Conceptual framework

Extreme heat and maternal, newborn and child health





Increased intensity, duration

and frequency of heat stress

Rise in average temperatures

Solar radiation, humidity, wind

Seasonal timing of events

Future climate scenarios

and heatwaves

Critical windows of exposure

Vulnerability factors

- Compound hazards · Biological
 - factors · Socio-political factors
 - Geographical factors
 - Socio-economic

factors



Direct impacts through

- Dehydration
- · Endocrine system dysfunction
- Vasodilation
- · Increased skin blood flow
- · Heat strain
- · Oxidative stress and release of stress hormones
- · Release of heat shock proteins
- · Elevation of core temperature · Hyperventilation/hypotension
- Sleep disturbances



Indirect impacts through

Individual level

- Work conditions
- · Self-care and family care practices
- · Lactaction and sub-optimal feeding practices
- · Care-seeking
- Social interaction
- · Food security
- · Risk and patterns of transmission of food, water and vector-borne diseases

Family and community level

- Family stress
- · Lack of local plans to prepare for extreme heat
- Food security
- · Risk and patterns of transmission of food. water and vector-borne diseases
- · Domestic violence/ community violence
- · Migration/immigration

Health worker and facility level

- · Health worker performance
- · Impaired cold chain and safe storage of drugs
- · Effects on service delivery, quality of care
- and response times
- Power outages

Organized services

- · Disruption to infrastructure (power, water, transport)
- · School closures
- Loss of productivity
- · Economic losses



Maternal health

- · Gestational hypertension
- · Pre-eclampsia
- · Gestational diabetes

Fetal and perinatal health

- Stillbirths
- · Congenital disorders

Newborn health

- · Preterm birth
- · Low birthweight
- Hospital admissions

Child Health and development

- · Infant mortality
- Respiratory diseases, including asthma
- · Wasting, stunting, being underweight, and weight loss
- · Heat stroke, heat related illness
- Infections, including
- vector-borne diseases · Gastrointestinal conditions.
- including diarrhoea
- Hospital admissions
- · Lower educational attainment



Drivers

- · Fossil fuel combustion
- · Increased GHG emissions
- Agriculture and land use change
- Industry processes
- Urbanisation



Additional information

Extreme heat and maternal, newborn and child health

Examples of vulnerability factors

· Compound hazards

(pollution, drought, wildfire, flash flood, and drought):

· Biological factors

(nutritional status, comorbidities, disabilities, etc...);

Geographical factors

(urban/rural, greenspace, infrastructure, altitude, access to water, etc...);

Socio-political factors

(complex emergencies, political stability, etc...);

Socio-economic factors

(poverty, displacement, occupation, cultural practices and gender norms, education, security, equity and human rights).

Additional direct impacts

Maternal and Fetal/Perinatal health

- Dehydration
- · Compromised placental development and function
- · Elevation of core temperature
- · Endocrine system dysfunction
- Vasodilation
- · Increased skin blood flow
- · Hyperventilation/hypotension
- · Heat strain
- · Oxidative stress and release of stress hormones
- · Release of heat shock proteins
- · Sleep disturbances
- · Impaired cognition
- · Lactation practices

Newborn health

- · Elevation of core temperature
- Impaired heat exchanges
- · Increased heat absorption rate (high ratio of surface area to mass)
- Dehydration
- Vasodilation
- Hypotension
- Hypernatremia
- · Inefficient heat dissipation
- · Oscillations in breathing patterns
- · Impact on the autonomic nervous system
- · Heat stress
- Sleep disturbances
- · Dependency on others for cooling and hydration
- · Lactation practices

Child Health

- · Elevation of core temperature
- · Impaired heat exchanges
- · Increased heat absorption rate (high ratio of surface area to mass)
- Dehydration
- Vasodilation
- Hypotension
- Inefficient heat dissipation
- · Small blood volume compared to body size
- · Low sweating rate
- Activation of inflammatory response
- Heat stress
- Sleep disturbances
- · Impaired cognition
- · Dependency on others for cooling and hydration

Additional maternal health outcomes

- · Antepartum and postpartum haemorrhage
- · Mental health
- · Infections, including vector-borne diseases
- · Prelabour rupture of membranes
- · Caesarean section
- · Skin disorders
- Renal disease
- Maternal admissions
- · Caesarean section rates

Additional newborn health outcomes

- Jaundice
- · Infections, including vector-borne diseases
- · INR alterations
- · Sudden infant death syndrome (SIDS)

Additional child health outcomes

- · Renal disease, including kidney stones
- · Cardiovascular disease
- · Unintentional injuries
- · Allergy development
- · Cardiovascular disease
- $\cdot \, \text{Violence against children} \\$

Sources

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- Chersich MF, Scorgie F, Filippi V, et al. Increasing global temperatures threaten gains in maternal and newborn health in Africa: A review of impacts and an adaptation framework. Int J Gynaecol Obstet. 2023;160(2):421-429.