



**AMREF INTERNATIONAL UNIVERSITY**  
**SCHOOL OF PUBLIC HEALTH**  
**DEPARTMENT OF COMMUNITY HEALTH**  
**BSC HEALTH SYSTEMS MANAGEMENT AND DEVELOPMENT /**  
**HEALTH RECORDS AND INFORMATION MANAGEMENT**  
**END OF SEMESTER FINAL EXAMINATION DECEMBER 2025**

**UNIT CODE: HRI 102 / HMD 133**

**UNIT NAME: BIostatISTICS**

**DATE:** December, 2025

**TIME:** Two Hours

**Start:**

**Finish**

**INSTRUCTIONS**

1. This exam is marked out of 60 marks
2. This Examination comprises TWO Sections  
**Section A:** Compulsory Question (20 marks)  
**Section B:** Long Answer Questions (40 marks)

**INSTRUCTIONS:** Answer Question **ONE** and any other **TWO** Questions.

**Question one (30 Marks)**

- 1) Distinguish by giving examples in Health systems.
  - i) Sample and Population (2mks)
  - ii) Null hypothesis and Alternative Hypothesis (2mks)
  - iii) Continuous and Discrete variables (2mks)
  - iv) Descriptive Statistics and Inferential statistics (2mks)

2. A regional hospital is evaluating the average patient wait time in its emergency department. Over five randomly selected days, the wait times (in minutes) were recorded as follows:

[15,22, x, 30,18]

The hospital administrator reports that the average waiting time over these five days was 21 minutes.

- i. Calculate the missing wait time (**x**) (2mks)

- ii. Compute the sample variance, Standard deviation and COV of the wait times. (6mks)
- iii. Discuss two ways in which the variance in wait times might affect patient satisfaction and hospital performance. (4mks)

3. Breast cancer is a major health challenge in Kenya, and Kenyatta National Hospital has been monitoring tumor progression among patients. The tumour has three stages in its lifecycle. Stage 1, Stage 2, and Stage 3. The probability that a randomly selected patient will be in a particular stage is shown in the table below.

Tumour Stage	Probability
Stage 3	0.60
Stage 2	0.15
Stage 1	0.25

Find the probability that of two randomly selected patients seen by the doctor:

- i) Both will be in Stage 3 (3 marks)
- ii) Exactly one will be in Stage 2 (3 marks)
- iii) None will be in Stage 1 (4 marks)

**Question Two (20 Mks)**

1. Polio is caused by the Polio Virus (also known as the Poliovirus or PV and primarily affects the central nervous system. It is a serious medical condition often linked to an overpowering immune response to infection. To improve patient outcomes, the health department in Kajiado initiated a study to examine factors influencing survival among patients diagnosed with Polio between 2020 and 2023. As part of the analysis, a Chi-Square test of independence was conducted to determine whether there is a significant relationship between age group and gender among patients who tested positive for polio. The PSPP output below summarises the results:

**Age \* Gender Crosstabulation**

		Gender		Total	
		Male	Female		
Age	Below 1 years	Count	3	0	3
		% within Age	100.0%	0.0%	100.0%
1 - 5 years	Count	20	20	40	
	% within Age	50.0%	50.0%	100.0%	
5 - 10 years	Count	31	19	50	
	% within Age	62.0%	38.0%	100.0%	
10 -15 years	Count	38	23	61	
	% within Age	62.3%	37.7%	100.0%	
Above 15 years	Count	35	25	60	
	% within Age	58.3%	41.7%	100.0%	
Total	Count	127	87	214	
	% within Age	59.3%	40.7%	100.0%	

**Table 6: Pearson Chi-Square and Likelihood Ratio Estimates for Table 5**

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.001 <sup>a</sup>	6	0.027		
Continuity Correction <sup>b</sup>	0.008	6	0.028		
Likelihood Ratio	0.002	6	0.026		
Fisher's Exact Test				0.008	0.046

- i) State the hypothesis and indicate the sample size (4mks)
- ii) Identify the age bracket is greatly affected by the Polio (2mks)
- iii) State the gender category that is least affected by Polio (2mks)
- iv) Explain why was the Chi square test appropriate in this case (3mks)
- v) Was there a statistical difference between gender and Age bracket, Justify? (4mks)
- vi) Discuss how these findings could inform health policy and patient management strategies for Polio in Kajiado. (5mks)

**Question Three (20 Marks)**

1. A health training institute offering Health Records and Information Management (HRIM) and Health Systems Management and Development (HSMD) programs conducted placement tests for new students. The aim of these courses was to equip learners with skills to manage patient records, ensure data accuracy, and support decision-making. Below are PSPP output for the test scores (out of 100) for Health Communication, Health Policy, Health Statistics and Clinical Documentation.

Test	N	Minimum	Maximum	Mean	Std. Deviation
Health Communication	831	59.83	101.95	82.7265	6.82982
Health Policy	835	55.11	103.62	82.0394	7.63745
Health Statistics	835	35.32	93.78	65.4512	8.29165
Clinical Documentation	835	64.06	93.01	79.5392	5.50151
Valid N	840				

- i. State the sample size (2 marks)
- ii. Calculate the range of Health Communication and Clinical Documentation tests. (4 marks)
- iii. Identify the most passed placement test. Justify. (3 marks)
- iv. Identify the worst placement test. Justify. (3 marks)
- v. Comment on the standard deviation of the placement tests. (3 marks)
- vi. Calculate the Coefficient of Variation (COV) for Health Policy and Health Statistics tests. (5 marks).

**Question Four (20 Mks)**

Kenyatta National Hospital has implemented a HRIM system to improve efficiency in patient care. The hospital management wants to understand how number of staff on duty and number of patients admitted per day influence average patient wait time in the outpatient department. A Biostatistician runs a multiple linear regression in SPSS using the following variables: Dependent Variable: *Average Patient Wait Time (minutes)*, Independent Variables:  $X_1 = \text{Number of Staff on Duty}$  and  $X_2 = \text{Number of Patients Admitted}$ . The PSPP output is shown below:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.651 <sup>a</sup>	.424	.421	.60800

a. Predictors: (Constant), Number of Patients Admitted, Number of Staff on Duty

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.748	2	43.874	118.687	.000 <sup>b</sup>
	Residual	119.032	322	.370		
	Total	206.780	324			

a. Dependent Variable: Average Patient Wait Time (minutes),  
 b. Predictors: (Constant), Number of Patients Admitted, Number of Staff on Duty

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.307	.105		2.910	.004
	Number of Staff on Duty	-.269	.055	-.257	-4.855	.000
	Number of Patients Admitted	.460	.053	.463	8.751	.000

a. Dependent Variable: Average Patient Wait Time (minutes),

- i. What is the predictive power of the model. (1 marks)
- ii. Write the regression equation. (3 marks)
- iii. Explain the effect of Staff on Duty on patient wait time. (3 marks)
- iv. Explain the effect of Patients Admitted on patient wait time. (3 marks)
- v. Which variable influences the most, Justify (3 marks)
- vi. Is the model statistically significant? Justify. (3 marks)
- vii. Discuss how these findings can inform staffing decisions in Kenyatta Hospital. (4 marks)