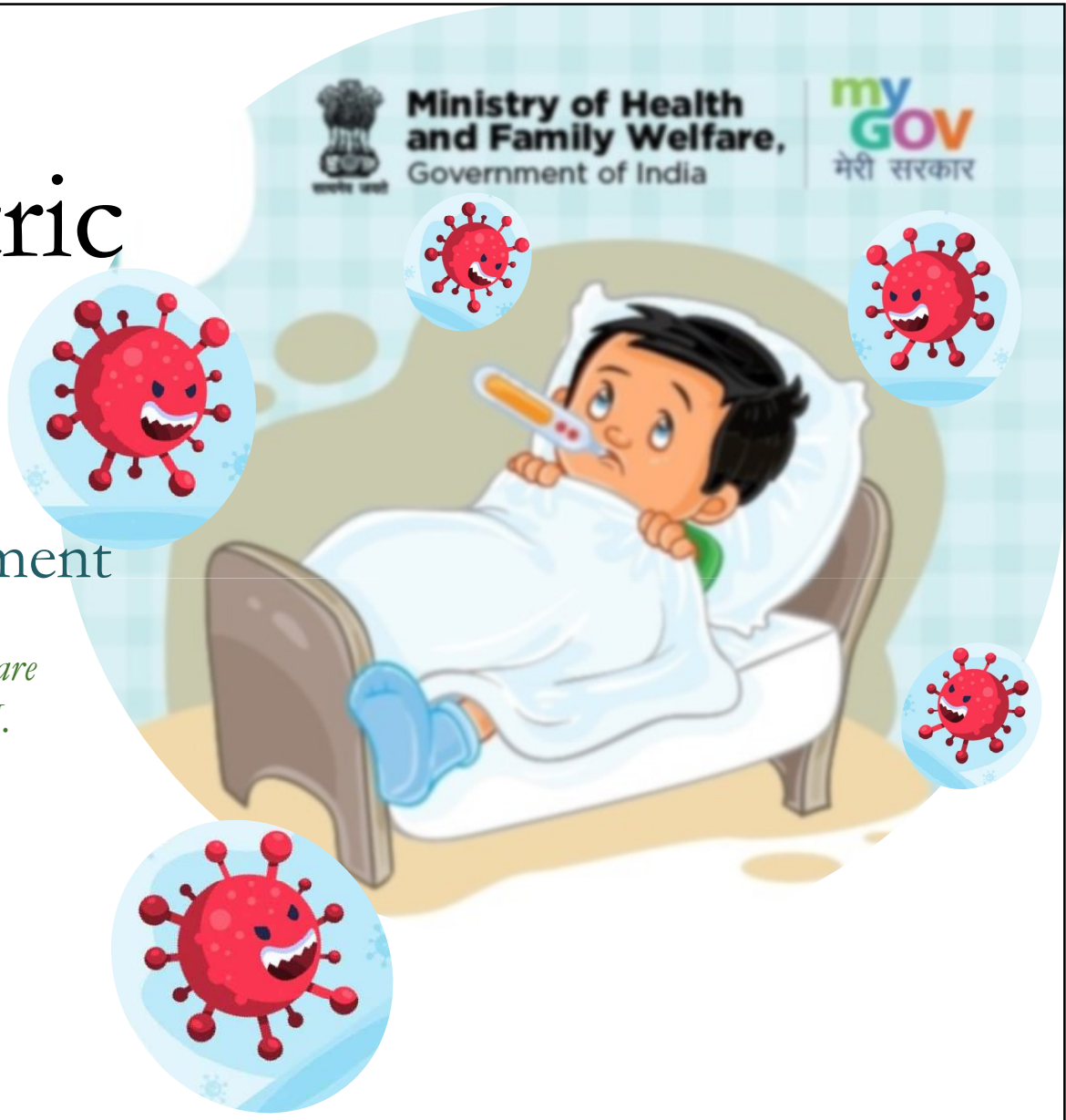
Managing Pediatric COVID-19



Infrastructures, Drugs, Equipment

Based on "Guidelines on operationalization of COVID care services for children and adolescents" By MoHFW, GOI. (June 2021)

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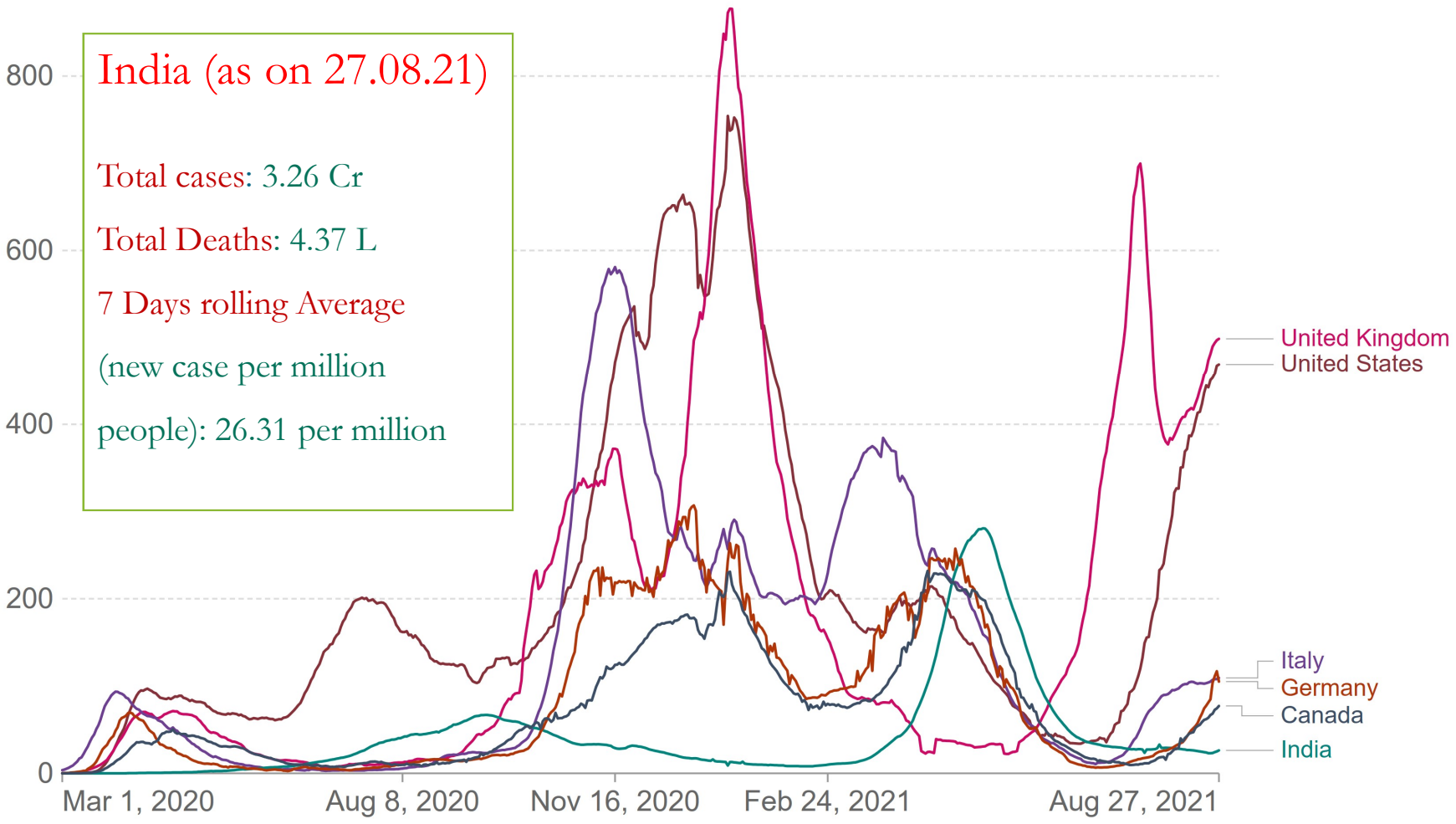
Daily new confirmed COVID-19 cases per million people

Shown is the rolling 7-day average. The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Our World in Data



Source: Johns Hopkins University CSSE COVID-19 Data

Total cases v/s New cases per day (as on 27.08.21)

S. No	State	Total No. of COVID cases	New cases added As on 27.08.21
1	Maharashtra	64.5 L	+4,654
2	Kerala	39.5 L	+32, 801
3	Karnataka	29.4 L	+1,301
4	Tamil Nadu	26.1 L	+1,542
5	Andhra Pradesh	20.1 L	+1,515
11	Rajasthan	9.54 L	+17

Covid-19 cases India (as on 27.08.21)

Total cases: 3.26 Cr
Total Deaths: 4.37 L
7 Days rolling Average: 26.31 per million (new case per million people):

Total vaccination: India (as on 27.08.21)

At least 1 dose: 4.76 Cr (34.8 %)
Fully vaccinated: 1.39 Cr (10.2%)

Pediatric COVID cases: Epidemiology

- AAP report >3.63 million children have tested positive since the beginning of the pandemic (13.6% of all cases)
- Rate of hospitalization 0.8% and mortality 0.06%
- ICMR report <20 yrs. population comprised 11.73% of total cases in India.
- Hospitalization rate was 10-20% and mortality rate was 0-0.7%
- Rajasthan: Epidemiological analysis of COVID cases Report 2021 states 14% of all cases were pediatrics (0-19 yrs.) age
- MIS-C cases have shown surge appearing nearly 2-6 weeks after covid infection

	India	Rajasthan
Total cases so far	3.26 Cr	9.54 L (3.18% of India cases)
Total Deaths so far	4.37 L (1.34% of total cases India)	8,954 (2% of India deaths) (0.09% of total cases in Rajasthan)
Total case 2nd wave (from 1.03.2021 to 18.06.2021)	1,86,84,030 (in 2nd wave) 43,77,749 (peak active case on 07.05.2021)	6,30,163 (in 2nd wave) 2,26,178 (peak active cases on 14.05.2021)
Pediatric cases in precious waves	Cases below age 20 years were 12% (39,12,000)	14% children (0-19 yrs.) affected in 2nd wave in Rajasthan, so this will be 77, 250 Pediatric cases (5,59,301 total cases in 2nd wave as per Epidemiological report)
Total cases projected for 3rd wave (double of cases in 2nd wave, AIIMS)	3.72 Cr (new cases only in 3rd wave)	11 L (3.2% of India)
Projected Pediatric cases need in 3rd wave (Projected as 10% by AIIMS)		1.1 L Pediatric cases
5-10% of these cases will be mod./ severe hospitalized in 3rd wave (It was 20% in 2nd wave, vaccination, heard immunity etc may reduce this) Considered 5% in most projections		5,500-11,000 pediatric cases will need admission for Mod/severe covid

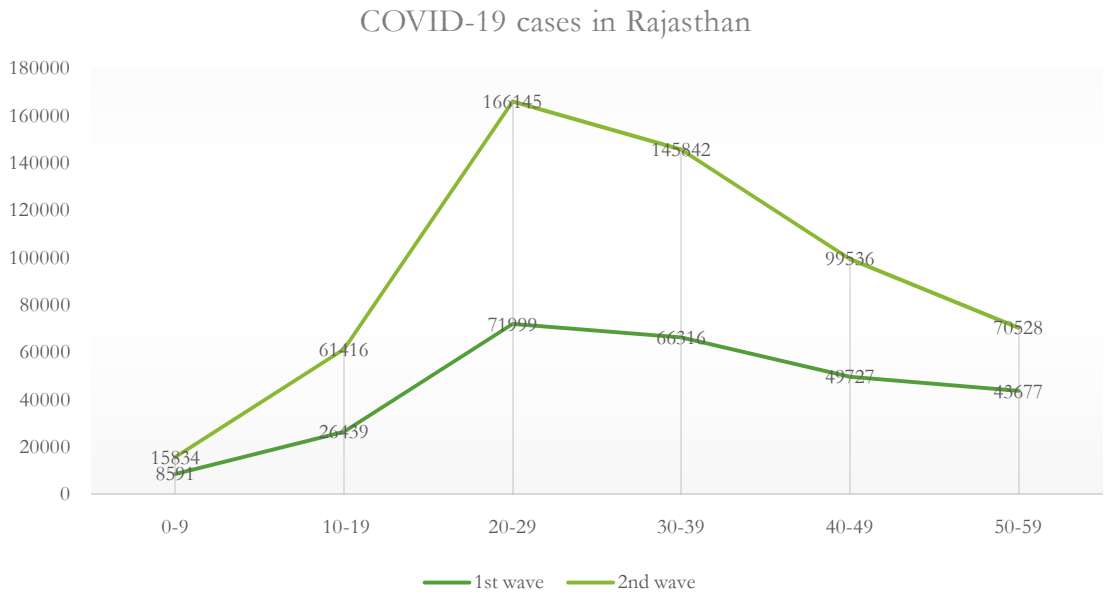
SOURCE: Our world in data & JHU CSSE COVID-19 DATA accessed 27.08.2021

3rd wave: Why we are worried for children than?

- In Rajasthan, increase in no. of cases in 2nd wave in children age group 0-9 yrs. was 84% and in age group 10-19yrs. was 113%.This rise was due to increase in total no of cases (overall) and not rise in % cases in pediatric population.
- % of cases affected (in same age groups) in children and even in adults also are same in both covid waves.
- So, unless we get a new SARS-CoV2 strain which infects more to pediatric population, it is unlikely that pediatric population will be more affected than adults in possible 3rd wave.
- What we are actually worried about is the total no. of pediatric cases we will be getting in this possible 3rd wave (1.1 lakh) and 5% will be severe to mod. Cases (5,500-11,000) needing admissions.

Rajasthan: Epidemiological analysis of COVID cases Report 2021

Age Group	1st wave	% cases	2nd wave	% cases
0-9 Yr	8591	3%	15834	3%
10-19 yr	26439	10%	61416	11%
20-29 yrs	71999	27%	166145	30%
30-39 yrs	66316	25%	145842	26%
40-49 yrs	49727	19%	99536	18%
50- 59 yr	43677	16%	70528	13%
Total	266749		559301	



Rajasthan: Epidemiological analysis of COVID cases Report 2021

In Rajasthan, increase in no. of cases in children age group 0-9 yrs. was 84% and in age group 10-19yrs. was 113%

There is same 14% of cases affected (in same age groups) in children and even in adults also.

Problem with this data is most children were mild/asymptomatic in 2nd wave and were not tested/ not advised for tests/ visited a Dr.

Children, second and anticipated 3rd wave

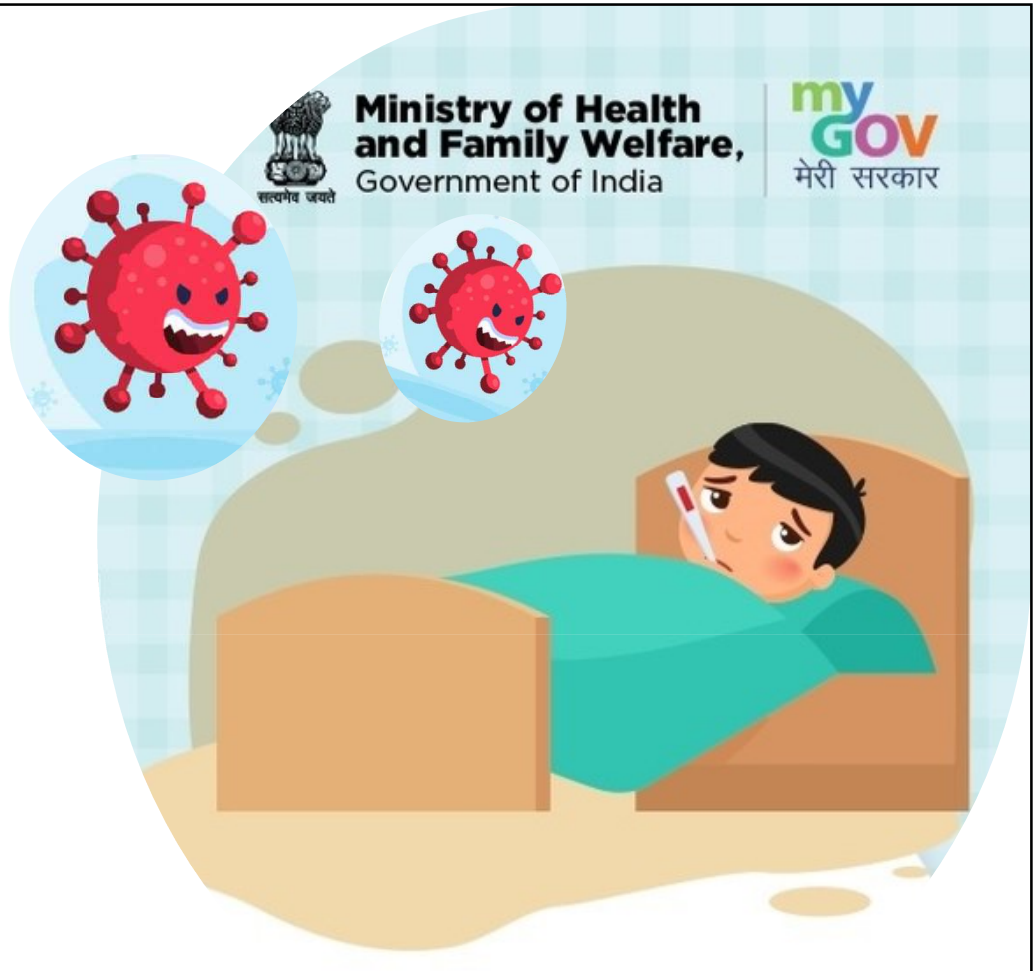
- Increased number of infections in children
  - Children going out
  - Transmission from adults
  - More infectious variant virus (entire household affected)
- Increased severity of infections
  - More fever and GI symptoms
  - Prolonged fever
  - COVID pneumonia and hypoxia especially in adolescents
- MIS-C has started appearing again
- Expecting large number of children with serious illness in 3rd wave
- Need of Triaging if number increses
- However, disease in children is milder than adults (4-5% will need hospitalization)
- No COVID vaccines is yet available for Pediatric age groups in India.

This is the time…

- There is need to prepare for any such surge of covid cases in pediatric age groups
- Therefore, It is important to augment existing health facilities for children esp. ICU & HDU facilities at medical college and districts level hospitals while also strengthening community level care at PHCs and CHCs

Brief Clinical Presentation

Understanding this will help us understanding
Requirements for infrastructure



Guidelines for Management of COVID-19 in Children

COVID-19 symptoms in children – at a glance		
Common symptoms		
Fever	**Sore throat/throat irritation**	**Diarrhoea**
Cough	**Body ache/headache**	**Anorexia/nausea/vomiting**
Rhinorrhoea	**Malaise/weakness**	**Loss of sense of smell and/or taste**

Differentiating symptoms/signs	Asymptomatic	Mild	Moderate	Severe
Respiratory rate/min	**Normal** with age dependent variation	**Normal** with age dependent variation	**Rapid respiration** (age based) <2 months ≥60/min 2-12 months ≥50/min 1-5 years ≥40/min >5 years ≥30/min	**Rapid respiration** (age based) <2 months ≥60/min 2-12 months ≥50/min 1-5 years ≥40/min >5 years ≥30/min
SpO_2 on room air	**≥94%**	**≥94%**	**≥90%**	**<90%**
Grunting, severe retraction of chest	✖	✖	✖	**+/-**
Lethargy, somnolence	✖	✖	✖	**+/-**
Seizure	✖	✖	✖	**+/-**

MoHFW guidelines for management of COVID in children 18 June 2021

MANAGEMENT OF MIS*
IN CHILDREN & ADOLESCENTS TEMPORALLY RELATED TO COVID-19

*Multisystem Inflammatory Syndrome

Ministry of Health and Family Welfare, Government of India

mygov मेरी सरकार

DIAGNOSTIC CRITERIA (1/2)

Children and adolescents, 0–19 years of age with fever ≥ 3 days AND two of these:

- Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs
- Hypotension or shock
- Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs
- Evidence of coagulopathy (by PT, PTT, elevated d-Dimers)
- Acute gastrointestinal problems (diarrhoea, vomiting, or abdominal pain)

AND

MANAGEMENT OF MIS*
IN CHILDREN & ADOLESCENTS TEMPORALLY RELATED TO COVID-19

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Ministry of Health and Family Welfare, Government of India

mygov मेरी सरकार

DIAGNOSTIC CRITERIA (2/2)

Elevated markers of inflammation such as ESR, C-reactive protein, or procalcitonin

AND

No other obvious microbial cause of inflammation, including bacterial sepsis, staphylococcal or streptococcal shock syndromes

AND

Evidence of COVID-19 (RT-PCR, antigen test or serology positive), or likely contact with patients with COVID-19

Investigations: as listed above in criteria and investigations to rule out common differential diagnoses

Place of testing

Box 2: Framework for sites for screening/ testing and management of children with COVID-19/ MIS-C

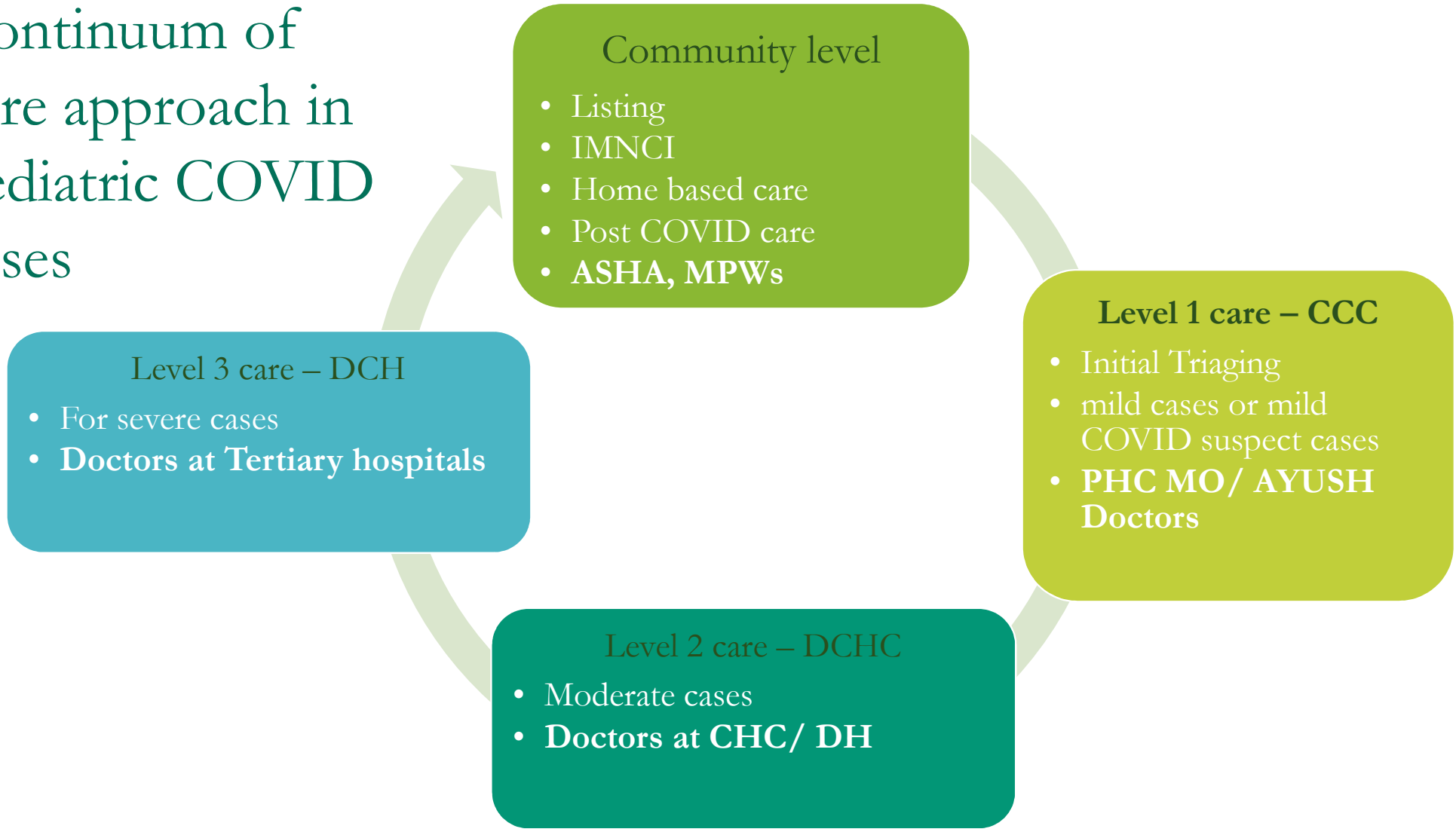
Screening	Confirmed COVID cases (PCR/ CBNAAT/ RAT positive)	MIS-C (PCR/ CBNAAT negative)
Existing screening facilities	Existing COVID facilities (CCC, DCHC, DCH, HDU, ICU)	In addition, also in existing Paediatric facilities- HDU/ ICU services.
Pediatrics ER		

- The indications for testing children for COVID-19 are the same as that proposed by the Ministry/ ICMR.
- Presence of a recent/ current confirmed case of COVID19 in a family member or a close contact raises the index of suspicion.

Infrastructure

Facility development, other services

Continuum of care approach in pediatric COVID cases

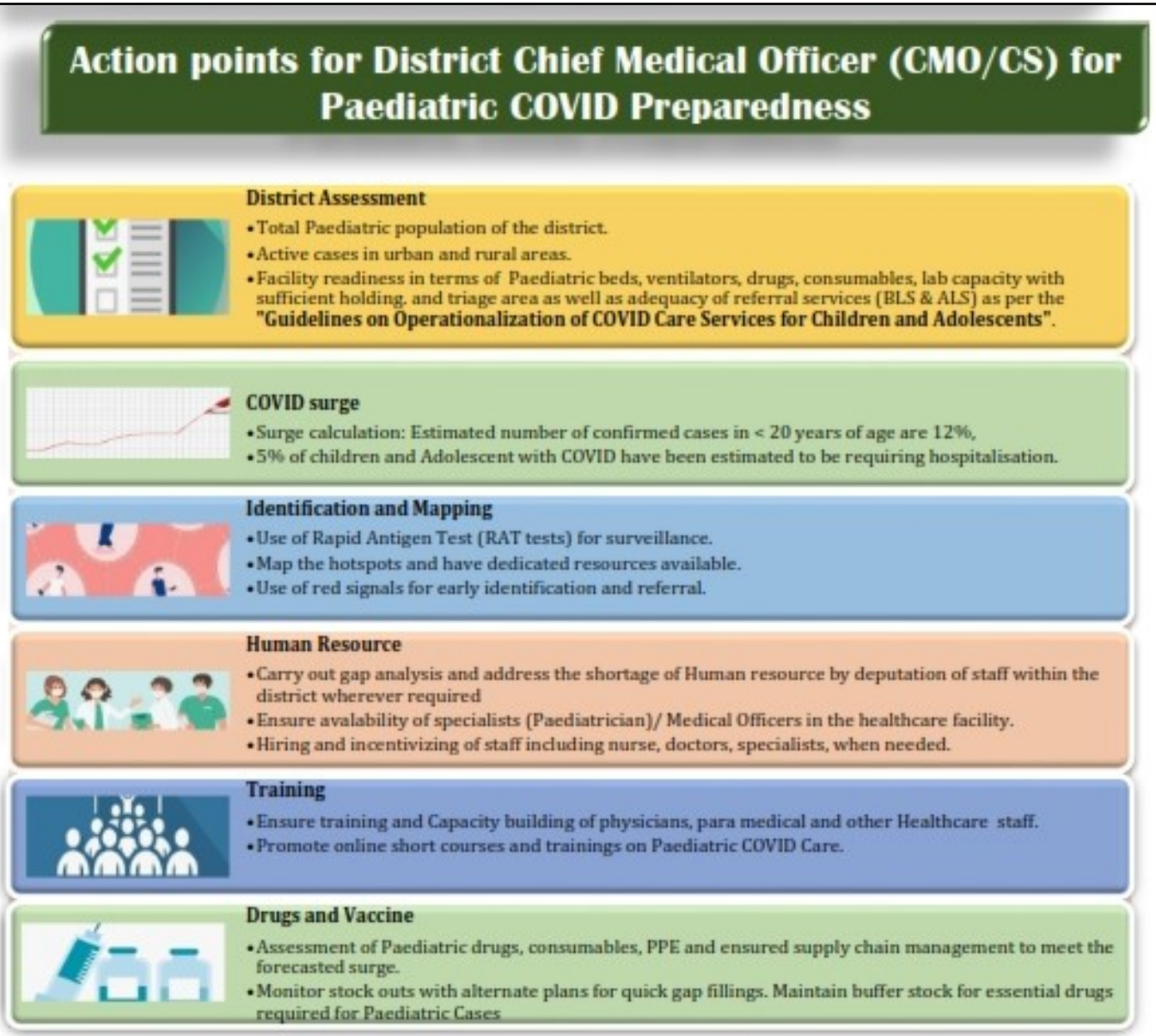


COVID-19 DISTRICT PREPAREDNESS & READINESS

FOR DISTRICT MAGISTRATE / DISTRICT MEDICAL OFFICER (FOR PAEDIATRIC COVID CARE)

What should District Administration Do

- Prepare District action plan (DAP) and mobilise resources for implementation of DAP.
- Promote IEC/BCC activities on Paediatric COVID care from community to facility level.
- Explore options for containment and control of COVID based on district specific context.
- Institute a mechanism for real-time data flow from the community and institutional based Paediatric COVID care for rapid response.



Action Points for ZD/CMHO/BCMHO/ RCHO

1. District assessment
2. COVID Surge
3. Identification and Mapping
4. Human Resources
5. Training
6. Drugs and Vaccine
7. IEC
8. COVID Grievances
9. District Control room
10. Quality assurance
11. Reporting
12. Monitoring of active cases in home isolation

IEC/BCC

- For the Community- Social distancing, avoid gathering, Vaccination, use of face masks & hygiene practices.
- Early reporting, testing, isolation and follow advise of healthcare workers.
- For Healthcare facility- covid protocols, hand hygiene, Infection prevention, use of PPE.

COVID Grievance

- Monitor 104/1031 for any COVID grievances. Ensure real-time response for emergency calls.
- Analyse the grievances for any health system gaps & ensure its response/gap.

District Control Room

. Ensure control rooms are functional round the clock, data from community & facility are received, real-time analysis is done.

. Technical manpower like pediatricians, physicians are linked for data analysis, forecasting & preparedness required for the district.

- The data is shared with State & National level functionaries for guidance.

Quality Assurance

- Work together with the facility's administration and doctors to ensure standards of care are of the highest possible quality.
- Adhere to the NQAS and Kayakalp Quality standards.
- Technical & administrative rounds are taken to ensure adherance.
- Infection prevention practices & BMW management of highest quality & standards is to be maintained.

Reporting

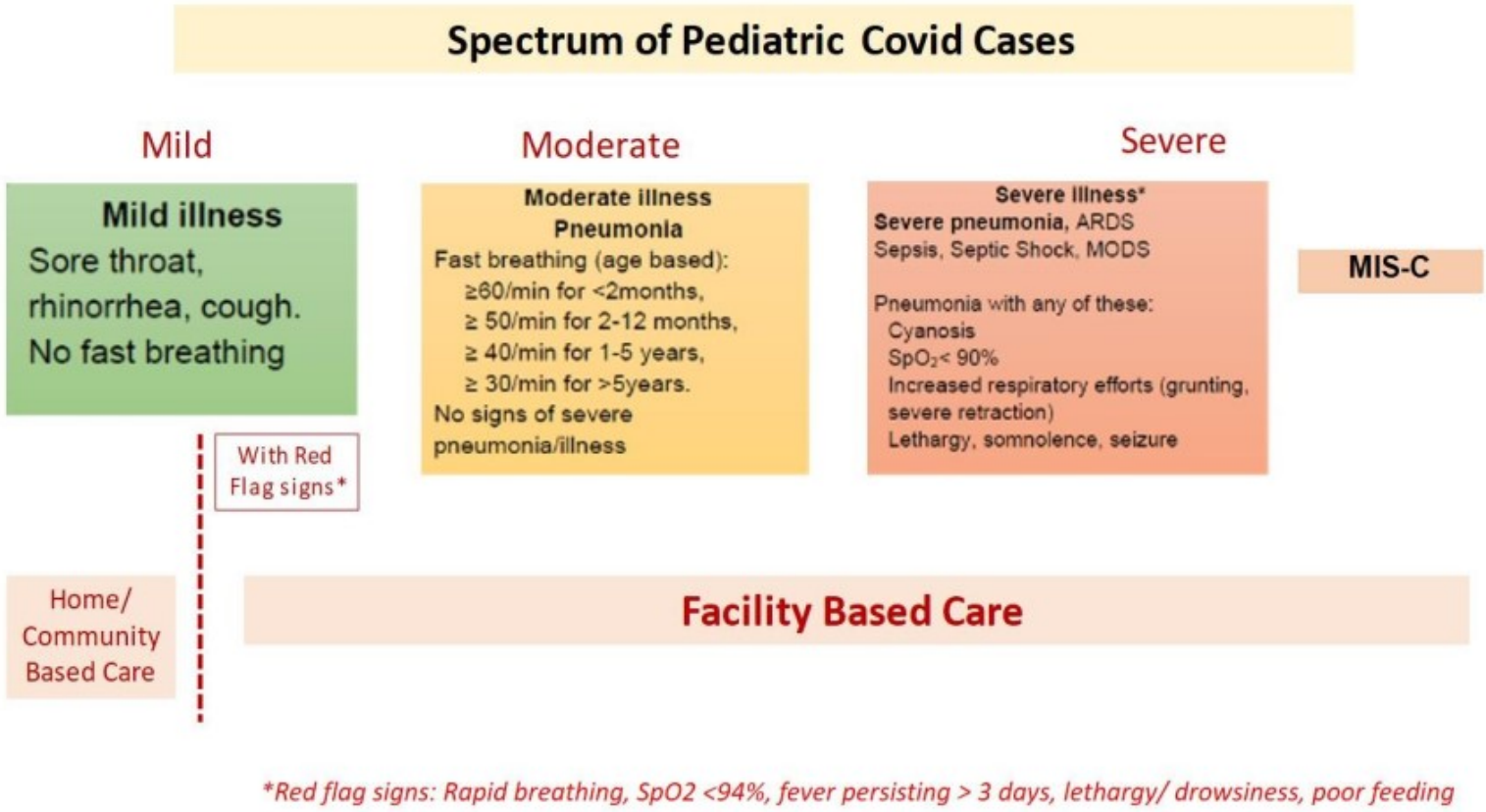
- Daily reporting of all the active Paediatric COVID cases, recovered cases and deaths.
- Ensure reporting of Oxygen supported beds, ventilator beds, bed occupancy for Paediatric COVID cases in the district.

Monitoring of Active Cases in Home Isolation

- Daily follow-ups for Paediatric patients under isolation/quarantine through telephone/household visits by a frontline worker/volunteers/teacher.
- Monitor adherance to infection prevention practices by healthcare worker visiting homes.

Place of treatment: Home or facility? Type of facilities ?

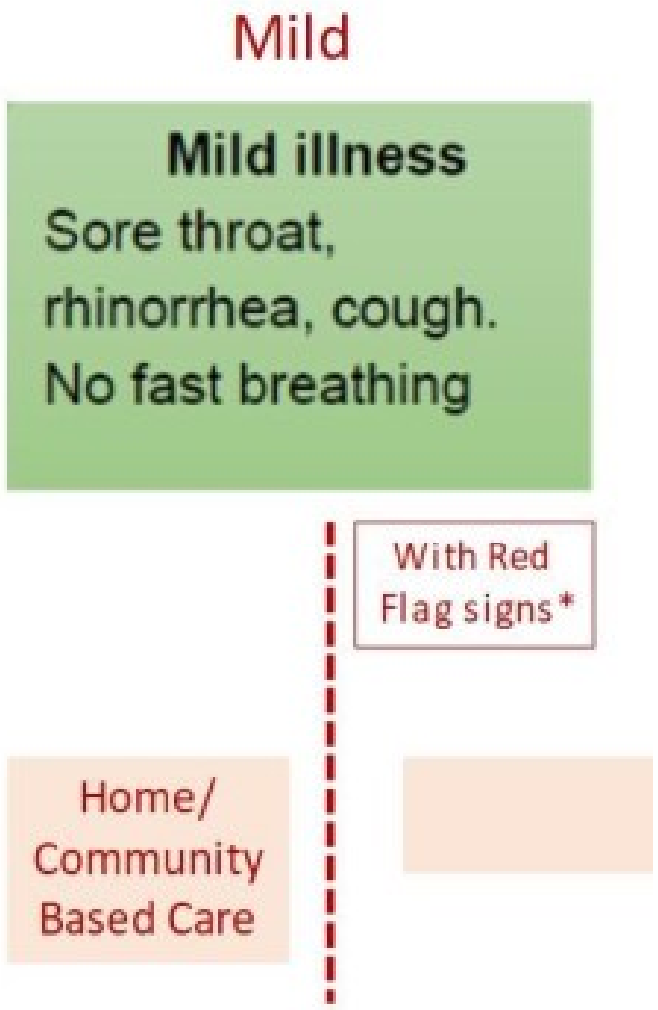
Figure 1: Spectrum of Pediatric COVID Cases and scope of management



Red flag signs: Rapid breathing, SpO2 <94%, fever persisting > 3 days, lethargy/ drowsiness, poor feeding

Home based care

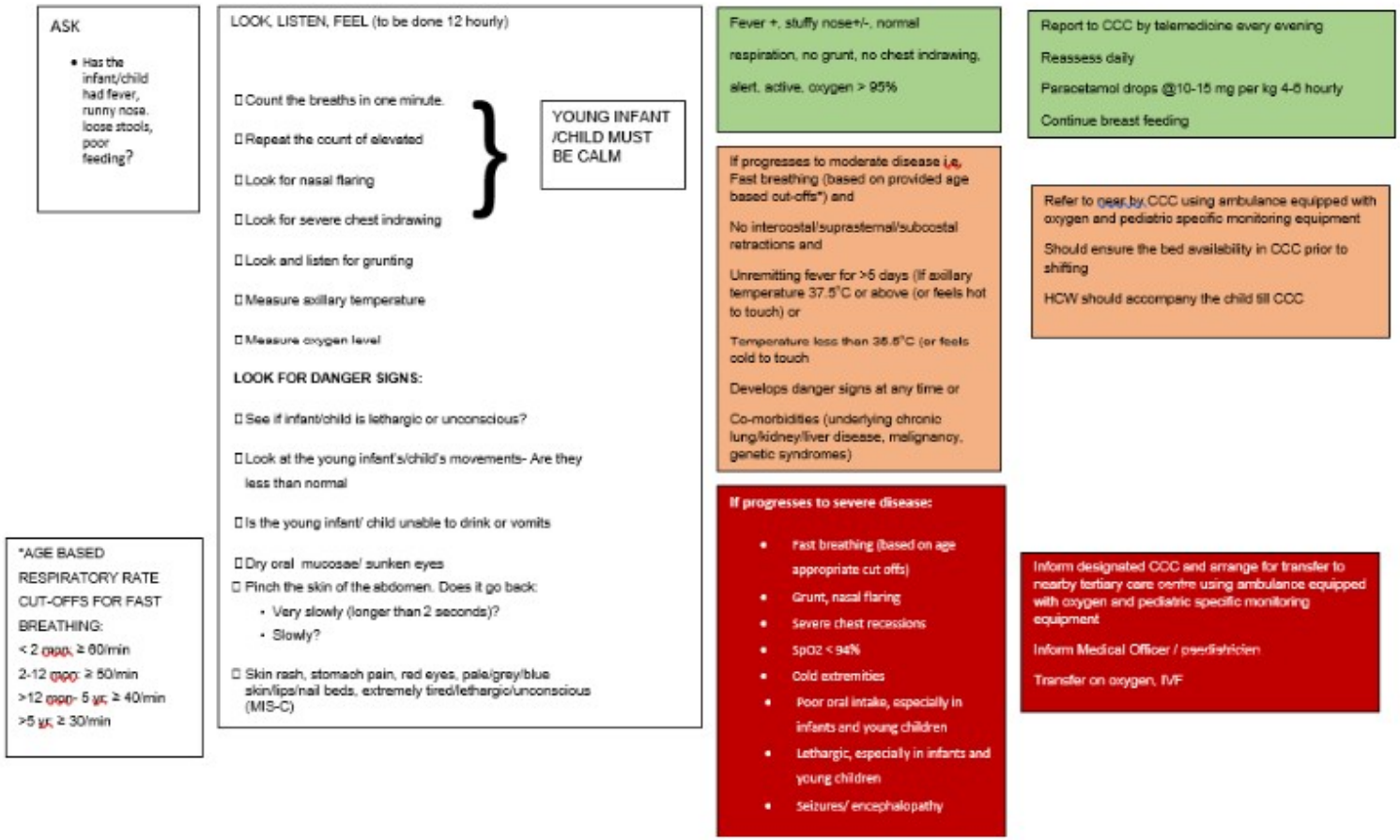
- Home based care provided to pediatric covid cases who are mild symptomatic/asymptomatic positive or contacts of positive cases at home
- Will be provided by ASHA/MPW/ANM/LHV
- Identification based on IMNCI type approach and prompt referral to facility based care when red flag signs are identified



IMNCI framework for Pediatric COVID

- At a community level, use of the IMNCI framework to manage children may suffice.
- Based on Same principals of IMNCI-Ask,, Look, Listen and Feel, Decide
- ASHA/MPW/ANM/SN/LHV can be provided with Pulse oximeter, Thermometers, and be trained in IMNCI based identifications and deciding basic primary treatment at community level or deciding for referral.
- The framework will be able to identify sick children needing referral. However, all children with fast breathing and confirmed COVID-19 will need referral for admission.

Figure 2: IMNCI type approach for COVID-19 in children



IMNCI type approach for covid-19 in children

ASK

Has the infant had fever, runny nose, loose stool, poor feeding

LOOK, LISTEN, FEEL (to be done 12 hrly.)

- ❑ Count the breaths in one minute
- ❑ Repeat the count if elevated
- ❑ Look for nasal flaring
- ❑ Look for severe chest indrawing

Young infant/child must be calm

- ❑ Look and listen for grunting
- ❑ Measure axillary temperature
- ❑ Measure oxygen level

LOOK FOR DANGER SIGNS

- ❑ See if infant/Child is lethargic or unconscious
- ❑ Look at the young infant/child's movements- are they less than normal
- ❑ Is the young infant/child unable to drink or vomits
- ❑ Dry oral mucosa/sunken eyes
- ❑ Pinch the skin of the abdomen. Does it go back:
  - Very slowly (longer than 2 sec.)
  - Slowly?
- ❑ Skin Rash, Stomach pain, red eyes, pale/grey/blue skin/Lips/Nail beds, extremely tired/lethargic/unconscious (MIS-C)

Age based Respiratory rate criteria for fast breathing

< 2 mo. ≥60/min
2mo-12mo: ≥ 50/min
12mo-5yr.: ≥40/min
>5 yrs.: ≥30/min

Fever, Stuffy nose +/, normal respiration, no grunting, no chest indrawing, alert, active, Spo2 >95%

Report to CCC by telemedicine every evening
Reassess daily
Paracetamol 10-15 mg/kg/ dose every 4-6 hrly.
Continue breast feeding

If progress to moderate disease i.e. fast breathing (based on provided age based cut-offs*) and

No intercostal/ suprasternal/ subcostal retractions and

Unremitting fever for >5 days (if axillary temp. 37.5C or above (or feels hot to touch)

Develops danger signs at any time or

Co-morbidities (underlying chronic lung/skin/liver disease, malignancy, genetic syndrome)

Refer to near by CCC using ambulance equipped with Oxygen and pediatric specific monitoring equipment

Should ensure the bed availability in CCC prior to shifting

HCW should accompany the child till CCC

IMNCI type approach for covid-19 in children

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If progress to severe disease:

Fast breathing (based on age appropriate cut offs)

Grunt, nasal flaring

Severe Chest retractions

Spo2 <94%

Cold extremities

Poor oral intake, especially in infants and young children

Lethargic, especially in infants and young children

Seizure/ encephalopathy

Inform designated CCC and arrange for transfer to nearby tertiary care center using ambulance equipped with oxygen and pediatric specific monitoring equipment

Inform Medical officer/pediatrician

Transfer on Oxygen, IVF

Age based Respiratory rate criteria for fast breathing

< 2 mo. ≥60/min
2mo-12mo: ≥ 50/min
12mo-5yr.: ≥40/min
>5 yrs.: ≥30/min

Roles & Responsibilities of ASHA for Paediatric COVID Care

Awareness Generation in community

- What are the signs and Symptoms of COVID -19 in Paediatric Age group
- What are the Red flag signs- Whom to contact in emergency
- Where to go in case of symptoms
- What are the COVID Appropriate Behavior (CAB)
- When and where to get tested
- Reassurance to community that there is no need for Panic

Whom to visit

- Visit all houses with children and communities.

How Often

- During routine services and house to house visit

Surveillance

- House to House survey

Whom to visit

All homes with special focus on:

- Influenza like illness in child (Fever/Cold/ Runny nose/ Sore throat/ Cough etc
- Acute respiratory symptoms in child
- When the child has co- morbid conditions (Chronic disease/ Malnutrition)

Case Management and follow-up for Paediatric COVID

- Adherence to Home isolation guidelines
- Linking of the child to the higher facility in case of complication
- Post COVID follow-up

Whom to visit

- COVID positive / suspected children

How Often

- At least once a day / Telephone enquiry

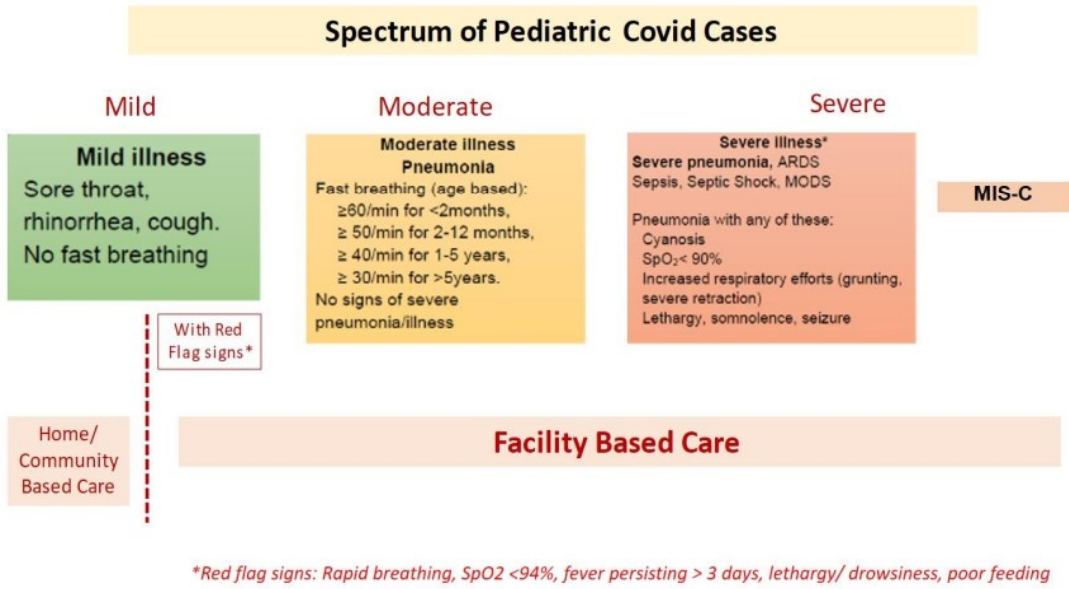
Vaccinations

- Dispel myths and misconception.
- Mobilization for Routine Immunization of the child
- Facilitation in registration of eligible parents and caregivers for COVID vaccination

Facility based care

- Facility based care to be given at CCC/DCHC/DCH
- Provided by medical officers and above

Figure 1: Spectrum of Pediatric COVID Cases and scope of management



Red flag signs: Rapid breathing, SpO2 <94%, fever persisting > 3 days, lethargy/ drowsiness, poor feeding

Facility Based Care

1. **CCC: Covid care centers-** are makeshift facilities proposed to offer care for cases clinically assigned as mild, very mild or COVID-19 suspect cases. (except as defined in moderate to severe categories)
2. **DCHC: Dedicated Covid-19 Health center-** shall offer care for 'moderate' cases (spo2 90-94%, asymptomatic but comorbidities/ age >50yr/ age <10 yrs./ Pregnant & lactating mothers)
3. **DCH: Dedicated Covid Hospital-** shall offer care primarily for 'severe' cases (Spo2 <90%, age >60 with comorbidities, all severe cases as assessed by medical officers)
4. **HDU:** High dependency Unit- offers semi ICU care with non-invasive ventilation, high monitoring etc.
5. **ICU:** Give highest medical care with invasive ventilation, vasopressor support etc.

https://www.mohfw.gov.in/pdf/FinalGuidanceonMangaementofCovidcasesversion2.pdf

Facilities based care: **COVID-19 Care Centre (CCC)**

- Where? All PHCs/Non-FRU CHCs/Urban PHCs
- If case overload occurs- make shift facilities can also be created so the existing hostels, hotels, schools, stadiums, lodges etc., both public and private facilities (Eg. Bilwa center in Jaipur) can be used for the same
- Which cases? Mild cases, Mild suspected cases where there is no facility for home isolation
- Essentials? All CCC should be mapped to one or more DCHC in case the patient requires referral.
- One BLS enabled ambulance is to be attached with each of these facilities with sufficient oxygen support on a 24x7 basis
- The AYUSH doctors can be utilized in giving clinical care in these hospitals.

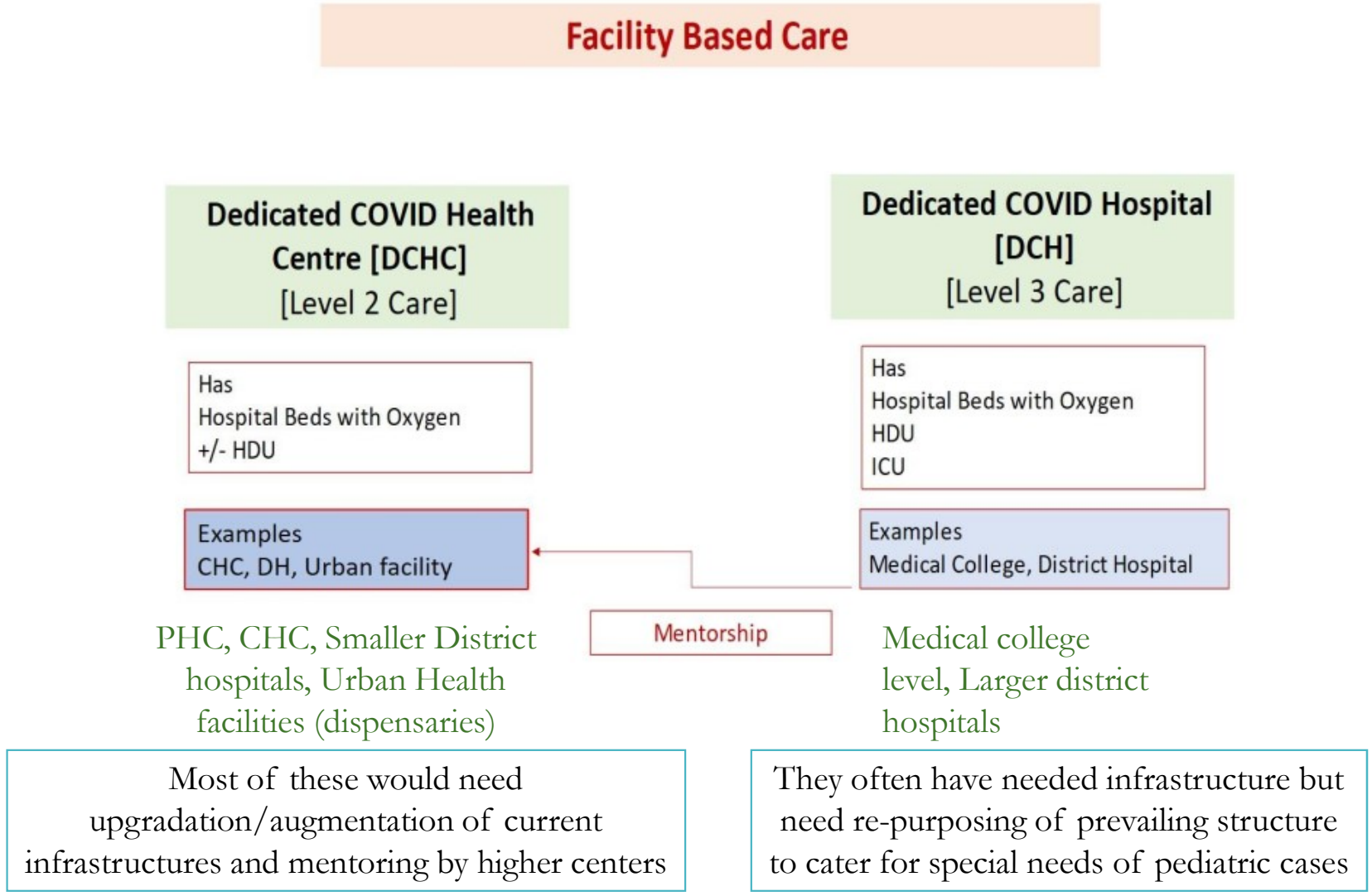
Facilities based care: **Dedicated COVID-19 Health Centre (DCHC)**

- Where? All FRU- CHC, SDH, DH, AH etc.
- Which cases? Moderate cases (as described before)
- Essentials?
- They are either a full hospital or a separate block in a hospital with separate entry and exit and zoning area.
- These hospitals are to have assured Oxygen support and have an appropriate referral mechanism for referring to higher centre i.e., DCH, if the symptoms worsen.
- 10% of total beds at DCHC can be earmarked for paediatric cases;
- these should be equipped well to handle pediatric cases.
- There should be provision for augmentation by another 10%, if need arises.

Facilities based care: **Dedicated COVID-19 Hospital (DCH)**

- Where? All FRU- CHCs, DH, SDH, GH, AH, Medical Colleges
- Which cases? Clinically assigned severe (as described before), all referred cases from CCC, DCHC
- Essentials?
- 10% Ten percent of total beds at DCH can be earmarked for paediatric cases and 10% more can be further augmented.
- All DCH with more than 300 beds should have a separate area designated for children.
- should be equipped with fully functional ICUs and Ventilatory beds with assured Oxygen Support.
- Smooth ambulance facility for inter-facility transfer
- Augmentation of additional beds/ ICUs will be done in the existing identified DCH facilities.

Figure 3: Types of Facility based care



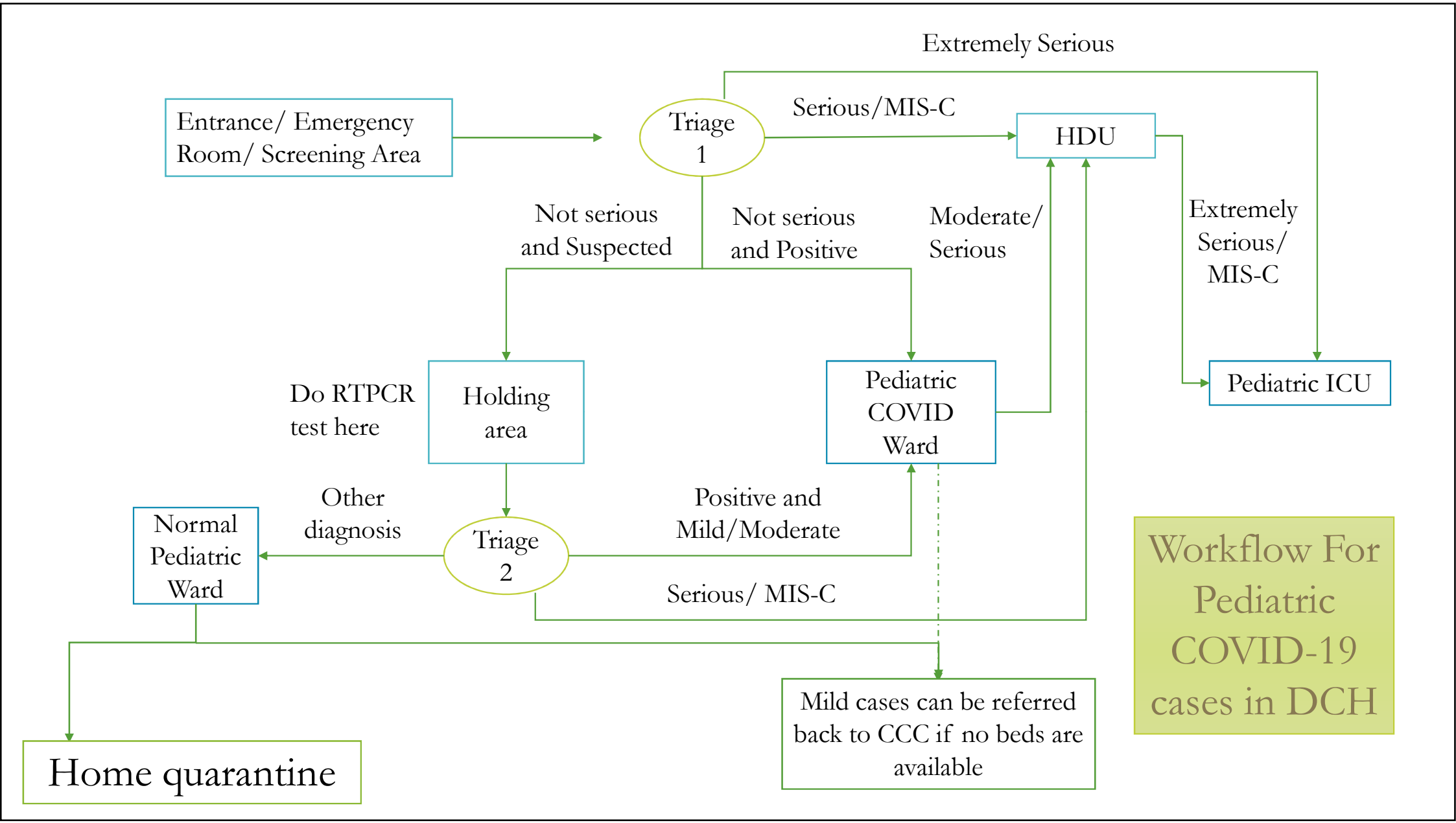
What are requirements for these facilities?

- Pediatric Wards: This infrastructure will need additional resources to care for the increased number of child patients who often would need accompanying one family member.
- Children's area/wards should preferably be separate from adult wards for their mental comfort and to ensure parent is allowed to accompany the child, in contrast to the policies in adult area.
- In addition, to cope up with a **COVID-19 related condition unique to children- MIS-C, there is also** a need to strengthen the existing health facilities for providing assured quality critical care.
- Emergency Room: The emergency services need strengthening.

- Holding Area: To keep patients suspected to have COVID-19, while awaiting reports, a holding area is required.
- The available holding area mainly for adult patients may be augmented to provide appropriate space for children.
- Triage System: There has to be appropriate triage systems in place.
- Triaging involves two stages - One at the entrance/ screening facility/ ER, and the other at the holding area before entering into the isolation ward/rooms.
- It consists of both screening plus detailed evaluation where in patients can be monitored before being wheeled into specific hospital isolation wards.
- HDU/ICU: Such a facility should have facilities for oxygen therapy, HDU and preferably ICU support.

Augmentation of the above facilities for pediatric care

- Most importantly, above said infrastructure should be developed- Separate Pediatric covid wards/dedicated covid beds with holding areas, triage system should be developed, referral system should be developed
- Appropriate tools for monitoring should be available (e.g., pulse oximeters with pediatric and newborn size probes), non invasive BP/invasive BP, ABG, Biochemical markers like TropT, ProBNP
- Appropriate formulations of medications required for supportive care should be available. e.g dopamine, dobutamine, milrinone, IvIG, MPS
- Adequately trained manpower (doctors and nurses) should be available for care of sick children (details below).


Extremely Serious
Entrance/ Emergency Room/ Screening Area
Triage 1
Serious/MIS-C
HDU
Not serious and Suspected
Not serious and Positive
Moderate/ Serious
Extremely Serious/ MIS-C
Pediatric ICU
Do RTPCR test here
Holding area
Pediatric COVID Ward
Other diagnosis
Positive and Mild/Moderate
Normal Pediatric Ward
Triage 2
Serious/ MIS-C
Workflow For Pediatric COVID-19 cases in DCH
Home quarantine
Mild cases can be referred back to CCC if no beds are available

Common examples of anticipated care at different levels of care for Pediatric COVID patients are

Table 1: Examples of type of Care vis-à-vis type of facility

Type of Care	Examples
Level 2 Care	• Oxygen requirement up to 5 L/min to maintain oxygen saturation ≥95% with stable vital parameters • Oxygen by face mask or nasal prongs or oxy-hood • Monitoring by Medical doctor with a remote on-call Pediatrician / Internal medicine specialist
Level 3 Care	• Oxygen requirement >5 L/min and/or unstable vitals • Requisite backup (Lab, Radiology, Blood bank services etc) to maintain 24X7 ICU Care • High flow oxygen: Non rebreathing masks, High flow nasal cannula • Non invasive ventilation: Bubble CPAP, BiPAP • Mechanical Ventilation, • Monitoring under supervision of Pediatrician/ Intensivists

Table 2: Summary of recommendations for type of facility-based care for pediatric COVID cases

Type of Care	Recommended number of beds	Examples of Care	Recommended Oxygen source	Pediatric Ventilators	HR needs	Locations for set-up (examples)
Level 3 **[at DCH]**	30 PICU and HDU beds HDU beds: 3:1 PICU beds	Mechanical / Non-invasive ventilation Continuous monitoring of vital parameters Delivery of COVID positive mothers and care of neonates	LMO, PSA Units	At least 1/3rd of all HDU/ PICU beds. There should be provision to convert HDU to PICU beds with minimal inputs	Pediatrician/ Intensivist/ Obstetrician/ Anesthetist and corresponding required numbers of SR/JR in Med Colleges	Medical Colleges, Large District hospitals, Private health facilities

LMO: Liquid medical oxygen PSA: Pressure Swing Adsorption

Level 2 **[at DCH and DCHC]**	30-50 beds or depending on regional needs capable of providing oxygen therapy	Oxygen therapy needing a flow of 5L/minute	PSA Units/ Oxygen cylinders	Nil Can have equipment for NIV if expertise available	General Medical Doctor with on-call pediatrician	Smaller District Hospitals and Community Health Centres
Level 1 **[at CCC]**	Depends on local needs, part of COVID Care Centres for adults	Children of adults who are admitted at COVID Care centres; children with co-morbidities not needing oxygen therapy and home isolation care is not feasible	Oxygen concentrators Oxygen Cylinders	Nil	Paediatrician / Medical Officer with teleconsultation from paediatrician (Public/ Private)	At Corona Care Centres

1. No. of beds required for Pediatric cases in DCH/DCHC will depends upon regional need
2. All levels of care should be equipped with optimal transport facilities
3. The actual needs will vary depending on regional requirement
4. The above models can be either a hybrid model (with re-purposed beds meant for adult care under a given setting) or a standalone model specific for pediatric care.
5. For immediate scale-up, it is recommended that hybrid model with re-purposing of existing adult beds for pediatric care be made available. Simultaneously, efforts should be undertaken to develop specific pediatric beds.
6. Each pediatric bed should also cater for beds for corresponding care givers, alongside. This should have provision for the stay of a parent/ care-giver with the child.

How many beds will be required?

2-05-2021: 18,298 (Rajasthan)/day

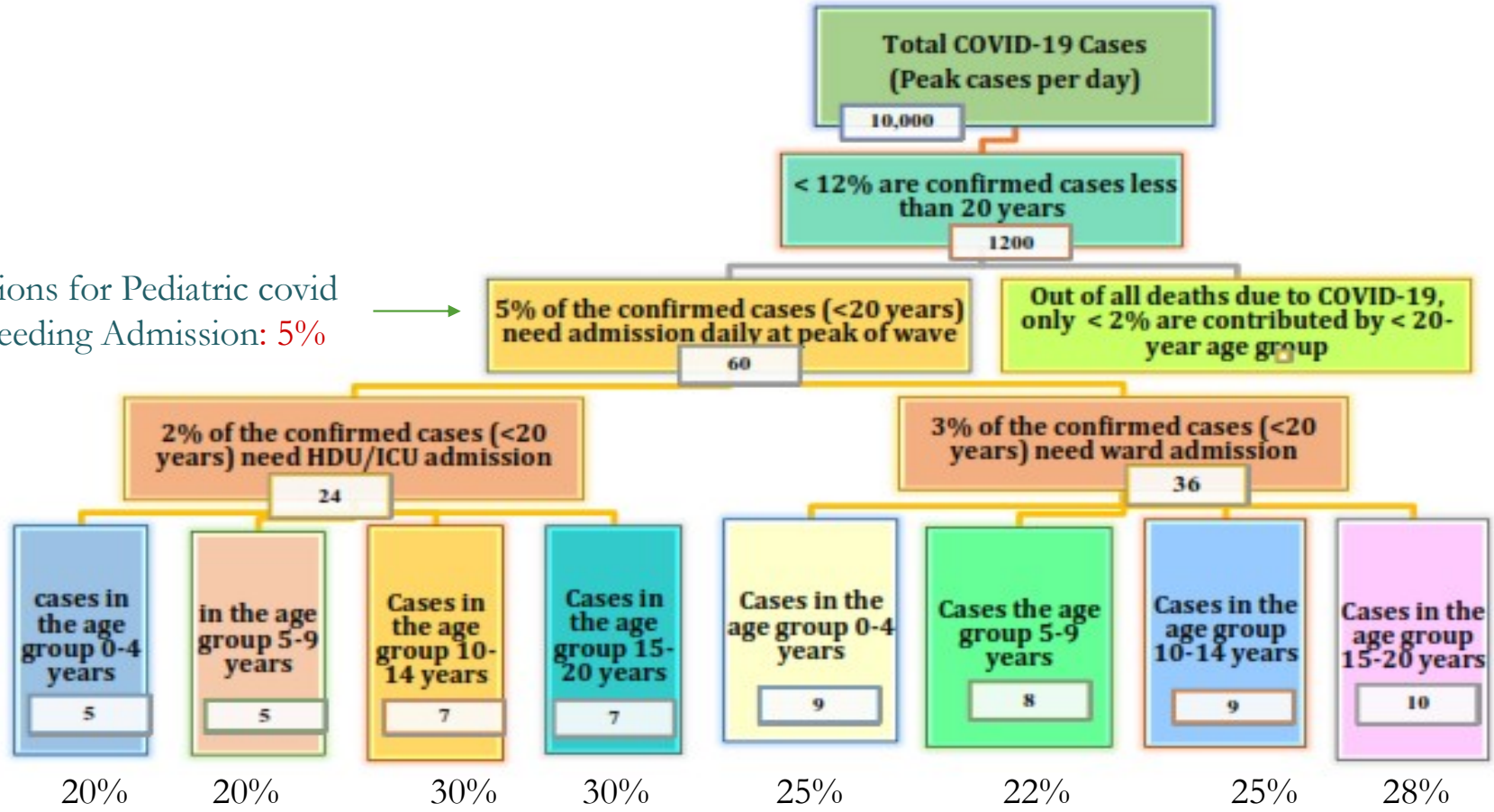
Box 1: Projections for beds for pediatric COVID care at different case loads

A	Peak cases per day →	100000	50000	20000	10000	5000	1000
B	Estimated number of confirmed cases in < 20 yr* at peak of the wave (@12% of A) [ref 1]	12000	6000	2400	1200	600	120
C	Percentage of children needing admission	5%	5%	5%	5%	5%	5%
D	Numbers of children needing admission daily at peak of wave (5% of B)	600	300	120	60	30	6
	1. Numbers needing ward admission	360	180	72	36	18	4 (3.6)
	2. Numbers needing HDU/ICU admission (2% of B)	240	120	48	24	12	2 (2.4)
E	Average length of stay of admitted child	10 days	10 days	10 days	10 days	10 days	10 days
F	Total Beds required for pediatric care for managing at the peak of the surge (D X E)	6000	3000	1200	600	300	60
G	Total Ward Beds required for pediatric care for managing at the peak of the surge (D1 X E)	3600	1800	720	360	180	36
H	ICU/ HDU beds required for pediatric care for managing severe disease at the peak of the surge (D2 X E)	2400	1200	480	240	120	24

* break-up for age groups available on NCDC dashboard at intervals of 10 yrs only.

Projections: Paediatric Ward, HDU/ICU beds requirement

Projections for Pediatric covid cases needing Admission: 5%



Bed & Oxygen requirements for Paediatric facilities

Bed Projections for Paediatric cases		
A	Peak cases per day	10000
B	Estimated number of confirmed cases in < 20 yr* at peak of the wave (@12% of A)	1200
C	Percentage of children needing admission	5
D	Numbers of children needing admission daily at peak of wave (5% of B)	60
D1	Numbers needing ward admission (60% of all admissions)	36
D2	Numbers needing HDU admission (25% of all admissions)	15
D3	Numbers needing ICU admission (15% of all admissions)	9
E	Average length of stay of admitted child (days)	10
F	Total Beds required for pediatric care for managing at the peak of the surge (D X E)	600
G	Total Ward Beds required for pediatric care for managing at the peak of the surge (D1 X E)	360
H	HDU beds required for pediatric care for managing severe disease at the peak of the surge (D2 X E)	150
I	ICU beds required for pediatric care for managing severe disease at the peak of the surge (D3 X E)	90

Oxygen requirements for Paediatric facilities		
J	Total Beds required for pediatric care for managing at the peak of the surge (D X E)	600
K	Total Ward Beds required for pediatric care for managing at the peak of the surge (D1 X E)	360
L	HDU beds required for pediatric care for managing severe disease at the peak of the surge (D2 X E)	150
M	ICU beds required for pediatric care for managing severe disease at the peak of the surge (D3 X E)	90
N	Oxygen requirements	
O	4 l/min for ward beds	1440
P	12 l/min for HDU+ICU beds	2880
Q	Total needed: L/min	4320
R	KL/day	6220.8
S	Add 20% for leakages, etc; Total required KL/d	7464.96
T	**Tonnes of liquid oxygen per day**	**10.67**

Pediatric Ward

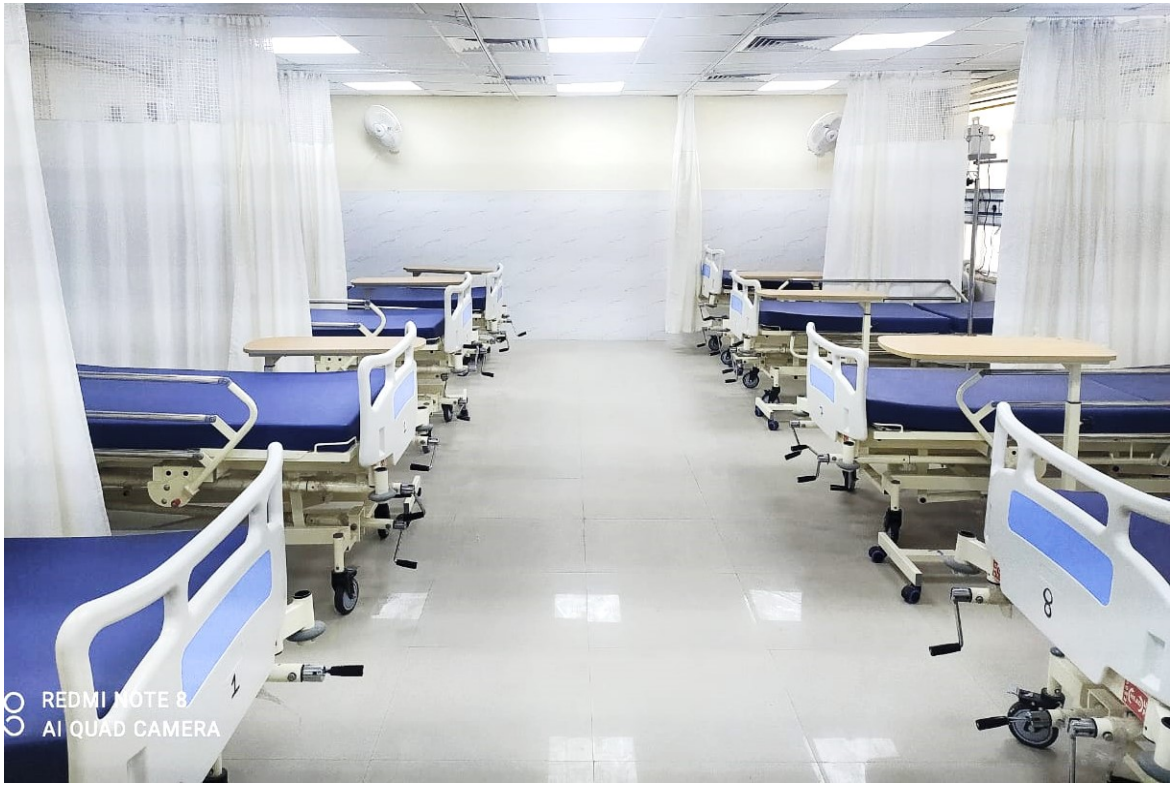
(Govt. RDBP Jaipuria Hospital, Jaipur)

Pediatric HDU

(Govt. RDBP Jaipuria Hospital, Jaipur)

Pediatric ICU

(Govt. RDBP Jaipuria Hospital, Jaipur)



Augmentation of facility for MIS-C

- MIS-C is a severe post-COVID-19 inflammatory disorder in children
- cases tend to peak 2-6 weeks following the peak of COVID-19
- MIS-C should be suspected in children with persistent fever beyond 3 days and some other clinical manifestation (see next slide, need different class on it)
- frequently associated with complications such as cardiac dysfunction, coronary aneurysms, thrombosis, and multi-organ dysfunction etc.
- Need early identification and management in HDU/PICU intensive care support (mechanical ventilation, shock management, facilities for echocardiography, as needed).
- Management: The main aspects of care are adequate monitoring esp. of the cardiovascular status. , organ support and immunomodulation (steroids-first line IV MPS), and IvIG

- For providing care to children with MIS-C, the existing pediatric facilities have to be strengthened.
- As per the IPHS norms, approx. 10% of beds in a district hospital should be earmarked for sick children.
- These facilities should be upgraded to have adequate emergency facility, and enough HDU beds.
- At a 300 bedded DH, the following can be recommended:
  - 4 beds in Emergency
  - 20 bedded Pediatric ward
  - 8 bedded HDU
  - 4 bedded ICU
- The numbers will proportionately be higher in DH with higher bed strength.
- These beds do not include the beds for newborn care and SNCUs.
- The administration should ensure that at least these minimum numbers of beds are assigned for Pediatrics and these are well equipped as well as well staffed.

Common services for all type of health facilities

- ***Waiting area***
- ***Diagnostic Services***
- ***Support services :*** Provision for medical gas pipeline system/ oxygen supply, laundry (on or off site), Sanitation, housekeeping services, Kitchen service, CSSD services (can be linked with main services). Services like Bio Medical Equipment Management, CSSD, Mechanized Laundry, Dietary Services
- ***Disaster Preparedness and Management***
- ***Fire Safety***
- ***Electrical Load*** Similarly, fluctuation in voltage also adversely affects the equipment and hence automatic voltage regulators which regulate fluctuating input power voltage should be provided

- ***Oxygen Support*** it is critical for Emergency Department, Intensive Care Units (ICUs), oxygen supported beds, isolation wards/rooms, etc. Oxygen generator based system to generate oxygen in-house is recommended
- ***Security arrangements*** Should be adequate, female security guards for female wards. CCTV cameras. Security services should be properly planned and staff should be trained accordingly.
- ***Staff room/Rest room***
- ***Development of inter-facility transfer*** preparation of ambulance with all necessary equipment for BLS and O2 supply, with trained personnel in BCLS
- **Records, Registers & Death Audits**

Equipment and Medications

Requirements at various covid facilities

Table 1: Proposed standard of Pediatric COVID Care at CCC (Level 1) facility/CHC

Essential Equipment (per 25 beds)	Consumables	Drugs / Medications
• Resuscitation Couch/ Bed (1-2) • Self-inflating bags newborn (250 ml), infant (500ml) & pediatric (750 ml) (1-2 of each size) • Masks newborn, Infant, child (00,0,1,2) • O2 cylinders / Oxygen concentrators (2 Jumbo) • Laryngoscope handle and blades (curved & straight) of all sizes (1-2) • Pulse oximeter (1-2) • Electrical / foot-operated suction machine (1-2) • Glucometer & strips (1-2) • Thermometer (1 per bed) • ECG machine -1 • Radiant warmer (1) • Emergency trolley (1) • Measuring tape (1-2)	• Oxygen delivery devices: Nasal prongs, simple face masks, non-rebreathing masks, oxygen hood • Pediatric NRBM masks, Simple face masks and nasal cannula of all sizes • Oral / nasopharyngeal airways (different Ped. sizes) • Endotracheal tubes (2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0 cuffed and uncuffed) • Intra-osseous needle • IV infusion sets/dosiflow • IV cannulae (size 20,22 or 24,26G), three way • Adhesive tape, 2 sizes • Syringes 1 ml, 2 ml, 5 ml, 10 ml • Disposable needles 22,23,26 G	• Oral Rehydration Solution • Paracetamol (oral Syp. And Tabs, per rectal, IV) • Inj. Atropine • Inj. Adrenaline • Inj. Sodium bicarbonate • Inj. Calcium gluconate • Inj. Magnesium Sulphate (50%) • Inj. Phenobarbitone, Inj. Phenytoin • Inj. Diazepam, • Nasal/ buccal/ rectal diazepam or midazolam (desirable) • Salbutamol (MDI) • Inj. Hydrocortisone, dexamethasone), Tab. Prednisolone • Inj. Furosemide • Inj. oral Ampicillin, Amoxicillin, cloxacillin

• Weighing scales for infants and children (1 each) • NIBP with all cuff sizes (1-2) • Torch (1-2) • Stethoscope (1-2) • Algorithms/flow charts • Printed drug dosages for children • AED (desirable) • X-ray view box (1) • Table and chairs for staff (2) • Almirah (2)	• Nasogastric tubes (sizes 6,8,10,16 fr) • Suction catheters: size 6, 8,10,12 Fr • RL / NS • 0.45% Saline with 5% Dextrose • Dextrose 10% ,25%, 50% • Povidone-iodine for local application, Spirit swabs • Spacers and Masks • Hand Rub • Gloves • Medical Waste Segregation Buckets	• 3rd generation cephalosporin • Inj. gentamicin/amikacin • Inj. Ranitidine/pantoprazole • Inj/Oral Anti-histaminics (Avil) • Inj. Potassium chloride • Inj. LMWH/UFH • Syp Zinc • Syp. Multivitamin
• IV stands (2) • Needle cutters (1) • Patient Stretcher and Wheelchair (1-2) • Water Cooler – 1 for each facility • Refrigerator – 1 for each facility • BLS Ambulance with 24X7 oxygen support – mandatory 24X 7	• Bandages, adhesives • Pediatric drip set	

Table 2: Proposed standard of Pediatric COVID Care at DCHC (Level 2) facility

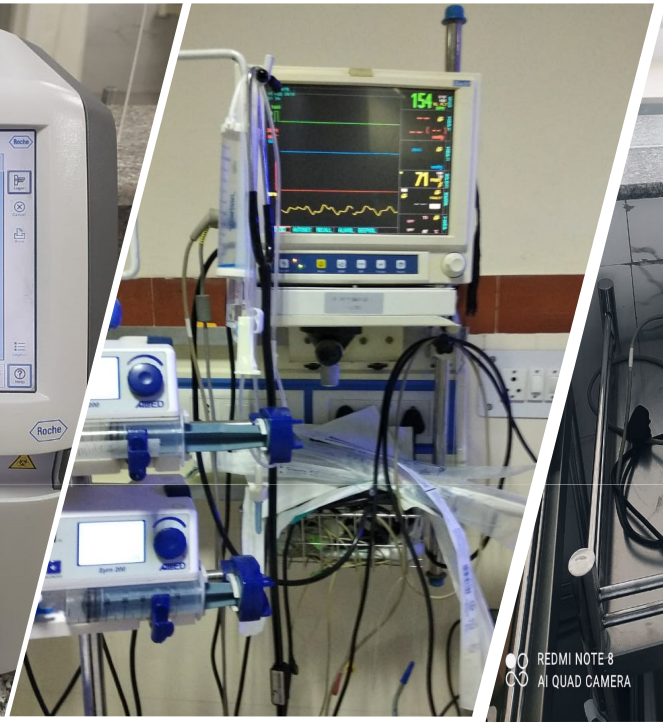
Essential Equipment	Consumables	Drugs/Medications
In addition to Level 1, • High flow nasal cannula (HFNC) • Bubble CPAP • BiPAP machine with appropriate pediatric NIV mask • Venturi masks • Syringe pumps • Otoscope • Ophthalmoscope • Defibrillator • Patient Transport trolley/ ventilator • Multi para monitors • 12 lead ECG machine • Ventilators (invasive & non-invasive) if skilled manpower is available • Indigenous CPAP/ Bubble	**In addition to Level 1,** • Blood transfusion sets • LP needles, ICD tubes (8,10,12 Fr), bags • Tracheostomy Kits • Ventilator tubing's • NIV masks(pediatric size) • Central venous lines (optional) • Umbilical catheters • Closed Suction Catheters(6,8,10,12Fr) • Urine Catheters and bags • Foley's catheters 6, 8, 10, 12, 14Fr • Urometers	**In addition to Level 1,** • Inj. Ketamine • Injections Dopamine, dobutamine, adrenaline, nor epinephrine, • Inj. Adenosine, Amiodarone, lidocaine • Inj. Fentanyl, Inj. morphine • Inj. Trenaxemic acid • Inj. Valproate, Inj. Leviteracetam • Inj Methylprednisolone • Inj IVIG

Table 3: Proposed standard of Pediatric COVID Care at Level 3 (DCH)

Essential Equipment	Consumables	Drugs/Medications
In addition to Level 2, • ICU ventilators capable of ventilating all pediatric age group including preterm neonates • Pediatric and neonatal reusable ventilator circuits with appropriate heating wire, humidification chamber, temperature sensor probes for humidification • Endotracheal cuff manometer • Portable USG with pediatric appropriate probes • Renal replacement therapy (in referral centers) • Transport Ventilator • Air Mattresses • Blood storage services	In addition to Level 2, Central venous access (3, 3.5, 4, 4.5, 5Fr catheters) Arterial line transducers Peritoneal dialysis catheters PD Dialysis Fluid Closed suction catheters Suction catheters sizes: 6,8,10,12,14,16Fr with gradation over (not plain) Pediatric and Neonatal HMEs • Neonatal and pediatric disposable ventilator circuits • Endotracheal tubes both cuffed and uncuffed (3,3.5,4,4.5,5,5.5,6,6.5) • Tracheostomy tubes (3, 3.5, 4, 4.5)	In addition to Level 2, Inj. Milrinone, Inj. Vasopressin Inj. Albumin Antibiotics: Piperacillin-Tazobactam, Meropenam, Colistin, Septran, Levofloxacin Inj. AMB, fluconazole

At all facilities esp. at DCHC & DCH

- 1. Beds: Includes standard electrical fittings per type of bed as per standard hospital parameters.
- 2. Oxygen source could be from central pipeline, cylinders or concentrators. But all ICU beds must have central pipeline oxygen source.
- 3. Compressed air source: Are mandatory for ICU Ventilators. If the ventilators are turbine driven, then air compressors not needed.
- 4. Suction source could be central suction or stand-alone suction machine.



ABG Machine

Multipara monitors &
Infusion pumps

ECG Machine

Crash Cart Trolley

Few essential equipment in a PICU

RDBP Jaipuria Hospital, Jaipur

Training

- Capacity building of HR on surveillance, infection prevention and control, clinical management and risk communication should be ensured.
- Both the doctors and nurses posted in emergency, HDU/ICU, pediatric wards should be trained in routine and critical pediatric care.
- A combination of online training with virtual interactions, and supplemented by in-person training (Hybrid) may be developed for optimal capacity building.
- The regional centers should supervise the medical colleges and each of the medical colleges could support/ mentor 2-4 district hospitals; appropriate linkages for the same should be developed.
- Training modules available on the website of MoHFW (https://www.mohfw.gov.in/) or iGOT Diksha portal

Neonatal COVID

Infrastructures

Care of neonates born to COVID-19 positive mothers

- Up to 10% of neonates born to COVID-19 positive mothers may be RT-PCR positive for SARS-CoV-2 during birth hospitalization.
- Majority of these neonates remain asymptomatic.
- Occasionally, moderate to severe infections with oxygen requirement can occur
- Separate facilities should be developed for delivery of covid positive mothers
- These neonates (covid positive mother) may however needs SNCU/NICU care for prematurity or other complications of birth
- Breastfeeding, KMC is not contraindicated, however all covid precautions like face mask, hand sanitization and clean clothes should be used
- Routine immunization should be done for all stable neonates

Neonates with Late-onset Covid-19 disease

- An increasing number of neonates with moderate to severe Covid-19 pneumonia and gastrointestinal symptoms have been seen.
- These neonates typically acquire the infection at home from other family members.
- Occasional cases of MIS-N related to COVID antibodies transmitted from the mother have also been seen.
- Where to deal such cases? The pediatric HDU/ ICU should have suitable equipment and surgical items for care of these neonates e.g., servo-controlled open care systems, air-oxygen blending systems, CPAP, ventilators capable of supporting preterms and appropriate sized nasal interfaces and endotracheal tubes.
- These Facilities dealing with late-onset neonatal covid should have all infrastructure/ equipment/ treatment as it is done in SNCUs

Table 3: Requirements for various scenarios for new born care

S No.	Type of facility	Type of care	Location	Remarks
1.	Newborn Care Corners	Resuscitation facilities	Next to or within each delivery area for suspect and confirmed Covid-19 pregnant women	Special attention required for ensuring thermoregulation and availability of blended air-oxygen
2.	Special Care Newborn Unit/Neonatal intensive care Unit for care of 'suspect' neonates	Special or intensive care for prematurity or other perinatal illnesses.	Ideally should be located close to the delivery area. Can be part of pediatric suspect ward, or as a standalone unit, or carved out of existing SNCU/NICU with separate entry/exit and donning/doffing facilities.	Special attention required for ensuring thermoregulation and appropriate equipment. As majority of neonates born to Covid-19 mothers will turn out to be negative and will need to stay in the area for 5-6 days before they can be confidently declared negative for SARS-Cov-2, this area will need the largest proportion of neonatal beds, staff and equipment

S No.	Type of facility	Type of care	Location	Remarks
3.	Special Care Newborn unit /Neonatal intensive care unit for care of 'confirmed' neonates	Special or intensive care for prematurity or other perinatal illnesses or early onset Covid-19 disease	Part of pediatric COVID confirmed area	As the number of such cases is going to be small, it will be more efficient to locate them within the pediatric COVID facility.
4.	Postnatal COVID ward /rooms for mother-baby dyads	Rooming-in of stable babies with suspect or confirmed Covid-19 mothers	Part of obstetric postnatal wards/rooms for 'suspect' or 'confirmed' Covid-19 mothers.	Equipment and staff for monitoring and essential neonatal care will be required. (thermoregulation, lactation and KMC support, monitoring for blood glucose, jaundice and phototherapy

S No.	Type of facility	Type of care	Location	Remarks
5.	Well-baby COVID area	Rooming-in of stable neonates with family caregivers in case of non-availability of mother.	An area under pediatrics will have to be marked for this. If such a facility cannot be created, these babies may be accommodated in the SNCU for 'suspect' cases (item no.2) until fit for discharge	Family members may also be positive or not available for baby care. In such cases, the babies can be accommodated in the SNCU for 'suspect' cases.

Practical tips: A separate SNCU nursery with separate exit, entry and staff area can be allotted for suspected/covid positive neonates where limitation of space for creating a separate facilities for covid neonates is not available

Management protocols for COVID neonates and infant is beyond scope of this presentation and will not be discussed here.

Take home message

- Prepare early for 3rd wave
- It is desirable to augment the existing covid care facilities to provide care to children with acute covid.
- This will need additional pediatric specific equipment, infrastructure, and pediatric formulations.
- In standalone pediatric hospitals, separate arrangements for example - separate bed for pediatric COVID care need to be established.
- Adequate number of trained manpower- both doctors and nurses should be provided.
- At the community level, it is important to train community health workers to pick red flag signs.
- All stake holders including the community should be educated by IEC.
- The health authorities should initiate capacity building programs for appropriate pediatric care.

THANK YOU

Together we can, and we will save children from this pandemic