# Effectiveness of the Existing Regulatory Framework for Biosecurity Preparedness Atgarissa Level Five Hospital, Garissa County, Kenya

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Abstract: Biosecurity is an emerging global security threat in the 21st century affecting public health and natural security in equal measures. This study assessed the effectiveness of the existing biosecurity regulatory framework for biosecurity preparedness and response at Garissa Level Five Hospital, Garissa County, Kenya. The study was guided by protection motivation theory. It adopted a descriptive survey design with a target population of 202, divided into five strata on medical officers, clinical officers, nurses, laboratory staff and hospital administrators. Simple random sampling was thereafter used for each stratum to select a sample of 139 respondents. A questionnaire was the main tool for data collection and key informant interviews were used to corroborate the findings from the questionnaire. Quantitative data was analyzed using percentages and frequencies while qualitative data analyzed using thematic analysis. From the study findings, there were general health laws in Kenya including the Public Health Act, Biosecurity guidelines, 2014, Biosafety Act 2009, Biosafety Regulations 2011 and Health Amendment Act 2019. In addition, specific biosecurity laws were limited hence effectiveness and implementation of such laws was poor. The study recommends the enactment specific biosecurity laws and biosecurity guidelines be distributed to all health facilities.

Keywords: Biosecurity, Effectiveness, Biosecurity Regulations/Laws, Garissa Level Five Hospital

#### 1. Introduction

#### 1.1 Background of the Study

Biosecurity is a nascent area that is currently developing due to the global threat posed by bioterrorism to public health and national security as well (Brachman, 2012). Current advances in life science technology as well as globalization have expanded society's vulnerability to such bio-risks (Mukhopadhyay, 2013), with no corresponding growth of multi-disciplinary interactions of bioscience and militaristic security. Mukhopadhyay (2013) argued that technological advances in life sciences have provided the know-how for systematic weaponization of pathogens and natural toxins. Twenty first century bio-warfare is thus a deliberate public health threats which, along with natural epidemics, have the prospects to endanger human livelihood by even targeting food supply system across national borders (Wein &Liu, 2015). Suk, Van Cangh, Beaute, Bartels, Tsolova, Pharris and Semenza (2014) suggest the need to regulate scientific research and also come up with governance tools to militate against the risk of bioweapon development and bioterrorism.

In 2003, morbidity of Severe Acute Respiratory Syndrome (SARS) in China and resulting death of about 286 persons as well as its rapid spread from Hong Kong in Asia to Canada in the West underscores the threat of disease outbreaks resulting from global inter-connectedness (Kaiser, 2018). Investigation by World Health Organization (WHO) attributed this acquired infection of SARS to poor Biosafety Level (BSL) -BSL-3/4 laboratory practices and insufficient biosecurity preparedness capacity (WHO, 2014). The December, 2019 Coronavirus (COVID-19) outbreak in

China is another case example of natural medical emergencies that needs biosecurity regulation across the globe (WHO, 2017). Due to global interconnectedness, outbreaks in China presents biosecurity risk to Kenya as Kenya Airways plies twice a week flights to Guangzhou, China's third largest city.

In Uganda Kirunda and Otimonapa (2014), assessed the level of biosecurity awareness and existence of procedures, regulations, laws and policies on biosafety and biosecurity among different institutions and professions across regions and found out low level of awareness in areas among the human health and public hygiene professionals. Reed (2010) and Heckert, Reed, Craig, Felix and Tonui (2011) postulates that low biosafety and biosecurity regulation, particularly in low-income countries including Uganda and Kenya, partly due to poor biosecurity funding (Reed, 2010).

On April, 2016 an Anthrax attack threat was foiled by security agencies and arrested medical interns at hospitals in Makueni and Kilifi Counties, while two others disappeared from Kitale hospital (GoK, 2016). Conversely, Gitau (2016) notes that due to Kenya's institutional weakness, the 2006/7 outbreak of Rift Valley Fever (RVF) affected 6 out the 8 regions of Kenya with reported human cases of 717 and 162 mortalities. Inadequate biosecurity legal framework, border security challenges and vulnerability to unnatural medical disaster has also been noted. Additionally, Ndhine, Osoro, Olsen, Rugutt, Wanjohi, Mwanda, Steenhard, and Hansen (2016) observed among Kenya public hospital laboratories facilities and storage units had no access control and staff had low skills on biosecurity. It is for this reason that the researcher carried out this study to ascertain whether the

existing regulatory framework for biosecurity in Kenya was effective or not.

#### **1.2 Purpose of the study**

The purpose of the study was to examine the effectiveness of the existing regulatory framework for biosecurity in Kenya, with focus on Garissa Level Five Hospital, Garissa County.

#### 2. Literature Review

#### 2.1 Theoretical Framework

Protection Motivation Theory (PMT) was developed by Rogers in 1975 and relates to how entities process threats and choose responses as well as come up with coping behaviours in regards to the impeding danger associated with the threat (Teodor, Henrik& Jonas, 2015). PMT is pegged on three elements of fear appeals: (a) the magnitude of noxiousness of a depicted event (severity); (b) the likelihood of the event occurrence (vulnerability); and (c) the efficacy of response measures. PMT assumes that actors or individuals decide to undertake risk prevention activities based on self-driven motivation to mitigate oneself from perceived threats emanating from both natural and unnatural hazards, harmful biological agents, radiological and chemical threat as well as change in the environment. This means that individual do risk-benefit analysis and look at the likely benefit if threat is removed or controlled (Gaston & Prapavessis, 2014).

The PMT anchors the research because it explains the way hospital medical staff and the administration are motivated in dealing with cautions emanating from biosecurity threat that might lead to unnatural medical disasters. Individuals' capacity to carryout bio-security precaution against prevailing threat is dependent on his/her capability and that of the organization they work in. Thus, individuals in the analysis of such appeals, deploy cognitive process to come up with response measures to deal with such threat. In this study the administration may adopt behaviours such as strict enforcement of biosecurity guideline polices compliance within the hospitals in order to ward off such threats.

Biosecurity incidences and attacks are done in stealthy manner and occur unexpectedly. They are intended to cause heavy public fear, crippling the health care industry. PMT therefore attempts to elucidate on the effects of biosecurity effectiveness to respond to medical disasters among medical staff at Garissa level five hospital.

#### 2.2 Empirical Literature Review

Gao (2019) in the study of biosafety strategies to protect global health observes, the importance of establishing international guidelines and partnerships in order to assess and reduce biological threats/risks and challenge at source including laboratory hospitals level. According to Gaudioso, Gribble and Salerno (2009), biosecurity regulations have not been adopted and implemented by many counties. Gaudioso *et al.* (2009),while analyzing biosecurity challenges also observed that some countries like Singapore, Denmark, Japan and South Korea have taken first steps in establishing regulatory requirement for biosecurity security and controls of pathogens and toxins. However, their study did not reveal the biosecurity status of the vulnerable countries in Africa and sub-Saharan region in particular.

In 1983, the WHO published the first laboratory biosafety manual, but not until 2006 when WHO initiated the development of biosecurity guidance (Chua, Ellis,& Johnson, 2009). Furthermore, in 2005, WHO Assembly resolution 58.29, urged member states to implement an integrated approach to laboratory biosafety and biosecurity by reviewing regulatory protocols for ensuring safe handling of harmful biological materials (WHO, 2017). Similarly, in 2004, the United Nations Security Council Resolution 1540 (UNSCR 1450), established a binding regulations on all member states of UN to take and administer effectives ways and means to mitigate the proliferation of weapon of mass destruction, their delivery and related materials by implementing laboratory biosecurity measures to secure biological agents.

According Nuclear Threat Initiative Report (NTI, 2018), the first annual Global Biosecurity Dialogue (GBD) was hosted in London and noted that biosecurity risks have become complex and global but many countries do not invest in biosecurity assistance and put in financial commitment. The dialogue in order to accelerate progress against the spread of weapons and materials of mass destruction, resolved to address three areas including biosecurity and biosafety policy frameworks, biosecurity and biosafety capabilities and emerging biological risks (NTI, 2018). In regards to models for building national action plans for health security and financing biosecurity, the NTI report states that government of Netherlands and Finland have made concrete avenue to increase political goodwill and suggested need to incorporate biosecurity experts in evaluation exercise.

Gaudiosoet al. (2009), described biosecurity regulatory frameworks as strategic and interlinked methods that include the legal, protocols and policy frameworks detailing actions, instruments and activities for the prevention, investigation and management of relevant bio-threats against human, animal and plant health and life, food safety, zoonosis, as well as the environment as whole. According to Wagener and Bollaert (2013), global treaties and initiative on Biosafety, Biosecurity, and Bioethics include: Biological and Toxins Weapons Convention (WBC) of April 10<sup>th</sup> 1972, Cartagena Protocol on Biosafety, and Nagoya Protocol among others. The WBC of 1972 negotiated for global standards to restrict the access to harmful biological agents in a bid to reduce bioterrorism such that it reinforced the legal frameworks and prohibition in the development and stockpiling of biological as well as toxin weapons (Wagener and Bollaert, 2013). The WBC has 182 state-parties and demands that after every five years, state parties hold review conferences with its initial meeting held in 1980 and the last one was held in 2016 with the next one to be held in 2021 to discuss way to strengthen the convention.

Suk *et al.* (2014) suggest that there was need to regulate scientific research and also come up with governance tools to militate against the risk of bioweapon development and

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bioterrorism, after Scientists in Australia constructed an influenza virus strains in 2007, and infected mice leading to severe disease and death of mice. The strain was constructed from published data of 1918 influenza pandemic. According to Suk *et al.* (2014), advancement in human and pathogen genomics have both positive and negative global health effects and articulates increased possibility of deploying the knowledge in malign purposes without stringent biosecurity regulation measures.

In the USA, a protocol on biosafety in microbiological and biomedical laboratories guidance was first developed in 1984. The CDC (2019), report points that the guidance was reviewed in 2007 and sections on biosecurity were for first time included during its fifth edition. Consequently, Wagener and Bollaert (2013) observed that after 2001, the US government enacted a raft of biosecurity legislation bearing criminal and civil penalties and allowing department of health and human services as well as agriculture regulatory powers to come up with controls on the possession, use and transfer of biological agents. Kaiser (2018) states that the USA enacted the USA PATRIOT Act and the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 in regards to enacting laws and regulatory frameworks that enhance laboratory biosafety and biosecurity. These laws regulate the use, handling, transfer of certain listed select agents. Additionally, US federal agencies have their own regulation too.

Mtui (2012) observes that existing national and international regulatory frameworks within USA. Europe and other Western countries have concentrated on biosafety as well as biosecurity issues as opposed to African countries where biosecurity frameworks are slowly taking shape. According to Mtui (2012), International Convention on Biological Diversity (ICBD) of 1992 is the father of biosafety systems. It acknowledges the usefulness of biotechnology and demands for safe handling of biotechnology so that both human and environmental health is safeguarded. Article 19.3 of ICBD nurtured the basis for the development of Cartagena protocol on biosafety (Kinderlerer, 2008). The Cartagena protocol was adopted in 29th of January, 2000 and became binding on 11<sup>th</sup> of September, 2003. It regulates trans-boundary movement of Live Modified Organisms (LMOs) whose aim is to ensure adequate level protection in the area of safe transfer, management and use of LMOs taking into account the risks to human health.

Similarly, according to Kingiri and Ayele (2009), the overall agenda of ICPB is the idea of precautionary principle, which state that "if a policy action is deemed to cause risk of harm to human or environment, in the absence of scientific consensus that adverse effect will not arise, the burden of proof lies with those taking action" (Mtui, 2012). Pythoud & Thomas (2017) reveal that globally, about 143 states ratified the Cartagena Protocol on Biosafety but some GMO producing countries such as USA, Canada, and Australia are yet to become members.

In Georgia, Bakanaide, Imnadze and Perkins (2010) in their study on biosafety and biosecurity as an essential pillar of international health security and cross-cutting elements of biological non-proliferation, states that Georgia, joined the BWC in 1995 and the National Centre for Disease Control and Public (NCDCP) is responsible for ensuring and advancing biosafety as well as biosecurity legislative framework and act as focal point for International Health Regulations (IHR). Georgia's current comprehensive biosecurity framework for managing biological threat are borrowed form USA select agents rule and regulation and covers personnel registration, security threat surveys, emergency response, inventory keeping, and supervision.

In Thailand, Jarunee, Somjai, Ruanchaimun, Patchimasiri, Banjong and Blacksell(2019) assessed biosafety in microbiological and biomedical laboratory biosafety level 2 (BSL-2) and found out that despite national policies on laboratory biosafety and biosecurity, there were huge challenges in regards to harmonization and enforcement of these policies. This study was however, largely centred on veterinary laboratories as opposed to human hospital-based laboratories, which is the goal of this study.

NTI (2018) states that the Africa Centre for Disease Control and Prevention (Africa CDC) will take new actions with in partnership with US Centre for Disease Control (CDC) to build in biosecurity as part of its regional preparedness coordinating centre network. Furthermore, Canada has taken novel actions within the global partnership against the spread of weapons and materials of mass destruction to drive biosecurity agenda for sustainable regional models in African countries (Erenler, Guzel & Baydin, 2018).

Kinderlerer (2008) also argues that about 41 African countries are members of Convention Biological Diversity, however, only few have biosafety and biosecurity regulations, and such limitations constitutes a big challenge and hampers the legislative frameworks use and evaluation of biosecurity and biosafety.

Kirunda and Otimonapa (2014) observes that Uganda enacted the National Biotechnology and Biosafety Act in 2010 which is heavily biased towards the Cartagena Protocol on Biosafety and handling of genetically modified crops. Daniele and Jessica (2007) further argued that the biosecurity agenda of Uganda was holistically drawn on guidelines of international frameworks such BWC of 1972, the International Health Regulations of 2005, and the international office of epizootics.

Mtui (2012) critiqued that the Ugandan National Biotechnology and Biosafety Act in 2010 did not sufficiently address biosecurity regulation issues. The establishment of Uganda biosafety law and regulatory framework in the areas of GMOs risk management is a replica of many African countries. For example, South Africa, legislated GMO Act in 1997, whereas, Kenya approved her Biosafety Act in 2009 (Muriithi, Bundi, Galata, Miringu, Wandera, Kathiko, Odoyo, Kamemba, Amukoye, Huqa Sora, Inoue and Ichinose 2018) with similar absence of biosecurity laws.

In Tanzania, according to the Academy of Science of South Africa (2018) report named "the state of laboratory biosafety and biosecurity in the Southern African Development

Community (SADC) regions workshop proceedings", the biosafety and institutional framework of Tanzania include: The Biotechnology/Biosafety Policy of 2010; The Environment Management Act of 2004; The Tanzania National Biosafety Committee and the Tanzania National Biotechnology Advisory Committee. The report indicate that the Department of Environment is the custodian of biosecurity and biosafety issues and that Environmental Management Regulations of 2009 provides details of structural information on emergency responses to any unauthorized release of specify bio -threats and agents.

In Kenya, Juma, Wadegu, Makio, Kirera, Eyase, Awinda, Kamanza, Schnabel and Wurapa (2014) in a survey of biosafety and biosecurity practices in the US Army Medical Research Unit-Kenya observed that Biosafety Regulations were enacted in Kenya in 2009, but only covered safe use of GMOs. Furthermore, Ndhine *et al.* (2016) in a Biosecurity Survey of Kenya carried out between November 2014 and February 2015, sought to gather data on the biosecurity level components on legislation and enforcement of biosecurity measures in Kenya. During the survey a total of 86 hospitals laboratory facilities were assessed and the study recommended the development of legal frameworks in Kenya for effective controls including biosecurity regulations and procedures in order to reduce the risk of laboratories becoming a source of future biological harm.

Similarly, Muriithi et al. (2018) also undertook a survey assessing biosafety and biosecurity capacity building and its insights on implementation of Kenya Medical Research Institute (KEMRI) Biosafety training model and observed that enforcement of biosafety guidelines was more prevalent that those of biosecurity guidelines within laboratories. While some of these studies were done to audit and assess laboratory biosafety and biosecurity in Kenya, they only concentrated around medical research institutions based in Nairobi and Kilifi Counties. Only one study done in Western Kenya (Ogaro, Kiiyukia, Mbatha & Ngayo, 2018), compared biosafety compliance among public and private hospital laboratories citing better preparedness in private hospitals. This study will go further and study biosecurity regulatory framework compliance/capacity if any at Garissa level five hospital.

The Kenya Health Act (2017) and raft of other legal frameworks such as The Kenya Medical Laboratory Technicians and Technologist Act (Cap 253A) and Public Health Act (Cap 242) as well as Health Amendment Act of 2014 and 2019 which provides regulations of health care services and health care providers, contractors and physical security for products including radioactive and biological products. Surprisingly, the Kenya health amendment laws of 2014 and 2019 majorly catered for control and regulation of health professional but not explicit on biosecurity and bioterrorism laws. Furthermore, Kenya's Security amendment laws of 2014 and Prevention of Terrorism Act (POTA) of 2012 falls short of mentioning possession of biological agents as presumed items for commission of terrorist act.

Kenya being a resource limited third world country, there is limited data available or research done in the area of biosecurity legislation and regulatory frameworks and its status of implementation among level five public hospitals. Furthermore, Kenya has not established a comprehensive program to securitize biosecurity issues and has not prioritized to put in place laws to control and regulate the same despite launching an array of overlapping counter terrorism strategies since 2011. It is from this background the researcher undertook a study on the effectiveness of the existing biosecurity regulatory frameworks in Kenya and Garissa County level five hospital in particular.

# 3. Methodology

The study adopted a descriptive survey design. Philip and Pugh (1994) stated that descriptive studies clearly bring out facts for the formulation of critical knowledge and solution to significant problems. Garissa County was selected because *Al Shabaab* and *Al-Qaeda* motivated terror groups have previously targeted both local and international entities within Garissa County including gun attacks, use of Improvised Electronic Devices (IEDs) bombs, and suicide attacks on human targets. The target population in the study comprised of 202medical officers, clinical officers, laboratory technologists, nursesand administrators. The study also targeted 5 counter-terrorism security experts as well as security managers operating within Garissa County as key informants to give views about countering biosecurity and corroborate the findings from the questionnaire.

The target population was divided into five strata such as medical doctors' stratum, clinical officers' stratum, laboratory technologist stratum, nurses' stratum and hospital administration stratum. Thereafter, from each stratum, simple random sampling was used to obtain the sample respondents. A questionnaire was used as the main research instrument, supported by key informant interviews. The reliability of the study was tested using the Cronbach Alpha test and the validity test was ensured by consulting experts and supervisors of the study. The study realized an overall Cronbach Alpha coefficient of 0.79, which meant that the research instruments were reliable and could be used to collect data from the field. The collected data was sorted, cleaned and coded into SPSS 25 for subsequent descriptive statistics. The analyzed data was presented using charts, figures and tables.

## 4. Findings

#### 4.1 Demographic Information

The study sought to comprehend the gender distribution of respondents as gender is important in determining the type of workforce in Garissa Level Five Hospital. The findings shown in Figure 1, shows that 55% of the respondents are female while 45% are male. The findings imply that there are more female hospital staffs (medical officers, laboratory technologist, clinical officers, nurses, and administration) than the male staff. This can be attributed to the prevalence of female nurses in the Kenyan hospitals, who formed the majority (58.6%) of the respondents in the study.

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The study sought to assess the age category of the respondents in order to determine the type of workforce in Garissa Level Five Hospital. The findings presented in Figure 2, indicate that 62% of the respondents are in the age category 18-35 years, 27% are in the age category of 36-50 years, 10% are in age category of 51-65 years while 1% are in the age category of more than 65 years. The findings show a youthful workforce in Garissa Level Five Hospital.

**Figure 1:** Respondents' Gender Source: Research Data (2020).



Source: Research Data (2020)

The level of education or academic background of the respondents was sought in the study in order to determine the capability of the respondents to answer questions postulated. The study findings presented in Figure 3, indicate that 61% of the respondents have attained college level education, while 39% have attained university education. The findings imply that the respondents have high levels of education, hence did not have problems answering the questions posited to them.



Source: Respondents' Education Level

The study sought to understand the designation of respondents in order to understand the respondents' role in the hospital and their contribution to the study. The findings presented in Figure 4, indicate that 59% of the respondents are nurses, 13% are clinical officers and 10% are laboratory

staff, 9% are medical officers while 9% are hospital administration staff. This can be attributed to the sampling framework of the study.



Figure 4: Designation of Respondent Source: Research Data (2020)

The study also sought to determine the relevance of the designation of the respondents in relation to biosecurity training. This was necessary to determine which hospital cadre was given priority in biosecurity/biosafety training. The study found that there was a significant relationship between designation of respondents and biosecurity training (p = 0.020). In addition, the numbers for those not having been trained were higher in all cadres except for clinical officers and laboratory staff, with the vast majority of the laboratory staff having been trained. The findings are shown in Table 1.

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Tuble It Designation and Diosecutity Training						
		Hospital staff trained on biosecurity frameworks/laws/policies in Kenya		D voluo		
		Yes No	Total	r value		
	Medical officer	5 7	12			
	Clinical officer	9 8	17			
Designation	Nurse	23 55	78	.020		
	Laboratory staff	10 4	14			
	Hospital administration	3 9	12			
Total		50 83	133			

Table 1: Designation and Biosecurity Training

Source: Research Data (2020).

The study sought to assess the years of experience of respondents. Some of these groups are expected to have knowledge and skills which will enable them handle their tasks well and hence the need to assess the years of experience for the purpose of this study as this significantly distinguishes the level of skills and knowledge garnered by an individual through field experience which enables him/her to effectively deliver on their job description with ease. The findings presented in Figure 5 indicate that 38% of those who took part in the study have worked for 5-10 years, 34% have worked for less than 5 years while 28% have worked for more than 10 years. The findings imply a majority of the respondents had more than 5 years' experience (66%), hence have the skills to handle their tasks well.



Figure 5: Respondents' Years of Experience Source: Research Data (2020).

#### 4.2 Presentation of the Findings

The objective of the study was to examine the effectiveness of the existing regulatory framework for biosecurity in Kenya. The study first sought to determine whether the respondents were aware of the existing biosecurity laws in Kenya. The findings indicate that 88% of the respondents said there are biosecurity laws in Kenya while 12% did not know of the existence of the laws. The findings are shown in Table 2.

Table 2: Knowledge of Existing Biosecurity Laws in Kenya

			Frequency	Percentage	
		Yes	117	88.0	
		No	16	12.0	
		Total	133	100.0	
nurce: Research Data (2020)					

Source: Research Data (2020).

The study sought to determine the existing biosecurity regulatory frameworks the respondents were aware of in Kenya. The multiple response findings indicate that Public Health Act, was the most known biosecurity regulatory framework, as identified by 69.2% of the respondents. Also, 32.3% of the respondents were aware of Biosafety and Biosecurity guidelines, 37.6% were aware of the Biosafety

Act 2009, and 21.1% were aware of the Biosafety Regulations, 2011 while 18.8% were aware of the Health Amendment Act 2019. The findings are shown in Table 3.

Table 3.	Existing	Riosecurity	Regulators	/ Frameworks
Table 5:	EXISTING	Dioseculity	Regulatory	/ Flameworks

	Frequency	Percentage
Public Health Act	92	69.2
Biosafety and Biosecurity guidelines	43	32.3
The Biosafety Act 2009	50	37.6
The Biosafety Regulations, 2011	28	21.1
Health Amendment Act 2019	25	18.8

Source: Research Data (2020).

The responses obtained from key informants to support existing biosecurity regulatory frameworks the respondents were aware of in Kenya were as follows;

The Kenya Government has enacted biosafety regulatory framework under the Biosafety Act and other related laws under the public health act but lacks Biosecurity laws (Source: Regional NGAO - Garissa). The government of Kenya has enacted laws which check the threats of biorelated security. Among them is the enactment of the Prevention of Terrorism Act No. 30 of 2012 which provides offences which guides the threats of terrorism (Source: Regional ATPU officer). The study also sought to determine whether the hospital staffs were trained on biosecurity frameworks/laws/policies in Kenya. The study findings presented in Table 4, indicate that 62.4% of the respondents indicated that they were not trained on biosecurity frameworks/laws/policies while 37.6% indicated that they were trained.

Table 4: Trained on Biosecurit	y Frameworks/Laws/Policies
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		Frequency	Percentage		
	Yes	50	37.6		
	No	83	62.4		
	Total	133	100.0		

Source: Research Data (2020).

For those who were trained, the study sought to determine when they were trained. The study found that 36% were trained more than five years as per the time of the study, 34% were trained less than three years as per the time of the study, while 30% were trained 3-5 years as per the time of the study. The findings are presented in Table 5.

**Table 5:** Period of Staff Training

	Frequency	Percentage
Less than 3 years ago	17	34.0
3-5 years ago	15	30.0
More than 5 years ago	18	36.0
Total	50	100.0

Source: Research Data (2020).

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The responses obtained from key informants to support these claims were as follows;

Biosecurity laws are used in training units. Training of the hospital workers on biosecurity and biosafety guidelines is done at least once for officials involved. However, the effectiveness is very low actually to the extent that I can say that most or good numbers of citizens do not know anything pertaining to biosecurity (Source: Health standards, quality assurance and regulations officer).

Training of Garissa County Level Five Health workers on biosecurity standard operating procedures and guidelines and other specialized security agencies on biosecurity and counter-bioterrorism issues is not entirely done for all employees, but done on a few employees, which is not enough (Source: Regional ATPU officer).

The researcher sought to know who trained the staff on biosecurity at Garissa Level Five Hospital in Garissa County. The findings indicated that 52% of the respondents were trained by government organizations, 44% were trained by both government and non-government organizations and 4% were trained by non-government organizations as shown in Table 6.

**Table 6:** Organization Responsible for Training

	Frequency	Percentage
Government organizations	26	52.0
Non-Government organization	2	4.0
Both Government and Non- Government organizations	22	44.0
Total	50	100.0

Source: Research Data (2020).

On the type of trainers, they had worked with in relation to biosecurity frameworks, the multiple response findings indicate that 33.8% of the respondents have worked with local trainers, 26.3% have worked with national trainers and 5.3% have worked with international trainers while 61.7% of the respondents have worked with no trainer at all as presented in Table 7.

Table 7: Type of Trainers

	Frequency	Percentage
Local Trainers	45	33.8
National Trainers	35	26.3
International Trainers	7	5.3
None	82	61.7

Source: Research Data (2020).

On whether there were standard operating procedures on biosecurity/biosafety within the hospital, the study found that 67% of the respondents identified existence of standard operating procedures on biosecurity/biosafety in the hospital, while 33% did not identify with the procedures, as presented in Figure 6.



Figure 6: Standard Operating Procedures on Biosecurity Source: Research Data (2020)

The responses obtained from key informants to support the existence of standard operating procedures especially after the COVID-19 pandemic were as follows;

Biosecurity regulatory frameworks have contributed to public health safety and reduced diseases (prevention). Compliance to standards has contributed to occupational safety and health of staff at the Hospital. It has also improved the practice of the laboratory staff in adherence to standard operating procedures and guidelines (Source: Health standards, quality assurance and regulations officer).

Following the nascent eruption of the Corona Virus (COVID-19) pandemic, the government enacted laws to check the spread of the virus, including measures by health facilities. Some of the laws regarding public health issues are: failing to keep social distancing of not less than one meter from one person to another in a public place including health facilities, being in a public place without wearing face mask, prohibition of public or private gathering, failing to provide washing station and failing to put in place measures of ensuring social distancing. The hospital has adhered to these standard operating procedures (Source: Regional ATPU officer).

From those who identified the existence of standard operating procedures on biosecurity/biosafety in the hospital, the study sought to determine who in-charge of biosecurity laws and procedures was. The study found that 53.9% of the respondents identified the County government, while 46.1% of the respondents identified the national government. The findings are presented in Table 8.

 
 Table 8: Body In-Charge of Biosecurity Laws and Procedures Enforcement

	Frequency	Percentage
National government	41	46.1
County government	48	53.9
Total	89	100.0

Source: Research Data (2020).

#### 5. Discussion

The findings show that 88% of the respondents indicated there were biosecurity laws in Kenya. The study findings are consistent with a study by Gitau (2016), who found that health workers were aware of harmful bio-agents, and further posited that awareness of the laws should be encouraged among staff working in hospitals, medical laboratories, both private and public clinics as well as those

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establishments that are in direct or indirect contact with affected patients. Various laws including the Public Health Act (69.2%), Biosafety and Biosecurity guidelines (32.3%) Biosafety Act 2009 (37.6%), Biosafety Regulations 2011 (21.1%) and Health Amendment Act 2019 (18.8%) were cited in this study.

The study findings indicated that 62.4% of the respondents had not been trained on biosecurity frameworks/ laws/ policies. Further, 36% of those trained were trained more than five years ago. In contrast to the study findings, Savoia et al. (2017) argued that health care workers were trained on medical disaster and emergency preparedness in the USA. The study revealed that training increases effectiveness as well as the importance of drills for improved discussion making and coordination. Gitau (2016) also found that training was carried out, and helped in linking better results especially when training is done during outbreak when the actual medical disaster has been encountered. Key informants were also in general agreement that training of Garissa County Level Five Health workers on biosecurity standard operating procedures and guidelines and other specialized security agencies on biosecurity and counterbioterrorism issues is not entirely done for all employees, but done on a few employees. However, Erenler et al. (2018) supports the current study findings that in Canada, most emergency service providers have not been trained to recognize and work under chemical, biological, radiological, and nuclear polluted environments.

The findings indicated that 52% of the respondents were trained by government organizations. In support of the study findings, Gillum *et al.* (2018) found that in order to prevent deliberate bio-agents' leakages, personnel vetting and biosecurity training of best regulations and control measures as well as accountability of institutions are necessary. Government coordinators that are highly trained experts and certified to act on such incidences offered the training to the health care workers. The key informants were also in general agreement that training of the hospital workers on biosecurity and biosafety guidelines is done at least once for officials involved in County Government affairs.

On standard operating procedures on biosecurity/biosafety within the hospital, the study found that 67% of the respondents identified existence of such procedures in the hospital. This was not corroborated by observation checklist findings. In support of the findings, Ndhine*et al.* (2016) reported lack of legal frameworks in Kenya for effective controls including biosecurity regulations and procedures in order to reduce the risk of laboratories becoming a source of future biological harm. The key informants were also in general agreement that that only laboratory officials of the hospital have adhered to some form of biosecurity standard operating procedures.

The study sought to determine who in-charge of biosecurity laws and procedures was. The study found that the County government (53.9%), and the national government (46.1%) were in- charge. In support of the findings, Bakanaide *et al.* (2010) argued that the national centre for disease control and public is responsible for ensuring and advancing biosecurity/biosafety as well as biosecurity legislative framework and act as focal point for international health regulations.

#### 6. Conclusions and Recommendations

The study concluded that biosecurity laws were not clearly defined and non-specific in Kenya, as regulations were centred around general public health and biosafety issues. Similarly, effectiveness of the regulatory framework was low, accompanied by low training. In addition, there are limited biosecurity frameworks in the Kenya. The existing ones have not been implemented effectively to achieve the intended objectives. Biosecurity guidelines and manual are only available at accredited laboratory and are not known to many as they lack dissemination.

Since there are limited biosecurity frameworks in the Kenya and the existing ones have not been implemented effectively to achieve the intended objectives, the study recommends biosecurity guidelines to be digitalized and made available to all health facilities. In addition, there should be an introduction of a regulatory agency for biosecurity to enhance quality control and ascertain the status of health facilities and hospitals' laboratories.

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