WEEKLY EPIDEMIOLOGICAL REPORT

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Vaccine Manufacturing Process - Part I

Vaccine Manufacturing Process

Annually, over 1 billion doses of vaccines are produced worldwide and are administered to perfectly healthy individuals as a preventative measure. This proactive approach is essential for maintaining public health, as it helps to build immunity within communities and prevents the spread of infectious diseases. Vaccinating healthy people protects them and contributes to herd immunity, which is crucial for safeguarding those who cannot receive vaccines due to medical conditions or other reasons.

A vaccine is a biological product designed to stimulate the immune system to recognize and protect against specific pathogens, such as viruses or bacteria. Vaccines are typically made from weakened or inactivated forms of the pathogen, parts of the pathogen (subunits), or genetic material (like mRNA) that encodes a portion of the pathogen. When a person receives a vaccine, it triggers an immune response without causing the disease itself. This response allows the immune system to "learn" to recognize and remember the pathogen, creating immunity.

The vaccine manufacturing process is inherently lengthy due to the need for thorough research, extensive testing, rigorous regulatory approval, and the challenges of scaling up production while ensuring quality and safety. This time lag is described as "MANDATORY ANTICIPATION," indicating that it is an inherent part of the vaccine manufacturing and distribution process. Vaccines delivered today began manufacturing in 2019. This indicates the importance of starting vaccine development well in advance to meet future public health needs.

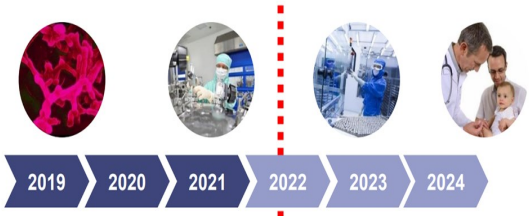

Figure 1: Mandatory Anticipation concept (SP Vaccinology Conference ADVAC, May 2022)

There is a significant time lag between the start of vaccine production and the delivery of the final product to the public. Initial Development and Research involves the initial discovery and research efforts to identify a potential vaccine candidate. Scientists study the pathogen (virus, bacteria, etc.), understand its structure, and determine the best approach for creating a vaccine. This stage includes laboratory research, preclinical studies, and initial formulation development. Once a promising candidate is identified, the process moves into early production and testing. This includes producing small batches of the vaccine for initial testing in clinical trials.

- Phase I clinical trials are used to demonstrate the safety of a candidate product in a relatively small number of healthy human volunteers (typically tens of individuals). These trials also verify the ability to manufacture the product by replicating the theoretical process used to produce preclinical materials for animal toxicology studies.

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- Phase II clinical trials are designed to demonstrate safety and dose-response in a larger target population, typically involving hundreds of volunteers. These trials aim to refine the initial consistency of product manufacturing, incorporating modifications and improvements based on the production and testing experience from Phase I trials.

- Phase III clinical trials are designed to demonstrate safety and efficacy in a statistically significant target population, which meet predetermined quality attributes. Based on the production and testing experience from Phase I and Phase II, modifications and improvements are incorporated into the manufacturing process, and specifications for process and control points are established.

Upon successful completion of early-phase trials, efforts shift towards scaling up the manufacturing process. This involves setting up large-scale production facilities, ensuring quality control, and producing larger batches of the vaccine. This stage also includes extensive regulatory reviews and compliance with Good Manufacturing Practices.

The vaccine manufacturing process is a complex and highly regulated procedure that involves several key steps to produce safe and effective vaccines. The specific process can vary depending on the type of vaccine (e.g., live attenuated, inactivated, subunit, or mRNA vaccines). Large molecule vaccines, such as certain subunit or recombinant vaccines, often involve complex manufacturing processes. The production of these vaccines can be more intricate than traditional small-molecule drugs. The complexity arises from the need to work with living cells, intricate purification processes, and precise formulation requirements. Some vaccines involve the use of live viruses or viral vectors, requiring strict bio-safety containment measures to prevent accidental release and ensure the safety of workers and the environment. This adds an extra layer of complexity and cost to the manufacturing process.

The figure provided outlines the vaccine manufacturing process, illustrating the key steps involved in both organic and biochemical manufacturing and pharmaceutical manufacturing.

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References:

- Complexity of Quality Control and Vaccines Manufacturing presented by Philippe Juvin, Chief Pharmaceutical Officer, SP Vaccinology Conference ADVAC (Advanced Course of Vaccinology) held in May 2022
- Global manual on surveillance of adverse events following immunization
- Gomez, P. L., Robinson, J. M., & Rogalewicz, J. A. (2013). Vaccine manufacturing. Vaccines, 44–57. https://doi.org/10.1016/B978-1-4557-0090-5.00019-7
- Study Master - Vaccine Manufacturing Module https://www.studysmarter.co.uk/explanations/biology/communicable-diseases/vaccine-manufacturing/#:~:text=Vaccine%20manufacturing%20is%20a%20complex,virus%2C%20bacteria%2C%20or%20toxin.
- Avantor Biopharma Educational Material - Vaccine Manufacturing https://us.vwr.com/cms/vaccine_manufacturing_process
- World Health Organization - Manufacturing, safety and quality control of vaccines https://www.who.int/news-room/feature-stories/detail/manufacturing-safety-and-quality-control

Figure 2: Vaccine Manufacturing Process (SP Vaccinology Conference ADVAC, May 2022)

To be Continued.....

Table 1: Selected notifiable diseases reported by Medical Officers of Health 13th – 19th July 2024 (29th Week)

RDHS	Dengue Fever		Dysentery		Encephalitis		En. Fever		F. Poisoning		Leptospirosis		Typhus F.		Viral Hep.		H. Rabiies		Chickenpox		Meningitis		Leishmania-		Tuberculosis		WRCD	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	T*	C**
Colombo	312	6761	2	21	0	7	1	45	1	15	4	292	0	8	0	7	0	0	18	307	0	22	0	0	55	1251	**89**	**100**
Gampaha	129	2968	1	27	1	14	1	11	1	70	13	425	0	4	0	2	0	0	13	243	4	79	1	14	0	678	**85**	**99**
Kalutara	55	1847	0	19	0	2	0	28	3	32	16	460	0	5	0	8	0	1	4	395	2	38	0	1	3	307	**93**	**100**
Kandy	105	2779	4	29	0	2	0	6	0	54	6	167	0	21	0	8	0	1	5	285	0	13	0	25	0	334	**100**	**100**
Matale	18	471	2	8	0	0	0	2	1	18	1	68	0	2	0	4	0	0	9	98	3	9	6	169	2	81	**100**	**100**
Nuwara Eliya	6	239	6	97	0	5	1	9	0	194	2	121	2	30	0	5	0	0	4	152	1	10	1	1	6	164	**85**	**100**
Galle	31	1363	0	33	0	18	0	8	4	70	11	475	2	68	0	7	0	1	12	440	2	50	0	3	12	252	**55**	**100**
Hambantota	15	607	0	24	0	3	1	4	1	43	7	325	2	33	0	5	0	1	5	203	0	22	6	312	0	80	**92**	**100**
Matara	27	564	2	7	0	4	0	2	1	26	11	298	0	12	0	3	0	0	8	222	2	59	0	79	5	90	**94**	**100**
Jaffna	18	5137	2	44	0	2	2	22	1	31	2	17	6	417	1	5	0	1	3	150	1	11	0	1	9	180	**100**	**93**
Kilinochchi	2	271	1	9	0	0	0	2	0	2	0	17	1	9	0	0	0	1	0	5	0	5	0	0	1	14	**100**	**100**
Mannar	5	202	0	4	0	0	0	1	0	0	0	21	0	10	0	1	0	0	0	5	0	3	0	1	1	41	**100**	**100**
Vavuniya	1	148	2	9	0	1	0	1	0	21	1	70	0	4	0	4	0	0	0	29	0	13	0	8	0	23	**100**	**100**
Mullaitivu	0	188	2	7	0	0	0	0	0	16	1	60	0	11	0	0	0	0	0	4	1	3	0	8	1	20	**83**	**100**
Batticaloa	11	1234	2	85	0	9	0	6	1	46	1	53	0	2	0	17	0	1	4	82	1	29	0	3	7	96	**93**	**100**
Ampara	4	194	3	26	0	3	0	0	0	15	5	146	0	1	0	5	0	0	4	78	1	28	0	12	1	88	**86**	**100**
Trincomalee	14	564	1	13	0	1	0	3	0	4	0	125	0	12	0	3	0	0	3	43	1	11	1	12	4	74	**75**	**100**
Kurunegala	38	1668	2	33	1	23	0	3	0	345	10	411	0	17	0	4	0	2	10	318	3	179	16	376	4	315	**90**	**100**
Puttalam	28	791	0	5	2	3	0	3	1	3	6	162	2	12	0	1	0	1	2	89	1	44	0	23	0	131	**77**	**100**
Anuradhapura	11	554	1	13	0	3	0	2	0	26	6	298	1	27	0	8	0	1	10	175	0	27	19	528	6	176	**100**	**100**
Polonnaruwa	14	264	1	16	0	0	0	1	0	6	5	197	0	1	4	10	0	0	1	87	1	21	14	326	2	63	**89**	**100**
Badulla	12	614	1	20	0	4	0	4	1	29	9	360	1	21	3	19	0	0	17	232	1	22	1	24	4	138	**94**	**100**
Monaragala	12	541	2	13	0	2	0	2	0	78	6	540	1	23	2	21	0	1	1	75	0	63	5	152	2	72	**73**	**100**
Ratnapura	81	1807	1	71	0	4	0	8	1	12	37	1123	1	16	1	18	0	2	5	208	8	87	11	120	8	185	**80**	**100**
Kegalle	35	1454	1	11	0	6	0	8	1	10	9	447	1	20	0	6	0	1	19	547	0	42	2	19	4	192	**82**	**100**
Kalmunai	8	598	0	15	0	0	0	0	0	5	1	54	1	3	0	4	0	0	5	151	0	11	0	0	3	84	**85**	**100**
SRILANKA	**992**	**33828**	**39**	**659**	**4**	**116**	**6**	**181**	**18**	**1171**	**170**	**6732**	**21**	**789**	**11**	**175**	**0**	**15**	**162**	**4623**	**33**	**901**	**83**	**2217**	**140**	**5129**	**88**	**99**

Source: Weekly Returns of Communicable Diseases (esurvillance.epid.gov.lk). T=Timeliness refers to returns received on or before 19th July, 2024 Total number of reporting units 358 Number of reporting units data provided for the current week: 356**C****-Completeness *

A = Cases reported during the current week. B = Cumulative cases for the year.

Table 2: Vaccine-Preventable Diseases & AFP

13th – 19th July 2024 (29th Week)

Disease	No. of Cases by Province									Number of cases during current week in 2024	Number of cases during same week in 2023	Total number of cases to date in 2024	Total number of cases to date in 2023	Difference between the number of cases to date in 2024 & 2023
	W	C	S	N	E	NW	NC	U	Sab					
AFP*	00	00	00	00	00	00	00	00	00	00	00	40	50	-20 %
Diphtheria	00	00	00	00	00	00	00	00	00	00	00	00	00	0 %
Mumps	01	00	00	00	00	01	01	01	00	04	05	162	126	28.6 %
Measles	00	00	00	02	00	00	00	00	00	02	33	227	95	138.9 %
Rubella	00	00	00	00	00	00	00	00	00	00	00	02	01	100 %
CRS**	00	00	00	00	00	00	00	00	00	00	00	00	00	0 %
Tetanus	00	00	00	00	00	00	00	00	00	00	00	04	06	-33.3 %
Neonatal Tetanus	00	00	00	00	00	00	00	00	00	00	00	00	00	0 %
Japanese Enceph-alitis	00	00	00	00	00	00	00	00	00	00	00	01	06	-83.3 %
Whooping Cough	00	00	01	00	00	02	00	00	00	03	00	34	05	580 %

Key to Table 1 & 2

Provinces: **W**: Western, **C**: Central, **S**: Southern, **N**: North, **E**: East, **NC**: North Central, **NW**: North Western, **U**: Uva, **Sab**: Sabaragamuwa.

RDHS Divisions: **CB**: Colombo, **GM**: Gampaha, **KL**: Kalutara, **KD**: Kandy, **ML**: Matale, **NE**: Nuwara Eliya, **GL**: Galle, **HB**: Hambantota, **MT**: Matara, **JF**: Jaffna, **KN**: Killinochchi, **MN**: Mannar, **VA**: Vavuniya, **MU**: Mullaitivu, **BT**: Batticaloa, **AM**: Ampara, **TR**: Trincomalee, **KM**: Kalmunai, **KR**: Kurunegala, **PU**: Puttalam, **AP**: Anuradhapura, **PO**: Polonnaruwa, **BD**: Badulla, **MO**: Moneragala, **RP**: Ratnapura, **KG**: Kegalle.

Data Sources:

Weekly Return of Communicable Diseases: Diphtheria, Measles, Tetanus, Neonatal Tetanus, Whooping Cough, Chickenpox, Meningitis, Mumps., Rubella, CRS,

Special Surveillance: AFP* (Acute Flaccid Paralysis), Japanese Encephalitis

CRS =**Congenital Rubella Syndrome

NA = Not Available

Number of Malaria Cases Up to End of July 2024,

06

All are Imported!!!

Comments and contributions for publication in the WER Sri Lanka are welcome. However, the editor reserves the right to accept or reject items for publication. All correspondence should be mailed to The Editor, WER Sri Lanka, Epidemiological Unit, P.O. Box 1567, Colombo or sent by E-mail to **chepid@sltnet.lk. Prior approval should be obtained from the Epidemiology Unit before publishing data in this publication**

ON STATE SERVICE

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