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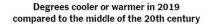
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Cyclone Freddy and its impact on maternal health service utilisation: Cross-sectional analysis of data from a national maternal surveillance platform in Malawi

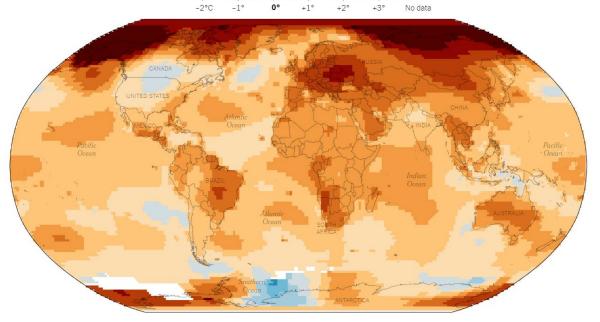


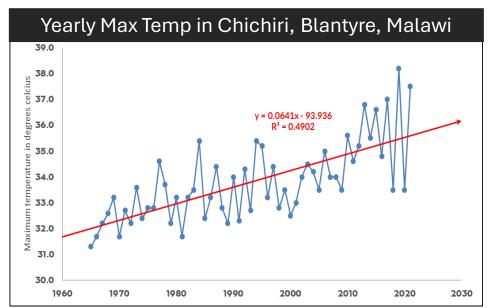












CLIMATE CHANGE IS ONE OF THE MOST PRESSING CHALLENGES OF OUR TIME!

The mean temperature rise per day globally from the 20th century to date is approximately

0.004 degrees Celsius

This means that the average temperature of the Earth has increased by about

0.14 degrees Celsius per decade since 1880.

The rate of warming has accelerated in recent decades, with the average rate of increase since 1981 being more than twice as fast:

0.32 degrees Celsius per decade

Climate Change and Maternal Health

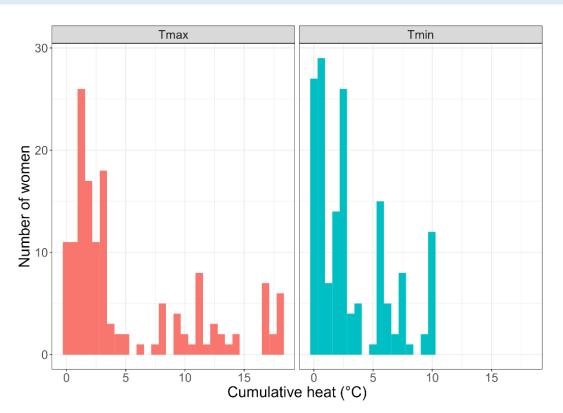


Climate change may exacerbate the challenges faced by women in low-income settings and marginalized areas resulting in worsening of maternal health outcomes

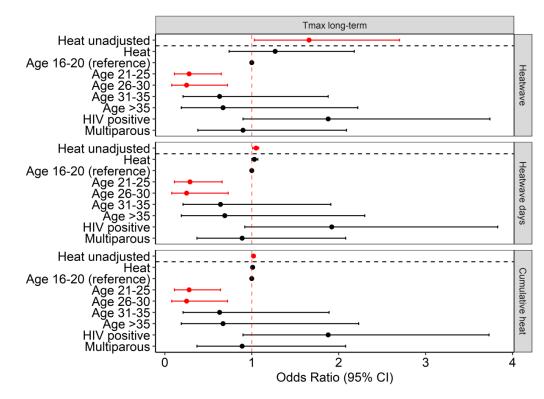








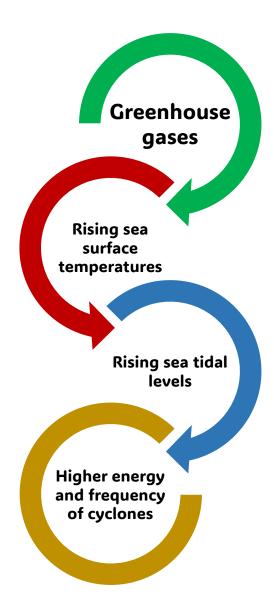


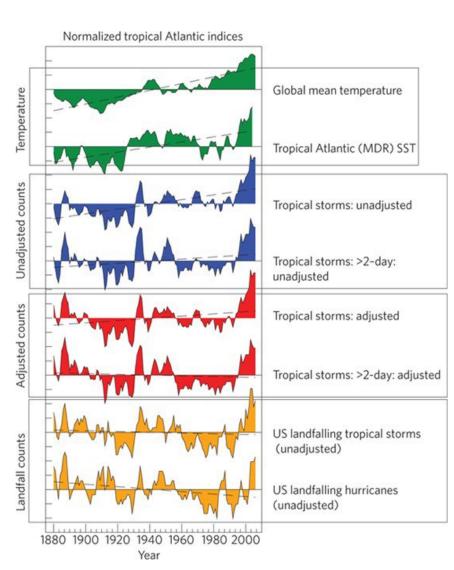


Odds of infection in pregnant women if exposed to one or more heatwaves, per heatwave day and per 1°C above the Tmax (32.1°C) throughout pregnancy

Tmax (32.1°C) and Tmin (20.6 °C)

Relationship between Climate change and Cyclones







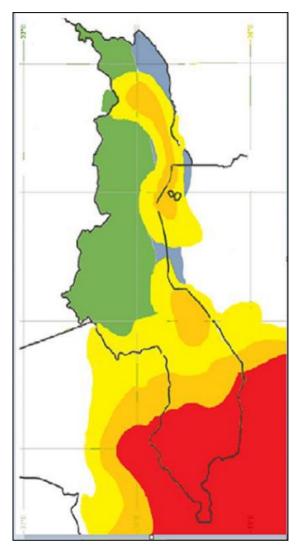


CHAC2024





Cyclone Freddy was the longest-lasting category 5 cyclone recorded worldwide, and its effects were first experienced in Malawi from 19 February 2023, and again from 12 March 2023







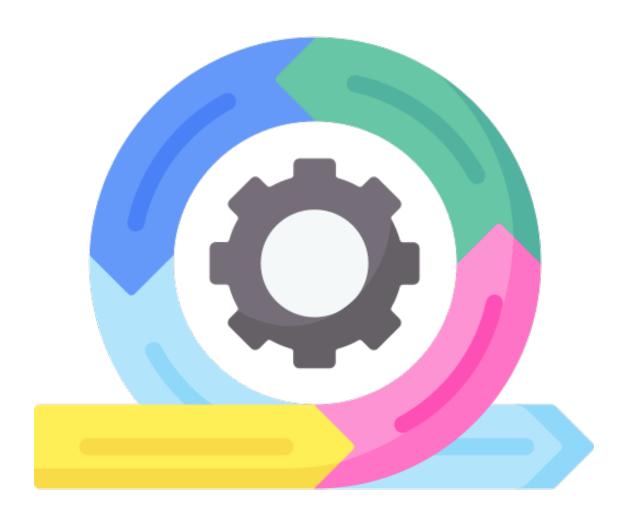










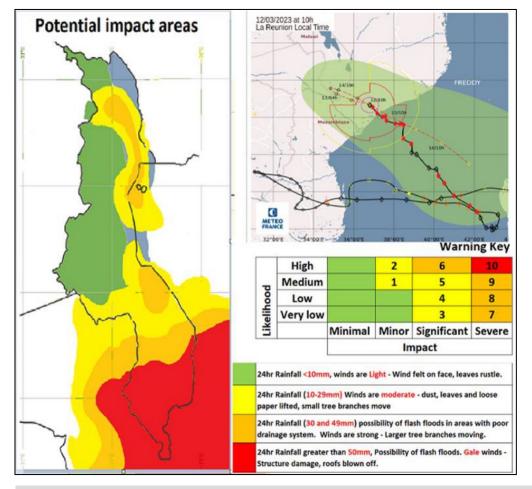


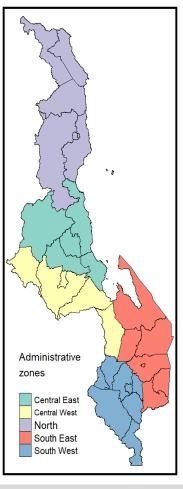
Methods

We investigated the immediate effects of Cyclone Freddy on maternal and reproductive health care service indicators using an existing national maternal surveillance platform in Malawi.

Data sources and period of observation







Data for this analysis was obtained from a
Maternal Surveillance platform
(Matsurvey) that reports aggregate facility
data for 33 facilities across the country.

We included data for six weeks leading up to the cyclone (1st January 2023, to 19th of February 2023) and the six weeks following the cyclone (19th of February to 30th of March 2023).

Cyclone Freddy was the longest-lasting intense cyclone recorded worldwide, reaching peak intensity on 19 February 2023, and moving inland to Malawi on the 12th of March 2023, where it caused the most devastation.



Study Design and Data Analysis

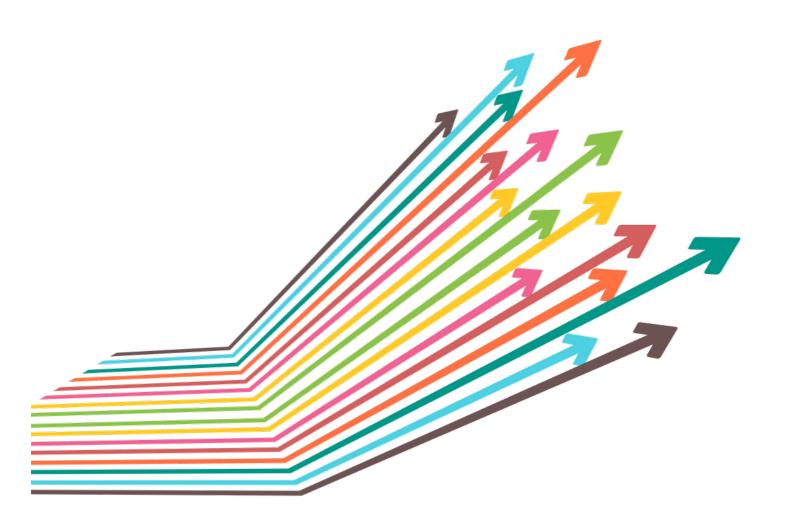
Interrupted time series design using a negative binomial approach with the following model equation

$$Y_i \sim NB(\mu_i, r)$$

$$log(\mu_i, r) = \beta_0 + \beta_1 Period + \beta_{2k} Zone$$

- Y_i is the count of service utilization indicator for the i^{th} observation.
- μ_i is the expected count of the service utilization indicator for the ith observation.
- ·r is the dispersion parameter for the negative binomial distribution.
- β_0 is the intercept, the adjusted log of rate in the pre-cyclone period.
- β_1 is the adjusted log of rate ratio comparing the post cyclone period against the pre-cyclone period
- β_{2k} is the log of rate ratio for geographical zone K against the reference zone.





Results



Summary Statistics





total number of live births

37,445



8

7,108 (19.0%)

Caesarean deliveries

545 (1.5%)

Instrumental deliveries



Total antenatal attendance
50,048
Total postnatal attendance
23,250



84
Maternal
deaths

1,166
Neonatal deaths



18
Medical doctors



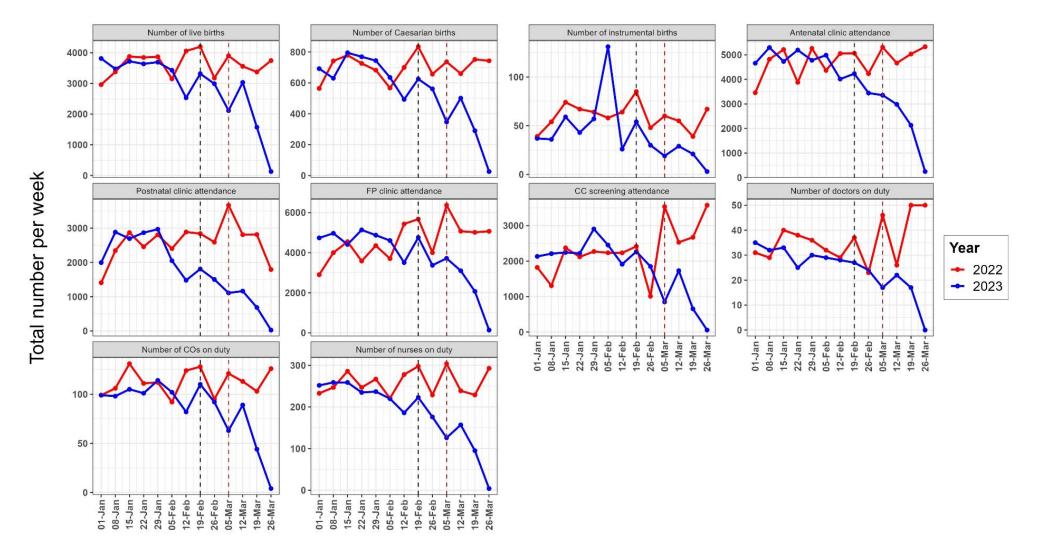
76Trained
Nurses



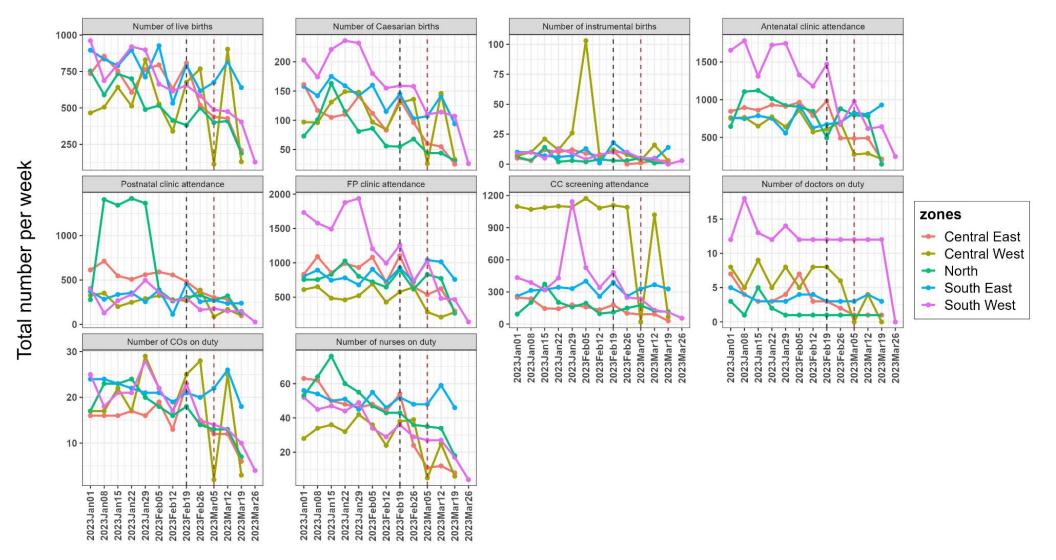
29 Clinical Officers

CHAC 2024 Cimate and Health Africa Conference

Temporal trends in weekly maternal health service utilisation from 1 January to 30 March for 2022 and 2023.



Temporal trends in weekly maternal health service utilization by administrative zone from 1 January to 30 March 2023



Stratified negative binomial model of effect of cyclone period or maternal health service utilisation

Services Pre:Median(IQR) Post:Median(IQR) RiskRatio(95%CI) Pvalue Antenatal clinic attendance 860(756.5;1060) 656.5(486.5;803.25) 0.66(0.55;0.78) < 0.001 493.5(401;670.25) < 0.001 712(561;815) 0.72(0.6;0.87) Cervical cancer screening 320(198;480) 162.5(103.5:328) 0.63(0.48:0.82) < 0.001 141(99:160.5) 99.5(46.75;134.5) 0.65(0.54;0.78) < 0.001 Family planning clinic 805(705;1010.5) 647(469;878.75) 0.73(0.61;0.87) < 0.001 4.5(3;9.75) Instrument deliveries (vacuum or forceps) 8(5:11) 0.59(0.4:0.85) 0.005 Available clinical officers in the maternity unit 20(17:22.5) 14.5(12;21.75) < 0.001 0.77(0.66;0.9) Available doctors in the maternity unit 5(3;8) 3(1;5.5) 0.65(0.51;0.82) < 0.001 355(279;552) Postnatal clinic attendance 261(154.25;305.5) 0.56(0.44;0.71) < 0.001

Pre(high) Post(high) Control Mont

		Central West				
Services	Pre:Median(IQR)	Post:Median(IQR)			RiskRatio(95%CI	Pvalue
Antenatal clinic attendance	753(644.5;768)	287(275;609)	-		0.58(0.4;0.84)	0.004
Births	513(485.5;584)	676(131;768)	—	——	0.95(0.51;1.78)	0.872
Cervical cancer screening	1093(1085.5;1098.5)	1019(69;1090)	-		0.6(0.24;1.51)	0.278
Caesarean sections	97(96.5;139.5)	130(33;136)	-	-	0.82(0.48;1.4)	0.471
Family planning clinic	521(472.5;630.5)	283(280;577)	-	-	0.73(0.51;1.04)	0.078
Instrument deliveries (vacuum or forceps)	12(8.5;23.5)	8(3;12)	-		0.32(0.12;0.85)	0.023
Available clinical officers in the maternity unit	17(17;22)	25(3;25)	-	· · · · · · · · · · · · · · · · · · ·	0.82(0.43;1.59)	0.566
Available doctors in the maternity unit	8(5;8)	4(0;6)	-		0.52(0.3;0.93)	0.028
Postnatal clinic attendance	291(264;325.5)	169(100;266)	-		0.7(0.45;1.08)	0.106
			0	1 2	3	
			Pre(high)	Post(high)	─	

		South East					
Services	Pre:Median(IQR)	Post:Median(IQR)				RiskRatio(95%CI)	Pvalue
Antenatal clinic attendance	753(687.5;774)	806(701;826)	-	•		1.07(0.91;1.25)	0.419
Births	835(751;896.5)	675(640;795)	-	+		0.89(0.75;1.06)	0.180
Cervical cancer screening	320(287;337)	328(328;367)	-	-		1.05(0.9;1.23)	0.538
Caesarean sections	158(142;159.5)	107(103;142)	•			0.79(0.67;0.93)	0.005
Family planning clinic	781(734.5;849)	926(758;1014)		\		1.13(0.98;1.3)	0.088
Instrument deliveries (vacuum or forceps)	7(6.5;10)	9(5;14)	· ·	*		1.3(0.71;2.36)	0.398
Available clinical officers in the maternity unit	22(21;23.5)	21(20;22)		—		0.97(0.76;1.24)	0.826
Available doctors in the maternity unit	4(3;4)	3(3;3)	-	-		0.86(0.46;1.61)	0.639
Postnatal clinic attendance	337(269.5;363.5)	256(239;272)	_	—		0.97(0.68;1.4)	0.876
			0	1	2	3	
			Pre(high)	Post(high	1)		

Central East

Services	Pre:Median(IQR)	Post:Median(IQR)			RiskRatio(95%CI)	Pvalue
Antenatal clinic attendance	896(853;922)	491(485;491)	-		0.6(0.42;0.86)	0.005
Births	754(683;779)	438(428;518)	-		0.65(0.47;0.9)	0.100
Cervical cancer screening	160(144;207.5)	93(90;101)	-		0.55(0.36;0.85)	0.008
Caesarean sections	112(107.5;129)	60(55;96)	—		0.63(0.41;0.96)	0.032
Family planning clinic	932(844.5;1035.5)	623(538;650)	-		0.69(0.5;0.96)	0.027
Instrument deliveries (vacuum or forceps)	9(6;11)	3(1;3)	-		0.43(0.2;0.94)	0.034
Available clinical officers in the maternity unit	16(16;16.5)	12(12;15)	-		0.84(0.62;1.14)	0.264
Available doctors in the maternity unit	4(3;5.5)	1(1;2)	—		0.36(0.17;0.79)	0.013
Postnatal clinic attendance	560(552;602.5)	304(286;367)	-		0.53(0.37;0.76)	< 0.001
			0	1 2	3	
			Pre(high)	Post(high)	→	

North

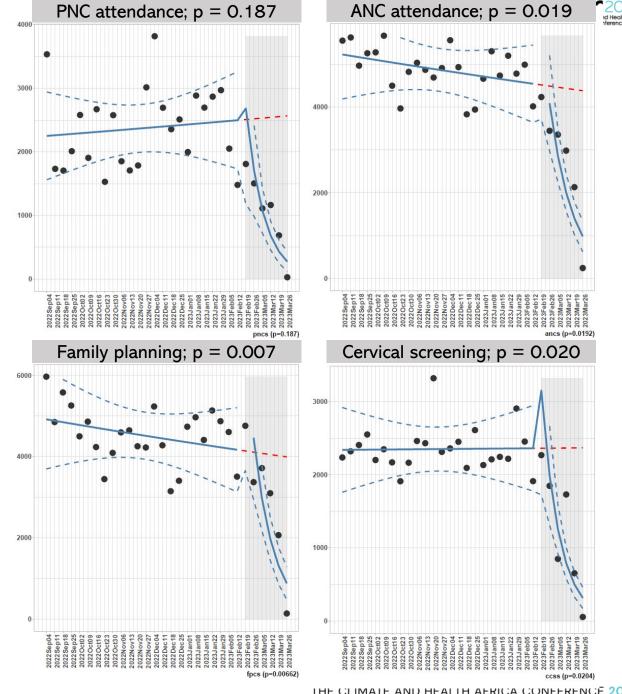
Services	Pre:Median(IQR)	Post:Median(IQR)				RiskRatio(95%CI)	Pvalue
Antenatal clinic attendance	923(876.5;1060)	781(495;795)	-	+		0.66(0.42;1.03)	0.069
Births	590(503;717)	400(382;410)	-			0.63(0.47;0.84)	0.002
Cervical cancer screening	194(128.5;202.5)	121(115;149)	-	-		0.71(0.47;1.07)	0.104
Caesarean sections	86(77;108)	44(44;55)	—			0.5(0.35;0.71)	< 0.001
Family planning clinic	756(738.5;817.5)	772(616;830)	-	_		0.85(0.62;1.17)	0.328
Instrument deliveries (vacuum or forceps)	3(2.5;5)	3(1;3)	-	_		0.54(0.23;1.24)	0.145
Available clinical officers in the maternity unit	20(17.5;23)	13(13;14)	-			0.65(0.48;0.87)	0.003
Available doctors in the maternity unit	1(1;2.5)	1(1;1)	-			0.5(0.18;1.39)	0.183
Postnatal clinic attendance	1343(331.5;1386)	306(269;322)	—			0.29(0.15;0.56)	< 0.001
			0	1	2 ;	1 3	
			Pre(high)	Post(high)			

South West

Services	Pre:Median(IQR)	Post:Median(IQR)					RiskRatio(95%CI)	Pvalue
Antenatal clinic attendance	1655(1319;1735)	656.5(623.25;899)		—			0.5(0.34;0.75)	< 0.001
Births	800(675;909)	481(421.75;559.75)		-			0.58(0.4;0.83)	0.003
Cervical cancer screening	429(364.5;480)	182.5(115.75;244.75)		—			0.41(0.23;0.74)	0.003
Caesarean sections	203(177;226.5)	112(107.75;147)		—			0.56(0.38;0.82)	0.003
Family planning clinic	1578(1347.5;1805)	609.5(469;953.25)		—			0.44(0.27;0.73)	0.001
Instrument deliveries (vacuum or forceps)	9(6.5;9.5)	5(3.5;8.75)		-	-		0.66(0.38;1.15)	0.144
Available clinical officers in the maternity unit	21(19.5;23.5)	13.5(10.75;14.75)		-			0.61(0.44;0.83)	0.002
Available doctors in the maternity unit	12(12;13.5)	12(12;12)		-	+		0.75(0.54;1.04)	0.086
Postnatal clinic attendance	337(265.5;383.5)	157.5(148.75;174.5)		-			0.5(0.29;0.85)	0.010
			0		1	2	3	
			←	Pre(high)	Post(high)		→	

Predicted trends in attendance to key maternal and reproductive health services from September 2022 to March 2023.

Significant reduction in attendance is observed after the cyclone, with no return to normal.





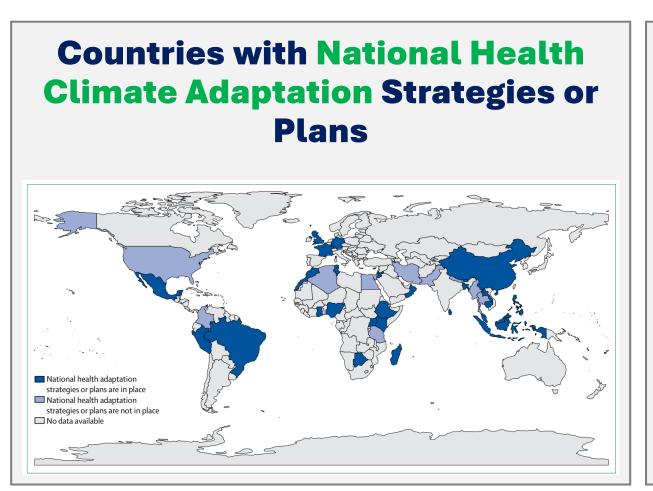


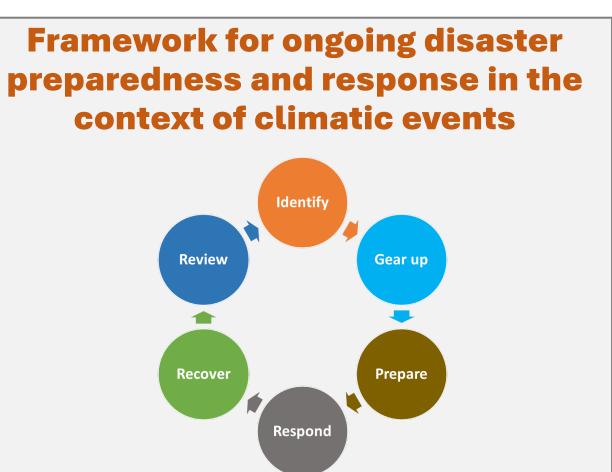
Discussion

There was a significant decrease in maternal and reproductive healthcare utilisation in the cycloneaffected regions of Malawi in the five weeks following Cyclone Freddy.

Further analyses with longer lag time is required

Policies and interventions should be tailored to emphasise the critical role of maternal and reproductive health services within disaster response frameworks.





There is need for robust methodologies to facilitate the surveillance, documentation and reporting of health effects of climate change















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