NEXT IAS

DAILY NEWS ANALYSIS

09th May

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EXPLAINED

1. AIR DEFENCE SYSTEM

Relevance: GS 2/IR GS 3 Security

Backdrop: India hits back after intercepting Pak. strikes

In the news:

- India shoots down a 'substantial' number of munitions fired at civilian, military locations
- Military stations in Jammu, Pathankot, Udhampur targeted late in the evening, but no losses suffered
- The Defence Ministry said the "Indian response has been in the same domain with same intensity as Pakistan".

About S-400

- The S-400 Triumf, developed by Russia's Almaz Central Design Bureau, is widely regarded as one of the most advanced and formidable surface-to-air missile (SAM) systems in the world.
- India has procured a total of five squadrons of the Russian-made S-400 Triumf air defence missile system, known in Indian service as "Sudarshan Chakra."
- Of these, three squadrons are already operational, while the remaining two are expected to be delivered by 2026.
- Highly mobile, the S-400 system can be deployed rapidly, becoming operational within five minutes while on the move and within 35 seconds from standby.
- Its launch vehicles are mounted on heavy-duty trailers capable of travelling at 60 km/h on roads and 25 km/h off-road, allowing swift repositioning.
- The S-400 missile's ability to engage multiple targets simultaneously and its extended range make it a critical asset for airspace denial and defence
- It can target a wide array of threats, including advanced stealth aircraft, airborne early warning systems (AWACS) and support jammers, thereby significantly enhancing a nation's aerial defence posture.

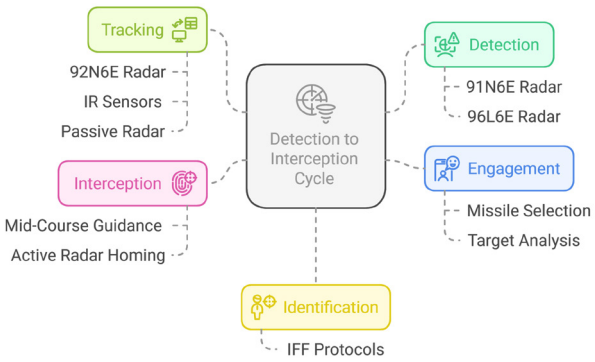
The S-400 employs four types of missiles to create a layered defence:

Missile	Role	Speed	Max Range	Altitude
40N6E	Long-range strategic targets	Mach 14	400 km	30–185 km
48N6DM	Long-range aircraft/cruise missile	Mach 6–8	250 km	30–150 km
9M96E2	Medium-range targets	Mach 3.5+	120 km	20–100 km
9M96E	Close-in, agile targets (UAVs, PGMs)	Mach 3	40 km	10–60 km

S400 : Radar System

Radar	Function	Range	Features
91N6E "Big Bird"	Long-range acquisition & early warning	~600 km	Detects 300 targets
92N6E "Grave Stone"	Fire-control & target illumination	~400 km	Directs missile launches
96L6E	High-altitude acquisition radar	~300 km	Can detect stealth aircraft
40V6M Mast System	Elevates radars	Variable	Increases radar horizon in mountainous terrain

Detection to Interception Cycle



Integration With Indian System

Indian System	Role	Integration
Akash	Medium-range SAM (25–30 km)	Provides close-in layered defence with S-400 as long-range shield
Rohini Radar	3D surveillance radar	Used to cue close-range systems like SPYDER & Akash
IACCS	Integrated Air Command and Control System	Connects S-400 to other AD systems & Air Force ops grid
BMD Phase-I (PDV + AAD)	Ballistic missile interceptors	Works in tandem with S-400 for missile defence

Air Defence and SEAD (Suppression of Enemy Air Defences)

Why is this significant?

- **Air defence systems are the shield** protecting vital infrastructure and urban areas.
- Neutralising Lahore's AD system:
  - **Weakens Pakistan's ability to defend its airspace**.
  - **Gives India air superiority**, at least locally and temporarily.
  - **Signals escalation**, as disabling AD systems is often a precursor to **deep strike missions** (bombing, surveillance, drone operations).

Air Defence Systems: Functions and Architecture

Air defence systems combine multiple technologies and layers to detect, track, and destroy incoming aerial threats.

1. Detection Phase

- Purpose: Identify potential threats as early as possible — before they reach critical targets.
- Technologies Involved: **Radar systems** (ground-based, airborne, and shipborne). **Satellites** (for early warning, especially against ICBMs or high-altitude threats).

How Radar Works:

1. **Transmitter** sends out electromagnetic pulses.
2. These pulses **reflect off objects** (aircraft, drones, missiles).
3. **Receiver** collects the reflected signals.
4. Data processed to determine:
   - Distance (based on time delay),
   - Speed (Doppler shift),
   - Altitude,
   - Object type (based on signature analysis).

Modern radars may also use **phased array** technology (e.g., the Israeli EL/M-2080 Green Pine used in India's BMD program) to scan multiple directions simultaneously.

2. Tracking Phase

- Purpose: Constantly follow the movement of the identified threat(s).
- Technologies Involved:
- **Fire-control radars**
- **Infrared sensors**
- **Electro-optical cameras**
- **Laser rangefinders**
- Challenges:
- Track **multiple threats** simultaneously in a cluttered environment.

- Avoid **fratricide** (targeting friendly aircraft).
- Maintain lock on **stealth or low-flying aircraft** that may use terrain masking.

3. Interception Phase

Once a threat is locked, the AD system deploys its weapons. Depending on threat type and proximity, interception can involve:

Tools of Interception

Interceptor Aircraft

- Role: **Air-to-air combat**; intercept intruding aircraft before they release payloads.
- **Indian Assets:**
- **Dassault Rafale** – Multirole, advanced EW, long-range interception.
- **Sukhoi Su-30MKI** – Air dominance with BVR missile capability.
- **MiG-29** – Agile, upgraded with AESA radar and BVR missiles.
- **HAL Tejas** – Lightweight, modern, rapid response.
- **MiG-21 Bison** – Legacy interceptor, still operational in limited roles.
- **Weapons**:
- **Astra**, **R-77**, **MICA**, **Python-5** air-to-air missiles.
- **Electronic Counter Measures (ECM)** and **chaff/flare dispensers**.

Surface-to-Air Missiles (SAMs)

- Role: Destroy enemy aircraft/missiles from the ground without endangering pilots.
- **Types:**

Class	Range	Mobility	Purpose
Heavy	200–400 km	Semi-mobile	Strategic air defence (e.g., S-400)
Medium	50–100 km	Vehicle-based	Tactical protection for troops/assets
Short	<10 km	MANPADS	Point defence against low-flying targets

- **Indian Systems:**
  - **S-400 Triumf** (Russian): Best-in-class, 400 km range, 80 targets simultaneously.
  - **Akash Missile System**: Indian-made, 25–30 km range, radar-guided.
  - **Barak 8**: Indo-Israeli medium-range SAM with naval and land variants.
  - **Spyder SR/MR**: Quick-reaction Israeli system using Python-5 and Derby missiles.

Anti-Aircraft Artillery (AAA)

- **Role:**
  - Provide **close-in defence**, especially against **drones and helicopters**.
  - Still used where radar-guided SAMs are impractical or too expensive.
- **Features:**
  - **High rate of fire** (1,000+ rpm).
  - **Timed or proximity-fused shells** scatter shrapnel in the target area.
  - **Fire-control systems** automate detection and firing decisions.
- **Examples:**
  - Indian use of **ZU-23-2**, **L70 Bofors**, **Skyshield 35mm** with AHEAD ammo (against drones).

Electronic Warfare (EW)

- Role: Neutralise enemy air threats **non-kinetically** by disrupting sensors and communications.
- Techniques: **Radar jamming, GPS spoofing, Data link disruption, False target generation**
- Platforms: Ground-based jammers (e.g., DRDO's Samyukta system), EW pods on fighter aircraft ,Dedicated aircraft (e.g., modified Gulfstream III by DRDO; U.S. EA-18G Growler)

C3: Command, Control, Communication

No AD system functions without integration:

- **C3** ensures real-time information flow from radar control centre launcher.
- Critical for **avoiding delays**, **minimising friendly fire**, and **multi-layered engagement**.

Neutralising Enemy AD Systems: SEAD Operations

Objective: Destroy, blind, or confuse enemy air defence networks.

Methods:

- **Anti-Radiation Missiles (ARMs)**: Home in on enemy radar emissions (e.g., AGM-88 HARM).
- **Standoff Precision Bombing**: Using stealth aircraft or cruise missiles.
- **Drone Swarms**: Overwhelm radar and launchers.
- **Electronic Attack (EA)**: Jam enemy communications and sensors.

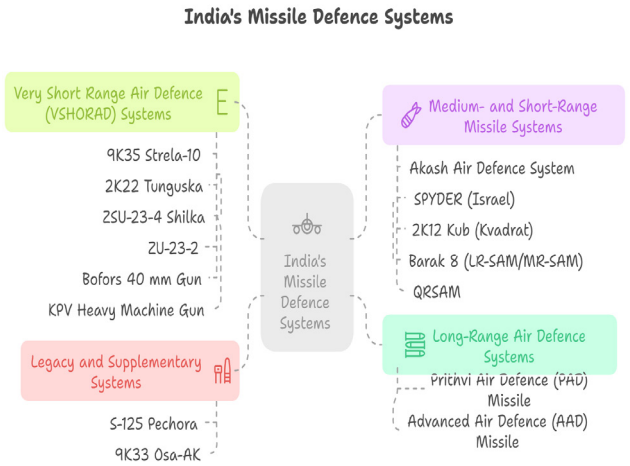
- **Ground Operations**: Special forces sabotage radars and missile launchers.

India's Evolving Air Defence Doctrine

India has significantly upgraded its AD network in recent years:

- **Procurement of S-400**
- **Indigenous systems** like Akash-NG, XRSAM in development.
- **BMD Phase-1** (Ballistic Missile Defence)
- Development of **integrated AD networks** with joint tri-service coordination.

India's Missile Defence System

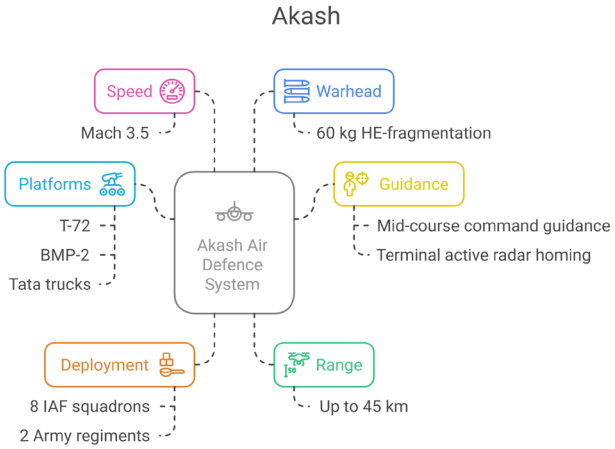


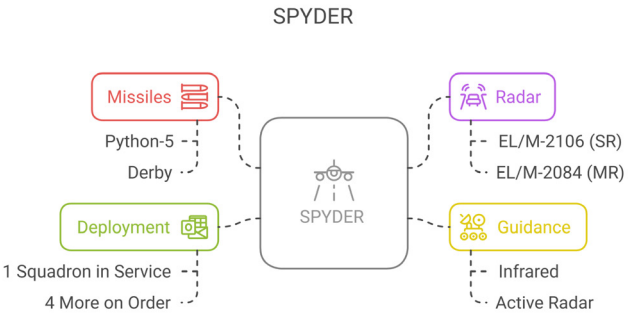
1. Long-Range Air Defence Systems in India

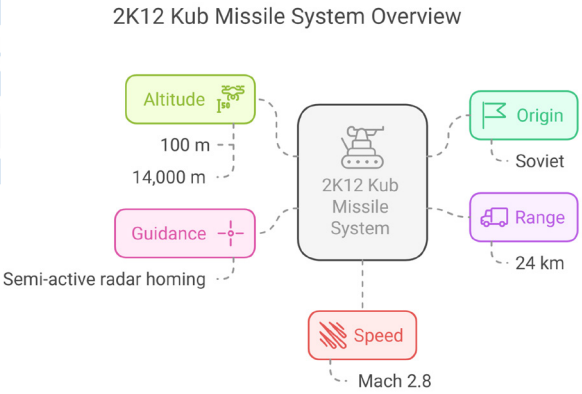
I. Indian Ballistic Missile Defence Programme

Characteristic	Prithvi Air Defence (PAD)	Advanced Air Defence (AAD)
Type	Exo-atmospheric interceptor	Endo-atmospheric interceptor
Range	300–2,000 km	150–200 km
Max Interception Altitude	80 km	30 km
Speed	Mach 5+	Mach 4.5
Guidance	Inertial, LRTR, radar homing	Inertial navigation, active radar
Radar	Tracks 200 targets at 600 km	
Role		Intercepts PAD layer penetrations

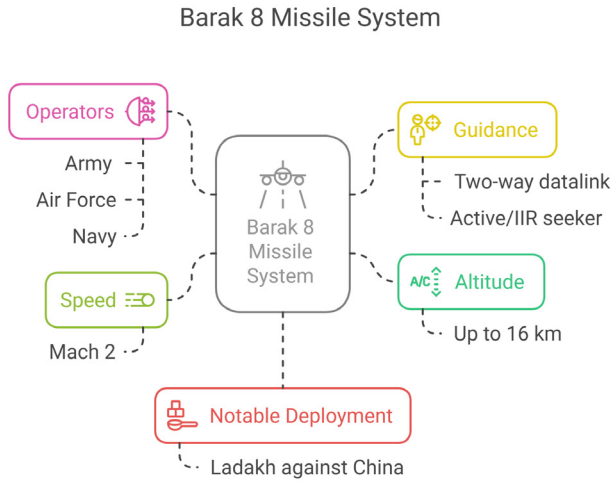
2. Medium- and Short-Range Missile Systems (less than 100 km)

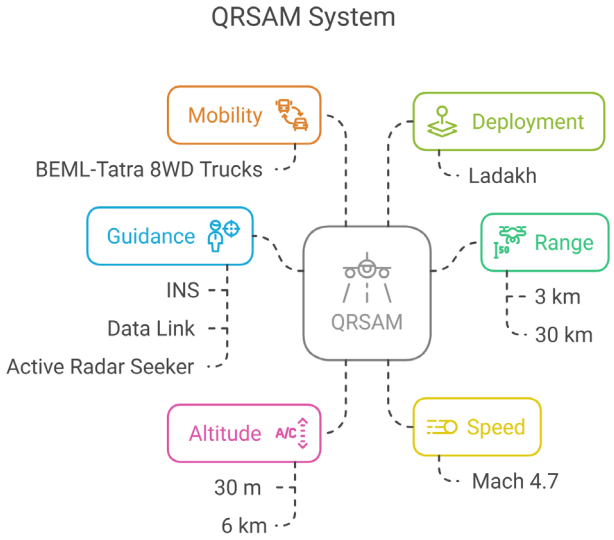






(iv) Barak 8 (LR-SAM/MR-SAM)





3. Legacy and Supplementary Systems

(i) S-125 Pechora

- **Origin:** Soviet
- **Range:** 30 km
- **Speed:** Mach 3–3.5
- **Deployment:** 25 squadron

ii) 9K33 Osa-AK

- **Range:** 15–18 km
- **Altitude:** Up to 12 km
- **Missiles:** 6 per TELAR
- **Radar:** Integrated plus external early-warning radars

4. Very Short Range Air Defence (VSHORAD) Systems

(i) 9K35 Strela-10

- **Range**: 5 km
- **Altitude**: 3.5 km
- **Speed**: ~Mach 2
- **Guidance**: IR/optical seeker

ii) 2K22 Tunguska

- **Armament**: 30mm twin cannons + 8 SAMs
- **Missiles**: 9M311 series
- **Vehicle Speed**: 65 km/h
- **Radar**: Integrated tracking and targeting

(iii) ZSU-23-4 Shilka

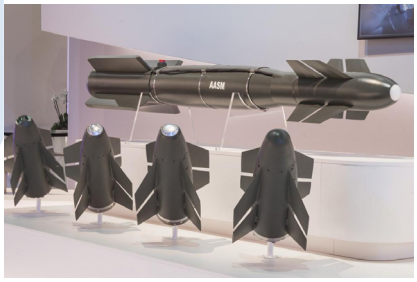
- **Guns**: 4 × 23 mm
- **Type**: Radar-guided SPAAG
- **Used by**: Indian Army in limited numbers

Missiles Used for Operation Sindoor

1. SCALP/Storm Shadow

- **Type:** Long-range, air-launched cruise missile
- **Range**: Approximately 250 kilometres (export variant)
- **Launch Platform:** Likely deployed from Rafale fighter jets
- **Guidance:** GPS and terrain reference navigation systems
- **Operation Role**: Used for striking high-value targets during Operation Sindoor
- **Developer:** European missile consortium, MBDA

2. HAMMER Missile



Full Name: Highly Agile Modular Munition Extended Range (HAMMER)

Type: Precision-guided bomb system

Range: Up to 70 kilometres (when released at optimal altitude and high velocity) **Operation Role:** Precision strikes against terrorist infrastructure

Drone Warfare

HAROP/HARPY Drones

- **Type:** Loitering munition/anti-radiation drone
- **Primary Function:** Targeting and disabling enemy air defence systems
- **Operation Role:** Successfully deployed to neutralise Pakistani air defence systems in the early stages of Operation Sindoor
- **Distinctive Feature:** Autonomous operation capability

Kamikaze (Loitering Munition) Drones

SkyStriker Suicide Drones

- **Origin:** Jointly developed by Alpha Design Technologies (Bengaluru, India) and Elbit Systems (Israel).
- **Type**: Loitering munition / Kamikaze drone.
- **Warhead:** 5–10 kg high-explosive payload.
- **Range:** Up to 100 km.
- **Endurance:** Can loiter over a target area before striking.
- **Guidance:** Autonomous or remote human control, with real-time video feed.
- **Role in Operation:** Used for pinpoint strikes on terror camps, radar systems, enemy drones, and launch pads.

Key Features:

- Silent approach and strike capability.
- Small radar signature, aiding in evading enemy air defences.
- Direct-fire aerial precision attacks.
- First operational use in Operation Sindoor.

LMS (Low-Cost Miniature Swarm) Kamikaze Drones

- **Origin:** Developed by DRDO and private Indian partners.
- **Type:** Swarm-capable loitering munition.
- **Range:** Comparable to SkyStriker (up to 100 km).
- **Warhead:** approx. 5–10 kg
- **Role in Operation:** Used in swarm tactics to overwhelm air defences and deliver precision strikes.

Key Features:

- Swarm deployment for simultaneous attacks.
- Cost-effective, indigenous technology.
- Two-way communications and live video feed during strikes.

Nagastra-1 Loitering Munition

- **Origin:** Developed by Solar Industries, Nagpur, India.
- **Payload:** 1 kg explosive warhead.
- **Guidance:** GPS-enabled, with strike accuracy within 2 meters of the target.
- **Role in Operation:** Deployed for precision strikes with minimal collateral damage.
- **Order Size:** Initial order of 120 units, with a total projected order of 420 for the Indian Army.

Key Features:

- Blends surveillance with strike capability.
- Designed for search-and-destroy missions and counter-terror operations

2. PREDATORY PRICING

Backdrop: CCI has notified new definitions to curb predatory pricing

Relevance: GS II/Health

About the news:

In a further bid to check predatory pricing and ensure fair competition, the Competition Commission of India has notified new definitions for various costs it will use to judge whether a

price charged by a company for a product or service is predatory or not.

Predatory pricing:

According to the Competition Act 2002, predatory pricing is where a product or service is priced

below its cost, with the aim of reducing competition and eliminating competitors.

Prohibition under the law:

In India, predatory pricing is prohibited under the Competition Act, 2002. Specifically, Section 4(2)(a)(ii) of the Act prohibits the abuse of a dominant position, which includes imposing unfair or discriminatory prices, including predatory pricing.

CCI (Determination of Cost of Production) Regulations, 2025,

- The "cost of a good or service would be assumed to be its average variable cost", which is the total variable cost divided by the total output during a particular period.
  - Total variable cost: Total cost (including everything that goes into the production of that good or service)- Fixed cost and fixed overheads attributable to the Product.
- The CCI has decided to avoid using sector-specific definitions of cost, and instead has decided to view them on a case-by-case basis. It

will enable the Commission to consider the unique features and evolving dynamics of digital markets when evaluating alleged predatory conduct.

Competition Commission of India (CCI):

The CCI is a statutory and quasi-judicial body operating under the Ministry of Corporate Affairs.

Established in March 2009 under the Competition Act, 2002, the CCI aims to prevent anti-competitive practices, promote and sustain market competition, protect consumer interests, and ensure the freedom of trade in India's markets.

Some key powers of the CCI:

- Regulation of Anti-Competitive Practices, including cartels, price-fixing, and abuse of dominant position.
- Review of Mergers, acquisitions, and combinations to ensure they do not lead to a concentration of power that may adversely affect competition.
- Conduct Investigations based on complaints, references by governments, or suo motu actions.
- Imposing Penalties for anti-competitive behavior.
- Advocacy and Awareness for enterprises, policymakers, and stakeholders.

3. MATERNAL MORTALITY RATE

Backdrop: Latest data released by the Office of the Registrar General, India.

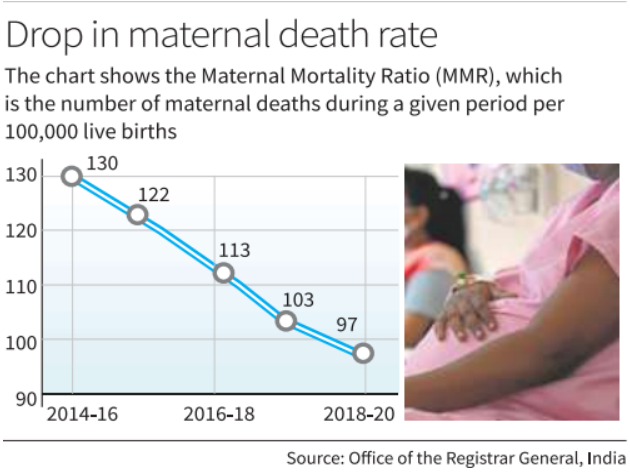
Relevance: GS II/Health

About the news:

Data released by the Office of the Registrar General and Census Commissioner of India

Key Findings:

- **Decline in MMR:** Maternal Mortality Ratio (MMR) in India declined to 93 per lakh live births in 2019-21 from 97 in 2018-20, and 103 in 2017-19.



- **Variation with age:** Highest MMR occurs in the 20-29 age group, and the second highest in the 30-34 age group.
- **States with High MMR:** MP (175), Assam (167), UP (151), Odisha (135), Chhattisgarh (132), WB (109), and HR (106), etc.

Global Scenario (as per WHO)

- Every day in 2023, over 700 women died from preventable causes related to pregnancy and childbirth.
- Between 2000 and 2023, the MMR dropped by about 40% worldwide.
- Just over 90% of all maternal deaths occurred in low- and lower-middle-income countries in 2023.

UN's SDG for MMR: The UN's SDGs aim at reducing global MMR to less than 70 per 100,000 live births.

Maternal death: As per the WHO, Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

Maternal Mortality Ratio (MMR): Defined as the number of maternal deaths during a given time period per 100,000 live births during the same time period, as reported.

Office of the Registrar General and Census Commissioner of India (ORGI & CCI)

Founded in 1961 by the Union Ministry of Home Affairs, for arranging, conducting, and analysing the results of the demographic surveys of India, including the Census of India and Linguistic Survey of India.

- Registrar General of India (RGI) is the head of the ORGI & CCI.
- The position of Registrar General and Census Commissioner is held by a civil servant holding the rank of Additional Secretary.
- The RGI serves as the principal advisor to the Government of India on all matters related to the registration of births, deaths, and marriages.

Major Functions of the RGI:

- **Census of India:** The Census provides detailed statistical insights into the demographic, socio-economic, and geographical aspects of India's population. Since its first complete survey in 1881, the Census has been conducted 15 times, with the latest round in 2011. Post-1949, the responsibility for conducting the Census has rested with the RGI.

- **Linguistic Survey of India (LSI):** Conducted alongside the Census, this survey offers a comprehensive overview of India's linguistic diversity. The original Linguistic Survey was completed by George Abraham Grierson in 1928.
- Civil Registration System (CRS).
- Sample Registration System (SRS).
- Implementing the Registration of Births and Deaths Act, 1969.

Sample Registration System (SRS):

- It is a large-scale sample survey conducted in a random sample of villages and urban blocks.
- It involves continuously recording births and deaths in a sample area and using this data to estimate vital rates like birth rate, death rate, infant mortality rate, and maternal mortality rate.
- It is a joint effort of the Central and State Governments.
- RGI arrives at estimates on fertility and mortality using the **SRS**.

Civil Registration System (CRS): Also known as the birth and death registration system, is the recording of vital events, i.e., Birth, Death & and stillbirth under the statutory provisions on a continuous and permanent basis.

- CRS falls under the Concurrent list of the Constitution of India.
- The registration of birth and death is done under the provisions of the **Registration of Births and Deaths (RBD) Act, 1969** (amended in 2023) and State Rules framed based on Model RBD Rules. This Act was amended in 2023.

Registration of Births and Deaths (RBD) Act, 1969

- As per the act, the registration of birth and death is **mandatory**.
- The events of births, still birth,s and deaths are registered at the place of **occurrence of the event** i.e, where the event took place.
- The normal period of reporting the event is **21 days from its occurrence**, however, the event can be registered after the normal period under the delayed registration provisions of Section 13 of the RBD Act.

4. CHIKUNGUNYA VACCINE

Bakdrop: Europe reviews Valneva's chikungunya vaccine

Relevance: GS III/ Science & Technology

About the news:

The European Union's health regulator said that it was reviewing the chikungunya vaccine, after reports of serious side effects in older adults.

IXCHIQ:

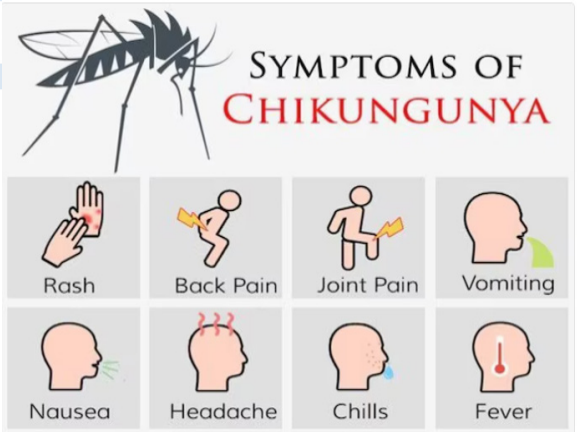
- IXCHIQ is the world's first licensed chikungunya vaccine.
- Developed by the French company Valneva SE.
- Approved by the WHO for use in preventing chikungunya virus infection in adults.
- It has also been approved for use in the USA, Canada, and the EU. Specifically, it's approved for people 18 years and older in the U.S., Canada, and the UK, while in the EU it's approved for individuals 12 years and older.

IXCHIQ in India:

- In December 2024, Valneva SE and Serum Institute of India signed an exclusive license agreement for Valneva's single-shot chikungunya vaccine that enables the supply of the vaccine in Asia.
- Under the agreement, Valneva will supply its chikungunya vaccine drug substance to SII, which will complete manufacturing and be responsible for seeking and maintaining regulatory approval of the vaccine in India and other countries in Asia.

Chikungunya Disease:

It is a mosquito-borne viral disease causing fever and severe joint pain. It is transmitted by infected **Aedes mosquitoes**, the same ones that spread dengue and Zika viruses.



- **Caused** by the chikungunya virus, which is a type of alphavirus.
- **Transmission:** Spread to humans through the bite of infected Aedes mosquitoes, primarily Aedes aegypti and Aedes albopictus.
- **Treatment:** There is no specific antiviral treatment for chikungunya. Treatment focuses on managing symptoms, including reducing fever, alleviating pain, and staying hydrated.
- **Prevention:** The best way is to protect oneself from mosquito bites by using insect repellent, wearing protective clothing, etc.

- **Outbreaks:** Chikungunya is considered a neglected tropical disease. The virus is endemic in many parts of Africa, Southeast Asia, and the Indian subcontinent, and has spread to other parts of the world, including the Americas.

DECODED

5. PUBLIC HEALTH SYSTEM IN INDIA

Backdrop: Challenges in Public Health System in India

Relevance: GS II/Health

About the news:

Public health

Public health is both an art and a science. It combines the best of medical sciences, engineering solutions, and social science understanding.

As a science, it is grounded in medical knowledge (like the germ theory of disease), engineering principles (such as water purification and sewage systems), and social sciences (which explain how poverty shapes health outcomes). This blend of disciplines makes public health a field unto itself

How does public health work in India?

- **Fragmented public health governance:** E.g., while drug safety falls under the Concurrent List, Quarantine, international health regulations, etc, belong to the Union List.
- **Disjointedness and Contradiction in Vision.** E.g., ICMR combats disease against tobacco, yet the ICAR's Central Tobacco Research Institute enhances tobacco Yield.
- **Issue with the Public health education:** Master of Public Health (MPH) curricula across India are as fragmented. E.g. Some universities restrict entry to those from medical, dental, or allied health backgrounds, while others accept graduates from any discipline.
- **Minimal attention to Public health engineering,** which includes designing and maintaining systems for water purification, waste disposal, and drainage.
- **Seeing Nutrition as a static concept**, with little integration of food processing, food handling practices, or food technology.
- **Inadequate focus on Health Technology Assessment**, which evaluates the Cost-effectiveness and impact of health interventions.
- **Two-year MPH programme:** Difficult to achieve mastery across epidemiology, health policy, behavioural science, and health economics within this time frame.

Way ahead:

- **Standard baseline curriculum**: The MPH courses needs to provide hands-on experience or technical depth.
- **Capacity building of FSSAI:** To ensure implementation of India's regulatory framework for food safety
- **Training in behavioural sciences,** which includes whether it is encouraging vaccine uptake, reducing tobacco consumption, or improving sanitation habits.
- **Evidence-informed policy decisions**- To build capacity, more institutions need to offer courses on Health Technology Assessment.

Conclusion:

Public health must be treated as a cohesive national agenda guided by a unified and coherent chain of command. A common vision rooted in equity, resilience, and preparedness is essential for national well-being and future readiness.

PRACTICE QUESTION

Q. What is the concept of Public Health? Explain the status and challenges faced by the Public Health system in India. Suggest measures.

DNA QUIZ

1. With reference to India's air defence systems, consider the following statements:

1. The Akash missile system is a long-range ballistic missile defence system developed in collaboration with Russia.
2. The S-400 Triumf system can engage aerial targets at ranges exceeding 350 km.
3. QRSAM is designed primarily for use by the Indian Navy to intercept submarine-launched ballistic missiles.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) 2 and 3 only
(d) None of the above

2. With reference to the Competition Commission of India (CCI), consider the following statements:

1. It is a statutory and quasi-judicial body established under the Competition Act, 2002.
2. The CCI is empowered to review mergers and acquisitions.
3. Under the new rule, CCI considers sector-specific cost benchmarks while evaluating predatory pricing allegations in digital markets.

How many of the above statements are correct?

(a) Only one
(b) Only two
(c) All three
(d) None

3. With reference to the latest data released by the Office of the Registrar General and Census Commissioner of India, consider the following statements:

1. The MMR in India decreased from 103 in 2017-19 to 93 in 2019-21.
2. The highest MMR is observed in the age group of 37–40 years.
3. Madhya Pradesh has the highest MMR among Indian states.

Which of the above statements is/are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

4. Consider the following statements regarding Chikungunya disease:

1. It is transmitted by the Culex mosquito, the same vector responsible for malaria transmission.
2. IXCHIQ vaccine is the first licensed vaccine for chikungunya and has been approved for use in both adults and children in the EU.
3. Chikungunya is endemic to parts of Africa and Southeast Asia but has not yet spread to the Americas.

Which of the statements given above is/are incorrect?

(a) 1 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) All of the above

Answer			
1. (B)	2. (B)	3. (B)	4. (C)