MONASH University

MALAYSIA

Science Communication



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Monash University Malaysia


"Science isn't finished until it's communicated."
- Sir Mark Walport,
U.K. Government Chief Scientific Adviser


SCIENCE
COMMUNICATION
SCIENTISTS
EFFECTIVELY
SKILLS
EFFECTIVE
PUBLIC
COMMUNICATE
TRAINING
STUDENTS

Background/Disclaimer:

- PhD in Molecular Virology
- Trained at Monash University Malaysia and Department of Microbiology, Icahn School of Medicine, Mount Sinai New York
- Work predominantly on crosstalk between RNA viruses with pandemic capabilities and different hosts
- ‘Accidental’ Science Communicator
- Not trained formally on Science Communication
- COVID19 myths and misinformation
- ‘Understanding the virus’ and ‘Vaccines’
- Majority of the examples will be based on recent pandemic





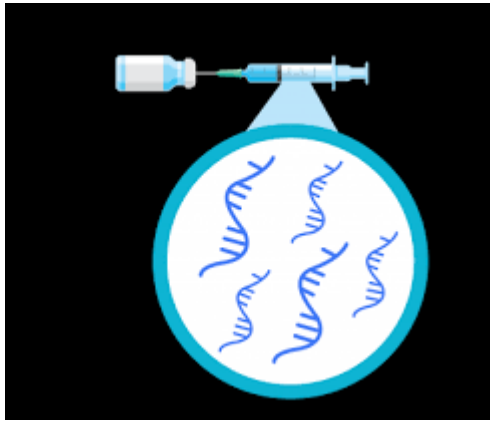


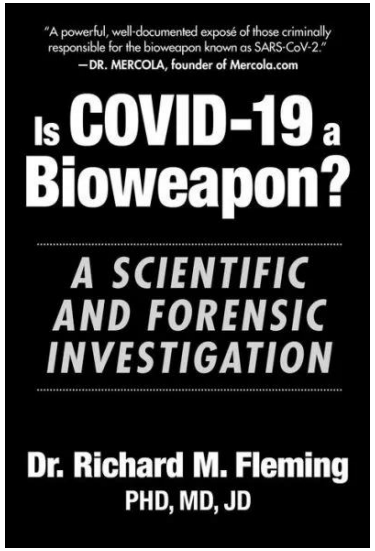


COVID19
'Infodemia'









National

- **COVID-19 cases Globally**

→ ~700 million COVID-19 cases

→ ~ 7 million COVID-19-related deaths

- Plethora of misinformation (infodemic) regarding the pandemic in the earlier stages.
- Disseminate facts to the public instead of plethora misinformation currently being circulated in social media.
- First approached by Malaysian Biotechnology Information Centre – Expert Reactions on COVID-19 for Science Media Centre (SMC) Malaysia.

MABIC MALAYSIAN BIOTECHNOLOGY INFORMATION CENTRE

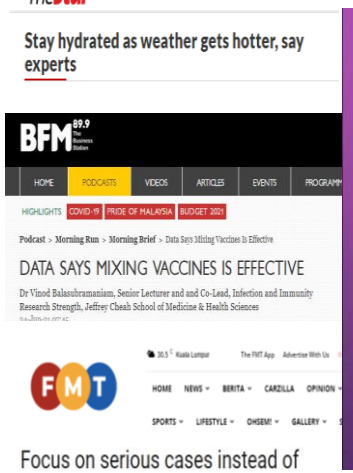
SCIENCE MEDIA CENTRE MALAYSIA

ausSMC

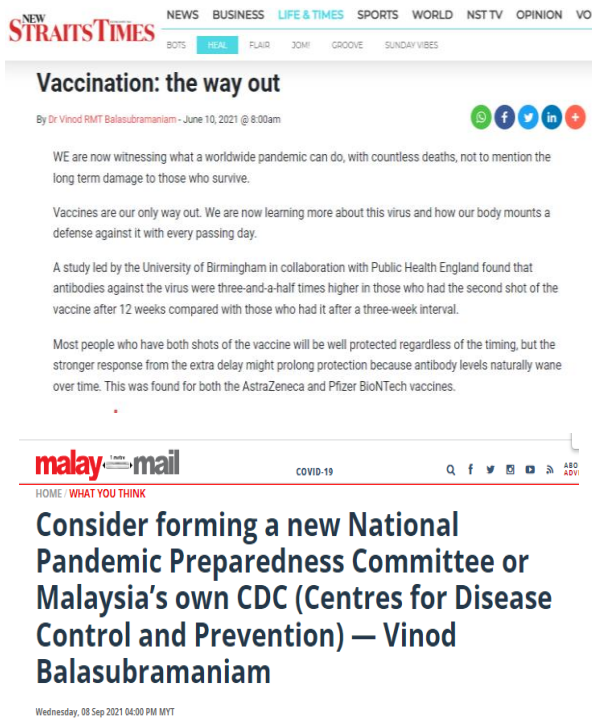
- Following that, extensive interviews invite/approach by some of the biggest media portals in the world both national and international based on our work and expertise.
- **National Media**

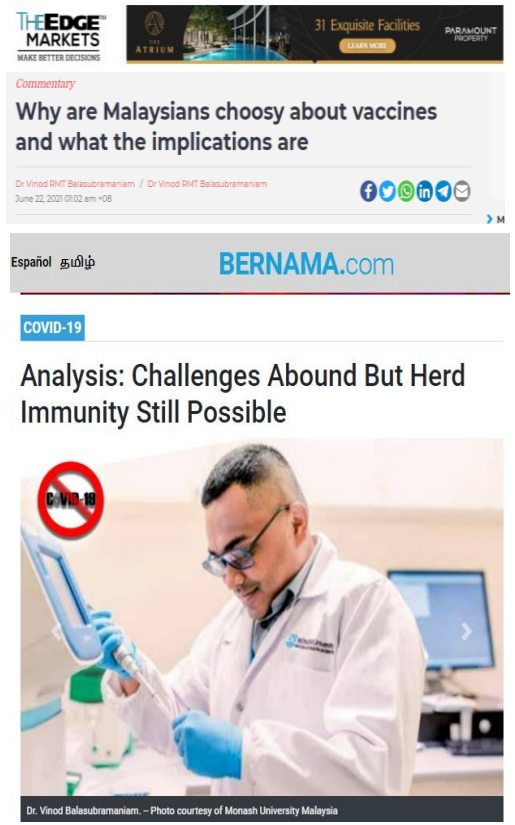
→***BERNAMA TV English, BERNAMA TV Tamil, China Press, Astro Awani, The Star, New Straits Times, The Edge, Free Malaysia Today, BFM89.9 radio, Business Today***











International

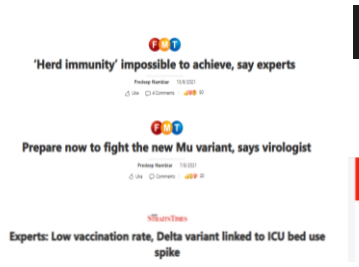
- **International Media**

→***From the US, UK, Australia, Hong Kong, Singapore, Vietnam, Indonesia, New Zealand, Netherlands, Brunei and many more***

- One of the biggest impact is to be featured in ***Newsweek*** (one of the oldest New York based magazine with more than 100 million users per month)
- Approached also by biggest medical health sites/news portal such as ***Medical News Today (US), Full Facts (UK), ABC News (Aus), CNA (Singapore), SCMP (Hong Kong) and continue collaboration with Scimex, the breaking science news portal for Australia & New Zealand, an initiative of the Australian Science Media Centre., in EXPERT REACTION***
- The focus of the interviews are mainly on various aspects of the pandemic:
  - The **emerging variants**,
  - Holistic management of the pandemic,
  - Preparation for future pandemics,
  - Importance of vaccination in fighting the pandemic.
- **Impact**

→ to provide better understanding on pertinent matters which includes the transmission of the disease, social distancing, vaccine advocacy and education of misinformation in Malaysia.

→ Increasing our visibility to worldwide scientific community, and public

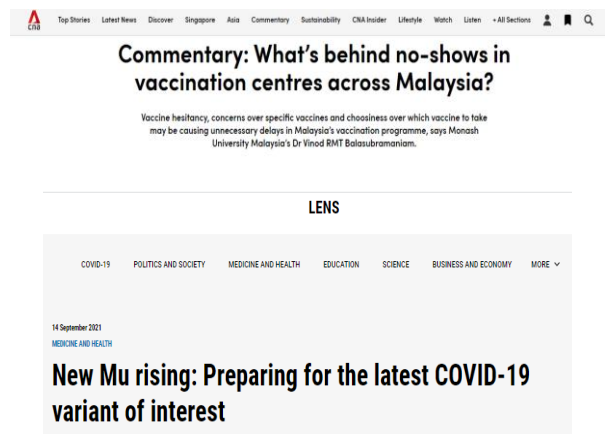












Measuring Impact/Reach?

- Mentioned/quoted more than 1000 times in worldwide media (2020-2023)
- Quoted/interviewed in majority of Tier 1 media in the world including Medical News Today, Full Facts (UK), Cosmos, Australian Science Media Centre, MSN News, Yahoo News, ABC News, Daily Mail (UK), Australian Doctor Group, BFM, The Star, NST and Bloomberg.
- Main ‘go-tos’ for tier 1 media titles
- Listed infectious diseases expert in Australian Science Media Centre.
- Top performing article published in Monash Lens. The news had 87.9 million reach.
- Combined media value of more than RM3.5 million.
- Invited for the launch of 'Sputnik V' vaccine for COVID19 as part of the roundtable discussion panel.

I think I know what Science Communication Is. But what is Science Communication????



Science Communication is broadly defined as “the practice of informing, educating, sharing, wonderment, and raising awareness of science related topics covering science outreach (typically conducted by professional scientists to non-expert audiences) and science” in-reach” (expert to expert communication from similar or different scientific backgrounds)”

Adapted from Science Communication in Practice: A Malaysia Perspective with Global Relevance, ASM

Initiation the era of Science Communication

- The **1633 trial of Galileo** is a cautionary tale in science communication.
- Began in 1609 when **Galileo's studies led him to support heliocentrism** – a model of the universe with the sun at its center – **over geocentrism**!
- Published these findings as a **series of dialogues between two philosophers and a layman**; an attempt to promulgate this knowledge to the lay public and not just academics
- Twenty four years after his first experiments, he was **tried by the church, found guilty** of heresy and sentenced to formal imprisonment



'Trial of Galileo'

Why???

Source: https://www.lindau-nobel.org/blog-the-challenges-of-science-communication/

Understanding need of science communication

- We are living in times of deep uncertainties and are **facing an unprecedented convergence of threats and multiple crises (public health, economic, political, environment)** due to the coronavirus outbreak.
- The pandemic has triggered a **massive infodemic** and **accelerated the dissemination of misinformation, fake news, half-truths, conspiracy theories, rumours, hoaxes and lies.**
- Different kinds of information disorders have been around for decades, while the **COVID19 public health emergency has certainly acted as a catalyst for the proliferation of disinformation in a digital communication infrastructure**.

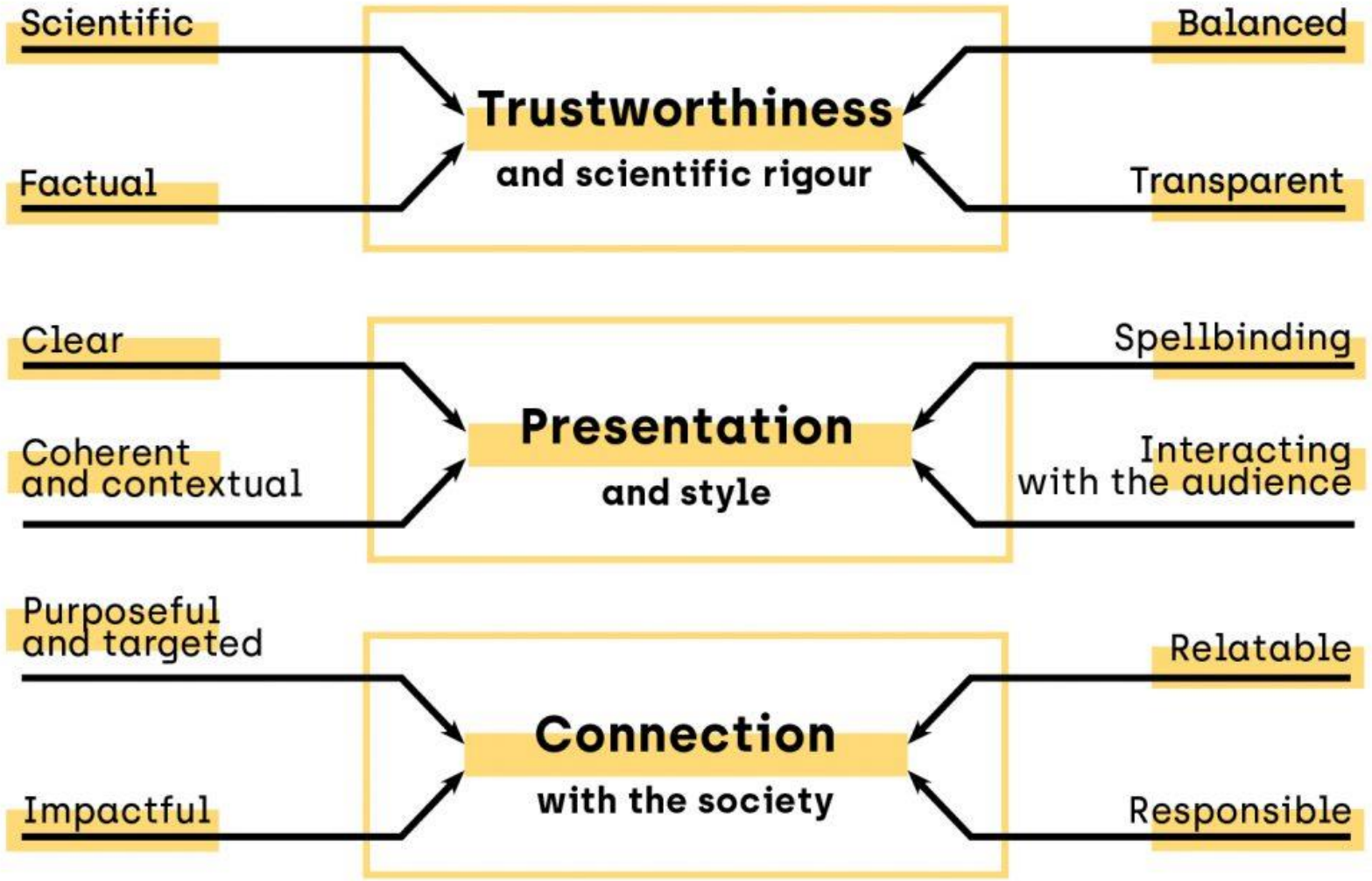
How science communication can solve modern day miscommunication issues of science

- To counteract mis/disinformation**, science journalism based on an evidence-based paradigm** could be a model
- Providing **evidence rather than opinions** and reporting facts and research transparently may improve the quality and credibility of journalism, reconnect it with the public, and build trust in news media



Source: ERUM – Enhancing Research Understanding through Media (2019-1-AT01-KA203-051482)

12 QUALITY INDICATORS for SCIENCE COMMUNICATION



https://questproject.eu/social-media-improving-science-communication-by-the-tools-of-science/

Pew Research Center

Google Scholar

PubMed

ResearchGate

LinkedIn

Source???

World Health Organization

ipcc
INTERGOVERNMENTAL PANEL ON climate change

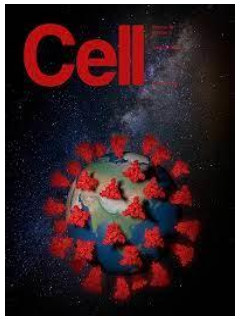
WORLD ECONOMIC FORUM

EurekAlert! AAAS

The Harvard Gazette









The NEW ENGLAND JOURNAL of MEDICINE

NEJM.ORG

The phenomenon of disinformation

- Disinformation threatens the virtue of knowledge. The **notion of truth** becomes **corrupted** when the public believe and **give credibility to false, inaccurate, or misleading messages.**
- This situation is particularly relevant in the digital age, where users of media platforms are **exposed to different sorts of persuasive statements** with uncertain origins and a **lack of authenticity.**
- How does academia understand the disinformation problem, and **are we equipped to offer solutions?**



Magnitude?

By the end of 2020, more than **300 million Twitter users** were posting some **350,000 tweets per minute or around 500 million per day.** The number of texts, photos, and videos posted on **Facebook** was just as colossal, thanks to its nearly **2.5 billion users** across the globe

Reference: Bienvenido León, Ignacio López-Goñi & Ramón Salaverría (2022) The Covid-19 catastrophe: A science communication mess?, Church, Communication and Culture, 7:1, 6-22, DOI: 10.1080/23753234.2022.2031236

Science and disinformation

Although the spread of false or **misleading content about Covid-19** has reached previously **unknown levels**, this is by no means the first time that disinformation about science-related issues has spread

Case 1: Asbestos

- Asbestos is a **building material** that was widely used between **1860 and 1980** (and is **still used** in some countries), **despite overwhelming evidence** that it is **carcinogenic and that it causes asbestosis (a type of pulmonary fibrosis)**

- As some research indicates, **asbestos producers developed powerful disinformation** campaigns in an attempt to deny or **cast doubt on the credibility of studies showing the harmful effects of asbestos** on human health, even though this knowledge is well-established in the scientific community

Case 2: Tobacco

- Another relevant case is that of tobacco. Doctors warned about the **harmful effects** of **cigarettes** in **1964,** but it was **not until 1999** that **American health authorities** declared that smoking was a **cause of cancer.**

- **Why** did it take so long to clearly alert the population to this danger?

- The answer can be found in a **2006 ruling** in which a U.S. federal tribunal found **tobacco manufacturers** guilty of **'conspiring to deny, distort, and minimize** the **hazards** of cigarette smoking to the public

Reference: Bienvenido León, Ignacio López-Goñi & Ramón Salaverría (2022) The Covid-19 catastrophe: A science communication mess?, Church, Communication and Culture, 7:1, 6-22, DOI: 10.1080/23753234.2022.2031236

What urges the need of the communications between scientists and public and what the current gaps ??

Why we fall for fake news: Hijacked thinking or laziness?

1. A lack of trust

- Between scientists, science writers or journalists, and the public itself. **Why?**
- Institutions also carry some responsibility due to expending more effort **bolstering their own** reputations, rather than **meticulously** reporting their research.
- Public resistance to scientific messages may stem in part from the **continuous stream of exaggerated claims**
- scientists need to be more **aware of possible reasons** for **communication failure** with the public
- There are all kinds of reasons that a scientific message will meet resistance, including **political and economic**, as in the case of global warming, **religious**, as in the case of natural selection and big bang theory, and **social**, as in the case of anti-vaccine movements

2. Peer pressure and perception

- **Mis-information** from lobby groups is a more serious problem (**influence legislation and government actions** on behalf of their clients and can work with individuals and non-profit organizations to achieve their goals.
- **Peer influence** positively influences behavioural intention to share misinformation
- **Fear of missing out** positively influences behavioural intention to share misinformation

Reference: https://doi.org/10.15252/embr.201643379

3. Targeting audiences

Communicators can and should at least attend to the half of the problem that they **do have control** over: the **engagement process** itself

- There is also a growing emphasis on **science communication** as a **two-way process** by which the course of research can be influenced by **societal feedback**.
- Embracing the **creativity** inherent in science can open up routes for **collaboration**, and many scientists say **working** with **artists, journalists**, and people from other fields improves their research.

4. Communicating uncertainty

How? Packaging the whole truth?

- Scientists should **be more honest** about the **nature of the research** and the **uncertainties involved**, even at risk of sowing confusion
- This way, the process of **understanding** and **embracing** the scientific facts will be much easier to the public.
- Give **examples,** probabilities etc

Reference: https://doi.org/10.15252/embr.201643379

5. The role of journalists

- **Exaggeration of scientific data by media?**
- One good example: **Pathomap study** in NYC - genomic analysis to take a microbial snapshot of the whole New York subway
- Public **fears were stoked** up by findings of various pathogenic bacteria amid the city's "microbiome". "This caused a pretty big stir, particularly because terms like **"anthrax" and "bubonic plague"** were thrown around
- Genomic data is complex, and explaining or **communicating genomic data** and findings is truly difficult, especially to **non-scientific audiences**, but it can also leave room for a bit of panic when done wrong.
- **Further clarification** were promptly addressed by the PI of the study, some media outlets **exaggerated** or **flat-out misinterpreted the implications of these data**".

6. Social Media

- **Social media outlets** - important modes of public communication for both scientists and journalists.
- Double edged sword? - Huge potential for **amplifying** knowledge and equally **spread misinformation**; indeed, this is more likely to go **viral** **than reliable information** from scientists
- Challenge for scientists to **counter propaganda** and hysteria on social media, as well as to **engage more directly** with people.
- In particular, **being open about uncertainties** and **open questions** could help earn public trust in science.

Reference: Afshinnekoo E, Meydan C, Chowdhury S, Jaroudi D, Boyer C, Bernstein N, Maritz JM, Reeves D, Gandara J, Chhangawala S ***et al*** (2015) Geospatial resolution of human and bacterial diversity with city-scale metagenomics. ***Cell Syst*** **1**: 72–87

Steps of successful science communication

Step 1: Spotting a science story worth covering

- Discovering a good science story is the first important step towards successful science news reporting.
-
- Large number of good sources to turn to for ideas and inspiration, including

- press releases from reliable institutions

- Blogs by world-leading scientists

- Podcasts, webinars, or social media platforms, amongst others

Important Questions to be asked:

- **How do I find the story (or, to be more precise, how does the story find me)?**
- **How do I know it is worth covering?**

Reference: https://uni-foundation.eu/uploads/2021_ERUM%20-%20IO2-CommunicationGuidelines.pdf

What ignites the need of science communication in times of crisis?

COVID19 story

- Society was faced with a **level of misinformation** that was probably **unknown** until then.
- The overall experience has allowed us to **learn some important lessons** which can be immensely **valuable** in dealing with **future crises**
- Concepts like **viruses, PCR, antibodies, vaccines, and immunity** have been headline news. There has been a **high demand for information**, and a **great effort** has been made to **convert complex** scientific concepts into **information** that is **accessible** to all citizens.
- There have been examples of **specialized science journalists** who have done an exceptional job
- The pandemic has also shown that **scientific communication** and **dissemination** are of **vital importance**, due to the intermediary role they play between science and society.
- Scientific knowledge enriches public debate, strengthens democracy, and forms critical and free minds. Communicating science is **much more** than publishing an article in a journal. High-quality scientific communication can help to **explain scientific knowledge and bring that knowledge to citizens.**

Reference: Bienvenido León, Ignacio López-Goñi & Ramón Salaverría (2022) The Covid-19 catastrophe: A science communication mess?, Church, Communication and Culture, 7:1, 6-22, DOI: 10.1080/23753234.2022.2031236

Step 2: Know your audience



Imagine you list your audience as "Simpsons characters." D'oh! They're all quite different, so if your audience is that broad, the only thing they might have in common is general antipathy toward Shelbyville

How to know your audience better:

- Identify audience types
- Consider the most appropriate mode of communication for engaging with particular audiences.
- Consider factors that influence individual reception and use of information.
- Reflect on the appropriate audience level for different communication objectives.
- Appraise the importance of culture and different world views.
- Increase equity and inclusivity

Reference: https://medium.com/science-communication-media/there-is-no-general-public-starting-with-audience-for-stronger-science-communication-plans-6603a81da8d6; https://link.springer.com/chapter/10.1007/978-3-030-91628-2_3#citeas

A good recipe to communicate with broader range audience:

Consider the following examples from the American Association for the Advancement of Science (AAAS):

- **General public** wants to know how your **research impacts their lives and their societies**. This communication could take the form of a **formal presentation**, or it could be a **casual conversation** with friends and neighbours.

- The **media wants to know** what makes the findings of your research important, including **how it's different from what others have done**.

- **Peers** will be interested in determining whether your work may provide an **opportunity** for future **collaboration**.

- **Leadership** at your company/institution needs to know if a project has achieved the expected results and should **progress to the next phase**, or if changes are needed.

Source: https://graduate.northeastern.edu/resources/tips-for-effective-science-communication/

Step 3: Avoid Jargon

When your goal is to reach a wide audience, such as everyone around the globe, you shouldn't use technical terms.

Avoiding jargon doesn't mean you should **never use technical** terms — scientific terminology is sometimes unavoidable — only that you keep it to a bare minimum.

Example 1: Using jargon is typical of the World Health Organization, as illustrated by a press conference where Maria Van Kerkhove, WHO's Covid-19 technical lead, made an unnecessary distinction between asymptomatic and presymptomatic transmission that many people found confusing.

Example 2: Distinguishing between droplets and aerosol particles is what led WHO to try and define 'airborne' — a word with a popular meaning — in a scientific sense, so it would be technically correct in stating "FACT: #COVID19 is NOT airborne."

Source: https://www.forbes.com/sites/jvchamary/2021/05/31/science-communication-tips/?sh=41ef20a65450

Step 4: Be relatable

- But a distinction between droplets and aerosols can't be communicated through clear language. Use sentence like **'spread by drops that fly through the air'**

- One way to avoid scientific jargon is to incorporate analogies and stories into your scientific communication. For example, to help distinguish between **weather and climate**, you can use “If you don’t like the weather, wait a few hours. If you don’t like the climate, move.”

- A **personal or professional anecdote** will make a potentially complex topic seem more approachable, and it may leave an audience with something to remember. Just be sure that it ties back to your key findings or overall message.

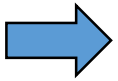
- **Conversations can enhance scientific communication**. Instead of simply presenting information in a **lecture format**, it’s important to **engage with an audience** whenever possible by **taking questions** after a presentation, responding to relevant comments on social media, and striving to **address** misconceptions instead of **dismissing** them. Conversations allow a dialogue to take place, which can help an **audience get more comfortable** with a scientific concept.

Source: https://graduate.northeastern.edu/resources/tips-for-effective-science-communication/

Step 5: Ways of communicate effectively

Choose the format/medium of communication:

1. **Oral**
2. **Visual**
3. **Written**



1. **What is the best format, medium, or genre to reach the intended audience?**

2. **Which communication format am I best prepared to work in?**

(i) Oral communication:

- Live talk can **maximize interactions** with the audience, allowing the speaker to **establish rapport**, check for **comprehension**, and **respond** to questions.

- The audience also has the opportunity to incorporate visual information such as the **speaker's body language** and slides or other visual aids.

- The live talk relies on **consistent attention** from audience members to follow the flow of information; those who become distracted are likely to miss information and may have difficulty re-engaging with the presentation

Reference: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7566313/

Once the format has been selected, answer these questions to identify how the format will affect the content and style:

1. What constraints does the format impose?

2. Is the format primarily written, oral, visual, or a combination of these?

- Audiences expect communication products to adhere to common characteristics of the genre or format. Examples??

- **Newspaper readers** will look for **headlines** to orient themselves and select articles to engage with.
- **Podcast listeners** will identify the **beginnings and endings of episodes** in response to familiar theme music or other regular audio features.
- **Scientists** expect journal articles to present **information in a particular sequence** (abstract, introduction, methods, results, discussion, conclusion, and references).

- While the common features of the genre and readers' expectations **place constraints on the scientific communication product**, they also help audiences **quickly orient** themselves to the format and more deeply engage with the scientific content.

Reference: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7566313/

(ii) Written communication:

(a) Academic writing:

- Focused academic articles on **narrow** and often **highly technical** topics;
- **Structure** them carefully, as required by targeted academic journals;
- **Objective, dispassionate, and scientific**

(b) Popular writing:

- Make **complicated** topics more **accessible** and **entertaining**
- Encouraging people to read rather than **skim**
- Opening up a whole **new world of learning** to many more people than an academic article would.

Key differences between academic writing and popular writing

	Academic writing	popular writing
Target Audience	research community	general public
Purpose	Report breakthroughs in the scientific fields	Educate, create awareness and sharing of information, knowledge and research experience to the public
Length	Very lengthy with scientific Jargon (average 10000-50000 words)	Very short with casual words (500-1000 words)
References	Long list of references with high accuracy and reliability	Minimum reference is required
Peer review	Peer reviewed by scientific fields	Review by editor, who is not a subject matter expert. Validation with experts if necessary

Source: https://www.tckpublishing.com/how-to-write-popular-nonfiction/; https://www.akademisains.gov.my/asm-publication/science-communication/

Activity: Try out yourself!

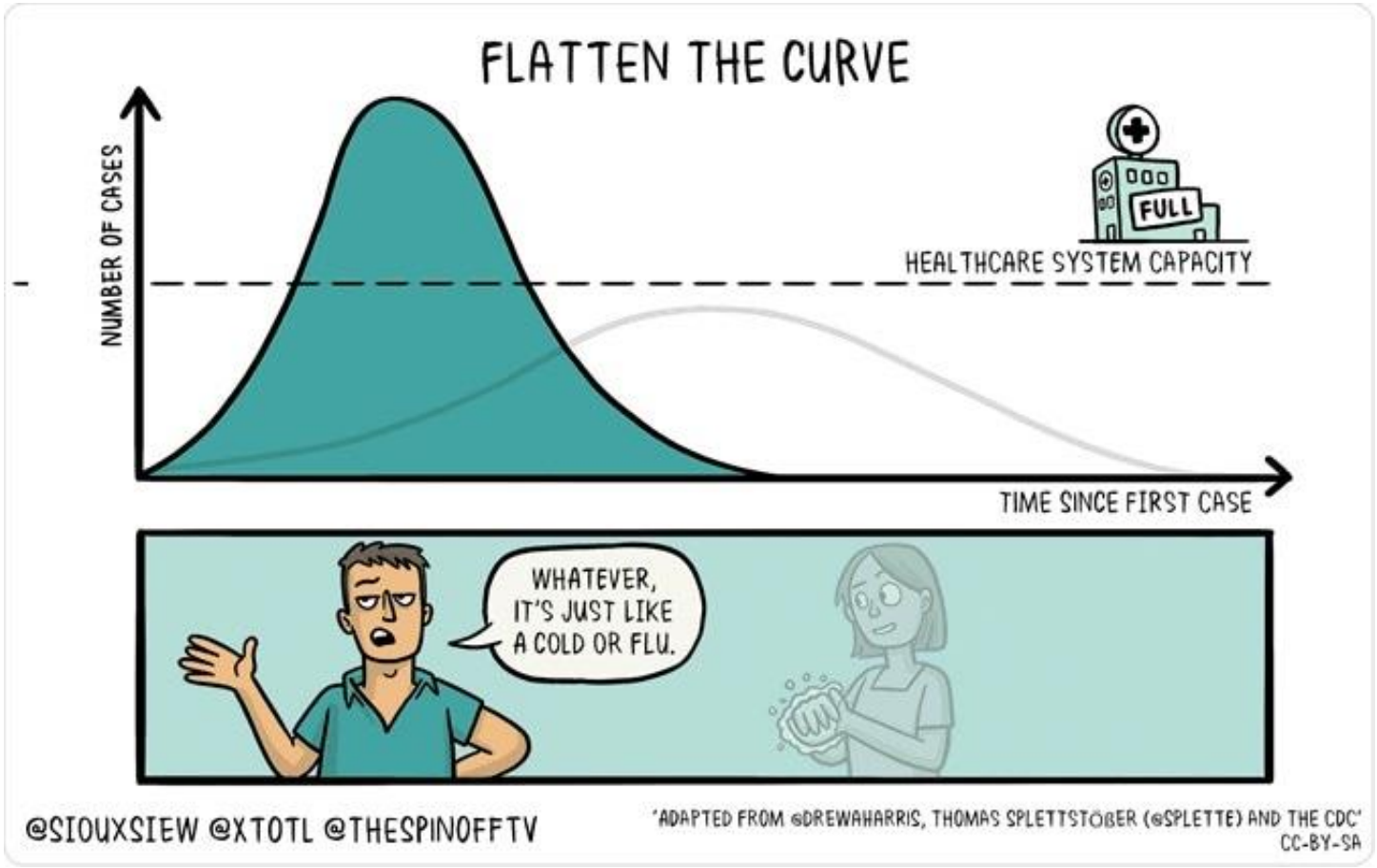
1. Write your research topic without using jargon.

2. Write a brief about your project (50-100 words) using minimum jargon.

3. Make it interesting, why the public should read and give importance to your research work?

4. How is it going to benefit them directly or indirectly?

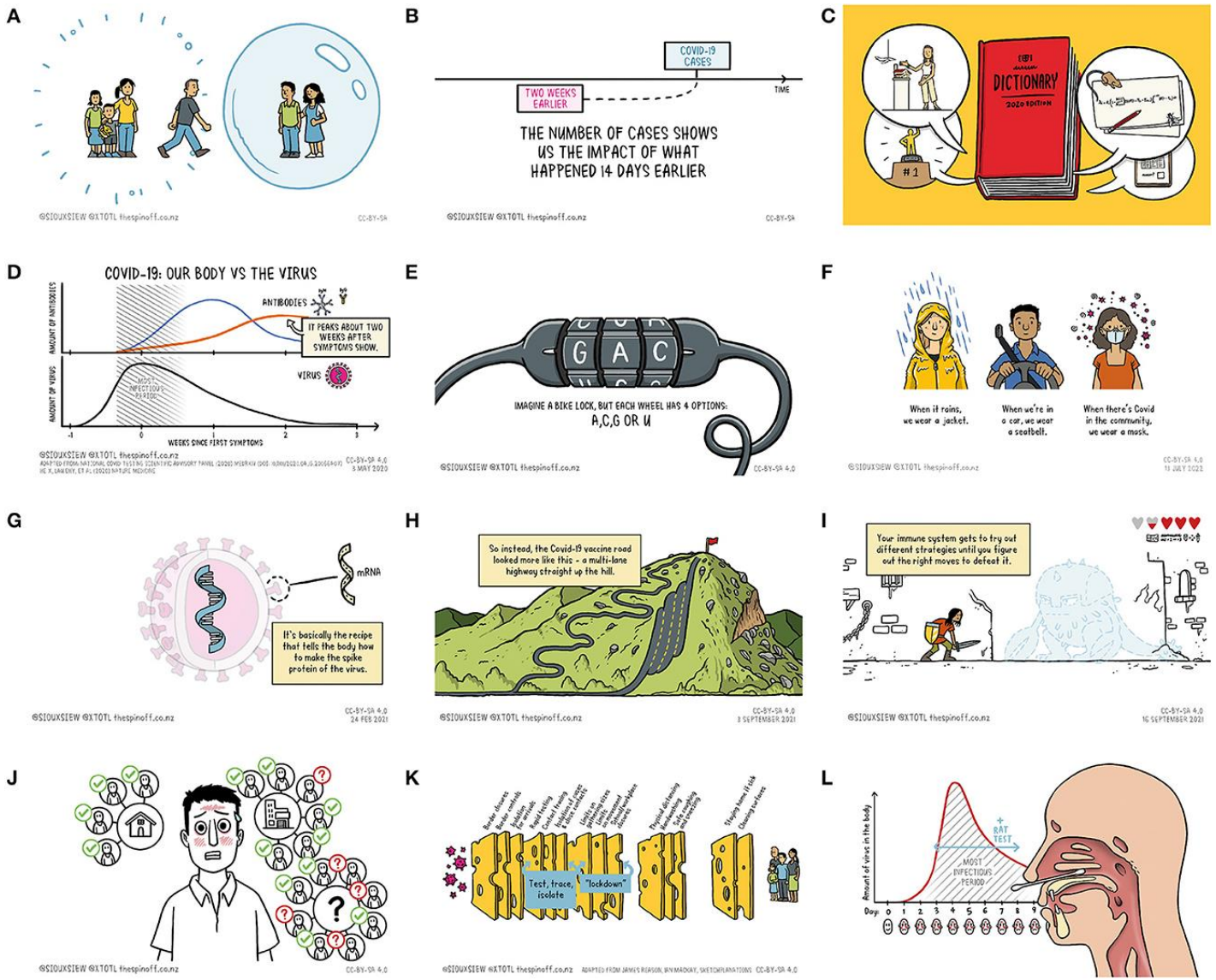
(ii) Visual communication:



On **9 March 2020**, 2 days before the World Health Organization declared COVID-19 a global pandemic, two of the authors (microbiologist and infectious diseases expert Associate Professor Siouxsie Wiles and cartoonist Toby Morris) released their first output together: an animated GIF known as **"Flatten the Curve"**. The graphic **went viral** on **Twitter with over 10 million impressions in 3 days**.

Source: https://www.news-medical.net/news/20200312/Flattening-the-curve-why-is-it-important-for-coronavirus.aspx

Example visual communication:



Selection of graphics produced by Wiles and Morris. Wiles and Morris' graphics include illustrations of the "bubble" concept for households **(A)**, how the incubation period of the virus results in a "lag" **(B)**, dual-meaning words **(C)**, different ways to detect a COVID-19 infection **(D)**, COVID-19 variants **(E)**, masks **(F)**, how mRNA vaccines work **(G)**, how the COVID-19 vaccines were developed so fast **(H)**, the concept of "community immunity" **(I)**, contact tracing **(J)**, the "The Swiss cheese model" **(K)**, and how to correctly take a nasal swab **(L)**.

Reference: https://www.frontiersin.org/articles/10.3389/fcomm.2023.1087120/full

Challenges in the field of Science Communication

Various deep rooted factors that tend to keep science at the bottom of newsgathering, packing and dissemination as pointed out below

1. **Use of Scientific Jargons and Complicated Statistics in Scientific Manuals**

- Scientific research remains an endless source of new and old terminologies that drive journalists mad.
- Mountains of raw data contained in research papers worsen it.
- It is a major professional challenge for even those with the best mass communications skills when one is to reduce piles of jargon and statistics into short, simple and clear message

2. The Social Responsibility Demands:

- Sustainable coverage of science remains elusive for many media houses.
- Even skilled science reporters first need to develop at least some strong interest in the coverage of science issues
- Despite being science journalists they are always bound to ask, ‘what is the people impact and is it for the common or public good?’

https://www.jheaonline.org/pdf/Wabwire_jhea.8.7165.pdf

3. **The Diverse Nature of Science Issues**

- Science issues tend to be diverse ranging from space science and engineering to the alarming evolution of highly drug-resistant tuberculosis (TB) and malaria germs apart from genetically engineered crops and microbes.
- There is need to specialize and cope with rapid changes in the world of science and technology.
- In Africa; health, environment, agriculture and emerging world of biotechnology are at the core of science reporting

4. **Journalistic Stereotypes and Myths**

- There is an assumption that when dealing with serious academic, professional and research issues, scientists have their own communication outlets especially peer-reviewed and high indexed scientific journals that are inaccessible to the general public
- Creates conflict and distrust with journalists

Reference: https://www.jheaonline.org/pdf/Wabwire_jhea.8.7165.pdf

Coping with the challenges in the field of science communication:

Tips for working with the Media

i. **Communicate simply and clearly:** well-written executive summary-style document, which outlines the key points of the research findings
ii. **Build relationships:** Ask your public affairs or media specialists to help communicate your published work to journalists to educate the public about it.
iii. **Set an embargo:** The most important way to make your findings as a researcher newsworthy to reporters is to make sure it's new.
iv. **Prevent misrepresentations:** Some scientists are wary of seeking press attention, fearing their findings might be exaggerated, sensationalized or otherwise misrepresented.
vi. **Finding a hook: Press release** should use one or two angles — or 'hooks' — that appeal to news values. Common hooks for science news include:

- **Broad impact:** does what the researchers found affect a large segment of the population?
- **Currency:** does the research findings connect to issues that are already in the spotlight?
- **Injustice:** does the findings highlight ethnic, socio-economic or other inequalities?
- **Irony:** are the findings unexpected?
- **Controversy:** are the findings likely to elicit a backlash from special-interest groups?
- **Local:** are the findings especially relevant to a particular geographical area?

Reference: https://www.jheaonline.org/pdf/Wabwire_jhea.8.7165.pdf

Simple Respiratory Protection—Evaluation of the Filtration Performance of Cloth Masks and Common Fabric Materials Against 20–1000 nm Size Particles

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A shortage of disposable filtering facepiece respirators can be expected during a pandemic respiratory infection such as influenza A. Some individuals may want to use common fabric materials for respiratory protection because of shortage or affordability reasons. To address the filtration performance of common fabric materials against nano-size particles including viruses, five major categories of fabric materials including sweatshirts, T-shirts, towels, scarves, and cloth masks were tested for polydisperse and monodisperse aerosols (20–1000 nm) at two different face velocities (5.5 and 16.5 cm s^{-1}) and compared with the penetration levels for N95 respirator filter media. The results showed that cloth masks and other fabric materials tested in the study had 40–90% instantaneous penetration levels against polydisperse NaCl aerosols employed in the National Institute for Occupational Safety and Health particulate respirator test protocol at 5.5 cm s^{-1}. Similarly, varying levels of penetrations (9–98%) were obtained for different size monodisperse NaCl aerosol particles in the 20–1000 nm range. The penetration levels of these fabric materials against both polydisperse and monodisperse aerosols were much higher than the penetrations for the control N95 respirator filter media. At 16.5 cm s^{-1} face velocity, monodisperse aerosol penetrations slightly increased, while polydisperse aerosol penetrations showed no significant effect except one fabric mask with an increase. Results obtained in the study show that common fabric materials may provide marginal protection against nanoparticles including those in the size ranges of virus-containing particles in exhaled breath.

TYPES OF FACE MASKS

		MATERIAL	FITTING	LEAKAGE	USAGE LIMIT
Surgical or disposable face masks		Usually made from non-woven fabric	Loose-fitting	Leakage can occur on the edges of the mask when wearer inhales	One-time use, must be changed whenever it becomes damp
N95 respirators		Non-woven polypropylene fibre	> Tight-fitting > Respirators are properly-fitted to a wearer to achieve a fit	When properly fitted and worn, minimal leakage occurs around the edges	One-time use
Cloth face masks		Made of cloth (such as cotton) and can be made at home	Loose-fitting	Leakage can occur	Can be washed and reused

Adapted from The STAR graphics

Past SARS-CoV-2 infection protection against re-infection: a systematic review and meta-analysis

*COVID-19 Forecasting Team**

Summary

Background Understanding the level and characteristics of protection from past SARS-CoV-2 infection against subsequent re-infection, symptomatic COVID-19 disease, and severe disease is essential for predicting future potential disease burden, for designing policies that restrict travel or access to venues where there is a high risk of transmission, and for informing choices about when to receive vaccine doses. We aimed to systematically synthesise studies to estimate protection from past infection by variant, and where data allow, by time since infection.

Methods In this systematic review and meta-analysis, we identified, reviewed, and extracted from the scientific literature retrospective and prospective cohort studies and test-negative case-control studies published from inception up to Sept 31, 2022, that estimated the reduction in risk of COVID-19 among individuals with a past SARS-CoV-2 infection in comparison to those without a previous infection. We meta-analysed the effectiveness of past infection by outcome (infection, symptomatic disease, and severe disease), variant, and time since infection. We ran a Bayesian meta-regression to estimate the pooled estimates of protection. Risk-of-bias assessment was evaluated using the National Institutes of Health quality-assessment tools. The systematic review was PRISMA compliant and was registered with PROSPERO (number CRD42022303850).

Findings We identified a total of 65 studies from 19 different countries. Our meta-analyses showed that protection from past infection and any symptomatic disease was high for ancestral, alpha, beta, and delta variants, but was substantially lower for the omicron BA.1 variant. Pooled effectiveness against re-infection by the omicron BA.1 variant was 45·3% (95% uncertainty interval [UI] 17·3–76·1) and 44·0% (26·5–65·0) against omicron BA.1 symptomatic disease. Mean pooled effectiveness was greater than 78% against severe disease (hospitalisation and death) for all variants, including omicron BA.1. Protection from re-infection from ancestral, alpha, and delta variants declined over time but remained at 78·6% (49·8–93·6) at 40 weeks. Protection against re-infection by the omicron BA.1 variant declined more rapidly and was estimated at 36·1% (24·4–51·3) at 40 weeks. On the other hand, protection against severe disease remained high for all variants, with 90·2% (69·7–97·5) for ancestral, alpha, and delta variants, and 88·9% (84·7–90·9) for omicron BA.1 at 40 weeks.

Take home message?

- Protection from past infection against re-infection from pre-omicron variants was very high and remained high even after 40 weeks.
- Protection was substantially lower for the omicron BA.1 variant and declined more rapidly over time than protection against previous variants.
- Protection from severe disease was high for all variants.
- The immunity conferred by past infection should be weighed alongside protection from vaccination when assessing future disease burden from COVID-19,
- Providing guidance on when individuals should be vaccinated,
- Designing policies that mandate vaccination for workers or restrict access, on the basis of immune status, to settings where the risk of transmission is high, such as travel and high-occupancy indoor settings.

Findings can help public health policy

Molecular Virologist Dr Vinod Balasubramaniam also reacted to the study, saying the results could be beneficial in providing information that can be used to tailor guidance on the number and timing of vaccinations.

"At the public health level, these findings can be combined with data on local infection prevalence, vaccination rates, and their timing," Dr Balasubramaniam said.

> "Interestingly, the level of protection from past infection by variant and over time is equivalent to that provided by two-dose mRNA vaccines has important implications for guidance regarding the timing of vaccine doses, including boosters.

"This finding also has important implications for the design of policies that restrict access to travel or venues or require vaccination for workers, where those with a documented infection should be treated similarly to those who have been fully vaccinated with high-quality vaccines."