






BMJ Open Opportunities and challenges to non-communicable disease (NCD) research and training in Pakistan: a qualitative study from Pakistan

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To cite: Almas A, Awan S, Bloomfield G, *et al*. Opportunities and challenges to non-communicable disease (NCD) research and training in Pakistan: a qualitative study from Pakistan. *BMJ Open* 2022;**12**:e066460. doi:10.1136/bmjopen-2022-066460

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2022-066460>).

Received 06 July 2022

Accepted 21 November 2022

ABSTRACT

Introduction Most of the global non-communicable disease (NCD)-related death burden is borne by low and middle-income countries (LMICs). In LMICs like Pakistan, however, a major gap in responding to NCDs is a lack of high-quality research leading to policy development and implementation of NCDs. To assess institutional opportunities and constraints to NCD research and training we conducted a situational analysis for NCD research and training at Aga Khan University Pakistan.

Methods We conducted a descriptive exploratory study using grounded theory as a qualitative approach: semistructured interviews of 16 NCD stakeholders (three excluded) and two focus group discussions with postgraduate and undergraduate trainees were conducted. A simple thematic analysis was done where themes were identified, and then recurring ideas were critically placed in their specific themes and refined based on the consensus of the investigators.

Results The major themes derived were priority research areas in NCDs; methods to improve NCD research integration; barriers to NCD research in LMICs like Pakistan; design of NCD research programme and career paths; and NCD prevention at mass level, policy and link to the government. In general, participants opined that while there was an appetite for NCD research and training, but few high-quality research training programmes in NCDs existed, such programmes needed to be established. The ideal NCD research and training programmes would have in-built protected time, career guidance and dedicated mentorship. Most participants identified cardiovascular diseases as a priority thematic area and health information technology and data science as key methodological approaches to be introduced into research training.

Conclusion We conclude from this qualitative study on NCD research and training that high-quality research training programmes for NCDs are rare. Such programmes need to be established with in-built protected time, career guidance and mentorship for the trainees to improve their research capacity in Pakistan.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Our study used a qualitative method based on grounded theory which specifically allows theory/theories to emerge from the data that are collected in a systematic yet flexible way.
- ⇒ Using qualitative methods, we supplemented the in-depth interviews with additional focused group discussion as well to generate new knowledge regarding non-communicable disease (NCD) research and training from low and middle-income countries.
- ⇒ We have reported the mechanisms to achieve rigour in this qualitative study using standard principles.
- ⇒ The findings are limited to NCD research and training that could be conducted in a university with resources in an urban setting.
- ⇒ The representation of policymakers and non-governmental organisations as stakeholders was limited.

INTRODUCTION

With global industrialisation and consequent lifestyle changes, non-communicable diseases (NCDs) now account for 72% of global deaths.¹ Most of the NCD-related death burden is borne by low and middle-income countries (LMIC).² NCDs have deep economic and societal consequences and thus their rising burden, especially in fragile LMICs, is alarming. In Pakistan, an LMIC with a population of over 220 million and with a total health expenditure of 2.6% of the gross domestic product (GDP), NCDs now account for >50% of mortality among adults.³ Four NCDs including cancers, cardiovascular diseases (CVD), chronic respiratory diseases and diabetes account for the most NCD mortality.⁴ Projection models derived from Global Burden of Disease 2010 data predict that there will be about 3.87 million premature deaths by 2025 from CVDs, cancers and



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Table 1 Comparison of social indicators and human development indices of Pakistan with other lower middle-income countries¶

	Population size in millions.	Life expectancy at birth, total in years	Literacy rate in %*	Gender equality in %†	Government expenditure on education‡	Human development index§
Pakistan	225	67	73	20	11.6	0.5
Bangladesh	166	73	94	21	11.7	0.6
Angola	33	61	77	30	6.9	0.5
Cameroon	27	60	85	34	14.9	0.5
Cote d'Ivoire	27	58	84	14	15.0	0.5
Kenya	54	67	88	22	19.0	0.6
Lesotho	2	55	87	23	13.7	0.5
Nigeria	211	55	75	4	5.7	0.3
Senegal	17	68	69	43	21.1	0.5
Zambia	18	64	92	15	11.5	0.5
Zimbabwe	15	62	90	32	19.0	0.5
Myanmar	54	67	95	15	10.6	0.5
Papua New Guinea	9	65	68	0.0	9.2	0.5
Mauritania	4	65	64	20	9.7	0.5
Sudan	44	66	73	31	12.5	0.5

*Literacy in % of people aged 15–24.

†Proportion of seats held by women in national parliaments (%).

‡% of total government expenditure.

§Composite score between 0 and 1 comprising life expectancy at birth, mean years of schooling and expected years of schooling. Gross national income per capita in US\$⁸¶Data from <https://data.worldbank.org/>.

chronic respiratory in Pakistan, with serious economic consequences.⁵ To meet the rising burden of NCDs in Pakistan, a national action plan was developed in 2004 and then a follow-up plan in 2014, but there are little data on its implementation across Pakistan. Interestingly, CVDs constitute a substantial proportion of projected deaths by 2025 in this analysis. In a bibliometric analysis of NCDs in LMICs, only 9% were published from countries in South Asia and only 1.7% from Pakistan.⁶ Also, presumably another reason for the lack of NCD data from LMICs could be a large amount of thesis work that never makes it to publication in indexed journals. More specifically to CVDs, we have shown in a bibliometric analysis over 10 years, LMICs contributed only 2.8% of the total research output.⁷ Pakistan as an LMIC also resembles social and human development indicators with other LMICs on the globe and NCD-related challenges are likely to be similar.⁸ (Table 1 shows a comparison of social indicators and human development indices of Pakistan with other lower middle-income countries.)

According to the WHO NCD fact sheet for Pakistan, many NCD global action plan indicators either lack data or all goals of the action plan have not been met. A major gap in Pakistan's response to the NCD epidemic is a lack of a high-quality research workforce that could subsequently advise the government in prioritising, policy development and implementation of NCD prevention programmes.⁹ This is also demonstrated by the lack of budgetary resources allocated to primary and secondary

prevention of NCDs.¹⁰ At present, provincial governments are the single largest institutional entity spending on health but most of this goes towards curative care, and the health system cannot allocate funds for NCD prevention and control.¹¹ The package of essential NCD interventions for primary healthcare in low-resource settings from WHO has also faced implementation challenges.¹² While inadequate research capacity is a pervasive, cross-disciplinary problem, understanding specific barriers and opportunities to develop NCD research capacity is necessary and foundational to endeavours aiming to build the capacity of a high-quality research workforce in Pakistan. To assess institutional opportunities and constraints to NCD research and NCD research and training we conducted a situational analysis for NCD research and training at Aga Khan University (AKU) Pakistan.

METHODS

Study design

We assessed opportunities and barriers to NCD research and training with a descriptive exploratory study. We used qualitative approaches to assess institutional opportunities and constraints faced at AKU and Pakistan in general about NCD research and training. For this assessment, we used the grounded theory suggested by Glaser and Strauss.¹³ Grounded theory is a type of qualitative research methodology that allows theory/theories to emerge from the data that are collected in a systematic yet

flexible way.¹⁴ The questions were explored in two ways: (1) through semistructured interviews of stakeholders including academia, non-governmental organisations (NGOs) and civil society, and different levels of governance, including national, subnational and municipal councils working on NCD; (2) conducting focus group discussions (FGD) of undergraduate students and postgraduate trainees from AKU.

Study setting

This work was conducted at a leading university in Pakistan from November 2018 to December 2021. Initially, the study was planned for 2019, but due to the COVID-19 pandemic the study had to be extended until December 2022. This also provided us the opportunity to gather perspectives during the COVID-19 pandemic. The AKU is a private non-profit international research university with its flagship campus located in Karachi. The Aga Khan University Hospital and its laboratory network encounter approximately 1 million patients annually and the university's health sciences portfolio has education programmes leading to the MBBS degree, degree in nursing, master's degrees in epidemiology and biostatistics and health policy and management, and PhD. In addition, there are 40 postgraduate programmes at AKU with >100 graduates every year.

Sample and recruitment

Stakeholder interviews

Stakeholders encompass members from academia, NGOs, civil society and different levels of governance, including national, subnational and municipal councils working on NCDs.¹⁵ As the focus was more on NCD research and training, we mainly conducted semistructured interviews with NCD researchers. Additionally, we also invited policymakers and government officials, health and social service providers, NGOs and private businesses. Those who had at least five publications on NCD or were supervising master's students in NCD research or junior faculty with community-based research projects with a focus on NCD were considered NCD researchers. A sample of 10–15 participants were determined to explore the capacity for NCD research and training. The purposive sampling method was used to include stakeholders using a framework described by Schiller *et al.*¹⁶ Written informed consent was obtained from all participants who were interviewed at the start of the study. For the FGD, an email invitation was sent to the group of house staff, but individual informed consent was not obtained.

Data collection tool

The semistructured interviews comprised open-ended questions and were focused on the following areas: priority NCD research areas; gaps in NCD research within the organisation's governance and administrative resources; factors that enable or impede implementation of an NCD training programme; opportunities for integration of NCD research in clinical hospital-based and

outreach programmes, and existing non-NCD research programmes; barriers to trainee retention at AKU and Pakistan; barriers to translating research to policy and practice; type of research training programme (master's, PhD or research course) feasible for trainees; and methods to attract trainees towards a research training programme. We used the WHO definition for NCDs: 'NCDs are chronic diseases mainly including CVDs, cancers, diabetes, and chronic lung diseases'. Additionally, we also included their risk factors.¹⁷ Semistructured study guides were pretested by the study team on two individuals who were not study participants. The study guide was developed and administered in English.

Focus group discussion

All postgraduates in the final year of training and medical students with an interest in NCD research as a career were invited to participate. A sample of approximately 10–14 (five to seven in each group) participants were determined to explore the perceptions of NCD research and training.¹⁸ Purposive sampling technique was used. A semistructured interview guide was used to conduct the FGD comprising three open-ended questions on the preference of clinical training over research as a career, opportunities, barriers on becoming an active NCD researcher and the kind of research training that suits them best.

Study procedures

A total of 16 NCD stakeholders were invited to participate in the study. Once the stakeholders agreed to participate in the study, informed consent was obtained, and interviews were arranged. In total, 16 semistructured interviews were conducted as data reached saturation after 16 interviews and no added information, but only repetition of information was evident (one interview was incomplete and hence was not included). To maintain gender equity, nine men and seven women were interviewed. Each interview was of a 1-hour duration and was conducted by at least one primary investigator (PI) and a coordinator in a seminar room in the Department of Medicine or in offices of stakeholders where confidentiality could be maintained. The PI has an interest in NCDs and is a practising internist with a master's and doctoral research degree and did not have a direct reporting relationship with any of the study participants. Interviews were only voice recorded once permission for recording was obtained from participants and field notes were minimally used to aid the response to various questions in the semistructured interview. The PI had the required knowledge and research skills to perform the interviews. The coordinator ensured that all responses and comments by the stakeholders were recorded in an unbiased and uninterrupted way during the interview process. This was done to ensure reflexivity (more effective and impartial analysis) at the researcher's end (online supplemental table A: strategies to achieve rigour). This was also to ensure that there was no cultural influence of the study team or

PI on the opinions of the stakeholders. All participants provided consent for voice recording. Strict privacy and confidentiality were maintained for all recordings and data. All interviews were conducted once only.

An FGD was conducted with 14 undergraduate and postgraduate trainees (seven in each group) over 1 hour. The discussion was conducted by the study coordinator under the supervision of the PI and was continued until the saturation level was reached by the end of the second FGD. Discussions were only voice recorded and permission for recording was obtained from all participants. Strict privacy and confidentiality were maintained for all recordings and data.

Patient and public involvement

Patients were not involved in this study directly as it was a situational analysis of the research training programme. As this was an exploratory study on NCD research and training, stakeholders from different fields including NGOs and researchers who have been involved in research projects in public health were involved. This indicates that there was indirect involvement of the public while formulating the research question. The focus of the research question on analysing the gaps in NCD research and training stems from NCD being an important health indicator for LMICs. Both faculty and student were part of the study.

Data analysis

The in-depth interview responses of the trainees were audio recorded (raw data) and were carefully transcribed, read, typed and organised. The field notes were compiled in an Excel sheet and helped in identifying sections of the interview while transcribing. Two research staff read the typed interview transcripts separately for accuracy and completeness. Both transcriptions from each interview were then compared for verification to increase the accuracy of the data by investigators Aysha Almas and SA. Codes were assigned to themes of semi-structured interviews. The investigators then reviewed all transcripts comparing the coding of the text. During the coding process, data were continuously reviewed, and emerging patterns were noted. Steps of simple thematic analysis were done where themes were identified, and then recurring ideas were critically placed to their specific themes (online supplemental tables B and C). This was followed by developing a refined list of themes based on the consensus of the investigators. A similar process was used for focused group discussion. Out of the total 16 interviews that were conducted, three were excluded due to conflict of interest as these participants were also the investigators during the current study. These additional interviews carried out during the pandemic were done with the same guide to understand if any new themes arose. We also conducted sensitivity analyses with and without excluded interviews to see if any new themes were developed.

Table 2 Distribution of participants for a semistructured interview

Participants in semistructured interview (n=13)	
Gender	
Male	7
Female	6
Professional group	
Policymakers/government officials	2
Practitioners and professionals*	6
Researchers*	4
Non-governmental organisation lead	1
Participants in focused group discussion (n=14)	
Gender	
Male	7
Female	7
Training programme	
Undergraduate students	4
Postgraduates	
Cardiology	4
Pulmonology	1
Internal medicine	2
Dermatology	1
Infectious disease	1
Endocrinology	1
*Areas of interest of these researchers are diabetes, obesity, cardiovascular disease (CVD), hypertension, chronic obstructive pulmonary disease (COPD) and stroke.	

RESULTS

Semistructured interviews

A total of 16 participants took part in the semistructured interviews, out of which data for 13 interviewees were analysed as mentioned in [table 2](#). Five major themes were derived from the semistructured interviews. No new themes emerged in doing sensitivity analysis with and without the excluded participants. The themes and subthemes are shown in [figure 1](#).

Top priority areas in NCD research

Most participants stated that CVD and CVD risk factors like hypertension, diabetes and smoking are the principal areas that need to be targeted in LMICs like Pakistan. Other areas that need exploration include mental health, trauma research, community-based screening programmes for prevention and control of NCDs, nutrition, cancers and environmental and women's health. Participants stressed that population-based research was needed but rarely conducted in thematic areas like mental health and injuries. Participants also stated that fields of e-health, hospital-based registries, big data and pharmacoepidemiology need to be methodological areas of focus across all these NCD priority areas. A female

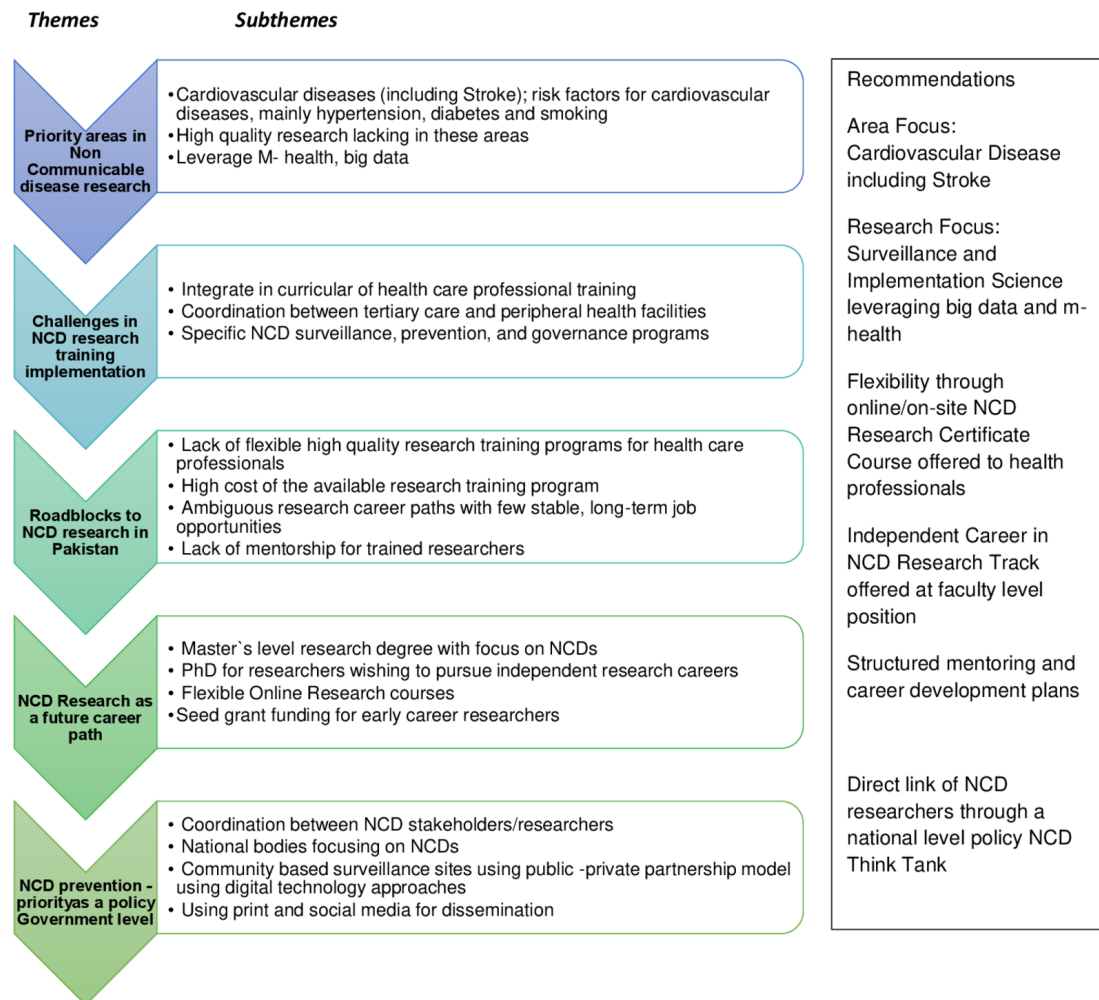


Figure 1 Themes and subthemes developed from the semistructured interviews. NCD, non-communicable disease.

senior researcher (ID_05) from the Community Health Sciences Department indicated:

Large databases are not explored, large datasets lying with governmental agencies remain untouched.

Scant use of large databases may be attributed to few partnerships between research scientists and public officials who have access to the data, ambiguity in data ownership guidelines and unexplored potential of such databases by the custodians.

Challenges in NCD research and training implementation

Participants stated that there is a lack of training for healthcare professionals to enable them to conduct high-quality research. There is no dedicated training to conduct research at the undergraduate or postgraduate level in public sector medical universities. The research conducted by postgraduate medical trainees as part of their mandatory requirement for appearing in exit examinations is not of high quality. National-level academic organisations like the Higher Education Commission of Pakistan and the College of Physicians and Surgeons of Pakistan need to collaborate to build capacity in research in general and specifically NCD. Such training needs to

be organised both for trainees and the trainers or supervisors. Simultaneously, there is a dearth of high-quality, international-level research training in Pakistan. Most universities offer master's in public health, but the quality of graduates sometimes does not translate into independent research. There is also a need to develop a disease-specific curriculum in epidemiology and NCD-specific courses. Also, there is a lack of coordination between apex tertiary care facilities and peripheral or basic health units (BHU; primary care). The BHUs can serve as a unit for NCD prevention by providing health services as well as data generation. There is a need to develop linkages with international organisations to promote the NCD research and training agenda in the right direction. A male, distinguished neurology researcher (ID_01) noted:

No centralized data system exists. These clinical centers are primarily designed for services. There is a need to develop an IT infrastructure between Afghanistan and other AKU centers through Aga Khan Development Network.

Participants also stated that there were no organised NCD prevention programmes led by the government

which were designed and implemented at a mass level. A male lead from an NGO (ID_06) noted:

Health is not a priority area for our governments.

An early career public health researcher from a public health institute (ID_06) stated:

The government should not only facilitate research training but also allocate small grants for trainees of Master level which can be utilized for NCD research in a transparent fashion.

Roadblocks to NCD research and training in Pakistan

Participants listed several barriers to NCD research and training in Pakistan. First, they indicated that few quality research training programmes exist, and these often have expensive tuition fees. Funding to attend these programmes becomes a challenge and is a major barrier for healthcare professionals to become trained in various research fields. There is a gap in commitment towards NCD research between researchers and policymakers. However, with the advent of the COVID-19 pandemic, this gap has reduced to some extent as reflected by the success of policies implemented by the National Command and Operation Center of Pakistan, clinical trials conducted over a brief period and changes in hospital infrastructure according to the demand of the pandemic. Second, healthcare professionals are hesitant to pursue a career in research as it has slower career progression and poor monetary remuneration compared with building a successful clinical practice. Third, participants felt that there was a lack of invested mentorship for trainees and early career researchers. The lack of individuals with expertise in quantitative research methods (eg, with master's and PhDs in the research field) was reported as a barrier. Additional barriers included a lack of protected time for research for those who do acquire formal research training and subsequently struggle to achieve success as independent researchers. Participants also pointed out that cumbersome research administrative processes and insufficient research administrative staff further add to the stagnancy in research culture. A distinguished male neurology researcher (ID_01) stated:

Lack of training and funding opportunities, research career does not have any compensation model for research.

NCD research as a career path in future

Overall, the participants agreed that there is a lot of potential in developing a career in NCD, if there are suitable research training programmes, as Pakistan faces a heavy burden on NCDs. Most participants considered master's in a research area such as epidemiology and biostatistics or health policy and management as a feasible programme option for healthcare professionals. They suggested introducing postgraduate clinical programmes that have a built-in master's programme within them. Some

participants, however, thought that long-term training such as PhD is especially important and having a cadre of PhD trained researchers is critical to furthering the long-term thematic research agenda for any university. Some participants also suggested that short-term research courses were also an alternate feasible solution. Better mentorship in research for trainees so they can pursue an independent research career is required to improve their research capacity. A female senior researcher (ID_04) with experience in implementing training grants suggested:

Offering them a structured research program within and during clinical training might be best suited.

It was suggested that more seed grant funding opportunities are needed to facilitate early career researchers.

NCD prevention priority as a policy at the government level

Most participants thought that an important reason behind the population-level NCD prevention agenda never gaining attraction in Pakistan was the lack of coordination between the NCD researchers and the government. Most participants felt that this connection needs to be improved by creating national-level bodies with stakeholders from the government, health sector and corporate sector. Better data needed to be generated and provided to policymakers. This could be derived from establishing community-based surveillance sites using public-private partnership models, using existing large governmental administrative data sets and leveraging other ubiquitous 'big data' resources. Participants felt that an often underemphasised yet important aspect of the research to policy link was the timely and comprehensive dissemination of research results. Participants felt that research results shared with the public using print and social media need to be highlighted. Research monitoring and evaluation systems are not sufficient in government institutions, while routine health information systems are also inadequate. There is a lack of interest and awareness about the dissemination and promotion of research results. There is a need to develop and improve a primary healthcare system in the country by strengthening the BHU system. Government hospitals and BHU should be connected through an information technology (IT)-based server. Additionally, postgraduate trainees should be given the chance to work for 1 month at BHU to improve community services. We need to develop facilities in BHUs, such as providing NCD preventive services.

Focus group discussion

The three main themes developed from two FGDs (seven participants in each) of the trainees are summarised in [table 3](#). Four undergraduate students and 10 postgraduates in their final year of training participated in the study. The postgraduates were from cardiology, internal

Table 3 Main themes from the focused group discussion from trainees*

1	Clinical versus research as a career path
i	Most trainees responded that they would prefer a clinical career track over a research track as it is difficult to do both simultaneously due to a lack of protected time for research during their clinical training.
ii	Financial compensation is a major factor which is more for clinical work than research, as they are told by their seniors.
2	Making research training more feasible/attractive for undergraduates/postgraduates
i	Research may be made more attractive by setting up a university-level body to function as a liaison between mentors and mentees.
ii	Giving incentives through competitions (eg, Shark Tank).
iii	Mentorship: will assign mentors to interested mentees and will allow for mentorship based on hierarchy: faculty → fellow → senior resident → junior resident → student.
iv	Formal and informal (peer teaching) teaching of core research concepts to facilitate those interested but feeling 'clueless' about where to begin.
v	'Advertising' of ongoing projects to facilitate interested mentees in finding a project they can attach to and learn from.
vi	Protected time for research (may be facilitated by spreading out a research module in clinical training).
3	Academic research training paths—options
i	Master's in epidemiology and biostatistics (clinical research track).
ii	Flexible research training modules in residency/fellowship.
iii	Most trainees felt that PhD can only be pursued if one completes a master's degree in research.
*Residents, fellows and undergraduate students.	

medicine, endocrinology, dermatology, pulmonology and infectious diseases training programmes.

The three themes that came out of the discussion indicated that most trainees preferred clinical training over research training due to lack of proper mentorship, lack of structured built-in research in their clinical training programmes and lack of a proper channel of communication between researchers and trainees.

More specifically in choosing clinical versus research as a career path, the trainee thought that monetary compensation was better for the clinical career track compared with a research career.

A young male cardiology trainee (FG-ID-06) stated:

Clinical work is more rewarding, has more predictable career course later.

To improve the mentorship structure the trainees suggested that there can be an overarching body at the university level which could oversee the research mentorship or supervision of these trainees.

A young female medical student (FG-ID-07) elaborated her concerns as follows:

Research may be made more attractive by setting up an official body to function as a liaison between mentors and mentees.

The need for flexible research training programmes for trainees was also emphasised by the trainees.

A young male neurology trainee (FG-ID-04) said:

A master in epidemiology biostatics will be ideal at this point since it will start from the basics.

DISCUSSION

We report here the systematic assessment of opportunities and constraints in NCD research and training faced by researchers in Pakistan through qualitative approaches using both semistructured interviews and FGDs.¹⁴ The main gaps identified as part of this assessment include a dearth of trained NCD training programmes and researchers, limited flexibility of current research programme offerings and lack of innovative IT and data science tools in existing research training.

The United Nations General Assembly has placed NCDs high on the global health policy agenda and reiterated the responsibility of governments to tackle the NCD crisis by developing adequate national policy responses.¹⁹ Recently, the Lancet NCDs and Injuries Poverty Commission concluded that national governments should set and adjust priorities based on the best available local data on NCDs and address the needs of those NCDs which constitute the major threat.²⁰ Even though all countries are signatories to this declaration, most LMICs like Pakistan are not adequately prepared to address this rising threat.²¹ Back in 2004, a National Action Plan for Prevention and Control of Non-communicable Diseases and Health Promotion in Pakistan was developed using a public–private partnership model.²² But data on its implementation and success are scarce and implementation of such programmes has become more challenging during the COVID-19 pandemic.²³ On the other hand, the pandemic has also opened opportunities for collaboration between policymakers, researchers and NGOs.²⁴ An NCD survey conducted in 2014 demonstrated a high prevalence of hypertension and risk factors such as



physical inactivity, poor diet and smoking.²⁵ Yet, to date NCDs are not mentioned in the list of priority diseases by the National Institutes of Health, Pakistan.²⁶ The total health expenditure of 2.6% of the GDP or approximately US\$45 per capita is a clear indication of the level of underspending and the need for enhanced funding to address the NCD burden in Pakistan.³ Besides lack of stable governance with consistent focus, limited resources, weak health systems and poor national capacity, a critical missing piece in the national NCD response in Pakistan is a skilled research workforce.²⁷ This dearth has been recognised at the national level as it severely constrains Pakistan's capacity to effectively address the NCD epidemic.^{28–32} Additionally, the focus on NCD research funding to LMICs like Pakistan in the last three to four decades has been very low compared with the size of the problem.³³ Limited funding opportunities are available within universities and through the Higher Education Commission, Pakistan Science Foundation and the Ministry of Science and Technology at the national level. Also, a few international funding agencies such as the National Institutes of Health-Fogarty, Wellcome Trust UK and International Diabetes Federation have funded NCD-based projects in Pakistan.^{34–37} But more national and international funding bodies need to reprioritise funding for NCD research based on public health needs.⁵

Barriers to the development of such a skilled NCD research workforce highlighted in our study included lack of high-quality research training programmes, resources and facilitatory career pathways for NCD researchers. We found that while there was a great appetite for such training, potential trainees and experts felt that there was a dearth of high-quality training programmes and systemic support structures necessary for the long-term career success of NCD researchers. But at the same time, many opportunities and ideas to address these barriers were also highlighted. Previous work has shown that there are low numbers of competent researchers in LMICs.³⁸ This is true for Pakistan too where a substantial increase in the number of medical graduates and postgraduates over the past few decades has not translated into more researchers or clinician-scientists. High-quality research training programmes for undergraduates and postgraduates are limited which is why there are few clinical scientists from Pakistan. Previously proposed solutions included strengthening 'in-house' research training to increase local capacity and reduce the 'brain drain' in Pakistan; strengthening research training programmes and developing schools of public health to develop health professionals: educators, practitioners and researchers who have critical thinking and research local solutions to fundamental health problems in LMICs.^{30 39 40}

Career pathways that are defined, with adequate protected time, and invested mentorship are important ingredients to developing research careers. In a study that assessed 294 medical students in Pakistan, only 19.4% of the participants thought that they would choose research as a career.⁴¹ Important barriers cited included

lack of protected time and mentorship. Lack of mentorship was also found to be an important barrier to understanding and pursuing research career paths in a study on postgraduates.^{42–44} It is known that mentorship early in one's career results in more productivity in terms of publishing, obtaining funding and transitioning to leadership. Similar challenges were reported through the focused group discussions with undergraduate and postgraduate students from this study including a lack in culture of mentorship and a dearth of clinical scientists who could serve as mentors. This highlights the urgent need for quality research training with in-built mentorship programmes that can develop a cadre of NCD researchers to serve as mentors in the future. In addition, structured mentoring individual career development frameworks need to be developed with institutional and facilitatory policies from the government; these include attractive compensation models for researchers, time protection, especially for early career researchers, and funded positions in leadership.^{30 45 46} Building a cadre of NCD researchers will contribute to the development of much-needed contextual and relevant evidence necessary to guide and implement effective local solutions and fill the data to policy gap.

Our findings highlight the need to develop a menu of short, medium and long-term NCD research and training programmes tailored to the needs of different health-care professionals at different career levels. Additionally, such programmes should have the flexibility for those pursuing clinical training.

From a research method standpoint, IT and data science were areas that were highlighted as opportunities by participants. Digitised information acquired as a by-product of clinical care, the government-maintained administrative data sets and digital online footprints represent untapped opportunities for NCD surveillance and targeting risk-mitigating interventions in Pakistan. This approach would also capitalise on a robust historical investment in IT.^{21 25 47–51}

Our study generates new knowledge and highlights important addressable barriers and opportunities that if fully leveraged will lay down the foundation of a future robust NCD training programme at leading institutions in Pakistan that have the necessary infrastructure to train the next generation of NCD researchers. The long-term sustainability of such programmes requires government support and investment. Also, these findings serve as a guide map for other LMICs that face a similar challenge in tackling the NCD burden, in developing research career paths in NCDs. We also call on international funding agencies like the Gates Foundation, Medical Research Council, National Institutes of Health, Wellcome Trust and others to support NCD projects in Pakistan.

The strength of this study is that it highlights NCD research and training using in-depth interviews with experts while supplementing it with focused group discussion from novice trainees interested in NCD research. We have shown how the study achieves rigour as

in a qualitative design according to principles of Lincoln and Guba (online supplemental table A).⁵² There are several limitations in this study; first, while this is a single-centre study the candidates interviewed in the study and included in the focused group discussions had diverse prior experiences at other universities in Pakistan and bring their opinions and those insights as well. Second, while researchers from different fields were included, only one policymaker and one NGO representative were interviewed for the study which could have affected the diversity of opinions. Third, no patient was interviewed as a stakeholder, which could have limited the findings to a predefined educated group of researchers, and the number of FGDs was minimum. Additionally, the findings are limited to NCD research in an urban setting from an LMIC; however, based on the similarity of the social and human development indicators of Pakistan with other LMICs, the findings can be reflective of these countries as well. While the study fulfilled most criteria to achieve rigour, peer debriefing was not done which is a limitation of the study.

CONCLUSIONS

We conclude from this qualitative study on NCD research and training in Karachi, Pakistan, that high-quality research training programmes (specifically for NCD) are rare. Such programmes need to be established with in-built protected time, career guidance and mentorship for the current trainees to improve research capacity in Pakistan. Additionally, strong networking mechanisms between NCD researchers, policymakers and government need to be facilitated to prioritise NCD research.

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Acknowledgements We thank all the study participants who gave their invaluable time in conducting this study.

Contributors ZS and AA designed the study and participated in getting ethical approvals, study implementation and writing the first draft. SA participated in the data collection, analysis and write-up. GB was also involved in designing and reviewing the manuscript. DBM, PD, JB, SS, SHS and THJ contributed to the study implementation and in writing the draft of the study. MIN, AA, SA and ZAB contributed to designing interviews with stakeholders and writing the final draft of the study. All authors read and approved the final manuscript. ZS is the guarantor

and accepts full responsibility for the work and conduct of the study, has access to the data, and controlled the decision to publish

Funding This study was funded by NIH-Fogarty Center D71 Planning Grant (grant number: 1D71TW011184-01).

Disclaimer The funders had no role in the study design, data collection, analysis, decision to publish or preparation of the manuscript.

Competing interests ZS has received funding from Bill & Melinda Gates Foundation (INV-021944, INV-050389) Fogarty International Center of the National Institutes of Health (D43TW011625); NIHR, UK; Yale University; Duke University; Certara Inc; PHRI.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by the Ethical Review Committee of Aga Khan University (2018-0803-1075). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; peer reviewed for ethical and funding approval prior to submission.

Data availability statement Data are available upon reasonable request. Data are available upon reasonable request to the corresponding author (email: samad.zainab@aku.edu).

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