4 Virus Testing & Therapies

image

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RNnext.com

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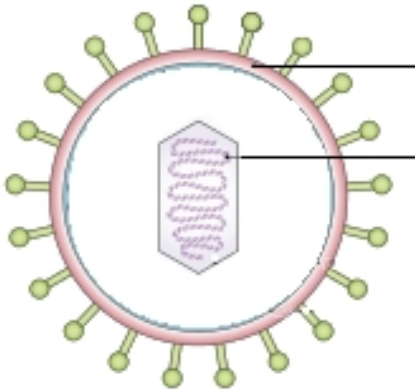
A self-study guide: *All references are active hyperlinks.*

VIRUS *(obligate intracellular parasite)*

REVIEW



Protein envelope

RNA *(or DNA)*

Primitive structure: lack any organelles for self-survival

Much smaller than bacteria

- **Nonliving parasite that infects a host cell**
  (in animals, plants and/or bacteria)
  - *Protein envelope contains only few dozen genes*
  - *Must be inside host cell to survive, reproduce*
  - *Host cell becomes "virus factory" – often causing symptoms*
  - *Most are self-limiting (last only few days in human body)*

- **Treatment challenges:**
  - ***Targeting virus inside cell without damaging host cell***
  - ***Viruses mutate***

Burchum & Rosenthal, 2019; *image*

VIRUS MUTATION

Every virus mutates.

- *Often changes aren't a big deal.*
- *Overall, SARS-CoV-2 has mutated slower than other RNA viruses.*
- *New more contagious variants from UK, South Africa, Brazil*

Typical virus evolution is to become *more* contagious, *less* deadly:

- *If mutation doesn't get to new host, its lineage ends.*
- *However, if death rate remains same, then more contagious strains = more deaths*

Mutation may require updates in tests & treatment.

- *Flu vaccine changes annually, but MMR vaccine effective for **45 yrs.***

Grubaugh, 2020; Korber et al., 2020; Ries, 2020; *image*

Galloway et al., 2021

TESTING: Types

type	**VIRAL** *(nucleic acid)* *also called:* ***molecular test*** *or* ***PCR (polymerase chain reaction)***	**VIRAL** *(antigen)*	**ANTIBODY** *(serological)* *also called:* ***serum test*** *or* ***IgG (immunoglobulin G) test***
for	**CURRENT infection**		**PAST infection**
sample	**resp. secretions** *(throat or nasal swab)* *also:* ***saliva tests*** *developed*	**resp. secretions** *(throat or nasal swab)*	**blood**
testing for	**virus RNA** *(genetic material)*	**virus proteins** *(antigens)*	**antibodies** *in serum*
results back in	sent to a lab, **hours to days**	on site testing, **less than hour**	sent to lab, **hours to days**

Note: there are also COVID-19 ***stool tests.***

(references on next slide)

TESTING: Efficacy

NO TEST IS PERFECT…

type	**VIRAL** *(nucleic acid / molecular)*	**VIRAL** *(antigen)*	**ANTIBODY** *(serological / serum)*
efficacy	***best* accuracy:*** ***3 to 4 days*** ***after COVID symptom onset*** ****best = 21% false negative*** *(patient has virus, but result incorrectly comes back negative)* *3 weeks after symptom onset: 66% false negative*	***less accurate*** ***(sensitive)*** ***than testing for virus RNA*** • *newer* • *wide range of accuracy: 50-90%* Satyanarayana, 2020; Scohy et al., 2020; Service, 2020	***best accuracy:*** ***3 weeks*** ***after COVID symptom onset*** • ***At 1 wk:*** *test will detect only* ***30%*** *of COVID-19 cases* • ***At 2 wk: 70%*** • ***At 3 wk: 90%*** *at this time, we cannot predict future immunity*

CDC, 2020i; Deeks et al., 2020; FDA, 2020c; FDA, 2020d; Kucirka et al., 2020

IMMUNITY TREATMENTS

ACTIVE IMMUNITY

when body creates its own antibodies due to exposure

VACCINES

trigger active immunity

PASSIVE IMMUNITY

Immunoglobulin (Ig) *("antibodies")* transferred *("donated")* from one person to another

CONVALESCENT PLASMA

donated from recovered individual

Burchum & Rosenthal, 2019

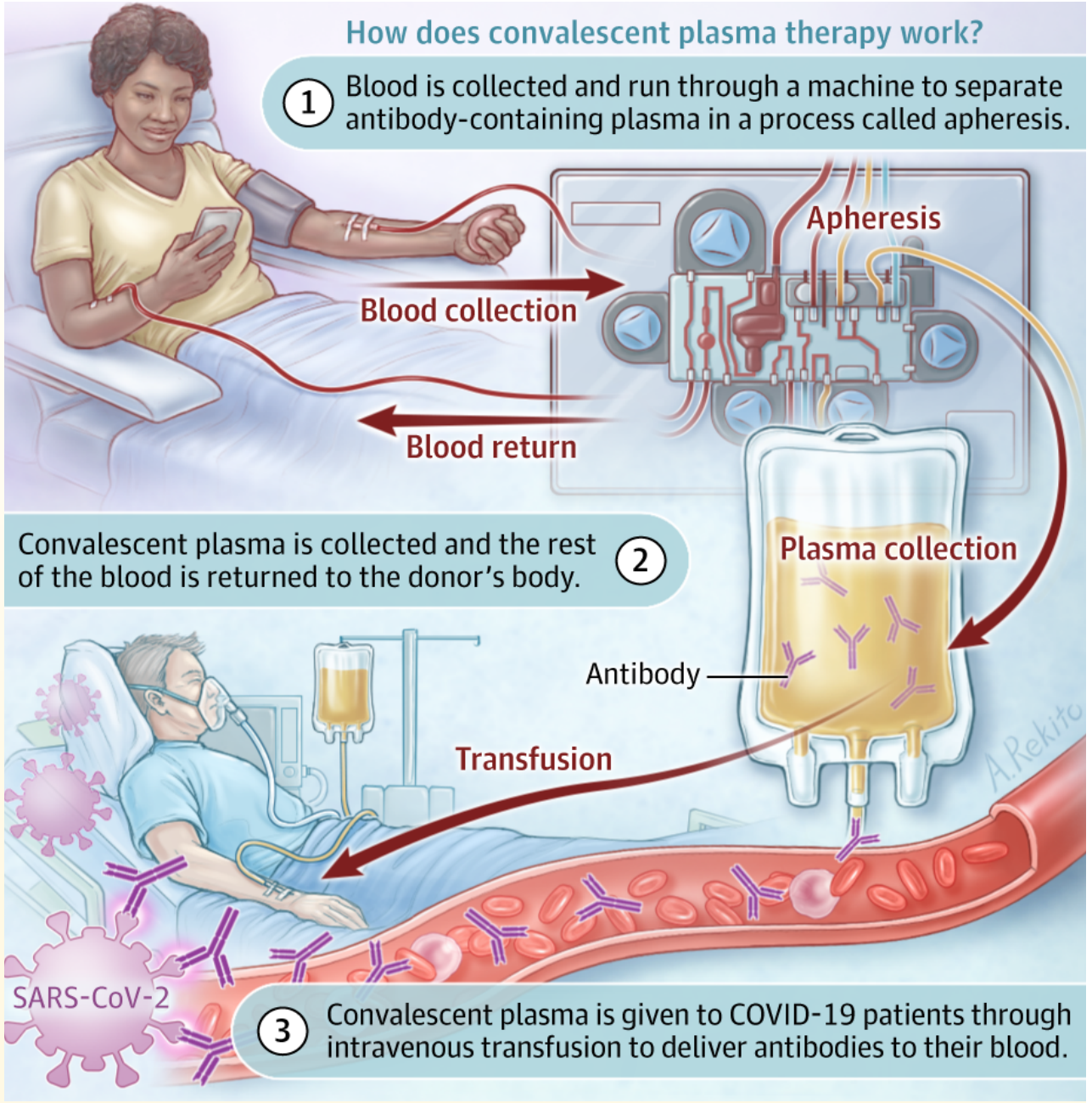
CONVALESCENT PLASMA

Passive **immunity therapy: provides antibodies** *(Ig)* **from convalescent** *(recovered patient)* **donor, but these proteins will** ***last only for a short time*** *(weeks to months).*

FDA approval process so far:

- *April:* **Emergency Investigational New Drug**
- *Aug:* **Emergency Use Authorization** *(EUA)*

Clinical trials ongoing. Not enough evidence yet for FDA to officially approve for COVID-19.



Cunningham, 2020; FDA, 2020e; Malani et al., 2020; Thomas & Weiland, 2020

REVIEW

VACCINES trigger *active* immunity

- Exposes client to modified harmless microorganisms or toxoids
- **HUMORAL** immune response occurs – **antibodies** produced
- Memory B-cells store information
- Antibodies quickly produced if later exposed to microorganism

Other terms to know:

- Sometimes ***booster*** *(follow-up vaccination)* needed for continuous protection
- ***Titers*** *are blood tests* that measure amount of antibody produced after vaccination

Burchum & Rosenthal, 2019; *image*

Types of Vaccine:

Over 40 vaccines
are in clinical trials.
Follow development at this website:
(Craven, 2020)

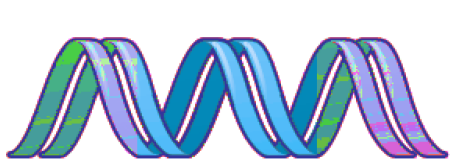
ATTENUATED *(means "weakened")* **VACCINE**	**weakened live** pathogen *stimulates humoral antibody immunity*	• ***MMR***
INACTIVATED VACCINE	**killed** pathogen *stimulates humoral antibody immunity*	• ***influenza*** • ***hepatitis A***
mRNA VACCINE	***New type of vaccine*** *stimulates humoral antibody immunity & innate cell-mediated immunity*	• ***COVID-19*** • ***has also been used against certain types of cancer***

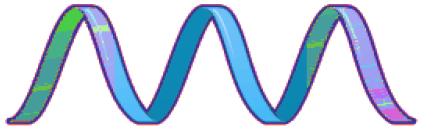
Burchum & Rosenthal, 2019; Roberts, 2020

1. What is mRNA?

messenger RNA is a molecule that puts DNA instructions into action to create a protein

DNA → **mRNA** → Protein





STORAGE

DNA stores instructions for proteins in the nucleus

SOFTWARE

mRNA is a temporary set of instructions for cells to make a protein; mRNA is made using DNA

APPLICATIONS

Proteins form the basis of life by performing the functions required by every cell; proteins are made using mRNA

Moderna, 2020

2. The body's two types of immunity

mRNA vaccines stimulate both…

1. Humoral *Antibody-Mediated* immunity	2. Innate *Cell-Mediated* immunity
neutralize pathogens outside cell	*neutralize pathogens inside cell*
Key role: B-cells produce antibodies that bind to antigens, cause pathogen to be destroyed or not work	**Key role: T-cells** cause *target-cell lysis*: destroy compromised body cells *(cancer cells or virus-infected cells)*

Burchum & Rosenthal, 2019

3. How does mRNA vaccine work?

Activates body's cell-mediated immunity to recognize and destroy specific cells…

Labs synthesize mRNA from target cells *(cancer or virus)* to inject into recipients, *then…*

Their bodies will produce target cell proteins, *which…*

Activates cell-mediated immunity.

Note: the body-created proteins are solitary: cannot assemble to form a virus or cancer.

Roberts, 2020

KEY FACTS: mRNA vaccine

Does **NOT** use the live virus that causes COVID-19.

Does **NOT** affect or interact with our DNA in any way.

mRNA vaccine **NEVER** enters the cell's nucleus,
which is where our DNA (genetic material) is kept.

The cell quickly breaks down and gets rid of the mRNA
from the vaccine soon after it is finished using the instructions.

CDC, 2021

VACCINE QUESTIONS:

- ***How long will immunity last?***
- ***Booster doses required? How often?***
- ***How do we ensure equity in distribution?***
- ***What % needed for herd immunity?***
  - *Initial projection: 60-70% of population*
  - *Dec. 2020: Fauci suggesting close to 90% based on new emerging data.*

Gallup survey: **One in 3 Americans do not want a COVID-19 vaccine**

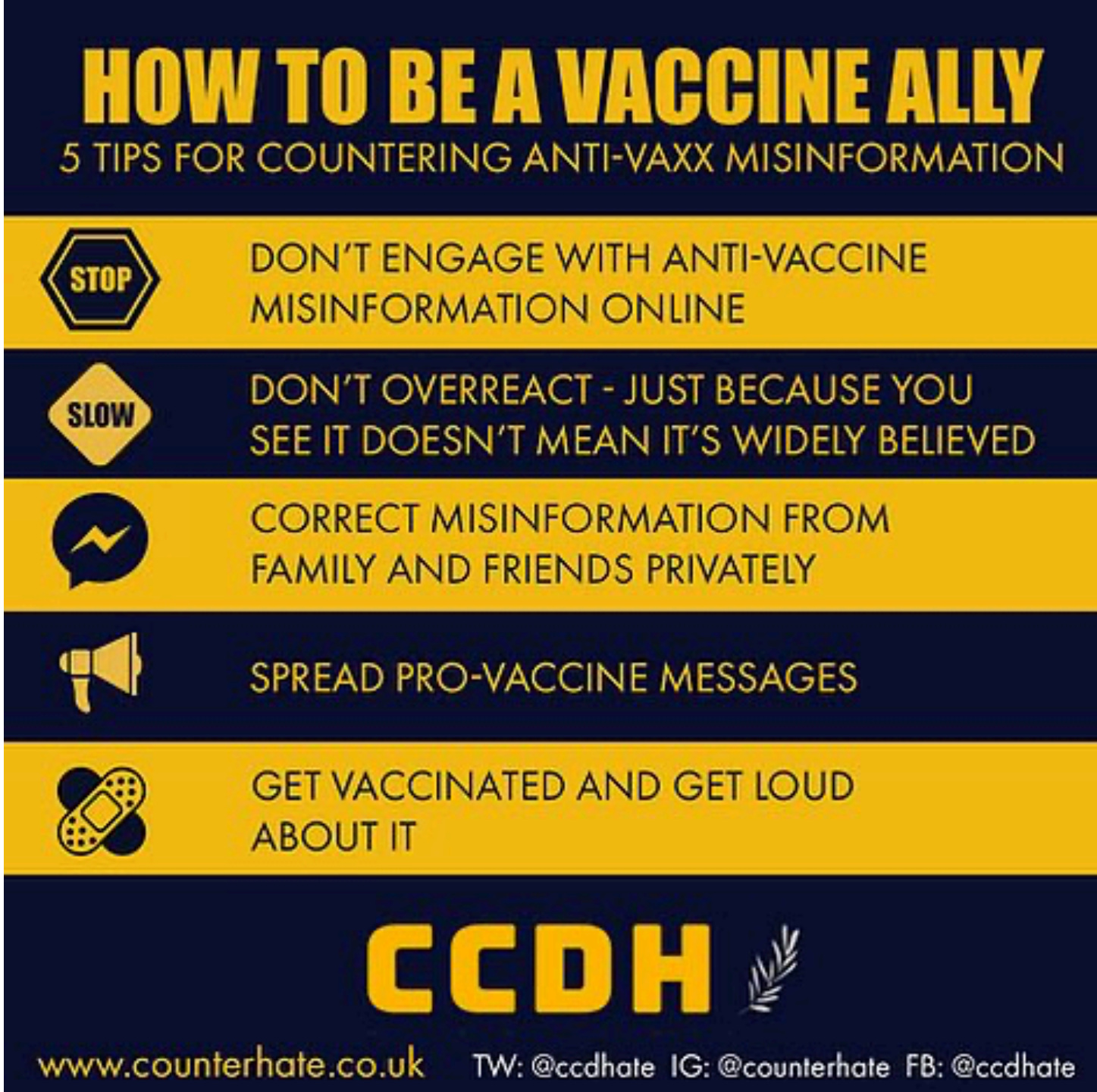
McNeil, 2020; O'Keefe, 2020; *image*

The Center for Countering Digital Hate (CCDH)

UK / US non-profit published **“The Anti-Vaxx Playbook”**

after recording a 3-day meeting of the world’s leading anti-vaxxers.

See executive summary on next page.



Center for Countering Digital Hate: Briefing Note

The Anti-Vaxx Playbook

WHO WE ARE – UK/ US non-profit that disrupts the spread of digital hate and misinformation.

OUR REPORT - Reveals the messages and strategies anti-vaxxers are using to exploit the Covid pandemic and disrupt the rollout of the Covid vaccine. We include detailed recommendations on how to counter anti-vaxxer narratives.

WHAT'S NEW? - In late October, the world's leading anti-vaxxers held a private three-day meeting in which they discussed how to destroy confidence in the Covid vaccine. Our research team was present to record, transcribe and analyse their candid discussions.

WHAT WE DISCOVERED

➔ THERE IS AN ORGANISED AND DISCIPLINED ANTI-VAXX INDUSTRY:

- Anti-vaxxers see Covid as an opportunity to drive long-term vaccine hesitancy.
- The total English-language audience for anti-vaxxers online has grown significantly in the past year and now stands at 59 million followers.
- Some anti-vaxxers are economically-motivated hucksters, some are true believers.
- Either way, to win, they need to undermine confidence in the scientific establishment.

➔ THIS IS AN ASYMMETRICAL CONFLICT:

- Health professionals need to persuade the public to take an action.
- Anti-vaxxers need only to create doubt as to its efficacy, safety or necessity.
- That's why anti-vaxxers operate by asking questions

➔ FORGET INDIVIDUAL ANTI-VAXX MEMES. THEIR GARISH CONTENT IS DESIGNED TO DISTRACT AND SEEK TO CREATE DOUBT ABOUT:

1. The threat posed by Covid
2. The safety of vaccines
3. Whether we can trust experts

➔ HERE'S OUR FIVE POINT PLAN FOR HEALTH PROFESSIONALS:

1. Focus your communications on our core messages:
    1. **Covid is deadly**
    2. **Vaccines are one of the safest, most effective, most consequential medical inventions. They have saved countless people from disease, disability and death.**
    3. **Doctors and scientists are motivated by wanting to help people.**
2. Do not share or engage with anti-vaxx misinformation online. This spreads it further. Instead, ask people to **share and engage with pro-vaccine messages**.
3. Meet people where they are online. Create "answering spaces" where the public can ask questions, e.g., doctors could join their local Facebook groups and offer to answer queries.
4. Empower, support and amplify a diverse range of expert message carriers on social media.
5. Expose the methods and motives of anti-vaxxers, not the content of their narratives.

To see the full report, go to www.counterhate.co.uk/playbook

For more information contact CCDH at info@counterhate.co.uk

4. Virus Testing and Therapies: References

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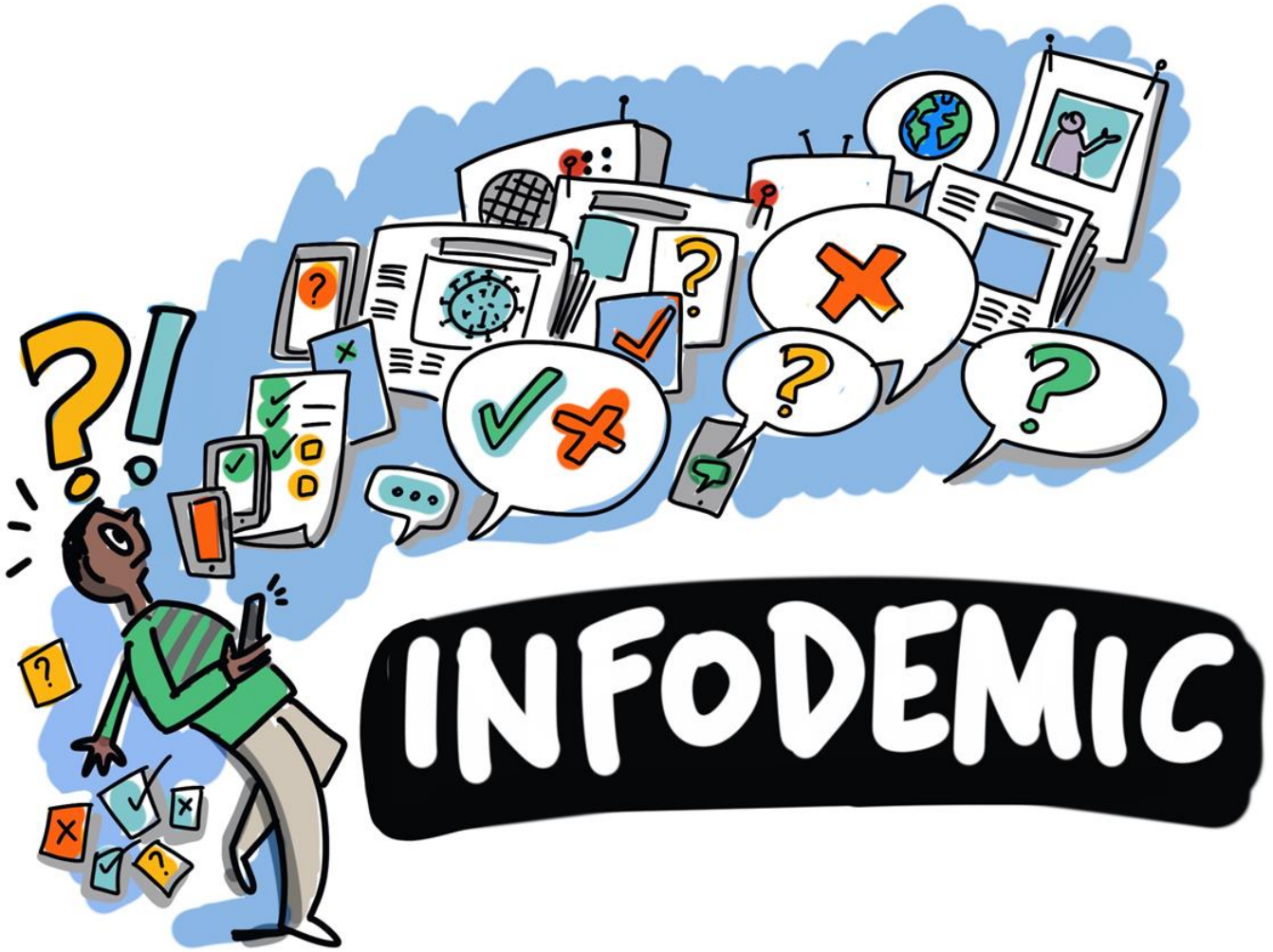
Please use your knowledge:

Help manage the "*infodemic*"

Overabundance of information – some accurate and some not – occurring during a pandemic, which can undermine public safety.

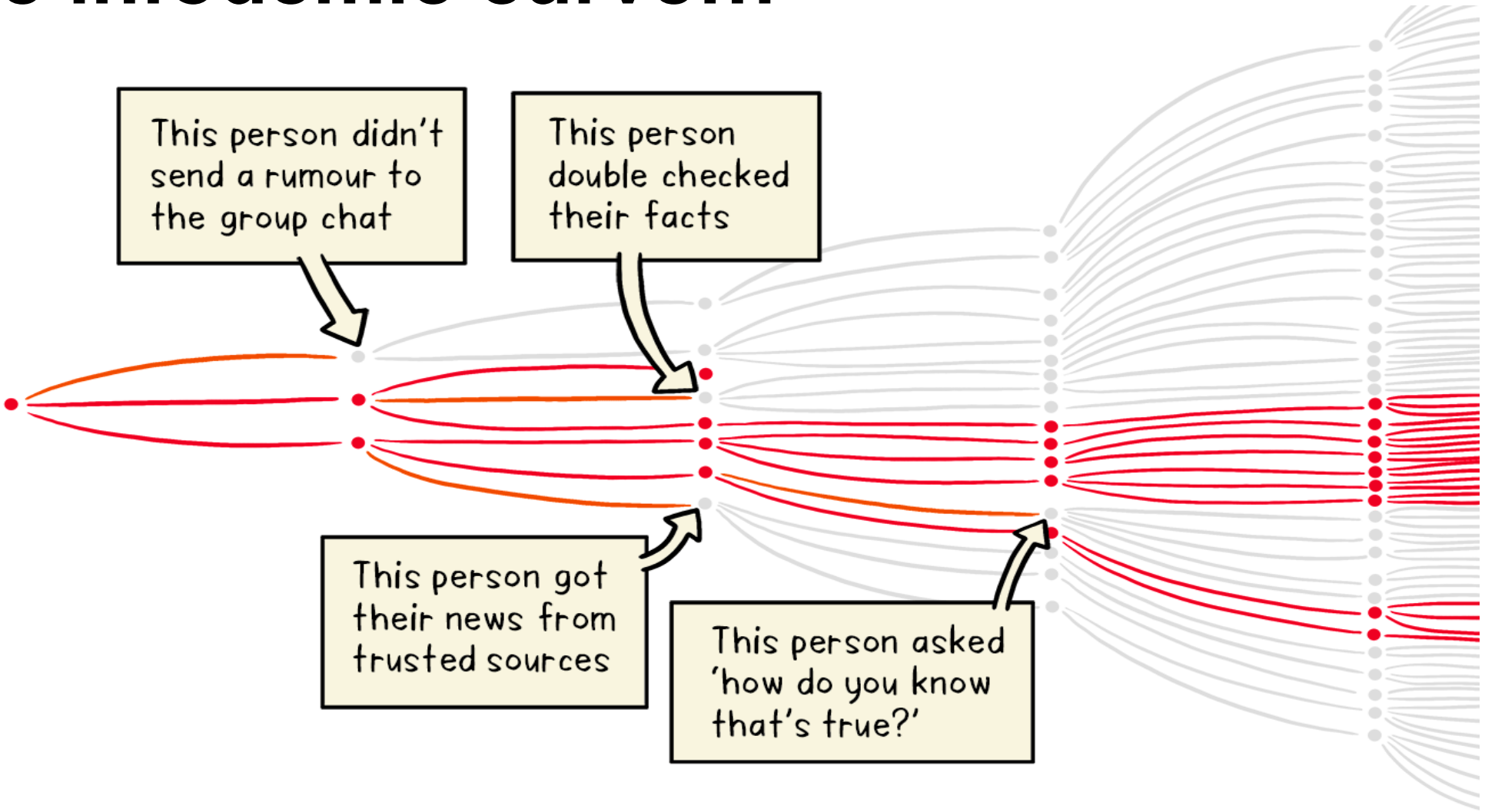


WHO's virtual global conference on Infodemic Management:
https://www.who.int/teams/risk-communication/infodemic-management/3rd-virtual-global-who-infodemic-management-conference

WHO, 2020a; *image*

Misinformation is like a virus: do your part to

Flatten the infodemic curve…

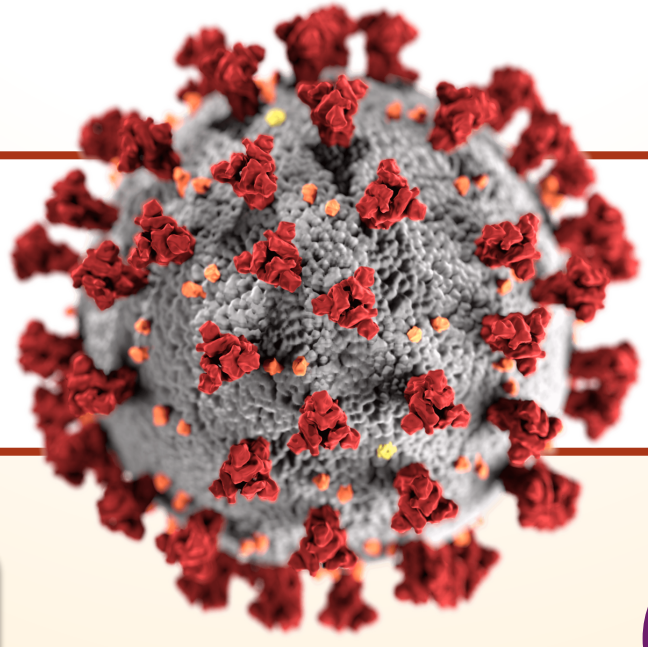


WHO, 2021


IF YOU SEE COVID-19 MISINFORMATION
1 DON'T ENGAGE
If you reply, share, or quote misinformation, you help to spread it.
2 BLOCK THEM
If someone you don't know is sharing misinformation, block them.
3 MESSAGE PRIVATELY
If someone you know is sharing misinformation, message them privately and ask them not to.
4 REPORT
Report misinformation to platforms or group admins asking them to remove that content.
5 INSTEAD, SPREAD OFFICIAL ADVICE
Drown out fake news by sharing official scientific advice, as well as posts promoting good causes in tough times.
www.counterhate.co.uk
Twitter @ccdhate | Insta @counterhate | FB @ccdhate
CCDH

CCDH, 2020

COVID-19



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1. COVID-19 Overview
2. Patho-physiology
3. Transmission & Precautions
4. Virus Testing & Vaccines
5. Epidemiology & Tracing

+ Ethics, Peds/OB Mental Health