Regional Network for Equity in Health in east and southern Africa

DISCUSSION Paper NO. 116

The International Health Regulations and health systems strengthening in east and southern Africa: A desk review

Rangarirai Machemedze
Southern and Eastern African Trade, Information and Negotiations Institute (SEATINI) and Training and Research Support Centre (TARSC)

In the Regional Network for Equity in Health in east and southern Africa (EQUINET)

EQUINET DISCUSSION PAPER 116

November 2018

With support from IDRC (Canada).

Regional Network for Equity in Health in east and southern Africa

DISCUSSION Paper NO. 116

The International Health Regulations and health systems strengthening in east and southern Africa: A desk review

Southern and Eastern African Trade Information and Negotiations Initiative

Rangarirai Machemedze
Southern and Eastern African Trade, Information and Negotiations Institute (SEATINI) and Training and Research Support Centre (TARSC)

In the Regional Network for Equity in Health in east and southern Africa (EQUINET)

EQUINET DISCUSSION PAPER 116

November 2018

With support from IDRC (Canada).

TABLE OF CONTENTS

Cite as: Machemedze R (2018) The International Health Regulations and health systems strengthening in east and southern Africa: A desk review, EQUINET discussion paper 116, SEATINI, TARSC, EQUINET, Harare

Acknowledgement: Thanks for technical input and support and peer review input from Dr Rene Loewenson, Training and Research Support Centre, and for external peer review by Patrick Saunders-Hastings and Gorik Ooms. Thanks to V Tyson for copy edit.

Thanks to IDRC (Canada) for financial support.

EXECUTIVE SUMMARY

In 2005, all member states of the World Health Organization (WHO) adopted International Health Regulations (IHR). The state parties to the IHR were given until June 2012 to develop minimum, core, public health capacities on national surveillance, reporting and response systems for public health risks and emergencies covered, and to provide the measures for disease control at designated airports, ports and other borders.

To measure progress on the development of these core capacities, the WHO implements a monitoring system based on self-assessment by countries through a questionnaire that covers the core capacity requirements. The indicators for monitoring IHR national, core capacity development involve eight core capacities (legislation, co-ordination, surveillance, preparedness, response, risk communications, human resources, laboratory), reviewed across five relevant hazards (infectious, food safety, zoonotic, chemical and radiological and nuclear) and their points of entry.

Despite the adoption of IHR, most African countries, including those in east and southern Africa (ESA), face challenges associated with weak and under-funded health systems and inadequate early warning systems for timely identification of epidemic risks (WHO Afro, 2015). For these countries, the capacities identified above are not only important for responding to public risks and emergencies but developing public health capacities to meet population health needs, as part of their measures for health systems strengthening (HSS).

Against this background, this review paper examines the extent to which these measures are also useful in supporting HSS. Produced under the regional network for Equity in Health in East and Southern Africa (EQUINET), the paper reviews evidence on the IHR 2005 design, capacities and implementation on health systems strengthening (HSS) in ESA countries, particularly in relation to:

a. Capacities of community health and primary-level health personnel and service capacities, including health information systems to this level;
b. Public health system capacities and functioning relevant to food safety;
c. Ensuring laboratory and pharmaceutical personnel capacities.

The paper explores the synergies and opportunities being generated, or not, between investments in IHR implementations and these three areas of HSS in the 16 ESA countries covered by EQUINET: Angola, Botswana, DRC, Eswatini (formerly Swaziland), Lesotho, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. It identifies key weaknesses and challenges and highlights case studies of good practice within the region.

The review findings presented in the paper indicate that:

- **On IHR and community and primary-level health personnel capacities:** countries in the region have committed to develop programmes that facilitate the development of human resources for health at all levels of health service delivery. Almost all ESA countries have strategies and plans put in place for this objective. Some plans explicitly identify training specific cadres to help implementing IHR (2005. To be implemented effectively, IHR strategies and plans need to be supported by budgetary allocations and law reform, taking advantage of institutional capacities to recruit and upgrade core capacities through universities and other training institutions in the region. Especially at community level, training needs to be complemented by retention strategies and local absorption of skills. However, some training programmes, such as epidemiology, are overly dependent on external funding, and sustainable financing for IHR capacities suggests that ESA governments plan for adequately resourcing these programmes from domestic financing and integrate these programmes within their overall strategies for human resources for health (HRH).

- The review highlighted that the majority of ESA countries have basic health information systems in place at the local level, although with gaps in key personnel for this, like data clerks. The evidence suggests a need and opportunity for investment in community and primary-care level personnel, as well as for local analysis and review, to meet both the core capacity requirements for implementing the IHR and for HSS.

- **On IHR and capacities and functioning for food safety:** the review raised the importance of the regulatory framework for ensuring quality and protection of consumers. ESA countries have developed regulatory frameworks for food safety as a public health issue, including measures for foodborne disease outbreak investigation and response. However, many laws need to be updated to comply with current regional and international standards. Non-adherence or enforcement of the laws and regulations, and the failure by service providers to play their roles, contribute to foodborne disease. Most ESA countries have basic systems, inspection mechanisms, laboratory-support services to provide safe foods. However, the majority of laboratories are not internationally accredited, and there are shortages of laboratory personnel for these services. Thus countries need to address gaps in qualified personnel, technical supervisory capacities, with adequate experience and resources for testing, not only as resources for IHR food safety but also for addressing wider public health risks as a part of HSS.

- **On IHR laboratory and pharmaceutical personnel capacities:** although it has been difficult to establish the specific levels of laboratory personnel capacities in this review, the progressive development of laboratories across the region with well-established linkages and collaborations internationally suggests a positive trend. In the few countries where details are available, the major weakness appears to be in personnel shortfalls in low-income countries, despite their high demand for routine laboratory services. The review identified collaborations in some countries, including within vertical support in key areas that may have wider horizontal benefit. It is suggested that linking diverse investments in these areas is important to overcome fragmentation.

The findings in the review suggest opportunities to strengthen links between IHR implementation and HSS by:

a. Establishing a committee or task force to assess, identify requirements for IHR implementation at all levels and integrate these within national plans, strategies, budgets and operational guidelines, so that countries can take leadership in negotiating these links within specific vertical programmes.
b. Establishing training in key areas of public health (such as epidemiology) for existing health personnel at national and subnational levels, expanding programmes in government and training institutions for IHR implementation and HSS.
c. Ensuring adequate HIS personnel at the primary-care level and encouraging local action-focused analysis of data from the health information system, improved information flow up and down the system and feedback from national to local levels on their own analysis.
d. Reviewing, updating and harmonising public health laws and policies, mainstreaming Codex Alimentarius standards and SPS measures in law, ensuring laws cover key areas and specialisations important for public health and the IHR (such as clinical, industrial pharmacists, laboratory technicians, scientist and engineers) and providing improved oversight, enforcement and accountability on implementation, with stiffer penalties for breach of public health law, such as on importers of substandard foods.
e. Investing in laboratory capacities to achieve international accreditation status, linking the improvements being made for specific diseases to ‘multi-purpose’ use.

Over the longer term, it is suggested that ESA countries would benefit from investment in research and development capacities and programmes, as key components for both HSS and IHR, taking into consideration the changing health profiles of their populations, emergent diseases and the advances in technology.

1. INTRODUCTION

The International Health Regulations (IHR) were adopted in 2005 by all member states of the World Health Organization (WHO) (WHO, 2008). In 2005, the state parties to the IHR (2005) were given until June 2012 to develop minimum, core, public health capacities as outlined in *Box 1.* Core capacities relate to national surveillance, reporting and response systems for public health risks and emergencies covered, and to provide measures for disease control at designated airports, ports and other borders. In east and southern Africa (ESA), the IHR is being implemented within the context of the Integrated Disease Surveillance and Response (IDSR), a comprehensive, evidence-based strategy that constitutes part of the broader health systems strengthening agenda. Its goal is to strengthen national public health surveillance and response systems in African countries (SEATINI, TARSC, 2012).

Box 1: Core capacities across the eight areas identified by the IHR (2005)

1. Rapidly determine control measures to prevent spread of risks.
2. Provide specialised staff, laboratory analysis of samples (domestically or through collaborating centres) and logistic assistance (e.g. equipment, supplies and transport).
3. Provide on-site assistance as required to supplement local investigations.
4. Provide a direct operational link with senior health and other sector officials to accelerate approval and implementation of containment and control measures.
5. Provide direct liaison with other relevant government ministries.
6. Provide, by the most efficient communication mechanisms available, links with hospitals, clinics, airports, ports, ground crossings, laboratories and other operational areas for dissemination of information and recommendations from WHO on events in the country and in other countries.
7. Establish, operate and maintain a national public health emergency response plan, including creation of multidisciplinary/multisectoral teams to respond to events that may constitute a public health emergency of international concern.
8. Provision of the above on a 24-hour basis.

Source: WHO, 2008.

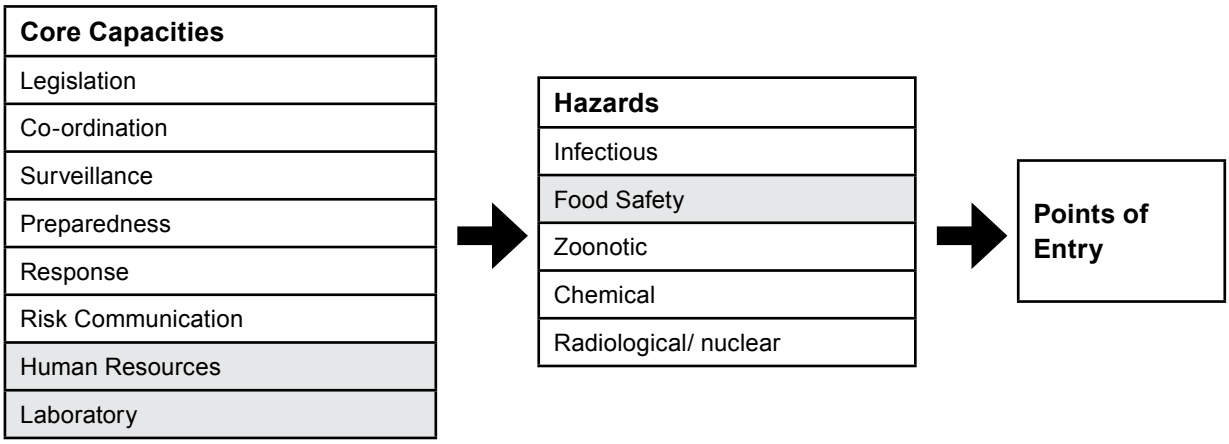
To measure progress on the development of these core capacities, the WHO implements a monitoring system based on self-assessment by countries through a questionnaire that covers the core capacity requirements. The indicators for monitoring IHR national, core capacity development involve eight core capacities (legislation, co-ordination, surveillance, preparedness, response, risk communications, human resources, laboratory), reviewed across five relevant hazards (infectious, food safety, zoonotic, chemical and radiological and nuclear) and their points of entry (WHO, 2009).

1.1 IHR and health systems strengthening

Despite adoption of IHR (2005), most African countries — particularly in ESA — face challenges associated with weak and under-funded health systems and inadequate early warning systems for timely identification of epidemic risks (WHO Afro, 2015). For these countries, the capacities indicated in *Box 1* are not only important for responding to public risks and emergencies but for developing public health capacities to meet population health needs, as part of their measures for health systems strengthening (HSS). Thus, the measures for the IHR should be implemented within and with co-benefit for the wider strategies for HSS, including: those for monitoring, surveillance, prevention of (and response to) health hazards and emergencies; environmental and occupational health and food safety; the organisation of health and other services for prevention, control, early diagnosis and management of disease, and health promotion measures and social machinery needed to maintain or improve health.

Under IHR Article 54, countries are required to report annually to the World Health Assembly on progress made in implementing the International Health Regulations, henceforth referred to as the Regulations or IHR (2005) (WHO, 2008). IHR review committees and other foras have recommended voluntary independent external evaluation of member states' progress in developing capacities to implement IHR. Consequently, the WHO has developed the Joint External Evaluation (JEE) tool based on earlier tools such as those used for monitoring IHR (WHO, 2011).

Figure 1: IHR core capacities and hazards



Source: WHO, 2009.

This review paper examines the extent to which these measures are also useful in supporting HSS. Within the regional network for Equity in Health in East and Southern Africa (EQUINET) research programme on Global Health Diplomacy (GHD) for equitable health systems in ESA, co-ordinated by the Training and Research Support Centre (TARSC) and the Southern and Eastern African Trade Information and Negotiations institute (SEATINI), it reviews evidence on the IHR 2005 design, capacities and implementation of HSS in east and southern Africa, through specific assessment of the role played in areas identified in earlier EQUINET work to be important for equitable health systems (SEATINI, TARSC, 2012), viz:

a. Capacities of community health and primary-level health personnel and service capacities, including health information systems to this level;
b. Public health system capacities and functioning relevant to food safety;
c. Ensuring laboratory and pharmaceutical personnel capacities.

This paper explores the synergies and opportunities being generated, or not, between investments in IHR implementations and these three areas of HSS. It focuses on an analysis of these capacities in the 16 ESA countries covered by EQUINET: Angola, Botswana, DRC, Eswatini (formerly Swaziland), Lesotho, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. It identifies key weaknesses and challenges and highlights case studies of good practice within the region.

1.2 Methods

The review compiles evidence from secondary data collection based on a literature review of published materials relevant to IHR capacities and the three dimensions above including issues in their implementation and on their link to supporting emergency responses and health systems strengthening. The review included published literature (qualitative and quantitative) including studies, policies, legislation, official documents, published materials from WHO, from ESA/Africa regional and other organisations, namely the East African Community (EAC), the East Central and Southern Africa Health Community (ECSA-HC) and the Southern Africa Development Community (SADC).

The methodology entailed searching the following databases: PubMed, EMbase, Web of Science and Google Scholar. This was complemented by a search of the websites of WHO, ministries of health in the ESA region,

ECSA Health Community, Centers for Disease Control and Prevention (CDC) and EAC, SADC and EQUINET. The search was conducted between April and July 2018 and sources included peer reviewed journal articles, policy documents, workshop reports, book chapters, media articles, academic reports, briefing papers and policy and parliamentary reports in English published after 2005. This publication date restriction reflects that 2005 is when the IHR (2005) were adopted. The references and bibliography of relevant papers were searched for additional papers and reports using the snowballing method. Articles meeting the assessment criteria, described below, were included in the review.

The following search terms were applied:

- **For International Health Regulations and community/primary-care health workers:** International health regulations AND (health workers OR community health workers OR personnel OR human resources for health) AND (Africa OR (specific country from ESA). Further searches were done for international health regulations AND (health information OR routine data OR surveillance) AND (primary care OR community) AND (Africa OR *[specific country in the ESA region]*).

- **For International Health Regulations and food safety:** International health regulations AND food OR toxins OR water OR AND Africa OR (specific country in the ESA region). The inclusion criteria focussed on papers that dealt with IHR related investments and legal, personnel and institutional capacity support for food safety, hygiene in port health, food trade; IHR related investment in personnel for food safety and hygiene (biochemists, nutritionists) and IHR related investments in surveillance and response capacity for food and waterborne disease risk or events.

- **For International Health Regulations and laboratory and pharmaceutical capacities:** International health regulations AND laboratory OR pharmaceutical OR medicine OR drug AND personnel OR human resources for health OR technician OR capacities AND Africa OR (specific country in the ESA region). The assessment criteria focussed on papers that dealt with IHR- related investments in personnel numbers, training, capacities and distribution for laboratory work for public health and port health; IHR related investments in personnel numbers, training, capacities and distribution for pharmaceutical negotiation, production, procurement, regulation, quality control and management and IHR-related investment in or support for national or regional training institutions/colleges/universities providing training for these categories of personnel.

All publications were subject to title and abstract review by the author. Full texts were obtained for included articles and these were again subject to screening against the assessment criteria. These database searches identified 220 abstracts. Of these, 51 full text papers met the inclusion criteria. As eight of these did not cover the ESA region, 43 papers were then included in this review. There were some overlaps where papers covered more than one of the three areas under review.

1.3 Limitations

The review faced some challenges regarding the availability of literature on IHR implementation and core capacity developments, as few relevant papers and reports are available in the ESA region. Papers produced in other languages (e.g. Portuguese and French) were not included, which limits the evidence available from Angola, DRC, Madagascar and Mozambique. Some work in these areas may also not be reviewed in journals or publically available online. This limitation was partly mitigated by the inclusion of the reports of the WHO-supported independent Joint External Evaluations of capacities for eight ESA countries. These give some indication of trends, best practices and deficits. The evaluations are based on the WHO Joint External Evaluation (JEE) tool intended to facilitate comparisons between countries. The eight countries where reports are available are in east Africa (Kenya, Tanzania and Uganda) and southern Africa (Botswana, Lesotho, Namibia, Mozambique and Zambia).

2. IHR AND CAPACITIES OF COMMUNITY AND PRIMARY-LEVEL HEALTH PERSONNEL

The 1978 Alma-Ata Declaration was a major milestone in public health. It identified primary healthcare (PHC) as the key to the attainment of the goal of Health for All (WHO, 1978). The declaration noted that the health system of a nation was founded on PHC, which, among others, "relies at local and referral levels on health workers, including physicians, nurses, midwives, auxiliaries and community workers as applicable, as well as traditional practitioners as needed, suitably trained socially and technically to work as a health team and to respond to the expressed health needs of the community" (WHO, 1978:2). For the health system to function optimally, it requires investments in personnel co-ordinated to deliver essential health needs at all levels.

Forty years after the declaration, developing countries, including all ESA countries, are yet to achieve the objectives of Alma-Ata Declaration (WHO, Afro, 2018). Health workers are a critical capacity for this. The WHO emphasises the importance of workforce development as an integral part of ensuring a sustainable public health system over time by developing and maintaining a highly qualified public health workforce with appropriate technical training, scientific skills and subject-matter expertise (WHO, 2016a).

The IHR core capacities on human resources refer to state parties having skilled and competent health personnel for sustainable and functional public health surveillance and response at all levels of the health system and for its effective implementation. In addition to primary-level health workers, this includes physicians, animal health professionals or veterinarians, biostatisticians, laboratory scientists, farming/livestock professionals, with an optimal target of one trained field epidemiologist (or equivalent) per 200,000 population. These groups should be able to co-operate to meet relevant IHR core competencies (WHO 2016b).

ESA member states have developed strategies for training, recruiting and retaining health workers, guided by their public health needs and priorities (Bakari, 2012; WHO, 2017a). *Table 1* below outlines the strategies for recruitment, training and retention of human resources for health in the ESA region.

Table 1: Strategies for human resources for health in ESA countries

Country	Strategy for human resources for health
Angola	Not available
Botswana	Botswana Human Resources for Health Plan 2007-2016
DRC	HRH strategic plan (Plan National de Development des Resources Humaines Pour la Sante (PNDRHS), 2011-2020)
Kenya	Health Sector Human Resources Strategy 2014–2018
Lesotho	National Health Workforce Strategy 2005-25
Malawi	Human Resources for health strategic plan (2012-2016)
Mauritius	Health sector strategy 2017-2021
Mozambique	National Plan of Human Resources Development in the Health Sector, 2008-2015
Namibia	Five-year Human Resource Strategy for Health
South Africa	HRH Strategy for the Health Sector: 2012/13 – 2016/17
Swaziland	Human Resources for Health Strategic Plan 2012-2017
Tanzania	Human Resource for Health Strategy 2015-2020
Uganda	Human Resource Strategic Plan 2005 – 2020
Zambia	National Human Resources for Health Strategic Plan 2016-2021
Zimbabwe	National Health Strategy for Zimbabwe 2016-2020

Source: Kingdom of Swaziland, 2012: Govt of Malawi, 2011; Govt of Kenya, 2013; Govt of Mauritius, 2017, Govt of South Africa, 2011; Govt of Zimbabwe, 2016; WHO 2016a, b, c, 2017a,b, c,d, e

Most health workers are primary care workers, mainly nurses and community health workers. For example, of the total health workforce employed in the public sector in Swaziland (now Eswatini), more than half (62%) are classified as direct or clinical health service providers while the rest (38%) are in administration or provide support services (Kingdom of Swaziland, 2012). "Nurses represent the largest share, comprising 41% of the total workforce, followed by environmental health officers at 3.7% and medical doctors who comprise 3.5% of the total workforce" (Kingdom of Swaziland 2012:28). Basing its evidence on available data and literature, the African Union (AU) notes: "2 million community health workers are needed by 2020 to help close the human resource gap for health and accelerate progress towards the broad array of health targets in SDG 3"(AU, 2017:3).

Generally in ESA countries, the majority of health workers are nurses and community health workers. The AU observes that a number of African countries have made commendable investments in community health workers and have included them as key in their health system. Kenya was reported to have 64,000 community health workers, neighbouring Rwanda 45,000 and Botswana 4,200, all contributing to healthcare delivery to the people (AU, 2017).

Whilst strategies for training and recruiting health workers in the ESA region are in place, there are limitations. Mozambique, for example, has a limited focus on public health and animal health, and a stronger focus on healthcare workers in medical service and practice. The country has a multidisciplinary human resource capacity (especially at the national level) but inadequate numbers of healthcare workers. Also capacity in epidemiology and disease surveillance at provincial and district levels is limited (WHO, 2016a). This trend is also evident in other countries like Botswana, Lesotho and Zambia, where the literature shows that the current strategies do not adequately address the requisite public health workforce capacity to implement IHR core capacity requirements. (WHO 2017b,d and e).

In Kenya, capacities vary geographically, even though the country has adequate training institutions for different cadres, including community health workers. "At the county [provincial] level, the distribution of capacities varies from county to county. All counties have eight to ten health workers trained in basic epidemiology. Laboratory personnel, health records and information officers, nurses, medical officers, clinical officers, surveillance, public health officers and technicians are available at all levels up to the sub-county level. Community health volunteers are available at village level to connect the community to the level 1 health facilities" (WHO, 2017a:37). Despite these capacities, the country's Health Sector Human Resources Strategy 2014–2018 (Govt of Kenya, 2013) indicates key challenges in terms of staff shortages, inequitable distribution, high attrition, especially in hard-to-reach areas, and out-migration of health staff, especially nurses and doctors.

The Malawi Human Resources for Health (HRH) Strategy (Govt of Malawi, 2014) indicated that by December 2012 the public health sector had 27,474 positions filled compared to 42,052 available positions, resulting in a vacancy rate of 35%. The HRH strategy acknowledges the critical shortages that the country is experiencing, and the plan is guided by seven key strategic objectives to ensure that human resources for health are adequate in number, properly trained and remunerated, motivated and capable of effectively delivering health services to the Malawi population.

While strategies are in place for health workers, their implementation has been hindered by a lack of financial resources, and critical shortages have been observed across the region. Citing extensive work by ECSA-HC on health worker migration in Africa, SEATINI and the Centre for Human Rights and Development (CEHURD) reported in 2014 that countries in the sub-Saharan Africa region (SSA) have been negatively affected by a human resources for health (HRH) crisis characterised by an absolute shortage of skilled health workers, particularly nurses. This was compounded by poor investment in production and retention of health professionals (especially in rural and remote areas), disparities between private and public sectors, inappropriate skills mix, and low morale and low productivity of the existing workforce" (SEATINI, CEHURD, 2014:24). As a result, the ECSA-HC has advocated for ESA governments to put in place strategies for training and retaining health workers (including those for public health emergencies).

The strategies reviewed have thus placed attention on the adequacy and equitable distribution of health workers, their role in access to health services and relevant recruitment and training strategies. While the role of community health workers has been raised, and the strategies generally cover community and primary care workers, few HRH strategies listed in *Table 1* have a clear plan for the recruitment of personnel for surveillance and disease control at the community or primary care level.

2.1 HRH for public health surveillance

Public health surveillance calls for different expertise at all levels but most importantly at primary care level. These include community health workers, nurses, laboratory personnel, health records and information officers, medical officers, clinical officers, surveillance, public health officers and technicians, among others.

The availability and distribution of these cadres in the region is mixed. According to the WHO Joint External Evaluation of Uganda's core capacities in implementing IHR, the country has a strong capability in training staff for public health, including a robust field epidemiological training programme (FETP) and the private and "public sectors providing Masters and clinical epidemiology modules which target both human and veterinary officers. Uganda's Public Health Fellowship Programme (PHFP) offers advanced epidemiology and targets human health officers, nurses, veterinary, environment, public health cadres. There is a One Health Central and East African Consortium (OHCEA) that focusses on multiple cadres and sectors, including Nurses as well as Animal Health, Environmental and Public Health staff." (WHO, 2017c:30).

The situation differs in Botswana, where there is a shortage of public health specialists with only "half of the health districts having these experts" (WHO, 2017b). The WHO Joint External Evaluation of Botswana's core capacities reported that community health nurses contribute to filling gaps by co-ordinating all preventive services and contributing to disease control programmes as technical persons, particularly on surveillance using technical guidelines adapted from IDSR, which include use of indicator-based electronic reporting systems. However, they are not distributed equitably throughout the country (WHO, 2017b). Others involved in public health include environmental health officers, health educators, monitoring and evaluation officers, dieticians and pharmacists. The Joint External Evaluation report for Botswana indicated that there was an FETP, which the Ministry of Health conducted at certificate level, but that the last training was done in 2014, after running for only two cycles, and it primarily targeted members of the rapid response teams in all the 28 health districts. It did not continue mainly due to lack of funding, a problem reported in other ESA countries (WHO, 2017b).

Box 2: Namibia public health HRH status

While the number of health staff available in Namibia is considered sufficient, the number of public health professionals has been found to be inadequate. In the Ministry of Health and Social Services organogram, 117 posts are for public health professionals. As of December 2016, only 13 of these posts were filled (vacancy rate of 89%). None of these posts are at regional or local levels. Namibia began a FELTP in 2014 and the programme is providing key staffing for the public health system, but is subject to the same limitations as other health fields, with an imbalance toward the country's few high-density urban areas and with a great risk of attrition of staff to other countries. The Ministry of Health and Social Services (MoHSS), in conjunction with the CDC country office, provides short courses on the FELTP and others for public health staff, having trained 137 people through these short courses. The National Planning Commission developed an overall human resource plan for 2007–2013, which guides the country. Meanwhile, the MoHSS has a document entitled "Five Year Human Resource Strategy" for health. This document, however, provides no specific guidance on the training, employment, career development or tasks for public health staff. The country's FELTP provides essential core training for the nation and connects Namibians to training opportunities and research mentoring internationally. It is not clear if there will be an FELTP in the future as the three-year programme is currently funded entirely by external resources.

Source: adapted from WHO 2016b.

Most ESA countries conduct training for the various cadres involved in public health, developing professional capacity locally in both government and private institutions (WHO, 2016a and c; WHO, 2017a; Kuonza et al., 2011). Many universities in the region offer specialised training, with programmes and courses for environmental health practitioners, laboratory technicians and emergency medical technicians, among others. Similar constraints in health workers prevail in other ESA countries. *Box 2* on the previous page describes the situation in Namibia and the challenges of external programme funding intended to address the core capacities for IHR implementation. The same challenges were also found in Mozambique (WHO, 2016a).

2.2 IHR and health information systems

Implementation of IHR requires functioning and adequate health information systems (HIS), particularly at the community level, for early identification of health needs and dissemination of routine information to local and national levels (Osika et al., 2010; Takondwa et al., 2010). . The literature shows that, although there are insufficient health workers, the majority of the countries have basic information systems that allow health providers at facilities to submit summary reports to higher jurisdictional levels with information, including disease outbreaks, hospital utilisation and human resources (Osika et al., 2010; Takondwa et al., 2010). However, in some countries like Kenya and Zimbabwe (Osika et al., 2010) the timeliness, accuracy, and completeness of the reports provided through standardised forms vary significantly by province and by district. In Zimbabwe, for example, health providers, including private sector providers, are included in HIS structures, but do not always provide information (Osika et al., 2010). In addition, the national Ministry of Health gives little feedback on data submitted by facilities, reducing motivation for reporting. Notwithstanding the challenge, a number of countries in the ESA region have adopted the District Health Information Systems (DHIS) to document data routinely collected in all public health facilities as an integral part of the HIS (Dehnavieh et al., 2018).

The majority of ESA countries have basic information systems in place, but there are inadequacies to address, including for IHR implementation (Mwalwimba et al., 2015). At the community level, health centre committees play a crucial role, particularly for public health promotion and information dissemination for key areas of IHR. In Lesotho, as in Uganda, Malawi, Zambia and Zimbabwe, Community health workers (CHWs) have also played a crucial role in health service outreach, uptake and communication at community and household levels (Takondwa et al., 2010). Their work and proximity to the people make them first-line cadres in identifying disease outbreaks, and put them in a position to provide rapid communication to higher authorities. In countries where CHWs are present in large numbers, and are linked to heath centre committees at the community level, their expertise and knowledge can boost surveillance capacities.

The experience in Kenya reflects this pattern of few capacities for co-ordination for information reporting and analysis, especially at the lower community levels (WHO, 2017a). As in other countries, the health information systems involve departments responsible for planning and performance monitoring, while the health sector strategy and its monitoring and evaluation framework call for personnel skilled in epidemiology, biostatistics, research, systems/internet and communication technology (ICT) management and health economics. Resources skilled in these areas are not always available. Those personnel available for information functions include: medical doctors, some with training in public health and/or epidemiology; epidemiologist/nurse; statisticians; and records officers. However, this leaves a lack of expertise in data analysis and information generation and in ICT, affecting capacities for HSS and for IHR implementation. Data analysis for evidence-based policy-making and implementation is critical as an integral part of health systems strengthening. Several studies and reports have observed that most African countries are not bereft of policies but lack proper co-ordination of existing resources and actual implementation. The evidence on capacities lacking, noted above, confirm this long-held observation.

At subnational levels in Kenya, provincial health records and information officers (PHRIOs) and district health records and information officers (DHRIOs) are responsible for management, verification, transmission and analysis of routine service data, as well as feedback of analysis and summary information to health facilities and other stakeholders. At the facility level, a data clerk and/or records officer is responsible for routine data capture and submission of monthly summary sheets. In Kenya's health system, an estimated vacancy of more than 4,000 records and information personnel was noted in 2017, especially of data clerks/records officers at the health facility level. As a result, healthcare workers are taking on these duties, while already burdened by heavy service delivery workloads (WHO, 2017a).

2.3 Summary

While ESA countries have developed strategies for training and recruiting HRH, these are not intended to address specifically IHR implementation; and IHR implementation has not necessarily strengthened these capacities, including the ability to address skills gaps and deficits at primary care level, or to adequately tap into community resources such as CHWs and health centre committees.

In summary:

- ESA counties have developed HRH strategies, but they do not address the public health capacities specifically required to implement IHR and the shortcomings associated with inequitable health worker distribution, high attrition in hard-to-reach areas, a lack of financial resources leading to shortages across the region. Strategies for training and retaining health workers (including those for public health emergencies) are a priority for the ESA countries for HSS and appear equally important for developing core capacities to implement the IHR.
- Opportunities and institutional capacities in countries for training and continuing education, including for public health, veterinary public health and field epidemiological programmes (FEP), could be expanded. It is unclear how well investment in the IHR have reinforced these programmes or levered national budget resources for them.
- The majority of the countries have basic health information systems in place at the local level, although gaps in key personnel, like data clerks, can shift the burden of reporting to already overburdened clinical staff. There are key assets that play roles in both HSS and early information for IHR, like health centre committees and CHWs. It is not clear how far they are supported through IHR-related investment.
- The timeliness, accuracy and completeness of the reports provided through standardised forms vary within countries, and poor feedback of information gathered back to local levels (or analysis at local levels) can demotivate accurate reporting.
- At intermediate and peripheral levels, health officers who carry out surveillance are trained and some have additional training in basic epidemiology. Multidisciplinary capacities at the national level for analysing and using information may be present, but not always in the health ministries, and the number of epidemiologists still falls well below the target of one trained field epidemiologist per 200,000 population.

In some ESA countries, there are promising practices to recruit skilled staff and upgrade core capacities that could be replicated in other countries. Whilst a dependence on external funding threatens sustainability of such programmes, the experience of Uganda tells a different story. Uganda has a strong capability in training staff for public health, including a robust FETP. Uganda's experiences could be shared across the ESA region to help develop core capacities required to support both HSS and IHR.

The evidence suggests a need and opportunity for investment in community and primary-care level personnel, as well as local analysis and review, to meet the core capacity requirements for implementing the IHR and for HSS.

3. IHR AND PUBLIC HEALTH CAPACITIES FOR FOOD SAFETY

The WHO has noted that food and waterborne diarrhoeal diseases, especially cholera and typhoid, are one of the leading causes of illness and death, particularly in low- and middle-income countries. The upsurge in the globalisation of food production and trade has also increased the potential likelihood of events or cases involving contaminated food moving across borders. Recognising this growing vulnerability, it has become increasingly important to put measures in place that would, within a reasonable period of time identify, source and contain a food or waterborne disease outbreak (WHO, 2016a).

On food safety, the IHR stipulate that "states parties should have surveillance and response capacity for food and waterborne diseases' risk or events. It requires effective communication and collaboration among the sectors responsible for food safety and safe water and sanitation" (WHO, 2016:16).

The majority of ESA countries are members of the Codex Alimentarius (Codex Secretariat, 2018). This is a collection of internationally adopted food standards — and related texts presented in a uniform manner — aimed at protecting consumers' health and ensuring fair practices in food trade. The Codex Alimentarius intends to guide and promote the elaboration and establishment of definitions and requirements for foods to assist in their harmonisation and, in doing so, to facilitate international trade. It includes provisions in respect of food hygiene, food additives, residues of pesticides and veterinary drugs, contaminants, labelling and presentation, methods of analysis and sampling, and import and export inspection and certification. The Food and Agriculture Organisation (FAO) and the WHO jointly administer it. Codex standards, guidelines and codes of practice are advisory in nature; for them to become legally enforceable, countries must voluntarily translate them into national legislation or regulations. *Table 2* below summarizes selected guidelines on food safety related to IHR (2005) implementation and capacity requirements.

Table 2: Selected list of Codex Alimentarius guidelines on food safety applicable to IHR

Guidelines for Food Import Control Systems
Principles and guidelines for the exchange of information in food safety emergency situations
Regional Guidelines for the Design of Control Measures for Street-Vended Foods (Africa)
Principles for Food Import and Export Inspection and Certification
Guidelines for the Design, Operation, Assessment and Accreditation of Food Import and Export Inspection and Certification Systems
Guidelines for the Assessment of the Competence of Testing Laboratories Involved in the Import and Export Control of Food
Food Control Laboratory Management: Recommendations
Recommended Methods of Sampling for the Determination of Pesticide Residues for Compliance with MRLs
Guidelines on Good Laboratory Practice in Pesticide Residue Analysis

Source: Author's tabulation from Codex Secretariat, 2018

In relation to guidelines for food import and control, the system calls for clearly defined and transparent laws and operating procedures. The laws should provide for the establishment of a competent authority with the mandate to:

- Appoint authorised officers;
- Require prior notification of and documentation for importation of a food consignment;
- Inspect, including to enter premises within the importing country, physically examine the food and its packaging; collect samples and initiate analytical testing; inspect documentation provided by an exporting country authority, exporter or importer; and verify product identity against documentary attestations;

- Apply risk-based sampling plans, taking into consideration the compliance history of the particular food, the validity of accompanying certification, and other relevant information;
- Recognise accredited or accredit laboratories;
- Accept, reject, detain, destroy, order to destroy; order reconditioning, processing or re-export; return to country of export; designate as non-food use;
- Recall consignments following importation; and
- Retain control over consignments in transit during intranational transport or during storage prior to import clearance (FAO, 2003:4).

Both the IHR and Codex Alimentarius enable or facilitate development of regulatory and technical capacities as part of HSS. In addition, the Codex standards also enable state parties to strengthen their capacities to timeously respond to any public health emergency of national and international concern regarding the outbreak of foodborne diseases. Codex standards and related texts are not a substitute for national laws but can support their development as a standards-setting resource for use by each country.

3.1 The regulatory framework

Some authors have noted that the foundation of a food control system is a comprehensive body of appropriate food law from which it derives its powers (Neeliah, Goburdhun and Neeliah, 2009). The law assures quality and demonstrates a government's desire to protect consumers. Alongside the law, the authors also argue that its administration (application and enforcement) is equally important, as it organises controls, ensures policy and operational co-ordination and prevents dangerous or substandard foods from reaching the market.

Over the years, ESA countries have developed laws governing food safety control, including for foodborne-disease outbreak investigation and response mechanisms (FAO, 2005; WHO, 2016a,b and c, 2017a,b,c,d and e). The laws cover issues such as the maximum levels of melamine in food; maximum levels of aflatoxins in food; marketing of foods for infants and young children; food-grade salt regulations; labelling of pre-packaged food regulations; and labelling of food additives, among others (Govt of Botswana, 2003). Some of these laws are now under review, such as in Botswana and Kenya, to meet international standards informed by the Codex standards and required by the IHR as binding rules, as well as other international, regional and national commitments.

In addition to Codex standards, the World Trade Organisation's (WTO) Agreement on Sanitary and Phytosanitary Measures (SPS) sets out the basic rules for food safety and animal and plant health standards. According to the WTO: these "measures can take many forms, such as requiring products to come from a disease-free area, inspection of products, specific treatment or processing of products, setting of allowable maximum levels of pesticide residues or permitted use of only certain additives in food. Sanitary (human and animal health) and phytosanitary (plant health) measures apply to domestically produced food or local animal and plant diseases, as well as to products coming from other countries" (WTO, 2018:online).

The African Union Commission has acknowledged the inadequate capacity of most African countries to meet SPS import requirements of trading partners and called for urgency to address the relevant SPS constraints and formulate sound programmes and initiatives (AU Commission, undated).

Most ESA countries have national food control systems that are fragmented across different ministries, government departments and agencies, including local authorities that are in charge of licensing and inspecting food vendors in their respective jurisdictions within the precincts of the laws (both by-laws and national laws) (FAO and WHO, 2005). For example, Kenya has 24 different pieces of legislation and regulations that affect food safety, while South Africa has 14, Tanzania 13, Zambia 10 and Mozambique 9 (FAO and WHO, 2005). Despite this, the co-ordination between these institutions in food control systems relies heavily on ministries of health through a designated agency or regulatory body, such as the Food Drug Authority (TFDA), established in 2003 as the food safety regulatory body for the United Republic of Tanzania (WHO, 2016c). In Kenya, the National Food Safety Co-ordination Committee, whose secretariat is in the Ministry of Health, is responsible for food safety issues (WHO, 2017a). Some countries, like Lesotho and Mozambique, do not have specific food safety authorities but have programmes that run under the Ministry of Health (WHO, 2016a; WHO 2017d).

When the IHR were introduced in 2005, the WHO and FAO did an assessment of the capacities of food systems in the African region; the findings are summarized in *Table 3*. The table highlights various challenges in the system and capacities. It also points to improvements in some ESA countries with regard to laboratory capacity and the establishment of institutions to co-ordinate and regulate food safety issues that could provide useful lessons for those countries in the region that are reforming their food control systems.

Table 3: Standards, services and capabilities to ensure food safety

Country	Food standards system	Inspection mechanism	Laboratory support services	Capability of food industries to provide safe food
Botswana	National standards prepared by Bureau of Standards in collaboration with other key stakeholders; mainly based on Codex standards	No well-established system	Rudimentary. Selected labs being assisted to build capacity. No lab accredited to ISO 17025	Meat industry has been assisted to build capacity and capability to provide safe products for the export market
Kenya	Fairly good system in place. Codex standards are used as reference documents in the development of food standards	A mechanism for food imports/ export inspection KEBS inspects food imports	Good lab support service. Accreditation for specific food tests secured	No ongoing programme for building capability in the food industry. The milk, meat and fishery industries are adequately assisted to build capacity for the provision of safe food Horticultural produce for exports also targeted for assistance
Lesotho	Not well established	No well-established system; mechanism for imports/exports of livestock available	A system in place for microbiological examination of food. No lab accredited to ISO 17025	Capacity developed for export products
Malawi	Fairly good system in place	Not well established	Needs improvement No accreditation	No ongoing programme to assist the food industry to build capacity
Mozambique	Not well-established system in place	Inspection of fish for exports well established	Rudimentary laboratory support service. No accreditation	Adequate capacity in fishing to provide safe fish for export
Namibia	Not well-established system in place. NSI yet to be established	Not well-established system in place	South Africa Bureau of Standards labs in Walvis Bay provide support	No ongoing programme to assist the food industry to build capacity. The fishing industry is assisted to provide safe fish for the export market
South Africa	Good system in place	Well-established inspection mechanism at domestic and international levels	Adequate and competent laboratory support services	Assistance is provided to the food industry to build capacity to provide safe food. Emphasis, as usual, is on the export food industry

Table 3: Standards, services and capabilities to ensure food safety (continued)

Country	Food standards system	Inspection mechanism	Laboratory support services	Capability of food industries to provide safe food
Swaziland	Not well-established system	Established mechanism for food exports and imports	Lab support available in City Council and Vet Med labs (Ministry of Agriculture). No accredited labs at this time	Export food industry (meat) is assisted to build capability to provide safe meat for export market
Tanzania	A fairly good system in place. Tanzania food safety standards are based on Codex standards, where they exist	Not well established	Basic lab support service, without accreditation. No capacity or ability to quantify pesticide residues in food and foodstuffs	Trade & Industry Associations, in collaboration with National Food Control Agencies have just started instituting measures for educating their members on QA practices
Uganda	A fairly good system in place	Established system for imports clearance, including food	Food laboratories of UNBS provide basic lab support. The Microbiology Lab is accredited for selected tests	As a result of the ban on fish exports to EU in 1997&2000, the fishing industry has been assisted to develop the capacity to meet the safety requirements of the market
Zambia	Zambia Bureau of Standards establishes voluntary standards while the Min of Health establishes mandatory standards	Established mechanism for imports. Inspection of fruits/vegetable exports is satisfactory	Lab support service is quite satisfactory. No accreditation for any of tests conducted	Horticultural industry has been assisted by the Zambia Export Growers Association to develop their capability to meet the safety requirements of the export markets
Zimbabwe	Food Standards Advisory Board established in 1996.	No documented policies and procedures for imported food inspection. Port health food inspection manual has been developed	Food control activities supported by laboratory services of the Ministry of Health, Government Analyst Laboratory and others.	Not available

Source: Taken from FAO and WHO, 2005.

3.2 Enforcement and laboratory capacities

Enforcement of existing regulations is a challenge, affecting HSS and the implementation of the IHR (FAO and WHO, 2005). One constraint is laboratory capacity. Mensah et al. (2012) observed that food laboratories in Africa improved substantially between 2002 and 2012, with several now conducting microbiological and chemical tests. However, challenges persist in the lack of equipment and human resources, underutilisation of certain laboratories and lack of synergy, e.g. on standardisation and selection of equipment and reagents among laboratories (Mensah et al., 2012; Mwamakamba et al., 2012).

Schroeder and Amukele (2014) did a comprehensive evaluation of accredited laboratories in sub-Saharan Africa and found that 37 of 49 countries evaluated had no medical laboratories that met internationally recognised quality standards. Although the evaluation did not make specific reference to food safety issues, *Table 3* indicates that, while most food safety tests are supported by medical laboratories, the majority of these were not accredited. In the remaining 12 countries in the 2014 evaluation, there were 380 medical laboratories, with South Africa (345), Botswana (6), and Namibia (7) (all in southern Africa) having the highest densities, with one to ten accredited laboratories per million people (see *Table 4*). The Association of North American Independent Laboratories documents the criteria for a laboratory to be accredited to international standards. They note that the laboratory, would have to meet several criteria including, but not limited to:

- Qualified human resources with technical supervisory responsibilities in the conduct of the laboratory with adequate experience in the testing work involved;
- Consistent application of accepted national or international consensus standards;
- Satisfactory record-keeping, supervision and checking and calculations of results;
- Laboratory equipment and facilities appropriately housed, properly maintained and adequate for the performance of the testing work;
- Measuring and testing equipment maintained by the laboratory together with any appropriate auxiliary equipment regularly calibrated or verified in terms of the relevant traceability (Association of North American Independent Laboratories, undated).

Table 4: Number and type of laboratories accredited to internationally recognised quality standards in the ESA region

Country	Type of laboratory			
	Private	Public	Research	Total
South Africa	276	62	7	345
Kenya	4	0	4	8
Namibia	6	1	0	7
Botswana	2	1	3	6
Uganda	2	0	3	5
Mauritius	1	0	0	1
Tanzania	0	0	1	1
Zimbabwe	0	0	1	1
Total	**291**	**64**	**19**	**374***

Source: Adapted from Schroeder and Amukele (2014).

Note: Number and type of laboratories accredited to quality standards of the Clinical Laboratory Improvement Amendments (CLIA) or International Organization for Standardization (ISO). Countries in SSA without laboratories accredited to these standards are omitted. * Six other laboratories outside the ESA region.

For the ESA region, Schroeder and Amukele (2014) found that few countries have internationally accredited laboratories. South Africa accounted for the vast majority of accredited laboratories. Many countries thus lack laboratory support for basic food safety investigations. The joint evaluation report of the core IHR capacities in Lesotho, for example, shows that the surveillance system currently in place is not well positioned to capture food safety events that could be due to chemical contamination (WHO, 2017d).

Nevertheless, ESA countries have several laboratories across different levels that contribute to food safety control and investigation of - and response to - foodborne disease outbreaks by conducting clinical testing of assessment food samples collected during field investigations. Laboratory services form part of the national health system and are an integral component of the epidemic alert and response system. Such functions demand a systems approach, with collaboration across stakeholders for sample collection, transportation, domestic diagnosis and use of external laboratory capacity if required. *Table 3* suggests scope to further strengthen these capacities in some countries.

The co-ordination of these various components of surveillance and response for food safety and regulation enforcement requires effective national capacities at central levels with representation of government laboratories for testing and providing empirical evidence.

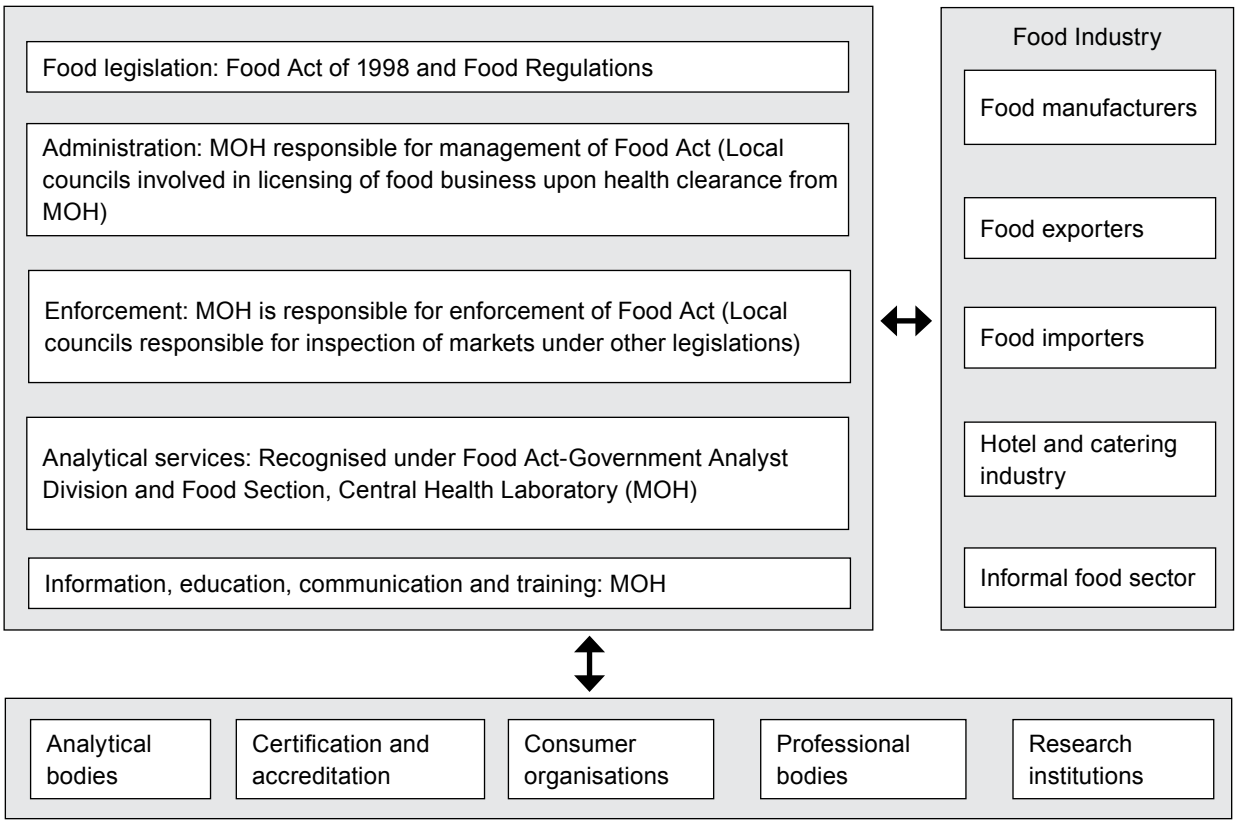
Mauritius, for example, provides an interesting co-ordination mechanism, illustrated in *Figure 1*, which provides crucial elements that may assist those countries developing their food control systems and capacities for HSS and IHR. Mauritius reviewed its 1940 Food Act in 1998 and incorporated modern standards. The new Food Act criminalises any imports of food that are not of "merchantable quality"; it also makes it an offence to import, prepare, distribute and sell any food that is "poisonous, contains foreign matter, that is adulterated or that is unfit for human consumption" (Neeliah et al., 2009:144).

Whilst these seem to be basic provisions, the importation of goods and products that are unfit for human consumption have been a serious threat to human health in different countries in the region with the failure of customs and port health authorities to detect such goods. The Global Panel on Agriculture and Food Systems for Nutrition has observed that food safety is an area of great concern for low- and middle-income countries, mostly in Africa where regulatory, surveillance and control systems are unable to address the potential hazards of foodborne diseases (Global Panel, 2016).

The Ministry of Health in Mauritius is the administrator of the Food Act, with regulations for enforcement and with various agencies like local authorities playing a crucial role. The system is supported by services that include laboratory, information (education, training and communication) and the role of different bodies (accreditation, consumer protection organisations, professional bodies and research institutions).

The food industry itself - including manufacturers, importers and exporters - is also an essential component of the system co-ordinated by the Ministry of Health. The existence of such basic infrastructure (laboratory capacities, personnel and institutions) is important; however, its co-ordination in terms of strengthening the different roles of the stakeholders is equally crucial in building and strengthening the core capacities necessary to meet the IHR on food safety.

Figure 1: Elements of the Mauritian food control system



Source: Neeliah et al., 2009.

Neeliah et al. (2009) noted that implementation is key, observing that implementation gaps in practice weaken co-ordination and coherence in the administration of food control, especially when many agencies are involved, with a potential for "conflicting information and duplication of efforts by enforcement officers" (Neeliah et al., 2009:153).

3.3 Summary

Besides IHR core capacity requirements on food safety, where countries should have surveillance and response capacity for food and waterborne diseases' risk or events, other international standards and guidelines set by the Codex Alimentarius help countries put in place legislation and regulation on food safety. In addition, measures defined in the World Trade Organisation's Agreement on Sanitary and Phytosanitary (SPS) Measures particularly relate to international trade. ESA countries are party to the Codex standards administered jointly by the Food and Agriculture Organisation and the World Health Organization. They are also members of the WTO SPS Agreement, which is legally binding on decisions agreed. In summary, the section raises that:

a. ESA countries have developed regulatory frameworks for food safety as a public health issue, including measures for foodborne disease outbreak investigation and response. However, many laws need to be updated to comply with current regional and international standards. Countries such as Mauritius that have already initiated this updating of legislation and regulations and systems could provide useful lessons for other countries in the region.

b. Most ESA countries have basic systems, inspection mechanisms and laboratory support services to provide safe foods. However, the majority of laboratories are not internationally accredited and have shortages of laboratory personnel for these services.

c. National food control systems are fragmented across different ministries, government departments and agencies, including local authorities that inspect and license food vendors. This fragmentation can affect food safety unless there is strong national leadership and co-ordination, generally by the Ministry of Health, with delegated (subsidiarity) to different agencies and levels. This calls for co-ordination of different stakeholder roles in many areas of public health, suggesting that investments in these system and capacity demands for food safety can also contribute to leadership, interactions, surveillance and response capacities for other public health issues.

d. The primary health workers raised earlier also play a role in specific measures for food safety and ensuring that law and health promotion on food safety reach communities.

4. IHR AND LABORATORY AND PHARMACEUTICAL PERSONNEL CAPACITIES

Public health laboratories have an essential role in disease surveillance and outbreak detection, emergency response and environmental monitoring. State and local public health laboratories can serve as a focal point for a national system, through their core functions for human, veterinary and food safety, including: disease prevention, control, and surveillance; integrated data management; reference and specialised testing; laboratory oversight; emergency response; public health research; training and education; and partnerships and communication (WHO Afro, 2013). Core capacity 8 of the IHR obliges state parties to establish mechanisms for providing reliable and timely laboratory identification and characterisation of infectious agents and other hazards likely to cause public health emergencies of national and international concern, including shipment of specimens to the appropriate laboratories, if necessary.

Countries in the ESA region have established laboratory capacities to perform basic functions required in disease and outbreak detection (WHO 2016a;b and c; 2017a,b,c,d and e). Besides these established capacities, there are reports of capacity-building activities aimed at enhancing the functionality of laboratories and upgrading human resource capacities of lab personnel in resource-constrained countries (Specter et al., 2010; Masanza et al., 2010; Barbe et al., 2017).

Over the past decade, laboratory capacity in Africa has generally improved, driven in part by the adoption of IHR 2005 and the strengthening and expansion of the Global Polio Laboratory Network (GPLN) and the Global Influenza Surveillance and Response System (GISRS) (Barbe et al., 2017; WHO Afro, 2016; WHO, 2017e).

The Ministry of Health in Uganda, for example, operates nearly 1,500 laboratories in the country, whose capacities range from laboratories attached to level III healthcare facilities at the sub-district level up to national referral laboratories (WHO, 2017c). *Table 4* below documents the evidence that shows the existence of laboratories across ESA countries at different levels with different capabilities. Even countries with small populations like Lesotho, Botswana and Namibia have well-functioning laboratory systems (WHO, 2016b; 2017b,d). Lesotho's national laboratory system is made up of one national referral laboratory in Maseru, a national referral laboratory for tuberculosis, 18 laboratories in the districts, a blood bank, and four private laboratories offering bacteriology, virology, parasitology, serology, biochemistry, haematology, and cytogenetic and transfusion medicine services (WHO, 2017d). Botswana has laboratories, with each district health management team having one laboratory, in addition to reference laboratories, private and mine laboratories (WHO, 2017b). The public laboratories in the country are classified from level I to level IV.

Namibia has about 84 clinical laboratories, 40 of which are run by the National Institute of Pathology (NIP) (WHO, 2016b). These laboratories offer diagnostic services to health facilities and private clinics. However, there is no public health reference laboratory in the country, though plans are underway to upgrade some laboratories into public health reference laboratories (WHO, 2016b). In Tanzania, a public health laboratory network exists with a national health laboratory and quality assurance training centre (NHL-QATC) at the top (WHO, 2016c). Four zonal reference laboratories support the NHL-QATC, which is capable of conducting tests on bacteriology, virology, serology, parasitology, biochemistry, haematology and molecular isolation and sequencing, among others. There are also two biosafety level III laboratories and one other laboratory currently undergoing an upgrade to allow handling and diagnosis of viral haemorrhagic fevers, such as Ebola and Marburg (WHO, 2016c).

Despite this progress in building laboratory capacity in the region, the Ebola outbreak (2014- 2015) exposed gaps in this area (Loewenson et al., 2015). Only a few countries have the technical ability and laboratory infrastructure for the diagnosis of emerging and dangerous pathogens (EDP) outbreaks, in particular viral haemorrhagic fever viruses (VHF) (WHO Afro, 2016). The WHO has reported that since the Ebola outbreak in West Africa in 2014, the DRC has increased its use of diagnostic tools for rapid initial testing of samples in suspected cases.

These new tools are currently being used in the ongoing outbreak of the virus in some remote parts of the country. Rapid testing involves gathering samples and transporting them to the capital city, Kinshasa, for testing at the National Institute of Biomedical Research (INRB). The results are shared with WHO collaborating centres, particularly the Centre International de Recherche Médicale de Franceville (CIRMF), in Gabon, and the tests were used to confirm the Ebola virus outbreak (WHO DRC, undated).

The WHO Regional Office for Africa (AFRO) established an Emerging and Dangerous Pathogens Laboratory Network (AFR EDPLN) in response to deficiencies in diagnosing EDPs. This is a network of "high containment diagnostic laboratories" collaborating and sharing knowledge, biological materials and trial research results to improve surveillance, preparedness and response to EDPs by enhancing diagnostic capacities (WHO Afro, 2016:8). A key and fundamental goal of the network, among others, is working towards establishing an External Quality Assessment scheme and a regional biobank.

As of 2016, the network had 14 national EDP reference laboratories (in Algeria, Cameroon, Central African Republic, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Ghana, Kenya, Madagascar, Nigeria, Senegal, Sierra Leone, South Africa and Uganda) (WHO Afro, 2016). The EDP reference laboratories are national institutions designated by ministries of health and recognised by the World Health Organization (WHO) for the purpose of participating in the work of the WHO regional EDPLN.

Since the adoption of IHR in 2005, the CDC and the American Society for Microbiology (ASM) have been providing assistance with capacity building related to global HIV and clinical microbiology laboratories in resource-constrained countries. The CDC and ASM established an International Laboratory-Capacity Building Program, LabCap, to utilise ASM's widespread resources and its membership expertise - 40,000 microbiologists worldwide - to strengthen clinical and public health laboratory systems in resource-constrained countries, mainly through training and onsite mentoring of laboratory staff (Spectre et al., 2010).

Several ESA countries have benefited from this programme, including Botswana, Kenya, Mozambique, Namibia, Rwanda, Tanzania, Zambia, and Zimbabwe (Spectre et al., 2010). Laboratory personnel have been trained in different areas, including: basic principles of epidemiology and outbreak detection; determination of proper samples to collect in an outbreak; collection, packaging, and transport of biological samples from an outbreak; and rapid testing for detection of, for example, causative agents for cholera, dysentery and typhoid, among others, with potentially wider spill over gains for other areas of public health (Spectre et al., 2010).

ASM LabCap experts travel to countries to provide onsite technical assistance and mentoring in an effort to help establish and fully transfer quality-assured laboratory diagnostic capacity (Spectre et al., 2010). The observed ongoing capacity enhancement activities include:

- Assessing laboratory systems and laboratory capacity mapping;
- Mentoring and training laboratory staff;
- Providing technical support for the customisation and rollout of consensus training packages and programmes;
- Assisting with the strengthening of laboratory quality systems, including development of Quality Control (QC) procedures, Quality Assurance (QA) programmes, and standard operating procedures (SOPs);
- Providing guidance for the standardisation and selection of equipment and reagents;
- Establishing, optimising, and validating laboratory techniques and procedures;
- Assisting with the establishment of national public health/reference laboratories and supporting the development of specimen referral networks;
- Assisting with the co-ordination of infectious disease surveillance and outbreak response;
- Developing national strategic plans for public health laboratory networks and guiding the development or optimisation of national laboratory policies;
- Assisting laboratories in their preparations for accreditation;
- Developing a certification programme for laboratory personnel.

The African Field Epidemiology Network (AFENET), a coalition of Field Epidemiology Training Programs (FETPs) initiated in 2005, further facilitates the strengthening of disease surveillance and public health responses to epidemics in Africa. The network also provides training to laboratory personnel in the areas listed above (Masanza et al., 2010).

The South African Field Epidemiology and Laboratory Training Programme (SAFELTP), created in 2006, has established a collaboration between the South Africa Department of Health, the National Institute for Communicable Diseases, the National Health Laboratory Services, the CDC and the University of Pretoria. The programme offers applied epidemiology and laboratory training that provides multidisciplinary field-based and problem-oriented instruction. It is a two-year full-time training and service programme, which "places emphasis on the application of epidemiological principles in public health surveillance, outbreak investigation, programme evaluation, health data management and the role of laboratory systems in epidemiology, among other public health areas" (Kuonza et al., 2011).

Besides the above laboratory capacity-building initiatives involving ESA countries, there is limited evidence on the existence of National and External Quality Assurance Schemes (EQAS and NEQAS), nationally driven (supported by the public budget) human capacity development programmes and implementation of Quality Management System (QMS).

Table 5 below, derived from the independent assessments of IHR capacities by the WHO, shows a marked improvement in laboratory capacities of ESA countries since the assessment by WHO and FAO was done in 2005, the year when IHR (2005) were also adopted. This is an area where greater investment appears to have been made and synergies built in relation to capacities for both IHR and HSS.

The evidence also shows major shortfalls in personnel. For example, Mozambique has 1,405 technicians across various categories to cover the 344 existing laboratories in the country (WHO, 2016a). In 86 laboratories, there is one technician per laboratory (WHO, 2016a), suggesting a major challenge that could be common to other low-income countries of the region, despite the high demand for routine laboratory services.

In Zimbabwe, the national action plan on antimicrobial resistance (AMR) notes the lack of meaningful surveillance data on resistance patterns and prevalent organisms due to constraints in laboratory testing systems. "Only 25% of the human public health laboratories have the necessary staffing, equipment and reagents to perform culture and susceptibility testing on human samples, which limits the diagnostic capabilities of healthcare professionals treating patients and the availability of antimicrobial resistance data to guide clinical practice and policy-making" (Govt of Zimbabwe 2017:9).

As noted above, the collaborations in some countries through vertical or integrated programmes with external parties have resulted in capacity building programmes aimed at facilitating transfer of quality-assured laboratory diagnostic capacity.

Table 5: Laboratory capacities of some ESA member states

Country	Level of capabilities	Laboratory testing for detection of priority diseases	Specimen referral and transport system	Effective modern point-of-care and laboratory-based diagnostics	Laboratory quality system
Botswana	Has laboratories, with each district health management team having one laboratory, in addition to reference laboratories, private and mine laboratories. The public laboratories in the country are classified from level I to level IV, with clearly documented services provided at each level.	Diagnostic algorithms and SOPs in line with international standards are available in all laboratories. Core tests for HIV, malaria, TB and salmonella are conducted across the tiered laboratory network. The Laboratory Information System is in place. Both animal and human health laboratories face issues in terms of equipment maintenance contracts.	The specimen transport system for both animal and human specimens uses respective ministry vehicles and couriers. There is a formal specimen referral system. The specimen referral network, while effective, could benefit from strengthening, e.g. through the provision of sealable bags to reduce contamination when specimen containers break.	Point-of-care testing implemented across the country for TB, HIV and malaria, ensuring public access. Culture media are made in the laboratories locally. Laboratories only have emergency money for routine tests but are not included in the public Health Emergency Preparedness budget.	All laboratories are licenced and inspected annually by the Health Inspectorate. There are five laboratories accredited to ISO standards and one has measles accreditation by the WHO. There is a need to ensure that external quality assurance becomes mandatory for all laboratories.
Lesotho	The national laboratory system for the human health sector is well developed, with one national referral laboratory in Maseru; a national referral laboratory for tuberculosis; 18 laboratories in the districts; a blood bank; and four private laboratories offering bacteriology, virology, parasitology, serology, biochemistry, haematology, and cytogenetic and transfusion medicine services.	Both national laboratory systems are collectively capable of conducting some 14 tests: tests for cholera, HIV, malaria, measles, meningitis, rubella, tuberculosis, typhoid and shigellosis in humans; and tests for anthrax, brucellosis, rabies, avian influenza and Newcastle disease in animals. Infrastructure and equipment should be improved in the animal sector national laboratory system. Maintenance and service contracts should be put in place for major and minor equipment in both laboratory systems.	80% of specimens are transported between district and national levels with the NGO, Riders for Health. A specimen tracking system is in place and specimen referral is documented on an electronic database. SOPs are available for sample collection, packaging and transport. The budget for regional transportation and testing of specimens is funded by WHO, raising sustainability issues. A specimen transport system is absent in the animal sector national laboratory system.	Point-of-care diagnostics are available for some tests, supported by standardised implementation guidelines. An operational plan should be implemented to expand coverage of point-of-care diagnostics. There should be less dependence on donor funding for laboratory activities.	Both national laboratory systems implement quality standards aligned to international standards (WHO and OIE, respectively). There is a quality manager and a quality assurance unit at central level. A national laboratory accreditation and licensing system should be established. Laboratories should be accredited by WHO, FAO or OIE.

Table 5: Laboratory capacities of some ESA member states (continued)					
Country	**Level of capabilities**	**Laboratory testing for detection of priority diseases**	**Specimen referral and transport system**	**Effective modern point-of-care and laboratory-based diagnostics**	**Laboratory quality system**
Kenya	The national laboratory system comprises the national reference laboratories at the Ministry of Health, medical research laboratories at the Kenya Medical Research Institute, teaching and referral hospital laboratories, government chemist laboratories and the Central Veterinary Laboratory.	Kenya has robust capacity to conduct all 10 core tests recommended by WHO through: availability of trained and competent personnel in human and animal health; robust infrastructure improvement of NPHLS; accreditation of the National Microbiology Reference Laboratory. However, there is a need to increase external quality assurance coverage at subnational level. The National Microbiology Reference Laboratory bacteriology external quality assurance programme needs to be expanded to all designated subnational laboratories.	Policy guidelines for laboratory referral networks for human health exist. The country participates in regional (international) laboratory networks. There is collaboration between public health, teaching and referral laboratories, research laboratories and private laboratories in specimen referral networks. Linkages between laboratory and programme information systems should be improved. Ministry of Health should look at vertical systems, such as polio, HIV and tuberculosis, to see if there are best practices that could be adopted for other IHR priority diseases.	Point-of-care testing guidelines for human health exist. Human capacity is available and testing services are decentralised. There is an urgent need to implement the point-of-care testing guidelines. This will require the wide dissemination of the guidelines to subnational levels.	A system of licensing of health laboratories that includes conformity to a national quality standard exists, but it is voluntary or is not a requirement for all laboratories There is a laxity in enforcing licensure of government laboratories. Development and implementation of mandatory legislation adherence procedures for public health laboratories by the regulatory body is needed.
Mozambique	Mozambique has an integrated network of laboratories that fall under various directorates within the Ministry of Health. Clinical laboratory services are integrated into a tiered National Health Service that consists of central, provincial, and district hospitals and health centres. There are veterinary laboratories in all provinces.	The country has the capacity to confirm priority pathogens in human and animal health sectors in bacteriology and virology. There are a number of routine laboratory tests, such as TB smear microscopy, malaria rapid test, HIV serology, and microscopy for intestinal parasites that are effectively implemented across the national laboratory network. Harmonisation of a laboratory plan should be conducted to cover all levels of the health system. There is a significant lack of human resources.	Specimen referral and transport systems are notably stronger for large, vertically funded disease programmes such as HIV, TB and malaria. The sample referral system needs to be strengthened to cover all levels of the health delivery system and further integrated with veterinary systems for animal health.	There is minimal point-of-care (POC) capability in the laboratories, which is attributed to a lack of an overall strategy for POC diagnostics. Individual strategies exist for some diseases such as HIV/AIDS, with sufficient funding and attention. A country strategy needs to be developed to ensure POC and laboratory-based diagnostics are adequately implemented.	There is not yet a comprehensive system for determining conformity to laboratory quality assurance standards across the laboratory system as a whole. However, laboratory quality assurance systems are in place for vertically funded programmes such as HIV and TB.

Table 5: Laboratory capacities of some ESA member states (continued)					
Country	**Level of capabilities**	**Laboratory testing for detection of priority diseases**	**Specimen referral and transport system**	**Effective modern point-of-care and laboratory-based diagnostics**	**Laboratory quality system**
	The country does not yet have a single national public health laboratory facility that integrates all the departments. The country's ten reference laboratories are under the National Institute of Health, mostly in the capital Maputo.			Capacity building to be prioritised to ensure that a tiered approach for specific diagnostic testing is implemented.	
Namibia	Laboratory services for human health are run by the National Institute of Pathology (NIP), set up by an act of parliament (NIP Act 15, 1999). The delivery of health laboratory services in Namibia is carried out by approximately 84 clinical laboratories: 40 of these are run by the NIP and the rest are privately owned. Clinical laboratories offer routine diagnostic services to health facilities and private clinics. There is no public health reference laboratory in the country, but plans are underway to upgrade some laboratories into public health reference laboratories.	The country has well-developed National Standard Laboratory Guidelines 2015 (draft), the National Public Health Laboratory Policy with Implementation Plan 2013, the Point-of-Care Testing Guidelines 2015 (draft) and national HIV / AIDS testing guidelines. There is effective co-ordination among NIP laboratories and stakeholders with participation in external quality control. The management of data from the laboratory, including analysis and sharing for decision-making, needs improvement. Co-ordination, communication and collaboration among sectors (human, animal, environment), under the One Health approach, need to be strengthened. Animal and human laboratories need more and better-trained staff.	The NIP transport network is able to transport specimens, and is complemented by a courier and back- up system for good turnaround time. The veterinary laboratory system also has a good transport system for transporting samples from lower levels to national facilities. The linkages and twinning between human, environmental and animal health sector laboratories and supporting transport of laboratory samples and specimens need strengthening. Laboratory data management and reporting need improvement.	All district hospitals have laboratories that perform basic chemistry bacteriology and haematology. The Laboratory Quality Management System needs strengthening.	The veterinary laboratory service has strong quality monitoring systems that are adequately supported. Training in quality monitoring and an increase in support for quality monitoring processes need strengthening.

Table 5: Laboratory capacities of some ESA member states (continued)					
Country	**Level of capabilities**	**Laboratory testing for detection of priority diseases**	**Specimen referral and transport system**	**Effective modern point-of-care and laboratory-based diagnostics**	**Laboratory quality system**
Tanzania	There is a functional public health laboratory network with a high quality national health laboratory and quality assurance training centre –The NHL-QATC is capable of conducting testing for 7 of the 10 priority areas: bacteriology, virology, serology, parasitology, biochemistry, haematology and molecular and has ISO 15189 international accreditation for laboratory competency and quality. All four zonal laboratories are ISO 15189 internationally accredited. There are two biosafety level III laboratories and one other laboratory currently undergoing an upgrade to allow handling/diagnosis of viral haemorrhagic fevers, such as Ebola and Marburg.	The NHL-QATC is housing the Network Information Centre which is WHO accredited. Algorithms are in place for HIV and viral haemorrhagic fevers (such as Ebola and Marburg), and the national and zonal laboratories are equipped with the necessary equipment. The robust laboratory network should play a more important role in antimicrobial resistance surveillance.	Laboratory SOPs are available for the specimen referral network under the laboratory component of IDSR; however, there are challenges in peripheral areas. There is limited analysis, feedback and information sharing between human and animal health from the laboratory surveillance systems that should be regularised and periodically conducted (weekly, monthly quarterly and annually) as part of a broader laboratory information management system.	Tanzania started with Pima machines for CD4 estimation but has now initiated the evaluation of two other points-of-care: PCR tests for HIV viral load testing and HIV early infant diagnosis.	The MoH CDGEC, through the national reference laboratory, sends blinded samples to regional and district laboratories for proficiency testing and maintenance contracts have been established with lower level laboratories.

Table 5: Laboratory capacities of some ESA member states (continued)					
Country	**Level of capabilities**	**Laboratory testing for detection of priority diseases**	**Specimen referral and transport system**	**Effective modern point-of-care and laboratory-based diagnostics**	**Laboratory quality system**
Uganda	The MoH operates nearly 1,500 laboratories in the country. These range from laboratories attached to level III healthcare facilities at the subcounty level up to national referral laboratories. In addition, there are laboratories attached to universities and research institutes that are supporting the public health and animal health sectors. There is also a Government Analytical Laboratory (GAL) that does forensic, DNA and toxicology studies. There is a private laboratory sector consisting of both for-profit and not-for-profit laboratories.	There are four well- established national referral laboratories Uganda Virus Research Institute (UVRI), the National Tuberculosis Reference Laboratory (NTRL), the Central Public Health Laboratories (CPHL), and the National Animal Disease Diagnostic and Epidemiological Center (NADDEC). Much of the capacity for laboratory testing at the national level is dependent on external support from development partners and is yet to be fully supported by the national government.	Existence of a good national health laboratory specimen referral system through health centrers III and IV, general hospitals, regional referral hospital laboratories, national referral hospital laboratories and national reference laboratories. This well-developed system for human specimens is functional from any part of the country. The animal sector lacks a specimen referral system; animal specimens are collected by the veterinarian or the farmer who pay to send them for testing.	Tiered testing regimes are in place for public health laboratories Bacterial culture is currently available only in five hub public health laboratories. The district and regional animal health laboratory system is not fully functional.	A good system of laboratory equipment servicing and maintenance is available in the human sector. There is an established External Quality Assessment (EQA) programme for national referral laboratories in the human sector as well as GAL. Licensing requirements don't currently include implementing a quality management system

Table 5: Laboratory capacities of some ESA member states (continued)					
Country	**Level of capabilities**	**Laboratory testing for detection of priority diseases**	**Specimen referral and transport system**	**Effective modern point-of-care and laboratory-based diagnostics**	**Laboratory quality system**
Zambia	Zambia operates a three-tier National Medical Laboratory System (district/provincial, regional and reference) with approximately 300 public health laboratory services of varying sizes and capabilities located mainly at the hospitals, health centres, research centres and private institutions, Defence, Mines, non-governmental organisations (NGOs) and animal health laboratories. At the apex, the laboratory system is supported by the University Teaching Hospital (UTH), Central Veterinary Research Institute, National Food and Drug Control Laboratory, National Chest Disease Laboratories, and the School of Veterinary Medicine (all located in Lusaka) and 5 regional veterinary laboratories.	The availability of a network of laboratories that are carrying out core tests for disease pathogens under the IHR. There is overconcentration of the reference laboratories in Lusaka and limited capacity of the regional laboratories to conduct some tests.	Existence of a budget line for sample transportation at the government level. Existence of a mechanism and consistency of sample transportation in partner-funded programmes (HIV, TB, malaria and polio). Availability of institutional SOPs and equipment for specimen reception, storage, packaging and transportation at reference laboratories and ongoing mapping of laboratories. Inadequate funding for specimen transportation that often results in some samples not being tested, delayed testing and prolonged turn-around-time.	Some point-of-care test kits are available and are being deployed to the field for real-time screening and diagnosis of specific diseases in some specific programmes (e.g. polio, measles, tuberculosis, paediatric bacterial meningitis, malaria, HIV). Insufficient procurement of rapid test kits and lack of national validation on the supplied ones. Limited sites currently using rapid test kits.	Laboratory premises licensing is mandatory for all laboratories and bi-annual inspection of licensed laboratories is documented.

Source: Adapted from WHO 2016 a and b; 2017a,b,c,d,e and f

5. DISCUSSION AND CONCLUSIONS

Despite the adoption of IHR (2005), health systems in most countries in the ESA region remain inadequate to meet the public health needs and requirements (WHO Afro, 2015). There are opportunities for improved synergies between developing the capacities to implement IHR to respond to public risks and emergencies and developing public health capacities and HSS to meet population health needs. This covers areas such as population health surveillance; monitoring and response to health hazards and emergencies; and addressing environmental, occupational and food safety issues. It also covers the organisation of health and other prevention services, control and management and care of communicable and non-communicable diseases and the education and social machinery for improvement of health.

Literature on the implementation of core capacities for the IHR (2005) in ESA countries points to evidence of progress as well as persisting gaps in certain areas. The region is not homogenous and countries vary in terms of their economic resources and capacities. There is also variation in the setting of national action plans for implementation of the IHR, which would be an important avenue to make explicit the links to HSS and the areas where investments are needed for mutual benefit. It is possible that the available published literature understates the existence of IHR (2005) implementation plans in the region; the limited documentation available suggests that such planning is an area for further investment by countries seeking to address both IHR and HSS.

The review did find reports of progress in putting in place some basic infrastructure necessary for meeting the targets of IHR that have potential benefit for HSS. The investment in capacities may, however, not be solely attributed to a response to IHR (2005) requirements, but may have been developed as part of normal state responsibilities in developing and strengthening their health systems. Notwithstanding, HSS investments are noted that facilitate IHR implementation. There have also been documented collaborations with other stakeholders in-country and with external partners in developing IHR capacities that have potential benefit for HSS.

The following sub-sections briefly summarize the key findings and present recommendations for future action.

5.1 IHR and community and primary-level health personnel capacities

The evidence available suggests a commitment by countries in the region to develop programmes that facilitate the development of human resources for health at all levels of health service delivery. Almost all ESA countries have put in place strategies and plans for this objective. Some plans explicitly identify the training of specific cadres that would help in implementing IHR (2005). Uganda's training in public health and in field and clinical epidemiology for those working on both human health and veterinary health are good examples. Others, including South Africa, Zimbabwe, Namibia and Kenya, have similar programmes.

However, inadequate financial and technical resources have led to shortfalls in the development, recruitment and retention of health personnel, especially at the community-care level where the need is greatest. The gap, for example, in those responsible for data collection at the health facility level means that their work is being done by clinical personnel. Given that clinical staff may already be overburdened, such new administrative responsibilities risk reducing the time available for clinical care.

To be implemented effectively, HRH strategies and plans need to be adequately supported by budgetary allocations and legislative reforms. There is a strong potential for recruiting skilled staff and upgrading core capacities through universities and other training institutions in the region, as was noted in Botswana. Training strategies need to be complemented by strategies for retention and for strengthening the employment of these skills locally, especially at community level.

Some training programmes, such as in epidemiology, are overly dependent on external funding. As Suthar et al. (2018) has noted, given that most health workforce strategies are long-term, they need curricula, competencies, and continuing education and licensing that reflects this that goes beyond the short term inputs of international support.

This issue of sustainable financing suggests that ESA governments should plan for adequately resourcing these programmes from domestic financing. This was highlighted in the case of Botswana, where the FETP run by the Ministry of Health and Welfare, in collaboration with the CDC, only ran for two cycles before being suspended due to a lack of funding. With the primary target members of the rapid response teams in all 28 health districts in the country, the gap is experienced at the district and local level, which are essential for both IHR and HSS.

The review highlighted that the majority of ESA countries have basic health information systems in place at the local level, although there are persisting gaps in key personnel, like data clerks. There are key assets that play roles in both HSS and early information for IHR, such as health centre committees and CHWs. It is not clear to what extent they are supported through IHR-related investment. The timeliness, accuracy, and completeness of the reports provided through standardised forms vary within countries and poor feedback of information given to local levels (or analysis at local levels) can demotivate accurate reporting.

To meet the core capacity requirements for implementing the IHR and for HSS, the evidence suggests a need and opportunity for investment in community and primary-care level personnel, as well as local analysis and review,

5.2 IHR and capacities and functioning for food safety

Developing core capacities to implement IHR and health promotion effectively, lead 'health in all policies' and engage on public health within HSS demand collaboration within and between different stakeholder groups and sectors. For food safety, this is particularly important as the food industry is made up of diverse stakeholders that include manufactures, importers and exporters. The roles of different service providers are fundamental as their services can affect the outbreak, detection and containment of foodborne diseases.

The review established the importance of the regulatory framework for ensuring quality and protection of consumers. ESA countries have developed regulatory frameworks for food safety as a public health issue, including measures for foodborne disease outbreak investigation and response. However, many laws need to be updated to comply with current regional and international standards.

Non-adherence or enforcement of the laws and regulations, and the failure by service providers to play their roles, also contribute to foodborne disease. Thus, application and enforcement of the law are equally critical to ensure that substandard foods are not sold or consumed. Most ESA countries have basic systems, inspection mechanisms, laboratory support services to provide safe foods. However, the majority of laboratories are not internationally accredited and have shortages of laboratory personnel for these services. They need further to address gaps in qualified personnel, technical supervisory capacities, with adequate experience and resources for testing.

This calls for clear SOPs in line with national or international standards consistently applied. Many ESA countries, although they have developed laboratory capacities at different levels, still have vertical disease control programmes and laboratories (e.g. focussing only on tuberculosis, malaria and/ or HIV). As some authors (Onyebujoh et al., 2016) have noted, the absence of a clear strategy and the necessary resources have created disjointed laboratory services in several countries.

This has resulted in disparate and loosely organised skill deployment, resource wastage and redundancies within the system, making it difficult for them to play their roles in detecting products that are contaminated or unfit for human consumption. This is not a laboratory problem per se but the result of a lack of co-ordination and leadership, which are essential in implementing the IHR core capacities and building synergies with wider HSS.

The co-ordination of the range of actors involved is thus key in this area, requiring national-level co-ordination capable of bringing all the stakeholders together aligned to law and policy. The Mauritian example of their food control system provides some lessons learned for other ESA countries looking to develop food safety control systems to provide a timely response to foodborne disease reports and events. Many countries still need to address the fragmentation of national food control systems across different ministries, government departments and agencies. This includes local authorities, which depend on strong national leadership and co-ordination in the Ministry of Health for food safety and for co-ordination of different stakeholder roles in other areas of public health.

Applying regional and international standards facilitates the production, manufacturing, trade and consumption of safe food to limit the outbreak of food- and waterborne diseases. The Codex Alimentarius and the WTO SPS measures are important components of the food system. This raises the question of whether they can be used to facilitate investment in IHR regulations on food safety.

It can be argued that IHR core capacities should be linked to other regional and international development processes to avoid a proliferation of vertical programmes that are uncoordinated and cumbersome to implement. Codex standard guidelines are not legally binding. However, most ESA countries have signed on to WTO agreements, including regional bilateral agreements on trade with their developed counterparts that are WTO compatible, like the Economic Partnership Agreements (EPAs) with the European Union. These agreements have far-reaching economic implications, include strict rules on SPS measures and are legally binding. Where these rules are beneficial to HSS, they need to be made an integral part of IHR implementation.

5.3 IHR laboratory and pharmaceutical personnel capacities

Although it has been difficult to establish the specific levels of laboratory personnel capacities in this review, the progressive development of laboratories across the region with well-established networks and collaborations internationally suggests a positive trend.

In the few countries where details are available, the major weakness appears to be in the area of personnel, especially in low-income countries, despite their high demand for routine laboratory services. The review identified collaborations in some countries, including within vertical support, key areas that may have wider horizontal benefit. The diversity of programmes, however, can result in fragmentation, particularly as many programmes are not linked. Some authors (Onyebujoh et al., 2016) have noted that laboratory workers with the cross-cutting skills to effect integrated services have been systematically underutilised, especially at district levels, as they are increasingly engaged in services for single-disease programmes. This observation points to the risk of vertical disease programmes, including laboratory services, that underutilise existing capacities and potentially stifle HSS efforts to respond to wider and emerging health burdens and outbreaks.

5.4 IHR and health systems strengthening – the missing link

In 2016 at a meeting on Global Health Diplomacy Initiative, under the auspices of EQUINET and the ECSA Health Community, some ESA member states categorically concluded that the IHR contributed to a proactive response, in not addressing emergencies after they happened but in building public health capacities and actions to detect, prevent and control them (ECSA HC and EQUINET, 2016). They also observed that at national level, the IHR should be understood as the umbrella for emergency and global health security issues, with measures for these aligned to it.

The evidence shows in various places how investing in the core capacities for IHR can also strengthen health systems to provide essential, comprehensive public health functions. Yet, current work to strengthen IHR capacities in the ESA region does not show evidence of deliberate, planned and well-co-ordinated efforts to link IHR with HSS. This may reflect that ESA countries have not yet comprehensively assessed where these links can be better made for their inclusion in IHR capacity plans. IHR capacity plans would need to include the different dimensions of HSS, such as planning, training and deployment of health workers, surveillance and diagnosis, infrastructure, co-ordination and governance.

As Loewenson et al. (2015) have observed, health systems [would be] more able to prevent and manage epidemics when they have good information and communication systems with health literate communities; when central surveillance systems link coherently to primary care level; and when they can mobilise the personnel, resources and services to respond rapidly to outbreaks.

The paper identifies deficits in IHR investments with regard to shortfalls in the production, recruitment and retention of adequate personnel, especially at community level, in laboratory personnel, technical supervisors, with adequate experience and resources for testing. These are also deficits in HSS.

Nevertheless, there is also evidence of positive developments in programmes being implemented for development of personnel and laboratory capacities and in law reform to align with international standards and guidelines (particularly around food safety issues). They show ways in which IHR implementation could facilitate HSS and the opportunity cost of not embedding IHR capacity building within the existing health system. This means that plans for IHR investment in health personnel should be linked to wider national strategies and plans for development of health personnel and links identified in filling vacancies, in training and in meeting the institutional needs for equitable deployment, where IHR programmes are embedded within comprehensive HRH policies. The training of field epidemiologists solely for IHR can lead to weak sustainability of programmes, as was found in the FETP in Botswana, suggesting that locating these programmes within wider health planning and budgeting would be important to sustain these investments.

IHR implementation is taking place in a complex global landscape of multiple donors and a range of related policies and strategies, including the Sustainable Development Goals (SDGs). This raises a critical role for co-ordination of these initiatives through government, and particularly the ministries of health, for both IHR implementation and HSS. This means linking IHR implementation to population health and public health interests and to the local and national health systems to detect, prevent, manage and respond to these public health issues.

5.5 Recommendations

The evidence in this review suggests that there are potential synergies and opportunities for investments to provide mutually beneficial capacity development for IHR and HSS. The notification and prevention of the spread of diseases and other public health risks across borders are longstanding areas relevant to both health diplomacy and health systems strengthening.

The reporting on progress in ensuring IHR capacities and its oversight in the World Health Assemblies, noted earlier, raises the profile of key areas important for the IHR and for HSS to meet public health demands. The areas of focus in this paper — capacities of community health and primary health personnel; local health information systems; public health system capacities and functioning and ensuring laboratory and pharmaceutical personnel capacities — point to three areas of HSS where synergies should be achieved with IHR implementation. This is not only to achieve the IHR but also for equitable universal health systems able to prevent and manage population health burdens.

The issues raised for the IHR are similar to those raised in HSS, including human and financial resources, technical capacities, a multi-sectoral approach, and co-ordination of different stakeholders with effective regulatory frameworks, strategies, plans and guidance. The findings point to areas where ESA countries may strengthen the investments in — and build synergies across — both IHR and HSS, through national-level leadership, co-ordination and planning, and where there is room for improved international responses in the short and medium terms.

In the short to medium term (up 10 years), we suggest a focus on ensuring that national strategies articulate plans for building synergies between IHR and HSS. This should be within specific areas as raised in the report. It could include sensitisation and engagement across different stakeholders on the deficits, options and on their roles and responsibilities. If not already in place, this calls for legislation that designates the Ministry of Health as the principal co-ordinator of IHR (2005) implementation, with funding from the public budget for its activities.

The evidence suggests some areas where positive practice in the region can be more widely implemented, including:

a. Establishing a committee or task force to implement assessments and identify requirements for IHR implementation at all levels, and particularly in relation to community and primary care cadres, CHWs and HCC roles, to integrate within national HR development plans and strategies, supported by financing plans and operational guidelines.

b. Establishing training in key areas of public health (such as epidemiology) for existing health personnel across different levels at national and subnational levels, and expanding programmes in government and training institutions for key personnel for IHR implementation.

c. Ensuring adequate HIS personnel at the primary care level and encouraging local action-focused analysis of HIS data, improved information flow up and down the system and feedback from national to local levels on their own analysis of findings.

d. Reviewing, updating and harmonising public health laws and policies, mainstreaming Codex Alimentarius standards in law, ensuring laws cover key areas and specialisations in the IHR (such as clinical, industrial pharmacists, laboratory technicians, scientist and engineers) and providing stiffer penalties for breach of public health law, such as on importers of substandard foods. Strengthening oversight, accountability and reporting of *implementation* of law and policy, including food safety, involving parliamentary and public mechanisms for such reporting.

e. Investing in further capacities for laboratories to achieve international accreditation status, linking the improvements being made for specific diseases to improvements needed in areas such as food safety, and making better 'multi-purpose' use of laboratory personnel in districts.

Over the longer term (year by year up to 20 years), ESA countries would benefit from investment in research and development capacities and programmes, as key components for both HSS and IHR, taking into consideration the changing health profiles of their populations, emergent diseases and the advances in technology.

As pointed out above, the arguments for strengthening bottom up, and for advancing greater country control and regional roles in the IHR should be clearly linked to population health and public health interests and to the effectiveness of building/strengthening local/national health systems to detect, prevent, manage and respond to public health risks and emergencies.

7. REFERENCES

1. African Union (AU) (2017) '2 million African community health workers: Harnessing the demographic dividend, ending AIDS and ensuring sustainable health for all in Africa', AU Commission: Addis Ababa.
2. African Union (AU) Commission (undated) Prioritising food safety in Africa, Mimeo, AU Commission, available at: https://au.int/sites/default/files/documents/33005-doc-prioritizing_food_safety_in_africa-eng.pdf (accessed 3 November 2018)
3. Association of North American Independent laboratories (undated) Laboratory Accreditation Program, Mimeo, available at: http://www.nail4pet.org/downloads/NAILCriteria06.pdf. (accessed 26 October 2018)
4. Bakari E (2012) 'Assessment of implementation of International Health Regulations (2005) of preventing infectious disease: A case study of Julius Nyerere International Airport', *Glob Health Action*. 2013 Aug 16;6:20942. doi: 10.3402/gha.v6i0.20942.
5. Barbe B, Yansouni C P, Affolabi D et al. (2017) 'Implementation of quality management for clinical bacteriology in low-resource settings', *Clinical microbiology and infection* 23: 426e433.
6. Codex Secretariat (2018) Codex Alimentarius, FAO, online, available at: http://www.fao.org/fao-who-codexalimentarius/about-codex/members/en/ (accessed 30 October 2018)
7. Dehnavieh R, Haghdoost A, Khosravi A, Hoseinabadi F, Rahimi H, Poursheikhali A, Khajehpour N, Khajeh Z, Mirshekari N, Hasani M, Radmerikhi S, Haghighi H, Mehrolhassani MH, Kazemi E, Aghamohamadi S (2018) The District Health Information System (DHIS2): A literature review and meta-synthesis of its strengths and operational challenges based on the experiences of 11 countries, *Health Inf Manag.* 2018 Jan 1:1833358318777713.
8. ECSA HC, EQUINET (2016) *Global health diplomacy in east and southern Africa, Report of a Regional Meeting,* 8-9 April 2016, Nairobi Kenya ECSA HC and EQUINET, Arusha
9. Food and Agriculture Organisation (FAO) (2003) 'Guidelines for food import control systems', CAC/GL 47-2003, FAO: Rome.
10. FAO, World Health Organisation (WHO) (2005) 'National food systems in Africa- A situation analysis', paper prepared by FAO Regional Office for Africa: Accra.
11. Global Panel (2016) 'Assuring safe food systems: Policy options for a healthier food supply', policy brief, Global Panel on Agriculture and Food Systems for Nutrition: London.
12. Government of Botswana (2003) 'Food control: Subsidiary legislation, Chapter 65:05', Gaborone.
13. Government of Kenya (2013) 'Health sector human resources strategy 2014', ms: pol, Ministry of Health: Nairobi.
14. Government of Malawi (2011) 'Malawi health sector strategic plan 2011-2016', Lilongwe.
15. Government of Mauritius (2017) 'Health sector strategy 2017-2020', Ministry of Health and Quality of Life, Port Louis
16. Government of South Africa (2011) 'Human Resources for Health South Africa 2030: Draft HR Strategy for the health sector:2012/13-2016/17', Department of Health, Pretoria
17. Government of Zimbabwe (2016) 'The national health strategy for Zimbabwe 2016-2020:equity and quality in health: leaving no one behind', Ministry of health and Child Care, Harare
18. Government of Zimbabwe (2017) 'Zimbabwe one health antimicrobial resistance national action plan 2017-2021', Ministry of Health and Child Care, Harare.
19. Kingdom of Swaziland (2012) 'Human resources for health strategic plan 2012-2017', Ministry of health, Mbabane
20. Kuonza L, Tint KS, Harris B (2011) 'Public health systems strengthening in Africa: The role of South Africa field epidemiology and laboratory training programme', *Pan African Medical Journal* 10(supp1): 8. Available at: http://www.panafrican-med-journal.com/content/series/10/1/8/full/.
21. Loewenson R, Papamichail A, Ayagah I (2015) 'African responses to the 2014/5 Ebola Virus disease epidemic', EQUINET: Harare.
22. Luoma M, Doherty J, Muchiri S et al. (2010) 'Kenya health system assessment 2010', Health Systems 20/20 project, Abt Associates Inc.: Bethesda.

23. Masanza MM, Ndlovu N, Mukanga D et al. (2010) 'Laboratory capacity building for the International Health Regulations (IHR[2005]) in resource-poor countries: The experience of the African Field Epidemiology Network (AFENET)', *BMC public health* 10(suppl 1): S8.
24. Mensah P, Mwamakamba L, Kariuki S et al. (2012) 'Strengthening foodborne diseases surveillance in the WHO African region: An essential need for diseases control and food safety assurance', *African journal of food, agriculture, nutrition and development* 12(4).
25. Mwalwimba A et al. (2015) 'The International Health Regulations (2005) in Malawi: Assessment of the status of implementation in 2015' Mimeo, Lilongwe
26. Mwamakamba L, Mensa P, Kwakye-Takyiwa A et al. (2012) 'Developing and maintaining national food safety control systems: Experiences from the WHO African region', *African journal of food, agriculture, nutrition and development* 12(4). Neeliah SA, Goburdhun D, Neeliah H (2009) 'National food control systems: Lessons from Mauritius', Ecology of food and nutrition 48(2): 137-56.
27. Neeliah SA, Goburdhun D, Neeliah H (2009) 'National food control systems: Lessons from Mauritius', Ecology of food and nutrition 48(2): 137-56.
28. Onyebujoh PC, Thirumala AK, Ndihokubwayo J-B (2016) 'Integrating laboratory networks, surveillance systems and public health institutes in Africa', *Afr J Lab Med* 5(3): a431. Available at: http:// dx.doi. org/10.4102/ajlm. v5i3.431.
29. Osika J, Altman D, Ekbladh L et al. (2010) 'Zimbabwe health system sssessment 2010', Health Systems 20/20 Project, Harare: Bethesda.
30. SEATINI, CEHURD (2014) 'Medicines production and procurement in east and southern Africa and the role of south-south co-operation', EQUINET discussion paper 104, EQUINET: Harare.
31. SEATINI, TARSC (2012) 'Implementing the International Health Regulations in Africa', EQUINET policy brief 31, EQUINET, ECSA HC: Harare. Available at: www.equinetafrica.org.
32. Specter S, Schuermann L, Hakiruwizera C et al. (2010) 'ASM LabCap's contributions to disease surveillance and the International Health Regulations (2005)', *BMC Public Health* 10(suppl 1): S7.
33. Suthar AM, Allen L G, Cifuentes S et al. (2018) 'Lessons learnt from implementation of the International Health Regulations: A systematic review', *Bulletin WHO* 8(96): 110–21E.
34. Takondwa M, Kariisa E, Doherty J (2010) 'Lesotho health systems assessment 2010', Health systems 20/20, Abt Associates Inc.: Bethesda.
35. WHO (1978) Declaration of Alma-Ata. Available at: http://www.who.int/social_determinants/tools/ multimedia/alma_ata/en/ (accessed 12 June 2018).
36. WHO (2008) 'International Health Regulations (2005)' (2nd ed.), World Health Organisation: Geneva.
37. WHO (2009) 'International Health Regulations (2005) 'Assessment tool for core capacity requirements for designated airports, ports and ground crossings', WHO: Geneva.
38. WHO (2011) Implementation of the International Health Regulations (2005), Report by the Director-General', EB130/16, WHO: Geneva.
39. WHO (2016a) 'Joint external evaluation of IHR core capacities of Republic of Mozambique', WHO: Geneva, 2017. Licence: CC BY-NC-SA 3.0 IGO.
40. WHO (2016b) 'Joint external evaluation of IHR core capacities of Republic of Namibia', WHO: Geneva, 2017. Licence: CC BY-NC-SA 3.0 IGO.
41. WHO (2016c) 'Joint external evaluation of IHR core capacities of the United Republic of Tanzania', WHO: Geneva, 2017. Licence: CC BY-NC-SA 3.0 IGO.
42. WHO (2017a) Joint external evaluation of IHR core capacities of the Republic of Kenya', WHO: Geneva. Licence: CC BY-NC-SA 3.0 IGO.
43. WHO (2017b) 'Joint external evaluation of IHR core capacities of the Republic of Botswana', WHO: Geneva, 2018 (WHO/WHE/CPI/REP/2018.18). Licence: CC BY-NC-SA 3.0 IGO.
44. WHO (2017c) 'Joint external evaluation of IHR core capacities of the Republic of Uganda', WHO: Geneva. Licence: CC BY-NC-SA 3.0 IGO.
45. WHO (2017d) 'Joint external evaluation of IHR core capacities of the Kingdom of Lesotho', WHO: Geneva. Licence: CC BY-NC-SA 3.0 IGO.
46. WHO (2017e) 'Joint external evaluation of IHR core capacities of the Republic of Zambia', WHO: Geneva (WHO/WHE/CPI/REP/2017.50). Licence: CC BY-NC-SA 3.0 IGO.

47. WHO Regional Office for Africa (Afro) (2013) 'Laboratory capacity requirements for International Health Regulations and their implementation in the WHO African region', WHO: Congo Brazzaville.

48. WHO Afro (2016) 'Report on the status of EDPLN BSL-3 in select countries in the African region', WHO: Congo Brazzaville.

49. WHO Afro (2018) 'Primary Health Care Programme in the WHO African Region from Alma-Ata to Ouagadougou and beyond, the Africa health transformation programme: a vision for universal health coverage', WHO Afro, Congo Brazzaville, available at: www.who.int/docs/default-source/primary-health-care-conference/phc-regional-report-africa.pdf?sfvrsn=73f1301f_2, accessed 18 November 2018

50. WHO DRC (undated) New technology allows for rapid diagnosis of Ebola in Democratic Republic of the Congo, Online at https://afro.who.int/news/new-technology-allows-rapid-diagnosis-ebola-democratic-republic-congo (accessed 24 November 2018)

51. WHO and Centers for Disease Control and Prevention (2010) 'Technical guidelines for integrated disease surveillance and response in the African region', WHO and CDC: Brazzaville and Atlanta: 1-398.

52. World Trade Organisation (WTO) (2018) WTO trade information website available at: https//www.wto.org/english/tratop_espsund_e.htm (accessed 26 October 2018)

Equity in health *implies addressing differences in health status that are unnecessary, avoidable and unfair. In southern Africa, these typically relate to disparities across racial groups, rural/urban status, socio-economic status, gender, age and geographical region. EQUINET is primarily concerned with equity motivated interventions that seek to allocate resources preferentially to those with the worst health status (vertical equity). EQUINET seeks to understand and influence the redistribution of social and economic resources for equity-oriented interventions. EQUINET also seeks to understand and inform the power and ability people (and social groups) have to make choices over health inputs and their capacity to use these choices towards health.*

EQUINET implements work in a number of areas identified as central to health equity in east and southern Africa

- Protecting health in economic and trade policy
- Building universal, primary health care oriented health systems
- Equitable, health systems strengthening responses to HIV and AIDS
- Fair Financing of health systems
- Valuing and retaining health workers
- Organising participatory, people centred health systems
- Promoting public health law and health rights
- Social empowerment and action for health
- Monitoring progress through country and regional equity watches

For further information on EQUINET please contact the secretariat:
Training and Research Support Centre (TARSC)
Box CY651, Harare, Zimbabwe
Tel + 263 4 705108/708835
Email: admin@equinetafrica.org
Website: www.equinetafrica.org

Series Editor: Rene Loewenson
Issue Editor: V Knight
DTP: Blue Apple Projects