the output for the intentions category will be displayed. As illustrated in figure 5 the distribution of the mean scores for emerging and established researchers, were not similar as assessed by visual inspection. The mean scores for the established researchers (mean rank = 13.79) for the intentions category, were statistically significantly higher than for the emerging researchers (mean rank = 7.79), $p = 0.02$. The intentions of the established researchers in carrying out clinical research related tasks in Zambia were therefore higher than those of emerging researchers.

Figure 5: Independent-samples Mann-Whitney U test for the difference in the change in intention mean scores between emerging and established researchers



Total N	19
Mann-Whitney U	68.500
Wilcoxon W	96.500
Test Statistic	68.500
Standard Error	11.495
Standardized Test Statistic	2.305
Asymptotic Sig. (2-sided test)	.021
Exact Sig. (2-sided test)	.022

4.6 Workshop Attendance and Presentations

The one-day skills sharing workshop targeted at all who were interested in the conduct of clinical research in Zambia drew about 60 attendees including the speakers. Among these 7 were members of the Zambian Clinical Research Forum comprised of six emerging researchers and one established researcher. The attendance at the workshop of the members of the online platform was therefore less than expected with more than half of the members not being able to attend, particularly the established researchers due to work commitments. Targeting the workshop to the wider research community in Zambia, therefore stimulated the attendance of individuals who were interested in the conduct of clinical research regardless of whether they were members of the online platform. Being the first of such research skills sharing workshops to be held in Zambia, the responses to the invitations and advertisements were very affirmative with a few of the respondents being put on a waiting attendance list. However not all of those who signed up were in attendance bringing the final number of attendees to 60 instead of the expected 70. Furthermore, a few of the attendees only attended the morning session of the workshop and left after lunch. A total 30 out of 60 workshop attendees completed the questionnaires. After counter checking the questionnaires it was discovered that 8 were incompletely filled in. The feedback questionnaires administered at the workshop were therefore not all completely filled in, to allow for a meaningful analysis of the influence of the workshop on the confidence of the attendees in conducting a number of aspects of clinical trials. A narrative description of the exchange of information, skills and experience that took place at the workshop was therefore conducted.

The workshop attendees had varied occupations which included Students, Research Nurses, Pharmacists, Laboratory Managers, Clinicians, Data Managers, Academicians, Project Managers and Senior Investigators. The speakers were all local experts on different aspects of clinical research in Zambia, such as clinical trials, research funding, ethical considerations, grant acquisition, community engagement and data management. The main motivation factors for attending the workshop as noted by the attendees were for the purpose of networking (73%) and career development (67%) particularly identifying research opportunities for different fields. Additionally the workshop was viewed as an occasion to gain more information about clinical trials (57%) and the Global Health Trials website (30%). The percentages portrayed are not cumulative as the attendees could note down one or more motivating factors. The attendees also had specific areas of interest that they hoped would be covered through the workshop presentations and these included the acquisition of research funds, grant applications, methods of data analysis and the research publication process. Generally the workshop was noted as having fulfilled most of the attendees' aims (67% of the attendees attested to this), despite not covering some areas of particular interest such as research publications. The workshop topics found to be most useful were those in which the attendees lacked previous knowledge. These included research financing in Zambia as it was revealed by one of the speakers that local funds for research were available through the National Science and Technology Council of Zambia (NSTC). This was opposed to the view that most attendees had lack of information of where to source for local funds for research in Zambia. In addition most of the attendees did not have previous knowledge of the Zambian Clinical Research Forum and the Global Health Network before the workshop and therefore found it insightful to learn of them and were interested in getting involved.

At the end of the workshop, the attendees provided some suggestions for improvement. These were mainly focused on allocating more time for the presentations and engaging in more discussions on how to improve the clinical research environment and encourage the conduct of more research in Zambia.

5 Discussion

This study aimed to assess the potential of local networking strategies to enhance clinical research capacity in Zambia. These included discussions on the Zambian Clinical Research Forum, an online platform specifically created for researchers in Zambia and a one-day skills sharing workshop. The workshop was conducted with the aim of bringing together individuals already conducting clinical research and those interested in getting involved in research, to encourage the sharing of skills, experiences and resources on different aspects of clinical research. The influence of the online platform on the research self-confidence and reported behaviour of the members to undertake certain clinical research related tasks was assessed using the Research Self-Efficacy Scale and the Stages of Change tool respectively. The following paragraphs give a critical analysis of the findings in view of existing literature as well as their influences on building clinical research capacity.

5.1 The Zambian Clinical Research Forum Participation

The online research platform created with the aim of bringing both emerging and established researchers together, achieved its purpose as individuals from both groups joined the Zambian Clinical Research Forum to engage in discussions and interactions on the conduct of clinical research in Zambia. A few individuals approached to join the online platform where unable to due to hindrances such as very busy work schedules, lack of internet access and inability to access the platform on their mobile devices. Such and other barriers to online platforms have been described by authors in literature (2,56), who have stressed the importance of considering ways of tackling such barriers before the implementation of online means of communication. The minimum requirement of participating in the discussions, of at least once every

week, was one of the means employed for addressing the busy schedules of the members of this study. This seemed to have worked well for those who managed to join the online platform as they were able to engage in discussions despite their busy work schedules. In addition the regular email reminders that I sent out to the members when I posted a new discussion topic at the beginning of the week, and the text messages sent as a follow up during the course of the week, seemed to stimulate continuity in taking part in the discussions. At times additional emails and text messages were sent out when the response rate was still low following the earlier reminders and this prompted more posts.

The period in which I posted the discussion topics and sent out the constant reminders was limited to five weeks and beyond this period none of the members initiated their own discussions or contributed to the already existing discussions. This inability of the members to continue discussions and interactions among themselves after the five week period indicates that both the emerging and established researchers may have been merely obliged to take part because they had agreed to, rather than being personally motivated to engage in discussions. The online platform may not have stimulated enough personal motivation among the members to continue discussions on the conduct of clinical research in Zambia. This may indicate the need for an individual to be responsible for stimulating discussion. As happens in other research forums, members may change their level of participation over time and different members may leave and join. The discontinuity of the discussions could have also resulted from the lack of involvement of the prospective members during the development stages of the Zambian Clinical Research Forum. This should be a vital consideration in the development of any online initiative as ultimately, the success and

sustainability of any network depends on its members (56–58). Therefore, it is paramount for them to be engaged during the initial phases for the purpose of incorporating their views and expectations (37). The World Health Organisation additionally stresses that despite networking and other capacity building initiatives being paramount for effective research, it is the people who do research who are most critical to the research enterprise (4). Apart from not involving the prospective members in the development of the online platform, the period of time during which the discussions were facilitated may not have been sufficient to build trust among the members and maintain their interest. It has been stated in literature that the investment of time may be what is particularly needed for the build-up of trust between different groups and individuals, which has been perceived as enhancing information and knowledge exchange (25). Moreover, it is important to understand that networks require a significant investment of time and effort to maintain and more often than not, greater than that required to launch them (58).

The creation of the Zambian Clinical Research Forum as a group on the already existing Global Health Network was for the purpose of providing the members with the wealth of open access resources and linkages that specifically support the conduct of clinical research in low- and middle-income countries. In line with this, successful networks have been known to have a support system in place to address the needs of its members (59), such as providing freely available resources or advice on how to go about the different stages of research. However, considering the limited time period (five weeks) in which the discussions took place and the focus of the network on stimulating discussions, the availability of support may not have been adequately communicated or understood by the members. Advance prompting to understand the

needs of the members during recruitment could have presented an opportunity to make them aware of such forms of support and resources.

5.2 Contributions on the Online Platform

The contributions to the discussions on the Zambian Clinical Research Forum revealed a tendency for the established researchers to engage in discussions that were more subject specific and relating to actual research conduct. The fact that they were or had been involved in conducting research studies, may have meant that they found it easier to contribute based on their experiences. Their contributions in most instances involved lengthy texts, sharing their experiences or expertise on certain aspects of clinical research such as how they involved the community in their studies to enhance participant recruitment and retention. The emerging researchers on the other hand, rather than only engaging in discussions related to actual research conduct were also keen on exploring general aspects of clinical research due to their lack of experience in conducting research. These included discussions on how individuals with different skills and responsibilities could contribute to the conduct of clinical research in Zambia and the different career options available for different members of the research team. Emerging researchers having an interest to get involved in research therefore tend to explore different areas and are more likely to be open to any opportunity for gaining knowledge, skills and resources. This observation could be used to encourage the established researchers to be open to the needs that the emerging researchers highlight through the discussions, and to support their development. There was need for more interactions particularly from the established researchers in providing feedback on the various discussions of the online platform. In the literature it has been emphasised that contributions to online discussion

platforms should not be limited to posting lengthy and well thought through knowledge entries, on the contrary, other knowledge exchange activities such as posting questions or providing answers and feedback to discussion threads should also be encouraged (56).

The Zambian Clinical Research Forum besides encouraging both the emerging and established researchers to contribute to the already existing discussion topics, also stimulated them to initiate their own discussions. This was a vital aspect of the online platform in enhancing research capacity particularly considering the discussion topic initiated by the emerging researcher. The topic was focused on gaining information on how an everyday pharmaceutical scenario involving the administration of medication to infants, could be turned into a research question. The emerging researchers were also observed to respond to discussions similar to their own field of specialisation. This could provide more opportunities for identifying areas of research particularly where clinical guidelines are lacking as was pointed out in the discussions. The initiation of discipline specific discussion topics, highlights the prospective benefit of supporting researchers by providing a field-specific basis for interaction through online networks. Exploring how interactions and contributions on online discussion platforms differ between emerging and established researchers could help identify necessary improvements to be made to the platform for the accommodation of individuals on various research levels. Interactions at any level are usually beneficial to those who are involved in them. The Zambian Clinical Research Forum having stimulated a level of interaction among both emerging and established researchers, could be vital to improving research capacity by addressing needs at several research levels. Online networks involving individuals with different levels of expertise, have been perceived

as enabling less experienced members to learn from interacting with more experienced members and from each other (56). The networks have also been said to have the potential to increase confidence to conduct research, and therefore contribute to research capacity building (3).

5.3 Nature of the Discussions and Interactions

The online network was designed to encourage experience exchange, knowledge sharing and building a community of researchers that could support each other and contribute to the strengthening of the capacity to conduct clinical research in Zambia. It was therefore not surprising that the nature of most responses to the discussions were more affirmative and supportive. This may indicate that individuals shy away from criticising or disagreeing to issues raised in an open forum, or that the online platform was genuinely viewed as supportive network where affirmative responses gave way to more positive posts and responses. This was observed particularly when members referred to each other by name in response to other members' posts and added vital information to the discussions or shared knowledge based on their expertise. This showed how such networks could be used to enable researchers to encourage each other and therefore potentially raise confidence. Apart from knowledge sharing, the online platform also stimulated specific discussions focused on the needs of the Zambian clinical research environment and these drew more participation from both the emerging and established researchers. These discussions were prompted by the topic on issues related to the conduct of clinical research in Zambia which included recruiting study participants, obtaining funding and research data management. Such a trend is supported by Vanderhoef (60) who stresses that, merely attributing online

networks to knowledge sharing may be too generic to stimulate enough interest to take part.

Discussions alluding to the challenges and strategies of conducting clinical research in Zambia were quite engaging of most members and particularly the established researchers, who as earlier noted were open to opportunities that allowed them to share their experiences. Most of the challenges including lack of research finances and difficulties in participant recruitment and retention were outlined as hindrances to the conduct of clinical research by emerging researchers. Established researchers on the other hand, apart from highlighting the challenges they encountered in conducting studies also shared how they overcame them. The evaluation of barriers to clinical research in low- and middle-income countries in literature has more than often, also included facilitating factors as a way of enhancing clinical research capacity to stimulate more research (6,8). The ability of the online platform to encourage discussions not only on challenges but also on facilitators to clinical research in Zambia was an indication of the potential for such discussion forums to enhance the local clinical research capacity by addressing issues that are unique to a particular area. This was a strength for the online forum because no matter how much the challenges to clinical research were discussed and highlighted, if they were not accompanied by ways to address them, then talking about them could not add much benefit to research. This also helped emerging researchers clarify any perceived challenges based on the experiences of established researchers. For example contrary to the barrier of a lack of local funds for clinical research in Zambia, the online platform revealed the availability of some local funds through an established researcher who had benefited from funds made available by the National Science and

Technology Council of Zambia (NSTC). NSTC mobilises and makes available financial, human and other resources including science and technology information to research and development institutions (61). This is in an effort to encourage more locally initiated research in Zambia.

5.4 Research Self-Confidence

Participation in the activities of the Zambian Clinical Research Forum which involved knowledge sharing, experience exchange and discussions on important aspects of clinical research in Zambia led to a slight increase in the research self-confidence of the emerging researchers. This was in relation to the performance of a number of research tasks outlined on the Research Self-Efficacy Scale (Appendix section 8.5). This is supported by literature proposing that interactions between experienced and inexperienced researchers may have the capability to increase confidence and contribute to research capacity building (3,62). The research self-confidence of the established researchers in performing clinical research tasks was however unaffected by their participation in discussions on the online platform. The influence of the online discussions and interactions on the research self-confidence of the members could be regarded as an expected outcome. This is because compared to the emerging researchers, the established researchers were perceived as being conversant with the performance of different research tasks such as identifying and formulating a clear research question and effectively presenting the findings of a study. This also indicates that the influence of the online discussions was beneficial to those with more gaps in research knowledge and skills than to those fewer gaps. However, because the acquisition of knowledge and skills cannot be exhausted, those already established in such areas as clinical research should embrace opportunities such as online

discussions to add to their existing capabilities. These and other activities for networking should also be viewed as occasions for getting to know about the needs of those lacking the necessary skills, confidence or knowledge to perform clinical research tasks.

The only minimal increase in the research confidence of the emerging researchers indicates that the Research Self-Efficacy Scale did not demonstrate huge changes. However, most of the scale items came up in the online discussions thus pointing to the usefulness of the online platform. In addition, the ability for the online discussions and interactions to effect even a slight increase in the research self-confidence of the emerging researchers indicates the potential for such an initiative to contribute to clinical research capacity development. This is from the consideration that certain strategies to enhance clinical research capacity such as knowledge sharing, experience exchange and collaboration have been proposed to do so by increasing the confidence and motivation to conduct research (8). The degree to which such an increase in research self-confidence translates to strengthening the clinical research capacity however requires further evaluation. Furthermore, developing assessment instruments that are aligned to the specific activities of online platforms may provide a more demonstrable measure of the research capacity strengthening initiative. The Research Self-Efficacy scale used for this study was deemed to be suitable as it had been previously validated and stated as being suitable for other professional programmes and not just the one it was developed for (44,45).

5.5 Research Behaviour

The assessment of the influence of the online platform on the attitudes, intentions and actions of the members in relation to the conduct clinical research, revealed that none

of the members exhibited a change in each of these behavioural stages. This was observed using the Stages of Change tool as a way of assessing progress in changing the members' attitudes, intentions and actions in performing a number of research related tasks (Appendix section 8.5). Such an evaluation tool along a change continuum provides an understanding of changes that can otherwise be overlooked if only changes in behaviour are measured (46). The assessment of the members' reported behaviour was done for both the emerging and established researchers as a combined group rather than as separate groups due to the inability of the individual group data to meet the assumptions of the relevant statistical test. This may have affected the observation of any measurable changes in the reported behaviour of the individual groups. Further studies would be needed to ascertain if the assessment by research level of emerging and established researchers would reveal a change in behaviour after taking part in a similar capacity building initiative. Comparison of the change in mean scores for the Stages of Change tool categories revealed that established researchers' intentions to perform clinical research-related activities were higher than for the emerging researchers. This might be an expected finding since established researchers were already involved in clinical research conduct and the performance of research tasks may have stimulated the intention to do more.

The lack of progress in changing members' attitudes, intentions and actions after taking part in the discussions and interactions on the Zambian Clinical Research Forum could be attributed to difficulties experienced in changing the behaviour of individuals especially over a short period of time (63). The online discussions took place over a period of five weeks and this may not have been sufficient time to influence the behaviour of the members. Moreover the Stages of Change tool research

tasks were not specifically tackled on the online platform but merely embedded in the discussion topics, therefore a specific activity incorporating these tasks could be necessary to effect a change in behaviour. This was observed for Buckley's (46) research transfer training programme that specifically tackled each of the Stages of Change tool research tasks and resulted in a change in reported behaviour for the attitude and intention stages. In addition, such an activity may have to be a standalone engagement that members will be obliged to be involved in at a particular point of time, as was the case for the research transfer training programme. This was in comparison to this study where the members took part in the online platform at their discretion when they could afford some time and in the midst of other engagements. Though the online discussions and interactions demonstrated no measurable influence on the reported behaviour of the members, they still gave insight into how similar research networking activities could be developed for the enhancement of clinical research capacity. The fact that slight improvements in each of the categories were observed, though non-significant gave an indication that activities arranged to be engaged in over longer periods of time may have the impetus to influence changes in attitudes, intentions and actions of researchers in relation to the conduct of clinical research.

Further assessments of capacity building initiatives that effect research self-confidence and behaviour may have to be done using tools specifically developed for such initiatives. This is because the Research Self-Efficacy Scale and the Stages of Change tool adapted for this study have been used mainly to evaluate knowledge gaining activities that offered qualifications on completion and these activities resulted in positive changes in research self-confidence and reported behaviour. This was the case for a learner-designed research skills course delivered in a teaching hospital in

Ghana were learners were highly motivated to learn research skills in order to obtain an internationally-recognised Diploma qualification (45). Apart from obtaining qualifications, it would also be paramount to point researchers to other benefits that could motivate them to take part in capacity building initiatives. For instance, the influences of networking on individuals could include benefiting from mentorship, clarification of career goals, and access to new opportunities such as research projects and fellowships. Other less tangible benefits that include learning a new methodology; gaining respect for other researchers or a greater sense of belonging; ownership and understanding could equally be obtained from networking (64). A lack of understanding of the benefits of such online capacity strengthening initiatives could therefore pose as a barrier to their use and uptake. Networking as part of health capacity strengthening strategies and among researchers with common interests, could also encourage the building of long term professional relationships and open avenues for the exchange of knowledge, resources and mutual support (64,65). Similarly, though open access networks tend to have more uncertain outcomes compared to closed rigidly defined networks, they could in fact be possibilities for more creative outcomes (59). Time frames for such initiatives should also be realistic as it takes time for inputs to bring about changes in behaviour and performance and enhancing capacity has been viewed as a long-term commitment (37,63).

5.6 Local Context of the Discussions

The online platform through the locally focused discussions also revealed several opportunities for capacity building efforts which included important research attributes such as mentorship, skills sharing and collaboration. These attributes could be viewed as building blocks of research capacity strengthening and when each attribute is

considered in terms of its requirements and how to enhance it, this could positively influence research capacity building. This was echoed through the discussions on skills sharing and collaboration by the members who pointed to the need for combining efforts and abilities in order to strengthen the individual skills. Some emerging researchers attested to this, by sharing how they benefited in strengthening their own research skills by tapping into the skills, knowledge and experiences of different researchers in their fields of interest. In addition, collaborative efforts apart from encouraging research capacity building were also viewed as a means of lobbying for more funds for research. Closely related to skills sharing and collaboration, the attribute of mentorship was regarded as an essential component particularly by the established researchers on the online platform. In literature, researchers have been said to need tailored, flexible and regular support from knowledgeable and passionate mentors in order to produce high quality, relevant and timely research (66). Different skilled researchers were also regarded through the discussions, as adding credibility to clinical research findings and in turn aiding the development of evidence-based clinical guidelines unique to the Zambian population. The mention of the generation of evidence-based guidelines demonstrates the success of the online platform in stimulating discussions that are vital to the conduct of clinical research and particularly tailored to the Zambian setting (1). This is because clinical research is often linked to the generation of evidence-based guidelines which are in turn regarded as aiding the improvement of health.

The discussions on research attributes were also related to another important aspect of research capacity building namely research teams. If online discussion forums could be considered as teams comprising different researchers sharing ideas, resources or

questions, then the fundamentals of research teams could also apply to online networks. These as discussed through the online platform included having a clear idea of the benefit of the team and interacting with others for the achievement of a common goal. In addition, understanding the expectations, benefits and challenges of working in research teams could also give a clearer picture of how online networks could work. The potential of the online research platform to encourage discussions on important aspects of local research, could be a point of reference to guide the choice of discussion topics when building other networking activities.

Online discussions focused on a local context are also a way through which local research capacity building activities could be monitored and evaluated. Evaluating the effectiveness of any initiative is crucial for improving ongoing activities, demonstrating their impact and enabling the sharing of experiences in what is still a developing idea (66). This has been a largely neglected yet essential component of research capacity building (67). The quality of networks should also be evaluated for the purpose of ensuring that those who take part feel that it is worth their time. Evaluation of local networks can also aid in the development of regional research networks among low- and middle-income countries which can be better suited to finding appropriate solutions to common problems hence increasing their participation in global science (68). It has however been argued that it is harder to impose formalised quality control mechanisms for open access networks (41). The evaluation of networks as a way of measuring their productivity and success has also been stated to be difficult for non-hierarchical networks with informal internal relationships based on trust and cooperation (25). Therefore, other options of evaluating quality, productivity and

success need to be explored. These may involve the use of constant feedback mechanisms on various features of online platforms.

The Zambian Clinical Research Forum though tailored to the local research context through the discussions and interactions did not exhibit a continuation in the discussions and interactions beyond the study period. This is contrary to the perception that capacity building strategies that are tailored to the local research environment have the ability to be sustainable. Other factors could have therefore limited the sustainability of the platform particularly the lack of an institutional basis. Though focused within the Zambian research setting, the online platform was not set up as part of a local working group that could gather more local support and provide the much needed local basis. Such a local foundation can provide an understanding of the local research environment and its unique needs through a continuous process with constant discussion of the issues affecting a particular area. This is consistent with studies that have stressed that capacity building initiatives should be based on a proper analysis of the local context for the purpose of understanding any underlying barriers to, and detecting specific opportunities for capacity building efforts (63,67,69).

5.7 Sustainability of the Online Platform

The discussions on the online platform were mainly driven by targeting the individual members to stimulate their participation rather than having a familiar driving force, such as a respected researcher in the institutions or organisations to which each of the members belonged. This focus on individual researchers to contribute to discussions on the conduct of clinical research in Zambia and sustain the online forum, may therefore have affected the continuity of the interactions as the online forum lacked an institutional basis. Encouraging individual researchers through their

institutions to join online research communities may provide the incentive to yield more positive results and more so when this is done through respected members of such institutions. The members of the online platform responded to discussion prompts and reminders that I sent out, probably because we shared the common factor of being Zambian and this enabled me to muster local support. Institutional online research communities may therefore yield to the desires of their members by having a common reference point which is separate and neutral but also using it as a link to network between institutions, in an effort of bringing these groups together. Kitau et al. (29) have supported the targeting of capacity building initiatives to institutions rather than individuals to ensure integration and long-term sustainability. The activities will be integrated in the institutional framework to be shielded from the shock of departure or demise of individual scientists, while creating a strong platform for developing generations of scientists (26). Local research institutions and networks of research organisations have also been seen as providing "the infrastructure and architecture on which individual researchers depend" (69). The institutional base may also offer greater opportunities for recognition and support by governments and facilitate inter-institutional collaborations among individuals from various institutions. These may in turn have a better influence on enhancing research capacity. This is from the understanding that networking, collaborating, communicating and sharing experiences have been viewed as simple ideas for strengthening research capacity in low- and middle income countries (66).

To further encourage networking focused on institutions in Zambia, the National Health Research Advisory Committee (NHRAC) which has incorporated the spirit of networking as a core foundation could be used as a means through which public sector

institutions could encourage the networking of their individual members (39). The Zambia Forum for Health Research (ZAMFOHR), a non-governmental organisation aimed at promoting research networking, could also be used as an avenue for encouraging the networking of researchers from private sector institutions (40). Collaboration with NHRAC and ZAMFOHR was however not possible for this study. This is because NHRAC was recently set up in 2013 and the secretariat was still being established, hence it was not fully functional at the time of the study. ZAMFOHR on the other hand though having been set up in 2005, was not active at the time of the study and it was established through contact with the chairperson that measures were being put in place to revamp it. The discussions also revealed that not all institutions and organisations in Zambia and particularly some service-oriented institutions have research support systems in place, and these may have to be fostered before institutions are used as the basis for research capacity strengthening initiatives. This could be done through government organisations such as the Ministry of Health as was suggested by one emerging researcher on the online platform:

> *"One strategy that should be adopted is a paradigm shift in how Ministry of Health perceives its workforce i.e. work is exclusively clinical care. Work should be perceived to entail clinical practice, teaching and research….If this is implemented, it should be very easy to encourage career progression in clinical research as healthcare professionals can then take up further training in clinical research with certainty that their knowledge will be applied within the Ministry."*

5.8 The Clinical Research Skills Sharing Workshop

The workshop on clinical research in Zambia achieved its aim of bringing together different individuals interested in the conduct of clinical research, to share their expert skills, experiences and knowledge. The fact that the local speakers tailored their

presentations to the Zambian research setting made the workshop more relevant for the attendees and stimulated more questions and feedback on how the different aspects of clinical research could be improved. The workshop further highlighted sources of support that were thought to be non-existent, such as the National Science and Technology Council of Zambia through which local funds for research could be accessed. This points to the possibility of such initiatives as research workshops to provide viable sources of information and links to further support structures that could contribute to the efforts of research capacity building.

The introduction of the Zambian Clinical Research Forum at the workshop was hoped to stimulate participation and continued discussions and interactions from the broader research community. This was however not the case and probably because the workshop was not a direct continuation of the discussions and interactions from the online platform. The attendees of the workshop in addition to the few members of the online platform also comprised a whole new group of individuals interested in clinical research and not involved in the online platform prior to the workshop. A workshop directly linked to the online discussions and interactions and involving only the members of such a platform would be better placed to enhance the success of online platforms. This is supported in literature and it is proposed that online communities accented by a series of seminars or workshops every once in a while for those important face to face conversations, could go a long way in promoting sustainability of such activities (60). This could aid in building familiarity and trust and accelerate gains in knowledge so that all those involved could contribute more effectively to challenges common to them (60,70).

5.9 Strengths and Limitations

This study assessing local networking strategies to enhance clinical research capacity would be regarded as the first study of this nature in Zambia as literature has no mention of the conduct of similar studies. This study could therefore stimulate thoughts for the need to have more robust studies on the area of research networking in Zambia as a form of capacity building initiative. The Zambian Clinical Research Forum enabled both emerging and established researchers to interact with each other and discuss among themselves. This is indicative that such an initiative has the ability to transcend hierarchy by engaging individuals across various research levels and hence overcome the isolation that is said to exist among most of the researchers in low- and middle-income countries. Additionally, the development of the online platform as a group on the already existing Global Health Network provided an opportunity for those who had not previously heard of the Global Health Network, to access the wealth of open access resources and additional research support networks available on this network. The inclusion of the one-day research skills sharing workshop into this study enabled the bringing together of individuals from different research organisations and service institutions, who would not have had the opportunity to interact before. Moreover by tailoring the various presentations and discussions at the workshop to the Zambian research setting, useful feedback on the different aspects of clinical research in Zambia was shared among the attendees and the speakers. For instance the feedback received from the workshop on the presentation covering ethical considerations, enabled the University of Zambia Biomedical Research Ethics Committee to amend their standard operating procedures in such a way as to ease the ethical application and review process for students. In order to build on these strengths and to understand

some of the factors behind the lack of achievement of some of the objectives of the study, the limitations of the study were also considered.

The recruitment method employed for the emerging researchers of this study being non-random, purposive and flexible incorporating both self-introductions and referrals through snowball sampling, limits the generalisation of the findings of this study to those who took part. This is because the members recruited were not representative of the broader population due to the reliance on referrals in identifying them. This means that those already recruited most often gave referrals to other individuals who they knew rather than those who could have been interested in research but were not within the connections of those approached. The non-involvement of the prospective members of the online platform and the lack of an institutional basis for this study, could have affected the continuity of the discussions as the topics might not have stimulated enough interest among the members to drive participation. The limited time-frame of the study may not have allowed for demonstrable improvements in the outputs that were measured particularly the reported behaviour of the members in performing research related activities. The limited period in which the study was conducted also led to the adaptation and use of previously validated assessment tools. However, tools that are specifically designed for use with online networks may have been more sensitive to measuring changes in research self-confidence and reported behaviour of the members in performing clinical research related tasks.

5.10 Implications for Practice

This study and its findings offer key lessons that could be a useful guide to the development and implementation of research capacity strengthening initiatives in

Zambia and particularly those of a networking nature. These are highlighted below and include suggested recommendations for practice.

1. The findings revealed that the members were stimulated to take part in the discussions on the online platform by constant reminders. The development of future network-based capacity building initiatives in Zambia should therefore be underpinned by clear and achievable objectives that could drive the participation of those involved;
2. The ability of the network to stimulate discussions on important aspects of clinical research among individuals in this study, should encourage further improvements to the online platform to make it more engaging. This could be done by using such a platform to discuss field specific problems or clinical scenarios that could be used as starting points for generating research questions and conducting studies among researchers in Zambia;
3. The inability of the members to continue the discussions and interactions on the online platform beyond this study implies the need to incorporate capacity building initiatives within the regular conduct of clinical research rather than as isolated ventures. This could be considered in Zambia by embedding such an online platform in institutions that could support such an initiative and stimulate participation amongst their members. This will be for the purpose of creating a strong platform for the developing generation of researchers;
4. The hindrances of busy work schedules and lack of internet access preventing members from joining and participating in the online network should be carefully considered for the use of online research networks in Zambia. This could inform the need to have alternative means of communication such as brief lunch time

meetings during busy periods and offline means of interactions when internet facilities are unavailable;

5. Based on the findings from the one-day research skills workshop where some attendees did not attend the afternoon session, it would be beneficial to consider some form of incentive such as attendance certificates in the development of future face to face research workshops or symposia.

6 Conclusion

Local networking strategies could be said to have the potential to enhance clinical research capacity in Zambia. This is particularly so for a research online network that has the ability of encouraging the sharing of experiences, knowledge and methodology amongst both emerging and established researchers. The Zambian Clinical Research Forum was one such online network developed to encourage discussions and interactions focused on the conduct of clinical research in Zambia. Both emerging researchers, who had an interest to get involved in clinical research conduct and established researchers, who were or had been principal investigators on current or previous studies were identified to take part in the activities of the online platform. The discussions focused on several important aspects of research capacity building and these included mentorship, skills sharing, collaboration and working in research teams. In addition, the challenges of conducting clinical research in Zambia and strategies to address these were discussed. The challenges which included lack of local sources for research funds and difficulties in participant recruitment and retention were perceived by the emerging researchers as hindrances to conducting research. The established researchers who mostly contributed from experience outlined the challenges they faced in conducting clinical research and described the strategies they had employed to overcome them. This also provided a means of addressing some of the perceived challenges raised by the emerging researchers.

The interactions of the online platform were characterised by being mainly affirmative, supportive, information seeking and in some cases field specific. The Zambian Clinical Research Forum therefore enabled the sharing of experiences, the exchange of knowledge and above all encouraged the focus of all of these activities to be within

the local context of the clinical research environment in Zambia. Furthermore, most of the contributions to the discussions on the online platform were aligned to what is known in literature, suggesting the truthfulness of the responses and the appropriateness of assessing the discussions.

Taking part in the discussions and interactions through the online platform led to measurable increases in the research self-confidence of the emerging researchers. This was however not the case for the established researchers who did not show demonstrable improvements in their research self-confidence. In addition the attitudes, intentions and actions of all the members as measured by the Stages of Change tool were unchanged. The discussions and interactions on the online platform were also not continued beyond the study period. The influence of the Zambian Clinical Research Forum on the research self-confidence of the emerging researchers, and its ability to encourage locally focused discussions even for the study period only, portrays the potential of the online platform to contribute to the enhancement of clinical research capacity in Zambia. The one-day skills sharing workshop having encouraged the sharing of expert knowledge and experiences also had the ability to contribute to strengthening clinical research capacity particularly when directly linked to other initiatives such as the online networking platform.

Further studies, involving such networking capacity building initiatives targeted at key institutions rather than directly at individuals, having clear objectives and assessment tools specifically developed to assess the progress of these initiatives are needed. This is in order to identify capacity building initiatives that will have a more lasting nature and influence. This study may not have achieved all of its objectives – for instance the fact that the discussions on the online platform were not ongoing beyond

the study– but it is still considered a great starting point for encouraging researchers to think about ways of effecting impactful local capacity building initiatives. The fact that a measurable change in research self-confidence was observed and that both emerging and established researchers got together to share knowledge, experiences and methodology, renders success to this study in enhancing the existing research capacity.

My experience of conducting this study indicated that both the emerging and established researchers were keen to get involved in initiatives to strengthen the clinical research capacity in Zambia with many stressing the importance of such local initiatives. This reinforces the need to identify, implement and sustain the most locally relevant capacity building initiatives and ensure that these have a positive influence on the conduct of independent clinical research in Zambia. Above all both the emerging and established researchers should realise that clinical research capacity strengthening will be better achieved by working together and while doing so, keeping in mind that networking needs effective communication across the research community.

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8 Appendices

8.1 Information Sheet

Assessment of local strategies to enhance clinical research capacity in Zambia

My name is Mukoma Kalumba and I am a Zambian Pharmacist currently pursuing a Research Masters at the University of Oxford. I am keen on getting researchers in Zambia connected and talking to each other through an online network with the aim of encouraging more Zambian-led research. If this is something you might be interested in, kindly take part in this study and contribute to strengthening the Zambian research environment. This information sheet serves to explain this study and requests your involvement.

If you are interested we would like to invite you to participate in discussions with other Zambian health workers interested in research, through an online community on the Global Health Network. The Global Health Network is a collection of interlinked websites with the common aim of sharing methods and knowledge to support low- and middle-income country-based research. Taking part in the online research network will also give you an opportunity to attend a one day skills sharing workshop on clinical research in Zambia. The workshop will be facilitated by Global Health Trials, a web-based collaborative programme on the Global Health Network and will be led by key representatives of research in Zambia. Taking part in this study will involve you filling in two questionnaires, one before the start of the online discussions and another after the workshop.

This study will be written up as a thesis and deposited in the University of Oxford open research archive and will be accessible to anyone. None of your personal details will be made available. We also aim to publish this work, again aiming to raise the profile of research in Zambia.

If you are happy to take part, kindly print your name and signature in the spaces provided below. Should you have any questions feel free to contact me on the address shown at the bottom of the page.

Looking forward to working with you to make a contribution to the conduct of clinical research in Zambia.

Name of Participant: _____ Date: _____

Signature: _____

8.2 Discussion Topics and Prompts for the Online Network

1. Discuss how individuals with different skills and experiences can contribute to the conduct of clinical research in Zambia?

   i. Discuss how understanding the roles of different members of the research team can influence your conduct of research.

2. What are some of the expectations and challenges of working in a research team?

3. Please discuss the following issues associated with conducting clinical research. Please describe any challenges and strategies for overcoming these.

   i. Recruitment of study participants

   ii. Obtaining funding

   iii. Data management

4. Please discuss the career progression options available to the different members of the research team.

   i. Please discuss any challenges experienced in developing your career within a clinical research setting, and strategies for overcoming these.

5. Within your current job, what opportunities for identifying areas of research are available?

8.3 Original statements for the Research Self-Efficacy Scale for assessing research self-confidence

As a result of the course I am able to.....

1. Identify a clinical problem that is amenable to research
2. Produce a realistic budget for my research project
3. Formulate a clear research question or testable hypothesis to address a clinical problem
4. Write a balanced and comprehensive literature review
5. Put together a team to help me to conduct my research
6. Teach someone else how to design and implement a simple research project
7. Do an effective electronic database search of the literature
8. Effectively present my study and its implications
9. Choose a research design that will answer my research question or hypothesis
10. Design and implement the best data analysis strategy for my research study
11. Design and implement the best strategy for collecting my samples

8.4 Original statements for the Stages of Change model for measuring development of research confidence about research-related behaviour

Attitudes

Learning research skills is important

Understanding how to do research is relevant to my work

I should incorporate research findings into my clinical practice

I should do more research myself

Intentions

I plan to learn more about how to do research

I will bring up the idea of incorporating research into our work with colleagues

I plan to include use of research findings in my clinical practice

I will suggest that we discuss how to improve our use of research results at our departmental meetings

Actions

I have suggested casually to some of my colleagues that they should do research

I have spoken in a formal meeting about increasing the amount of research done by our department

I have changed my clinical practice as a result of doing research

I have spoken in a formal meeting (or to my Head of Department) about increasing the use of research/guidelines in our unit

I am currently working on another research project

8.5 Structured Questionnaire

Part I: Research Self-Efficacy Scale

On a scale of 1 (= not very confident) to 10 (=very confident) please rate how confident you are in undertaking the following tasks related to clinical research in Zambia.

Statement	Scale									
I am confident that I am able to…..										
1. Identify a clinical problem that is amenable to research	1	2	3	4	5	6	7	8	9	10
2. Formulate a clear research question or testable hypothesis to address a clinical problem	1	2	3	4	5	6	7	8	9	10
3. Choose a research design that will answer my research question or hypothesis	1	2	3	4	5	6	7	8	9	10
4. Develop an outline for a protocol	1	2	3	4	5	6	7	8	9	10
5. Identify sources of funding/grants	1	2	3	4	5	6	7	8	9	10
6. Share my skills and experiences on how to design and implement a simple research project	1	2	3	4	5	6	7	8	9	10
7. Approach individuals to help me conduct my research	1	2	3	4	5	6	7	8	9	10
8. Design and implement the most effective community sensitisation programme	1	2	3	4	5	6	7	8	9	10
9. Design and implement the best data management strategy for my research study	1	2	3	4	5	6	7	8	9	10

10. Effectively present my study and its implications to my colleagues	1	2	3	4	5	6	7	8	9	10

Part II: 'Stages of change' model

For each of the following statements choose one of the following responses: strongly agree, generally agree, generally disagree or strongly disagree

Statement	Strongly agree	Generally agree	Generally disagree	Strongly disagree
Attitudes				
Learning research skills is important	☐	☐	☐	☐
Understanding how to do research is relevant to my work	☐	☐	☐	☐
I should incorporate research findings into my work practice	☐	☐	☐	☐
I should do more research as an individual	☐	☐	☐	☐
Intentions				
I plan to learn more about how to do research	☐	☐	☐	☐
I will bring up the idea of incorporating research into our work with colleagues	☐	☐	☐	☐
I plan to include use of research findings in my work practice	☐	☐	☐	☐

I will suggest that we discuss how to improve our use of research results at our departmental meetings	☐	☐	☐	☐

Actions

I have suggested casually to some of my colleagues that they should do research	☐	☐	☐	☐
I have spoken in a formal meeting about increasing the amount of research done by our department	☐	☐	☐	☐
I have changed my work practice as a result of doing research	☐	☐	☐	☐
I have spoken in a formal meeting (or to my Head of Department) about increasing the use of research/guidelines in our unit	☐	☐	☐	☐
I have spoken to some colleagues about career options in research	☐	☐	☐	☐
I am currently working on another research project	☐	☐	☐	☐

8.6 Workshop Topics and Speakers

Capacity development through research networking in Zambia

One Day Research Skills Sharing Workshop – 6th June 2014

Agenda

Time	Activity	Speaker
08:00 – 08:15	Registration	
08:15 – 08:30	Welcome and Opening Remarks	
08:30 – 08:50	Setting up a clinical trial in Zambia: who should be involved?	Dr. Duncan Chanda (IMRET)
08:50 – 09:10	Ethical Considerations: application process and challenges in granting ethical approval in Zambia	Dr. Munthali (UNZABREC)
09:10 – 09:40	Questions and discussions	
09:40 – 10:00	Choosing a Research Topic	Dr. Yassa
10:00 – 10:20	Research Financing in Zambia: current trend and future prospects	NSTC representative
10:20 – 10:40	Tea break	
10:40 – 11:10	Grant application: how to make a compelling application	Dr. Chilengi (CIDRZ)
11:10 – 11:50	Questions and discussions	
11:50 – 12:10	Data Management	Moses Simuyemba (UNZA-SOM)
12:10 – 12:40	Community Engagement: the role of the Zambian Community in research	TBC
12:40 – 13:00	Questions and discussions	
13:00 – 14:00	Lunch	
14:10 – 14:30	Career development in research: managing time between profession and research	Dr.James Chipeta (UNZA-SOM) – to confirm
14:30 – 15:10	The Global Health Network: Global Health Trials	Liam Boggs (TGHN)
15:10 – 15:40	The Zambian Clinical Research Forum	Mukoma Kalumba (TGHN)
15:40 – 16:00	Questions	
16:00 – 16:20	Tea Break	
16:20 – 16:50	Group discussions on research networking: the influence of networking on clinical research in Zambia	All members
16:50 – 17:00	Closing remarks and acknowledgements	Liam Boggs

8.7 One-Day Skills Workshop Feedback Questionnaire

Global Health Trials Workshop Questionnaire

Global Health Clinical Trials is an open collaborative programme that aims to support and encourage clinical trials in all disease areas and across all regions in the field of global health.
The purpose of this questionnaire is to better understand the impact of this workshop and to seek feedback in order to guide improvements. All question and responses will be kept anonymous and confidential.
Thank you very much for taking the time to complete this questionnaire
Please complete page 1 before the start of the workshop. Please use the extra space provided on page 3 if needed.

1. What is your job role (Select all that apply)?

- ☐ Student
- ☐ Research Coordinator
- ☐ Project manager
- ☐ Investigator
- ☐ Senior Investigator
- ☐ Research Nurse
- ☐ Field Worker
- ☐ Laboratory Staff
- ☐ Laboratory Manager
- ☐ Statistician
- ☐ Data Entry Clerk
- ☐ Data Manager
- ☐ Clinical Research Associate
- ☐ Pharmacist
- ☐ Administrator
- ☐ Monitor
- ☐ Ethics Committee/ IRB Member
- ☐ Social Scientist
- ☐ Ethicist
- ☐ Academic
- ☐ Public Health
- ☐ Regulator
- ☐ Manufacturer/ Industry Provider
- ☐ Other: _____

2. Please select any of the following factors that motivated you to come to the workshop today:

- ☐ Networking
- ☐ Career development opportunities
- ☐ To gain information about conducting clinical trials
- ☐ To learn about the Global Health Network

Other :

3. Is there anything else you would specifically like to learn about today?

We are interested in how confident you are to conduct the following aspects of clinical trials before the workshop

4. Please rate out of 10 how confident you are that you can:

i.	Formulate a clear research question	
ii.	Choose a research design that will answer your research question	
iii.	Obtain fully informed written consent from a study participant	
iv.	Design the best community sensitisation programme for your research study	
v.	Select the best data management strategy for your research study	
vi.	Identify each of the members of the clinical trial team and their roles	

We hope you have enjoyed participating in the workshop
Please help us understand more about your experiences today by completing the following questions

5. Did the workshop fulfil your aims in coming today?

No	To some extent	Mostly	Yes
☐	☐	☐	☐

Please feel free to comment

6. Were there any parts of the workshop that you found particularly useful? Please describe

7. Do you have any suggestions about how to improve the following aspects of the workshop:

i. Range of topics covered

ii. Quality of presentation(s)

iii. The program e.g. Time allocated to each component of the workshop

8. Now that you have completed the workshop, please rate out of 10 how confident you are that you can:

I. Formulate a clear research question ☐

II. Choose a research design that will answer your research question ☐

III. Obtain fully informed written consent from a study participant ☐

IV. Design the best community sensitisation programme for your research study ☐

V. Select the best data management strategy for your research study ☐

VI. Identify each of the members of the clinical trial team and their roles ☐

Please use this page to provide any other comments about the workshop today or feedback on this questionnaire

Thank you for taking the time to complete this questionnaire
Your feedback is greatly appreciated

8.8 Box Plots and Outputs for Tests of Normality

Figure 6: Box plots testing for outliers for the Research Self-Efficacy Scale (RSES) data

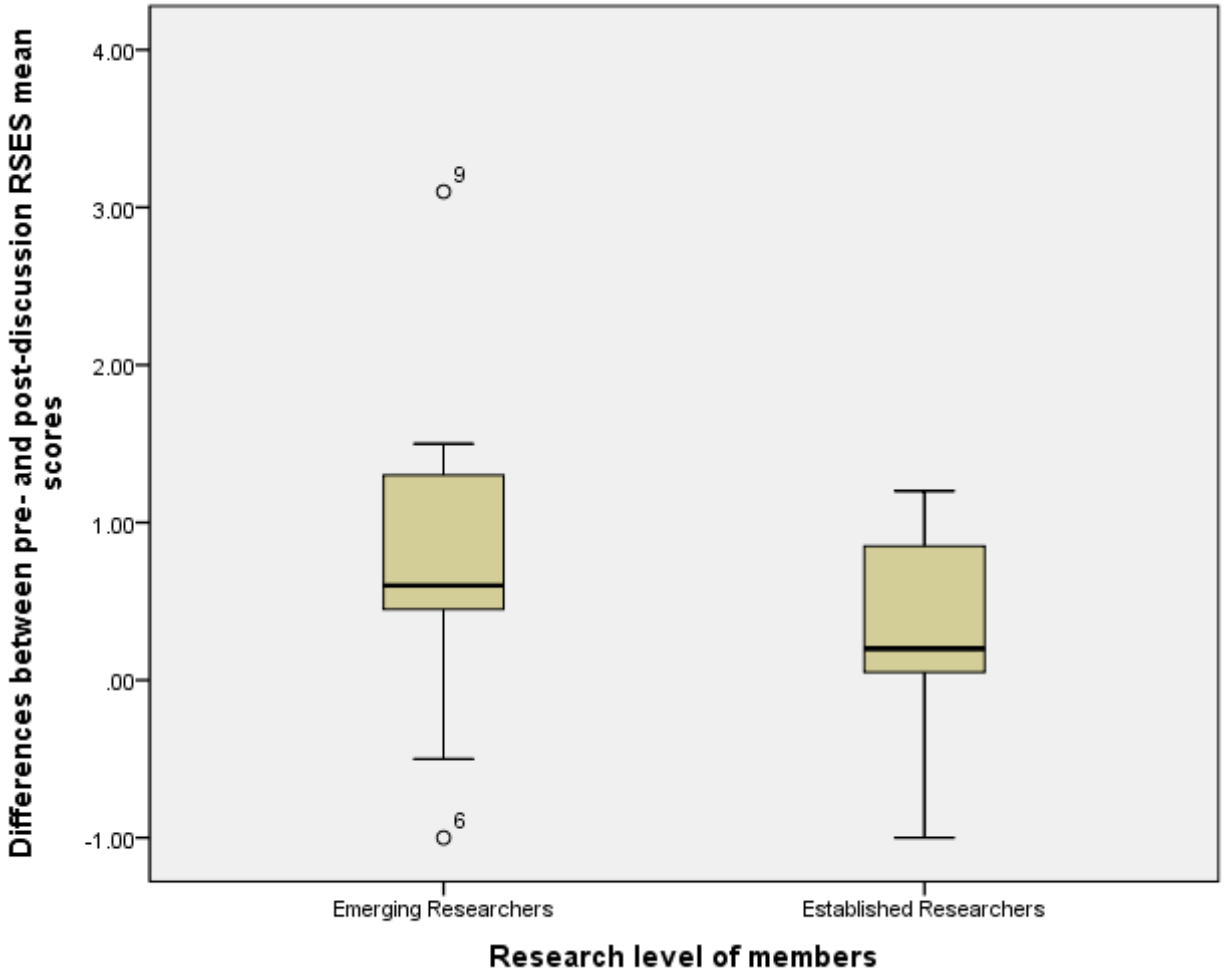

Table 6: Output for the tests of normality for the Research Self-Efficacy Scale (RSES) data

	Research level of members	Shapiro-Wilk		
		Statistic	df	Sig.
Differences between pre- and post-discussion RSES mean scores	Emerging Researchers	.92	12	.30
	Established Researchers	.94	7	.64

Figure 7: Box plots testing for outliers for the Stages of Change (SOC) tool attitudes category data

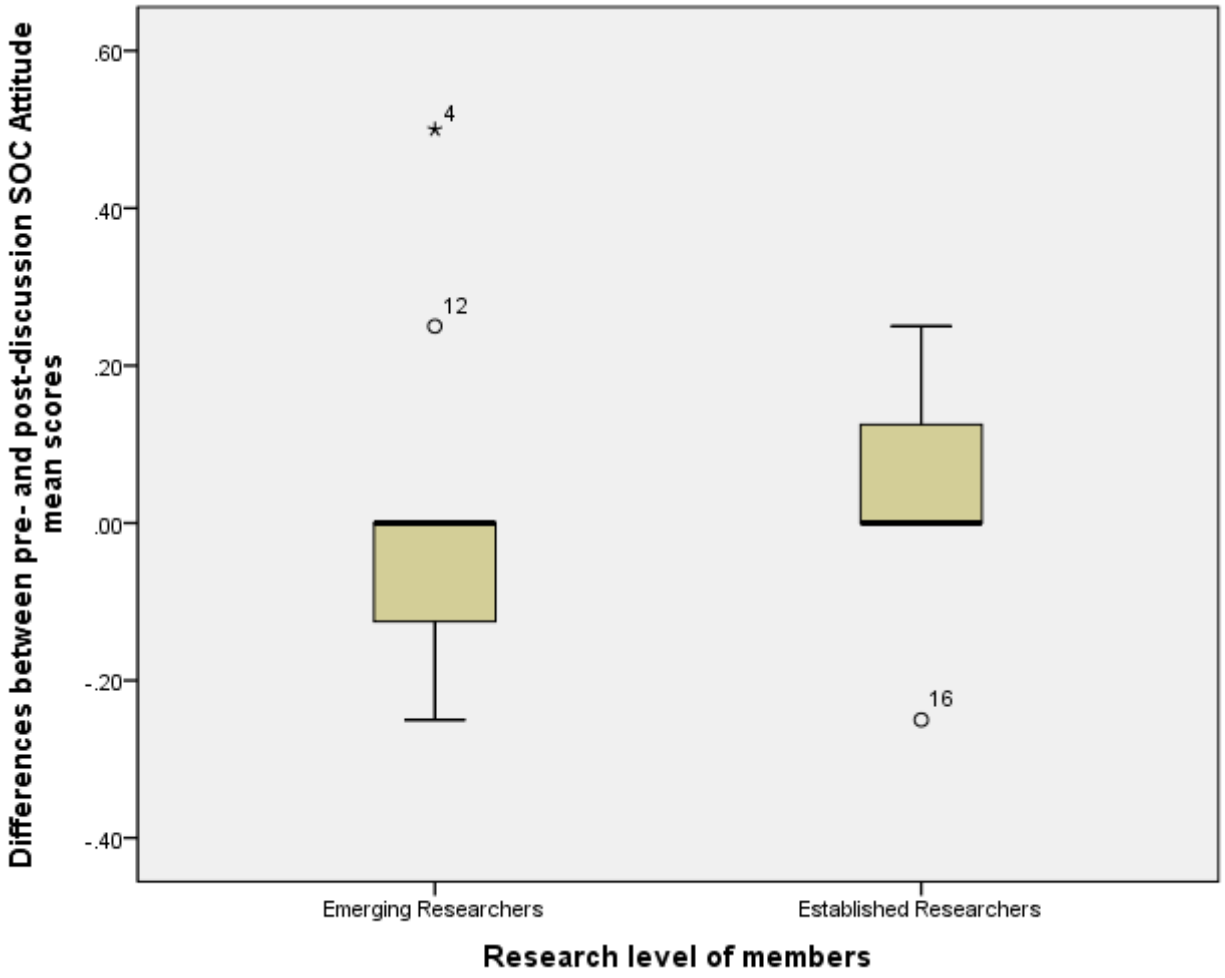

Table7: Output for the tests of normality for the Stages of Change (SOC) tool attitudes category data

	Research level of members	Shapiro-Wilk		
		Statistic	df	Sig.
Differences between pre- and post-discussion SOC Attitude mean scores	Emerging Researchers	.81	12	.01
	Established Researchers	.84	7	.10

Figure 8: Box plots testing for outliers for the Stages of Change (SOC) tool intentions category data

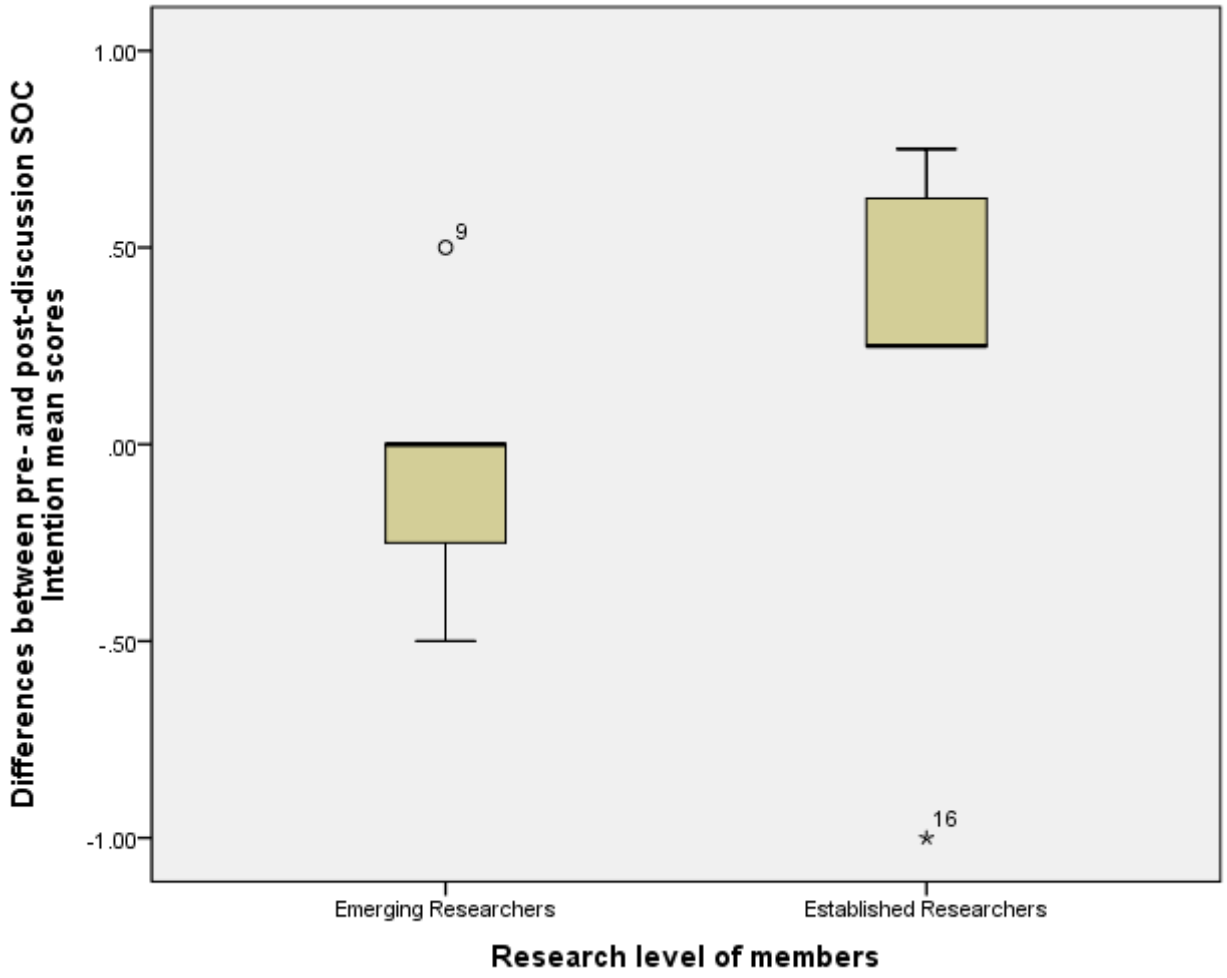

Table 8: Output for the tests of normality for the Stages of Change (SOC) tool intentions category data

	Research level of members	Shapiro-Wilk		
		Statistic	Df	Sig.
Differences between pre- and post-discussion SOC Intention mean scores	Emerging Researchers	.83	12	.02
	Established Researchers	.77	7	.02

Figure 9: Box plots testing for outliers for the Stages of Change (SOC) tool actions category data

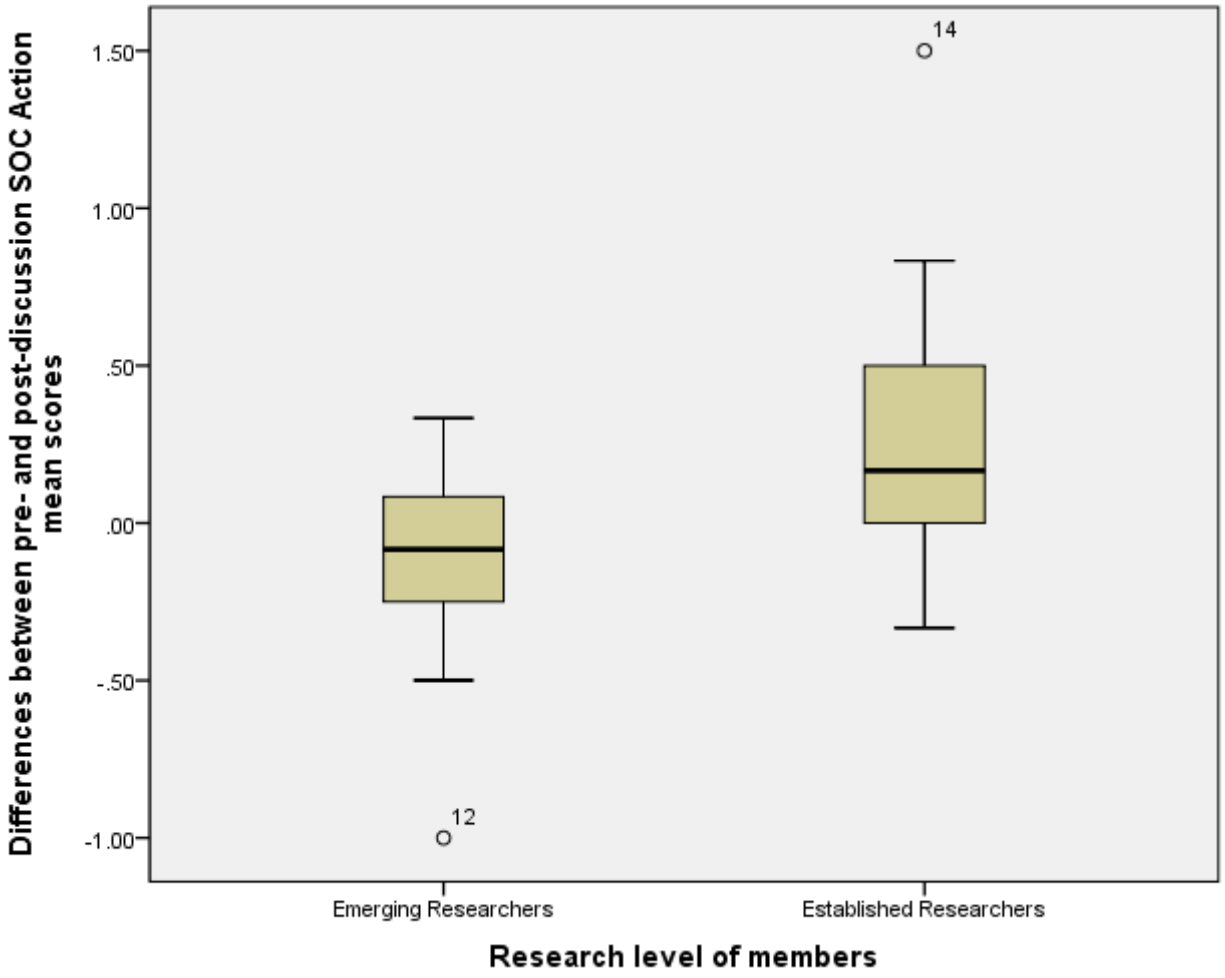

Table 9: Output for the tests of normality for the Stages of Change (SOC) tool actions category data

	Research level of members	Shapiro-Wilk		
		Statistic	Df	Sig.
Differences between pre- and post-discussion SOC Action mean scores	Emerging Researchers	.90	12	.17
	Established Researchers	.86	7	.16