A Needs Assessment for Postgraduate Training in Selected Public Health Disciplines at the University of Zambia: A Mixed Methods Study

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Abstract

Background: As most low and middle-income countries seek to achieve universal health coverage targets, there is an ever-increasing need to train human resources with the required core skills and competencies. This study reports on the needs assessment conducted to understand postgraduate training needs for three selected public health disciplines – Health Policy and Systems, Health Economics, and Healthcare Management and Planning – at the University of Zambia.

Methods: The study adopted a cross-sectional survey design. Data were collected through semi-structured interviews administered to 32 participants, identified through a comprehensive stakeholder mapping process, holding selected management positions in public and private health service organisations across Zambia. The organisations included regulatory authorities, research institutions, government ministries, insurance firms, multilateral and health services organisations.

Results: Overall, more than 68% of the stakeholders reported that they had no employees that were formally trained in the three disciplines. More than 90% of the stakeholders opined that training in these disciplines would be beneficial in providing competencies to strengthen service provision. The horizontal skills mismatch for health economics, and health services management and planning were found to be 93% and 100%, respectively. Among the key public health training needs were: policy development and analysis, economic evaluation, and strategic management.

Conclusions: This study confirms that introducing postgraduate training in the proposed public health disciplines will not only benefit Zambian health services
organisations, but also help strengthen the health systems in general. For other empirical contexts, the findings imply the need for the introduction of academic programmes which respond to ever-changing public health skills demanded; and should be matched with local priorities and service delivery. Key words: Health policy & systems, health services management & planning, health economics.

1. Background

Human resource for health is one of the six building blocks of a health system. Inadequately trained or unequally distributed health workers hampers the goal of providing access to quality health care to achieve Universal Health Coverage as espoused in the Sustainable Development Goals (SDGs). Although the gap in human resources for health for clinical areas, e.g., medicine, nursing, pharmacy, etc., has been appreciated [1, 2], the need to train complementary public health experts, such as those involved in health promotion, health services management, health policy analysis, health economics, and health systems research, among others, has received inadequate attention. As a matter of concern, and partly resulting from limited number of trained professional, a number of clinicians end up taking health systems management positions and yet they are rarely equipped with the ability to manage a diverse workforce; effectively use data in decision-making; and efficiently use scarce health sector resources [3].

The limited attention on public health training in most low and middle income countries (LMICs) is symptomatic of health systems that emphasize treatment and less investment on prevention. While noteworthy reductions in the burden of disease and gains in global life expectancy have been achieved over the past several decades, studies show that more could have been achieved if there was
greater emphasis on public health, or prevention, rather than treatment [4]. For example, it has been found that 60% of all premature deaths in the US are due to factors that need public health programs, namely, behavioural, social, and environmental circumstances, while medical care can only prevent 10% of all premature deaths [5].

Developing countries are faced with similar and complex health issues that are responsible for untold levels of mortality and morbidity [6, 7], which can greatly benefit from public health approaches. For example, Cutler and Miller [8] found that water and sanitation improvement was responsible for nearly half of reduction in mortality, and that this has implications for life expectancy improvements in LMICs. Other studies show that medical care may have also accounted for half the gains in global life expectancy[9]. Yet reaping full benefits of public health interventions requires appropriately trained public health professionals.

Medical care may not have the required impact if there are inefficiencies in the use of resources, for example, due to limited management capacity, inability to plan, cost, implement, and evaluate health programs [10-12]. Some of these challenges could be addressed by improving training in public health areas that include health policy, health services management, health economics, and health systems strengthening [13, 14]. Indeed, it goes without mentioning that the current double burden of communicable and non-communicable diseases grappling most LMICs requires reorganisation and realignment of health systems, which can greatly benefit from the mentioned disciplines.

In Zambia, the need to expand public health training has seen the establishment of the first ever school of Public Health in Zambia at the University of Zambia – the leading public university in the country [15]. The School intends to introduce a
number of postgraduate and undergraduate programs in various fields of public health. Before introducing new training programs, it is important to conduct a needs assessment so as to match public health training and service delivery needs, and more so, to gauge demand for the proposed training programs [16]. Various studies have conducted training needs across different public health domains [17-20]. These studies have been very critical in the development of appropriate public health training programs and core competencies. However, there is limited evidence particularly in sub-Saharan Africa around needs assessments for public health training programs. Thus, we conducted a needs assessment to understand postgraduate training needs and service gaps for selected public health disciplines; Health Policy and Systems, Health Economics, and Healthcare Management and Planning.

2. Methods

2.1 Research Design

The study adopted a cross sectional survey design, encompassing both open and closed ended questions. This enabled us to strengthen knowledge triangulation and ensure validity of findings [21] relating to the training needs and skills gaps of interest for health service organisations.

2.2 Sample and Sampling Techniques

Thirty-two semi-structured interviews with key health sector stakeholders in Zambia were conducted. The stakeholders were purposefully sampled from local public and private health service organisations including; health insurance companies, relevant government departments, former and practising public health graduates, health professional association leaders, regulatory authorities, research institutes, and
local and international organisations working in the health sector. The respondents were almost evenly split between public and private health service organisations (HSOs). Seventeen (17) were public HSOs while fifteen (15) were private HSOs. The respondents were drawn from a number of regulatory authorities, line ministries, insurance providers, health service providers, international partners, and public health research organisations. Stakeholder mapping was used to identify key stakeholders to participate in the study. Stakeholder mapping is particularly useful when the aim is to produce a prioritised list of stakeholders for a given undertaking [22]. Using this technique, stakeholders who are more likely to be competent enough to comment on context specific training needs for each of the four disciplines. The breakdown of the final sample is summarised in Table 1 below.

**Table 1: Participant Categories**

| Category                  | Organisation                                                      |
|---------------------------|-------------------------------------------------------------------|
| Regulatory authorities    | Zambia National Medical Regulatory Authority (ZAMRA)              |
|                           | General Nursing Council of Zambia (GNCZ)                          |
|                           | Zambia Medical Association (ZMA)                                  |
|                           | Health Professional Council of Zambia (HPCZ)                      |
|                           | National Aids Council (NAC)                                       |
| Line Ministries           | Ministry of Health- Directorate Public Health and Policy and Plannir |
|                           | Ministry of Economics and development planning                    |
| Health Insurance          | SANCARE Insurance (private)                                       |
|                           | Prudential Insurance (private)                                    |
| Health services           | Zambia Medical Stores Ltd (MSL)                                   |
|                           | Churches Health Association of Zambia (CHAZ)                      |
|                           | ST Johns Private Hospital                                         |
|                           | Right to Care EQUIP                                               |
|                           | Right to care Zambia                                             |
| International Partners    | World Bank Country Office                                        |
|                           | World Health Organisation Country Office (WHO)                    |
| Public health Research    | Population Council–Zambia                                         |
|                           | Akros Research                                                    |
2.3 Data and Data Collection

This study relied on primary data collected using a researcher-administered questionnaire administered between September and October 2018 (attached as a supplementary file). Qualitative data were collected using open-ended questions while closed-ended questions were used to collect quantitative data. The respondents provided responses to selected open ended questions in open text, allowing us to capture of more information based on complete knowledge, feeling and understanding. Some of the open text is presented as quotes in the results. The interviews were conducted by trained researchers (some of whom are co-authors) with good understanding of the study disciplines as well as research practice.

2.4 Data Analysis

The data collected were entered and organised in Microsoft Excel 2013. Quantitative data was analysed using proportions and tables. The analysis of quantitative data was conducted in the following manner. Firstly, we analysed the proportion of organisations who reported to have had people formally trained and the level of training in the three public health disciplines: Health Policy and Systems, Health Economics, and Healthcare Services Management and Planning. Secondly, we examined the skill gaps by examining the proportion of organisations who would find training across the three disciplines beneficial. In particular, we present the proportion of respondents who thought that training in each of the three disciplines would be beneficial to their organisations as well as their rating of the skills gap for each discipline. Relatedly, for each discipline, the specific skills required in order of importance were also identified.
Lastly, we assessed the skills mismatches relating to health economics, and health services management and planning. The concept of ‘skill mismatch’ is multidimensional. It is commonly defined in two ways: vertical or horizontal mismatch. Vertical skills mismatch refers to a situation where the level of education or skills is either less or more than is required to perform a given job. On the other hand, horizontal skills mismatch exits whenever an employee’s level of education or skills is not appropriate to perform a given job[23]. In this study, we defined the skills mismatch from a horizontal perspective. In particular, a skills mismatch is said to exist whenever we have employees performing roles relating to Health Policy and Systems, Health Economics, and Healthcare Management and Planning, for which they are not formally trained.

Data from the open-ended questions was analysed using thematic analysis. The text across the three predetermined themes; health policy and systems training, health economics training and health services management and planning was read and re-read. The data was then summarised by theme, across the different stakeholders included in the study. The open text format allowed for the capture of training needs in the words of the participants.

2.5 Ethical Considerations

This study was grated ethical exemption by the University of Zambia Biomedical Research Ethics Committee (UNZABREC) as it was deemed to fall under non-human subject research (attached as a supplementary file). Administrative permission to conduct the study was obtained from the National Health Research Authority (NHRA) as provided by the Zambian law. We ensured confidentiality by de-identifying all the data and only respondents who verbally consented were interviewed. This approach to obtaining informed consent was approved by UNZABREC. The approach was
appropriate since the study was broadly classified within the realm of non-human subject research.

3. Results

All 32 potential respondents who were identified in the stakeholder mapping also responded to the questionnaire. This represents a response rate of 100%. Key results from the study are summarised in the sections below.

3.1 Level of Training

We first report on the levels of training in the specified public health disciplines, skills gaps and need for training. In particular, the respondents indicated whether their organisation had anyone with some training in each of the three public health disciplines (see Table 2). For health policy and systems, 56% of the respondents indicated that no one had been formally trained in their organisation. For those who reported having had some form of training in the health policy and systems, 19% were trained at masters’ level, 13% had received in-service training, 9% had been trained at the bachelor’s degree level, and 3% at the PhD level. However, it is important to note that in almost all instances the health policy and systems training was received as a part of training in other public health disciplines and not as a specialist field of study.

Only 34% of the respondents reported having someone with some training in health economics in their organisation. Among those trained, 3% received in-service training, 3% were trained at the bachelor’s degree level, and 28% at the master’s degree level. In terms of full or specialized training, only one respondent reported having had someone in the organisation specially trained in health economics; at the master’s level. The rest received health economics training either in-service or
as part of other public health related training.

For health services management and planning training, only 22% of the respondents reported having had some training in health services management and planning. Of these, 3% had received in-service training, 3% at the bachelor’s degree level, and 16% at the master’s degree level. Strikingly, none of the people trained had a full or specialized training in health services management and planning.

**Table 2: Level of Training across the Three Disciplines**

| Discipline                  | No Training | Trained |
|-----------------------------|-------------|---------|
|                            | In-service  | Certificate | Diploma | Degree | Masters |
| Health Policy and Systems   | 18 (56%)    | 4 (13%)   | 0 (0%)  | 0 (0%) | 3 (9%)  | 6 (19%) |
| Health Economics            | 21 (66%)    | 1 (3%)    | 0 (0%)  | 0 (0%) | 1 (3%)  | 9 (28%) |
| Health Services Mgt. & Planning | 25 (78%) | 1 (3%)    | 0 (0%)  | 0 (0%) | 1 (3%)  | 5 (16%) |

3.2 Stakeholder Perspectives on Training Needs and Skills Gap

Almost all organizations indicated that training in the proposed public health disciplines would be beneficial to their organizations (see Table 3). We found that 94% of the respondents felt that specialized postgraduate programs in health policy and systems as well as health economics would be very beneficial to their organisations. In addition, 91% of the respondents were of the view that formal training in health services management and planning would benefit their organisations.

**Table 3: Whether the Training Would be Beneficial to the Organisation**
In terms of the extent of benefit, we asked respondents to indicate, on a Likert scale (High, Medium, and Low), how important specialized training for each discipline would be for their organization. Most respondents indicated that the need is high (see Table 4). In particular, across all three disciplines, at least two-thirds of the respondents were of the view that formal training in these fields was a matter of agency; while at least a quarter of the respondents were of the view that skills gap across the three fields was moderate.

**Table 4: Ranking of the Importance of Introducing Each Programme**

| Discipline                          | Yes | No | Do Not Know | Total |
|------------------------------------|-----|----|-------------|-------|
| Health Policy and Systems          | 30  | 0  | 2           | 32    |
|                                    | (94%)| (0%)| (6%)        | (100%)|
| Health Economics                   | 30  | 2  | 0           | 32    |
|                                    | (94%)| (6%)| (0%)        | (100%)|
| Health Services Mgt. & Planning    | 29  | 3  | 0           | 32    |
|                                    | (91%)| (9%)| (0%)        | (100%)|
| Discipline                           | High  | Medium | Low  | Total |
|-------------------------------------|-------|--------|------|-------|
| Health Policy and Systems           | 23 (72%) | 8 (25%) | 1 (3%) | 32 (100%) |
| Health Economics                    | 22 (69%) | 9 (28%) | 1 (3%) | 32 (100%) |
| Health Services Mgt. & Planning     | 21 (66%) | 8 (25%) | 3 (9%) | 32 (100%) |

Participants’ views in the semi-structured interviews were captured through open text – respondents were required to write down detailed explanations on some of the open-ended questions. Below, we report some of these views using the exact text as provided by the respondents. These views illustrate participants’ perspectives on why training in the three discipline is critical, and more so, what kind of competencies they expected and how they would benefit their organisations.

3.3 Health Policy and Systems Training

Most of the participants agreed that health policy and systems training was important across the entire health sector. They thought having many professionals trained in health policy and systems would provide competencies to improve the running of the health sector. It would help change paradigm shift from mostly focusing on clinical challenges within the health system, but also focus on supporting functions and how the interact with broader structural factors within which services are provided. Furthermore, health policy and systems was said to be critical in providing skills to people to handle systems issues like managing change within health systems and being able to set achieve strategic goals for population health improvement. It was also stated that health policy and systems training at postgraduate level had a greater role to with regards facilitating innovative research to strengthen health systems.
“Zambia has a gap in this health policy and systems training and if this is strengthened, it means even employees in MOH will be keen to carry out the right procedures when it comes to health systems strengthening. These skills will benefit both the private and public health sectors.” [KII 23, Research]

“Very essential especially for Directors because they are the policy makers. They need to know what it takes and the impact of their decisions on health services. They also need to be able to do research.” [K1115, Government Ministry]

“Trained people would know what to do and how to go about formulating policies. When evidence is provided trained personnel would know how to transform it into policy brief and present to the government.” [KII19, Cooperating partner]

3.4 Health Economics Training

For health economics, the respondents reported that it would benefit their organisations through providing competencies to facilitate efficient use of meagre health resources. Priority setting was said to be one of the key areas that this training may consider addressing. Health economics was said to be vital in producing professionals with competencies to formulate, evaluate health policies and strategies using economics analysis tools. This training would help health sector personnel to participate adequately in shaping health policy and development on health financing. Health financing was reported to be a huge challenge, particularly in the Zambian context. It was also reported that health economics training could enable the Zambian health sector to count on a pool of locally trained health economists; with full understanding of local context as opposed to outsourcing from outside the country, which is the practice in most HSOs.

“This would be important for our organisation to conduct research, analyse policy
and participate in policy shaping and development of health financing” [KII18, Regulatory]

“This training would benefit the organisation because many health service providers we deal with lack the necessary acumen to efficiently manage their health services delivery. This often leads to disputed insurance claims.” [KII 27, Insurance]

3.5 Healthcare services Management and Planning Training

Participants reported that training people in management functions like planning would greatly benefit their institutions. For example, they stated for planning functions, the Ministry of Health (MoH) would greatly benefit from personnel trained in key competencies in planning and with good understanding of health services and local systems dynamics. Furthermore, management training was said to be critical in proving competencies to enhance leadership across health services teams and organisations.

“We will be more precise in planning and avoid budget variations. Secondly, it would also be more beneficial to planners in MoH. Currently they employ people who have done development studies. But the demographers don’t have a good understanding of the health system” [K14, Regulatory]

“Effective health services management and planning will help assist both public and private institutions in planning and managing resources and programs effectively in organisations where resources are finite.” [K22, Health services]

3.6 Skills Training Needs

We also identified the particular skills training needed in order of importance. These are summarized in Table 5. For health policy and systems training, the top skills desired were policy analysis and planning, monitoring and evaluation of health
programs, and health systems research capacity; followed by implementation and management of health programs, change management, and training relating to policy, politics and power; in that order. For health economics training, the most pressing skills needs are health care financing, economic evaluation of health programs; followed by decision analytic modelling, and health economics research capacity. There is also a demand for training in the operations of the health insurance market and measuring health system efficiency. For health services management and training, the most sought out skill was strategic management in health programs, followed by leadership and management in health programs, and program implementation.

**Table 5: Competency Needs by Discipline**

| Health Policy and Systems                          | Health Economics                          | Health Services Management               |
|---------------------------------------------------|------------------------------------------|------------------------------------------|
| · Policy analysis and Planning                     | · Health Care Financing                   | · Strategic Management in Health Programs |
| · Monitoring and Evaluating Health Programs in Health Systems | · Economic Evaluation of Health Programs | · Leadership and Management in Health Programs |
| · Health Systems Research Capacity                 | · Decision Analytic Modelling              | · Implementing Programs in Health Systems |
| · Implementing and Managing Programs in Health Systems | · Health Economics Research Capacity      |                                           |
| · Managing Change in Health Systems                | · Understanding the Health Insurance Market |                                           |
| · Policy, Politics and Power                       | · Measuring Health System Efficiency      |                                           |

**3.7 Skills Mismatch**

An alternative way of looking at the skills gap is to look at the skills mismatch – the misplacement of skills for a given job description. In this study, this is taken to imply a situation where a person not formally trained (as part of a specialist programme) to perform roles related to a given public health field is performing those roles. We found significant horizontal skills mismatch in both health
economics and health services management and planning (see Table 6). All people performing roles relating to health services management and planning were not formally trained to perform them. For health economics related roles, 93% of people performing them were not formally trained.

Table 6: Assessing the Level of Skills Mismatch

| Disciplines               | Someone Performing Related Roles | Formally Trained for the Role | Skills Match | Skills Mismatch |
|---------------------------|----------------------------------|-------------------------------|--------------|-----------------|
| Health Economics          | 14                               | 1                             | 79%          | 93%             |
| Health Services Mgt. & Planning | 14                               | 0                             | 0%           | 100%            |

4. Discussion

Achieving universal health coverage (UHC) requires a well-trained health workforce. This study has highlighted the significant skills gap which exists across selected public health disciplines. For example, the study found that almost two-thirds of stakeholders indicated a lack of capacity in health policy and systems training. They also indicated the need to introduce formal programme training in this public health discipline. The skills gaps in health systems and training is not unique to Zambia. Uzochukwu and colleagues highlight the inadequacy in health policy and systems capacity in Nigeria, and the subsequent reliance on the developed world for training (19).

With respect to health economics, the study finds that almost 70% of the stakeholders report that no staff members were formally trained in relevant health economics components. The most sought after competencies were in health care financing and economic evaluation. The latter competency was also found to have the most significant knowledge gap in a recent study on health economics
knowledge needs assessment for Latin America (20). For organisations with a staff member performing health economics-related roles, we found a horizontal skills mis-match of 93%; a further reflection of the health economics knowledge gap.

An important finding of this study was that health services management and planning had the highest skills gap across the three disciplines. It also had a horizontal skills mis-match of 100%. The depth of the skills gap in health services management and planning is also pronounced in other sub-Saharan African contexts. For example, a self-assessed assessment of relevant health services management skills among healthcare managers in South Africa find significant skills gaps in strategic planning, health delivery and people management (21).

Overall, the study has identified significant skills gaps across the selected disciplines. The study also uncovers evidence that similar skills gaps are present in other sub-Saharan African contexts such as Nigeria and South Africa as well as other developing contexts such as Latin America. An important implication of this observation for closing relevant public health skills gaps in other empirical contexts is the need to introduce academic programmes which respond to ever-changing local public health training needs. Relatedly, curricula for these programmes should be regularly reviewed to make them relevant to public health skills demanded, which are often dynamic. These reviews should be guided by formal needs assessments.

**Limitations**

This study is ground breaking in the sense that no published study has assessed the skills needs relating to health policy and systems, health economics, and health services management training in Zambia. However, it has a number of limitations. Firstly, the study is ‘static’ in nature in the sense that it has been unable to track
the changing skills needs in a dynamic healthcare sector. Future studies should analyse the dynamic nature of the market for public health professionals. These studies will help to inform curricula modifications in order to respond to changing needs.

Secondly, the study takes a demand-side perspective. It has analysed the skills gap from the perspective of the demanders of the various public health competencies. Future studies should also incorporate a supply-side perspective. For example, there is need to assess the various institutional factors that impede training in selected public health disciplines. Despite these limitations, the study has provided important evidence to support the case for introducing structured programmes in health policy and systems, health economics, and health services management and planning in Zambia’s public health training institutions.

5. Conclusions

Inadequate and/or poorly trained human resources for health remain a major constraint to achieving UHC – a key policy objective of many countries around the world. This study assessed the skills gaps and mismatches in health policy and systems, health services management and planning, and health economics. This study found significant skills gaps across all the three disciplines. For example, over two-thirds of all interviewed stakeholders reported that they had no staff members in their organisations who had formal training in relevant competencies across the disciplines of interest. Additionally, a significant skills mismatches were identified in health economics, and health services management and planning. Our findings provide support for the introduction of structured training programmes in the three public health disciplines. However, there is need for more research on
the ever-changing training needs of the health sector. This will help academics to tailor public health training to local context needs.

**Abbreviations**

| Abbreviation | Description                                      |
|--------------|--------------------------------------------------|
| HSOs         | Health Service Organisations                     |
| LMICs        | Low and Middle Income Countries                  |
| MoH          | Ministry of Health                                |
| NHRA         | National Health Research Authority                |
| SDGs         | Sustainable Development Goals                     |
| UHC          | Universal Health Coverage                         |
| UNZABREC     | University of Zambia Bioethics Research Committee |

**Declarations**

*Ethics approval and consent to participate:* Ethical waiver was sought and provided by the University of Zambia Bioethics Research Committee (UNZABREC). In addition, informed consent was verbally obtained from the study participants. This approach to obtaining informed consent was verbally approved by UNZABREC. In addition, the letter of ethical exemption is attached as a supplementary file.

*Consent for publication:* Not applicable

*Availability of data and material:* Key data summaries are included in the manuscript. The full dataset used for the current study are available from the corresponding author on request.

*Competing Interests:* The authors declare that they have no competing interests.

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*Authors’ Contributions:* All the authors collected, entered and cleaned the data.
MB, AS, MNM, and MC analysed and interpreted the data. CM\textsuperscript{1}, CM\textsuperscript{2} and PH conceptualised the study. All the authors drafted and revised the manuscript. All authors read and approved the final manuscript.

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References

1. Gow J et al. *Health worker shortages in Zambia: an assessment of government responses.* Journal of Public Health Policy. 2011; 32(4); 476-488.

2. Kamwanga J et al., *Understanding the labour market of human resources for health in Zambia.* WHO. 2013.

3. CDC. *DPHSWD Zambia.* 2013. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwiyr9XTn9rcAhUjjcAKHTAxACQQFjAAegQIABAC&url=https%3A%2F%2Fstacks.cdc.gov%2Fview%2Fcdc%2F23180%2Fcdc_23180_DS1.pdf&usg=AOvVaw30YC5IIMdtdsYGDpjkdhYxs. Accessed 07 Aug 2018.

4. Ünal B. et al. *Life-Years Gained From Modern Cardiological Treatments and Population Risk Factor Changes in England and Wales, 1981–2000.* American Journal of Public Health. 2005; 95(1); 103-108.

5. Schroeder SA. *We Can Do Better — Improving the Health of the American People.* New England Journal of Medicine. 2007; 357(12); 1221-1228.

6. Cohen AJ et al. *Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015.* The Lancet. 2017; 389(10082); 1907-1918.

7. Mokdad AH et al. *Global burden of diseases, injuries, and risk factors for young people's health during 1990–2013: a systematic analysis for the Global Burden...*
of Disease Study 2013. The Lancet. 2016; 387(10036); 2383-2401.

8. Cutler D and Miller G. *The role of public health improvements in health advances: The twentieth-century United States.* Demography. 2005; 42(1); 1-22.

9. Mathers CD et al. *Causes of international increases in older age life expectancy.* The Lancet, 2015; 385(9967); 540-548.

10. Danielson J, Zahniser SC and Jarvis D. *Identifying training needs in the public health workforce: the public health prevention service as a case study.* Journal of Public Health Management and Practice. 2003; 9(2); 157-164.

11. Lindley LL, Wilson RW and Dunn JD. *Assessment of the training needs of Kentucky public health educators.* Health Promotion Practice. 2005; 6(1); 97-104.

12. Mahat A et al., *Assessment of graduate public health education in Nepal and perceived needs of faculty and students.* Human Resources for Health. 2013; 11(1); 16.

13. MacVarish K et al., *Practice Full Report: Building Professionalism Through Management Training: New England Public Health Training Center's Low-Cost, High-Impact Model.* Journal of Public Health Management and Practice. 2018; 24(5); 479.

14. Ye J et al., *Perception of workforce skills needed among public health professionals in local health departments: staff versus top executives.* Journal of Public Health Management and Practice. 2015; 21; S151-S158.

15. University of Zambia. *UNZA Splits School of Medicine into Four Schools.* 2018. https://www.unza.zm/uncategorised/unza-splits-school-of-medicine-into-four-schools. Accessed 5 Aug 2018.
16. Fineberg HV, et al., Changing public health training needs: professional education and the paradigm of public health. Annual Review of Public Health. 1994; 15(1); 237-257.

17. Hsu CE et al., Assessing the readiness and training needs of non-urban physicians in public health emergency and response. Disaster Management & Response. 2005; 3(4); 106-111.

18. Kreitner S et al., Assessing the competencies and training needs for public health professionals managing chronic disease prevention programs. Journal of Public Health Management and Practice. 2003; 9(4); 284-290.

19. Story MT et al., Management of child and adolescent obesity: attitudes, barriers, skills, and training needs among health care professionals. Pediatrics-Springfield. 2002; 110(1; SUPP); 210-214.

20. Ariff S et al., Evaluation of health workforce competence in maternal and neonatal issues in public health sector of Pakistan: an assessment of their training needs. BMC health services research. 2010; 10(1); 319.

21. Schoonenboom J and Johnson RB. How to Construct a Mixed Methods Research Design. Kolner Z Soz Sozpsychol. 2017; 69(Suppl 2); 107-131.

22. BSR. Stakeholder Mapping. 2011.

https://www.bsr.org/reports/BSR_Stakeholder_Engagement_Stakeholder_Mapping.final.pdf. Accessed 5 Aug 2018.

23. Handel MJ. Skills mismatch in the labor market. Annual Review of Sociology. 2003; 29(1); 135-165.

Supplementary Files

This is a list of supplementary files associated with the primary manuscript. Click to
download.
Questionnaire.pdf
STROBE_checklist_cross-sectional.pdf