

Operations Research in Israel MOH Covid-19 Task Force

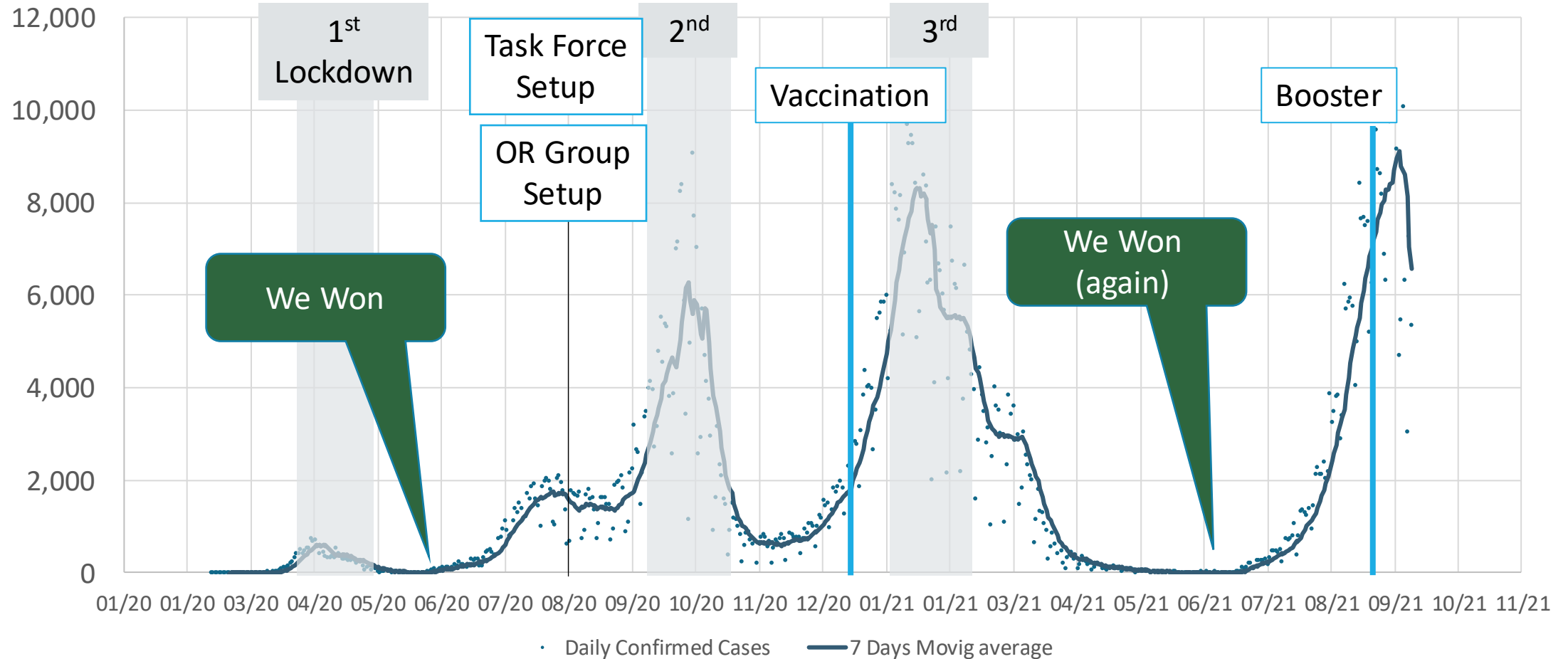
Mizrahi Ami

Head of the OR group

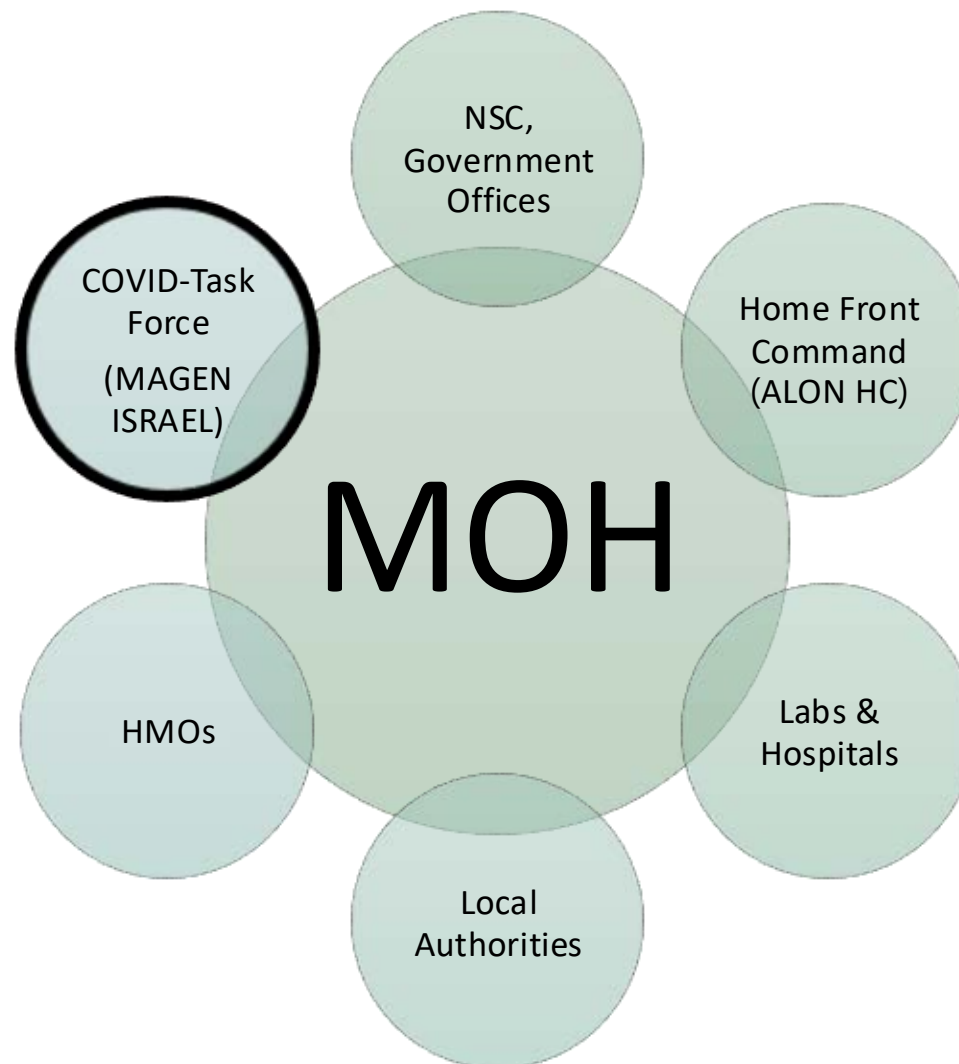
Takeaways from setting up a new OR group

Covid-19 in Israel

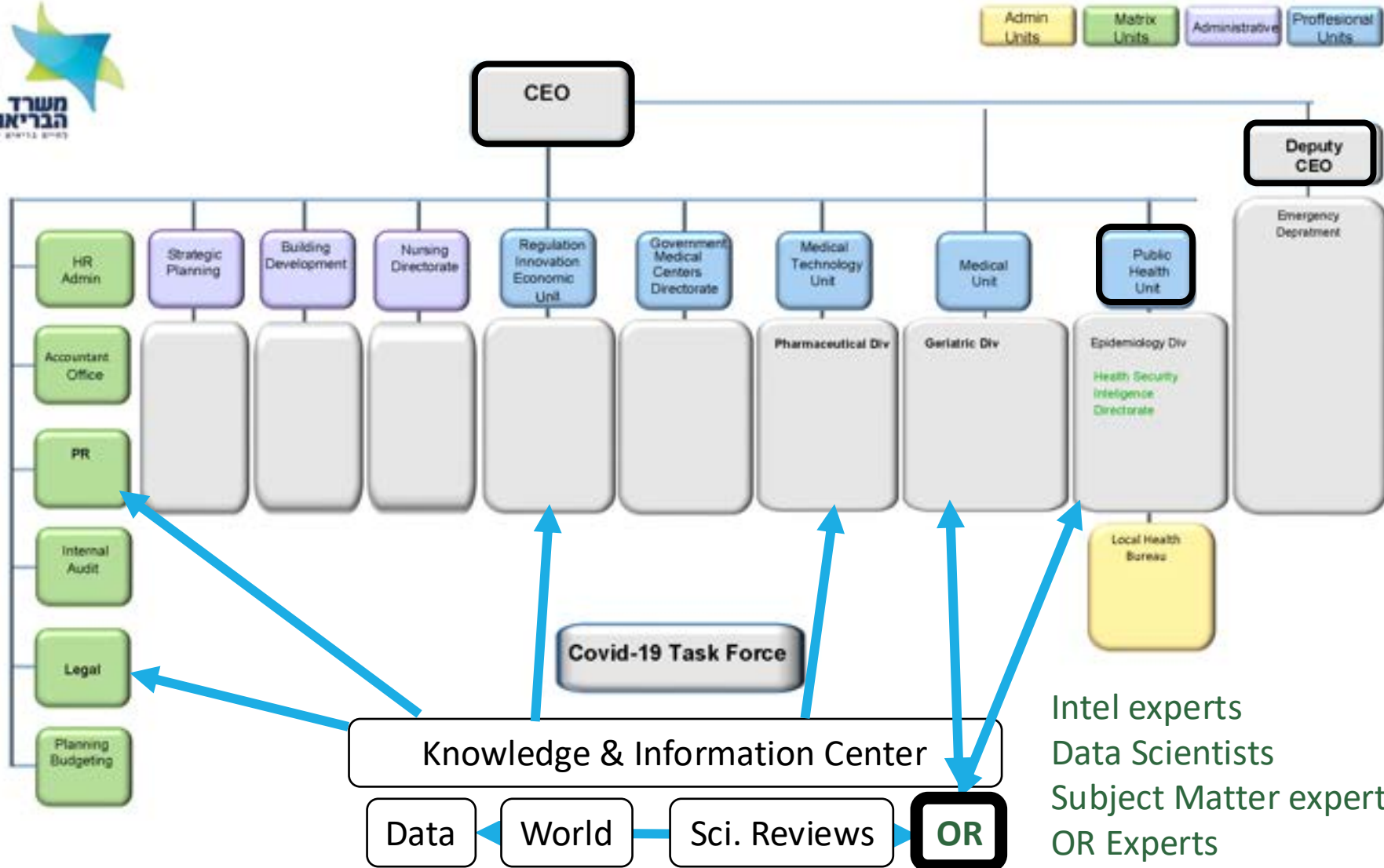
Daily new confirmed COVID-19 cases in Israel



MOH and Partners Dealing with Covid Pandemic



The OR Group and the Israeli MOH



Professional and Environment

- Professional:
 - Build the team
 - Utilize available research capacity
 - Earn trust
 - Create partnerships & Dissolve differences and tensions
- Environment / Decision Process
 - Head of public health (2)
 - Health ministers (4) ; CEO's (3) ; Deputy CEO (1.5)
 - Advisory Committee for Epidemics (1)
- Corona Task Force – starting Aug. 2020

Examples to go along and tell the story

- Domestic Policy
- Vaccines
- Border Control

Domestic Policy

Stoplight policy

Effectiveness of Local Policy Measures



פתיחת עסקים לפי תקנות שעת חירום

אסור בהפעלה כלל כמפורט בתקנה 5(א)

מותר בפתיחה בכפוף להגשת הצהרה לרשות המקומית, על ערידה בתאום המפורט בתקנה

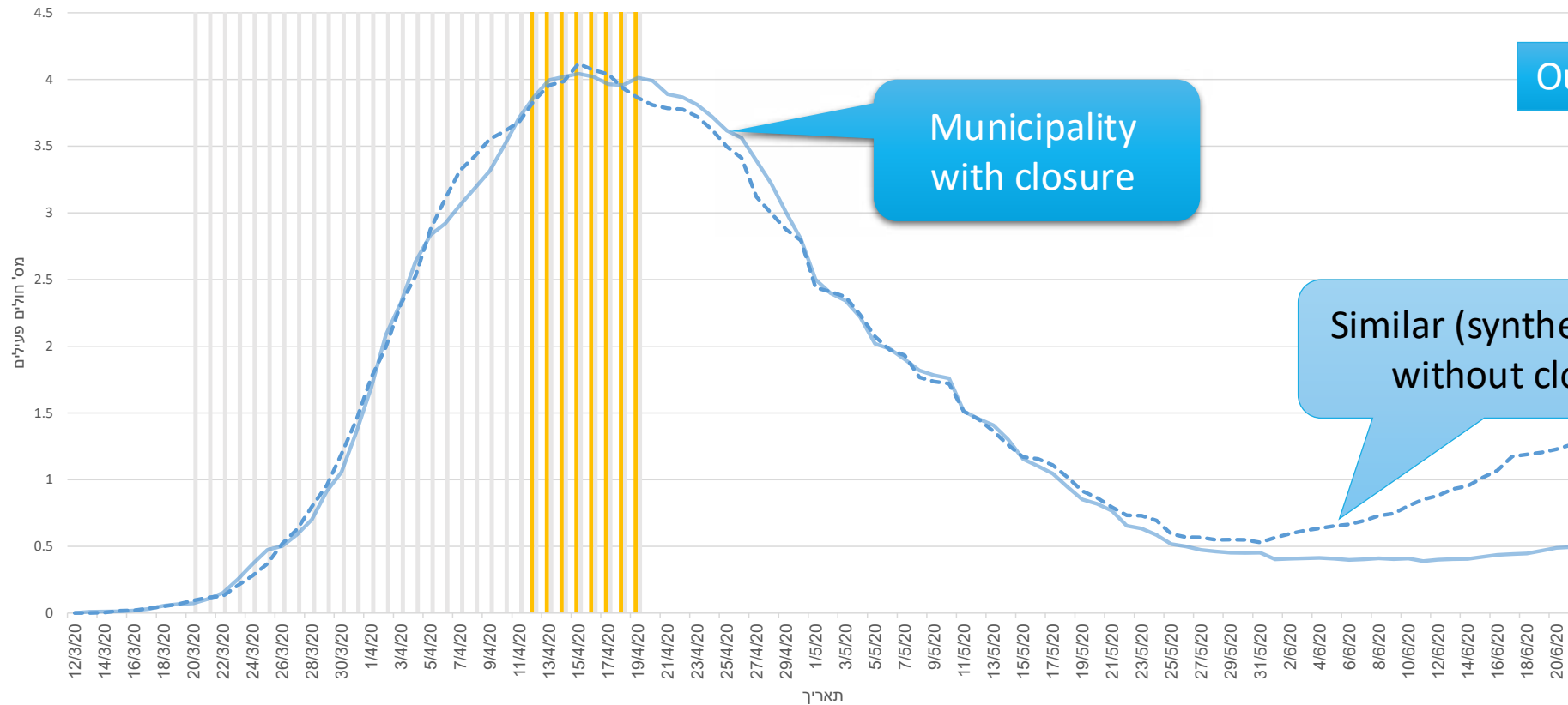
מותר בפתיחה בכפוף לתנאים המפורטים בתקנה 5(א) ו-5(ב) - ללא הגשת הצהרה

Local Closures (are not) Effective to reduce infections IN the municipality

הסגר של 12-19.4.20:
אמידה סינתטית מול השפעה בפועל
חולים פעילים - מתוקנן ל-100,000 איש

9.2020

Outsourced to HUJI



Municipality with closure

Similar (synthetic) area without closure

סגר מקומי (Yellow vertical lines) | סגר כלל ארצי (Grey vertical lines)
 מס' חולים פעילים (מתוקנן ל-100,000 איש) - ממוצע ערכים בפועל (Solid blue line) | מס' חולים פעילים (מתוקנן ל-100,000 איש) - ממוצע אמידות סינתטיות (Dashed blue line)

Local Closures (are not) Effective to reduce infections OUTSIDE the municipality

Infections per 1,000 infected in original municipality		Origin Municipality			
		RED	ORANGE	YELLOW	GREEN
Destination municipality	RED	52	42	28	20
	ORANGE	79	49	82	78
	YELLOW	45	57	134	144
	GREEN	30	50	104	170
total infections in other municipalities		0.20	0.20	0.35	0.41
Total infections per infector		1.02	0.99	1.01	0.98

9.2020

Done by students during summer-break

People from highly infectious municipalities – infect more, but mostly in the original municipality

Local closures in RED municipalities are NOT EFFECTIVE

1 Researcher
+ 4 Students

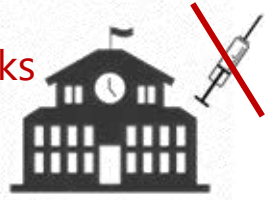
What are the other policy tools?

Done in collaboration
Intelligence Group

9.20
Closure Ends

Crowds, time limit,
Ventilation, PPE/Masks

Infections



Schools



Bars



Gyms

25-50

+50



Culture/Shows



Events



Restaurants



Shopping Centers



Personal Services

+18



Non-Personal Services

Reduce Infections

- PPEs/Masks
- Limit Capacity & time
- Ventilation
- Outdoor events
- Recent Test

Reduce Severe Sickness

- Age Limit
- Open only to vaccinated

1 Researcher
+ 4 Students

Age/Vaccination

Severe Sickness

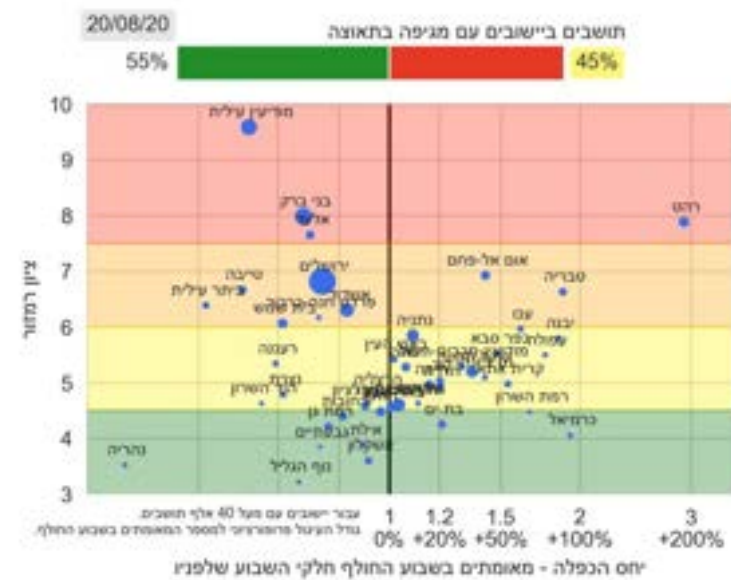
The original rationale of STOPLIGHT KPI proved not effective but it was adopted with limited tools

8.2020

- STOPLIGHT = F(new infections in locality , % positive)
- The original rationale of closures on “red” municipalities proved not effective
- **The Stoplight policy was adopted to compel local politicians to join**
 - Our work helped direct the policy towards more relevant policy tools (education, gathering restrictions)
 - It became a national KPI

Our Data Group produced daily STOPLIGHT KPI nationally

1 Researcher + 4 Students



Border Control

1. Tools for assessing KPI's based on partial data
2. Change of KPI's over time

Border Control

- What is the KPI?
 - **Infections**
 - significant level of infections compared to local levels
 - **Variants**
 - dangerous variants compared to local variants
- Reliability of data
 - Available data - Our World In Data
 - Check Covid mortality and excess mortality data to estimate cases (IFR)
 - Use incoming flights **tests** and **sequencing** to estimate risk

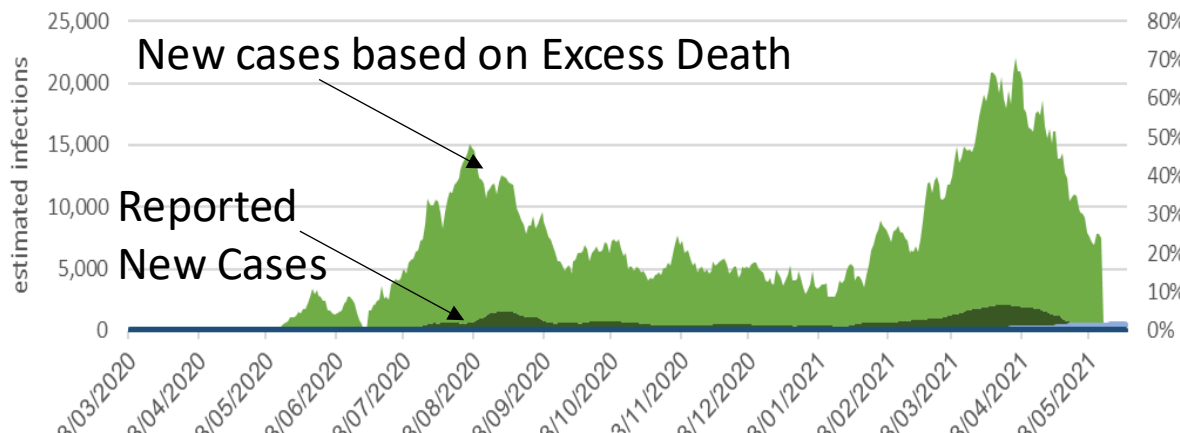


Data is incomplete → Assess what you can't measure

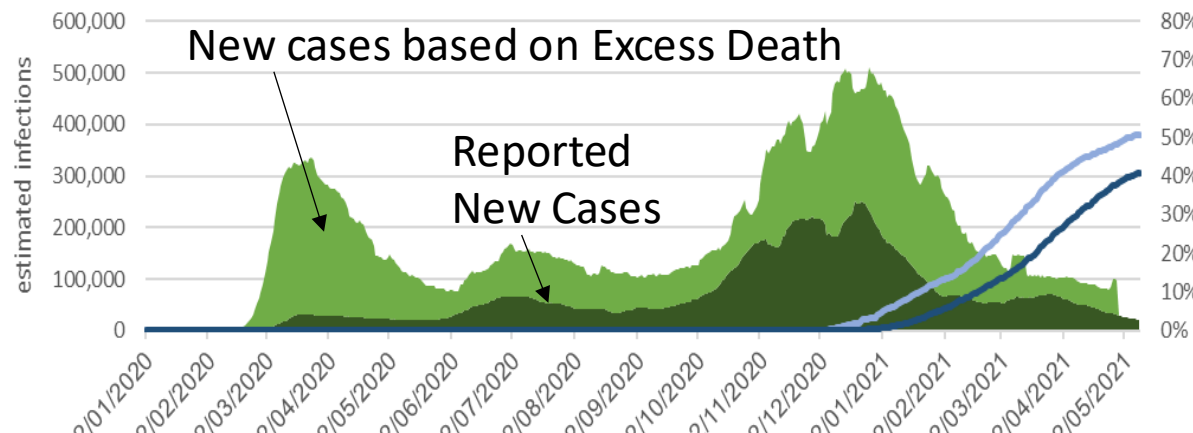
Thanks to OWID



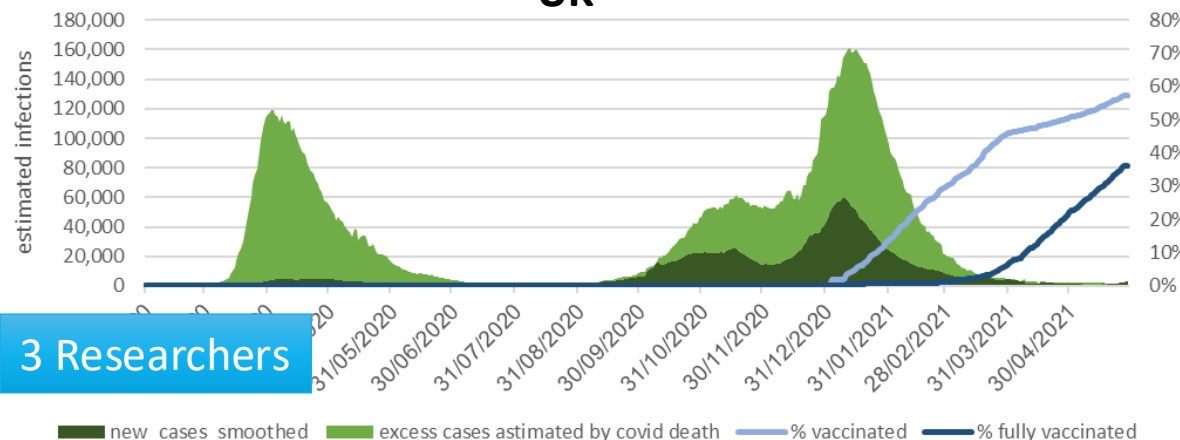
Daily infections estimation in Ethiopia Ethiopia



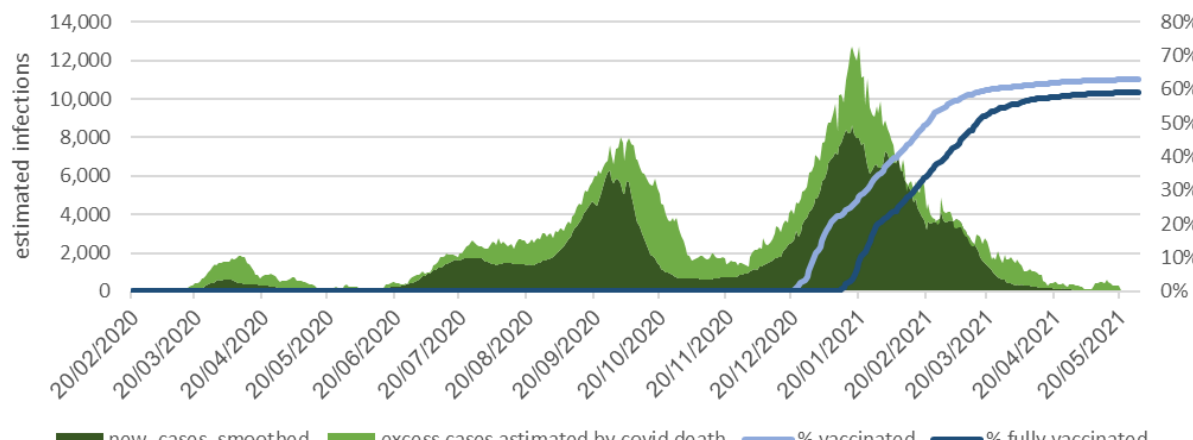
Daily infections estimation in United States USA



Daily infections estimation in United Kingdom UK



Daily infections estimation in Israel Israel



We suggested that tests could substitute isolation

Test Strategies

34.3	20.1	11.4	8.0	6.3	3.3	1.8	0.7	0.5	מדינה	סיכוי הידבקות לתושב ממוצע
Landing + 7 Days After	Landing + 6 Days After	+ בנחיתה 5 ימים	Landing + 5 Days After	Landing + 4 Days After	Landing + 3 Days After	2 Days after	At Landing	No test	Israel	124
+	+	+	+	+	+				Argentina	374
+	+	+	+	+	+		+	+	Australia	2
+	+	+	+	+					Austria	433
+	+	+	+	+	+				Bahrain	106
+	+	+	+	+	+				Belarus	295
+	+	+	+	+	+				Belgium	162
+	+	+	+	+	+		+	+	Botswana	41
+	+	+							Brazil	468
+	+	+							Bulgaria	998
+	+	+	+	+	+		+	+	Cambodia	0
+	+	+	+	+	+				Canada	226
+	+	+	+	+	+		+	+	China	0
+	+	+							Croatia	1305
+	+	+	+	+					Cyprus	516
+	+	+	+	+					Czech Republic	433
+	+	+	+	+	+		+	+	Democratic Republic of Congo	34
+	+	+	+	+	+				Denmark	253
+	+	+	+	+	+				Egypt	114
+	+	+	+	+	+				Estonia	364
+	+	+	+	+	+		+	+	Ethiopia	22

4-11.2020

Research Volunteer

The suggestion was not accepted then
Only a year later, the policy was accepted

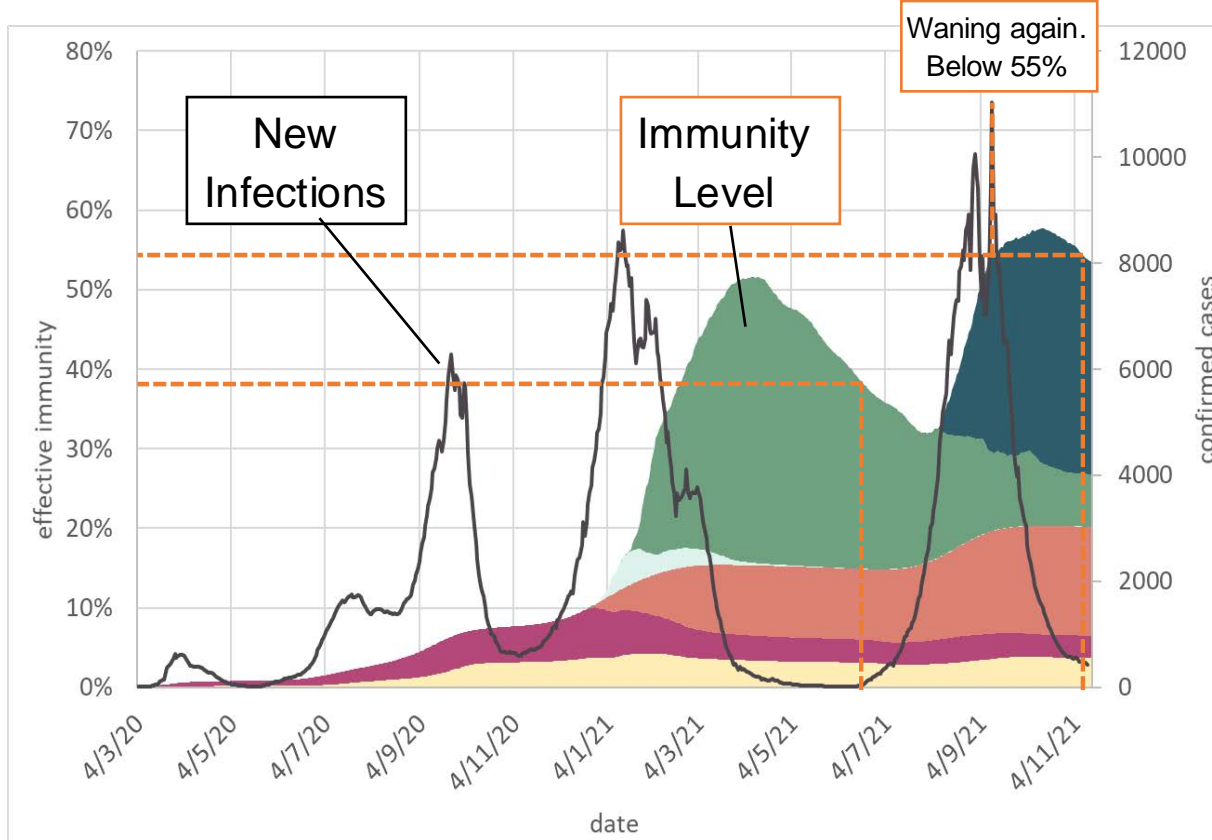
3-4 Researchers

Assessing is harder – Multitude of Vaccinations, Variants and decay times

We assessed the empirical protection threshold

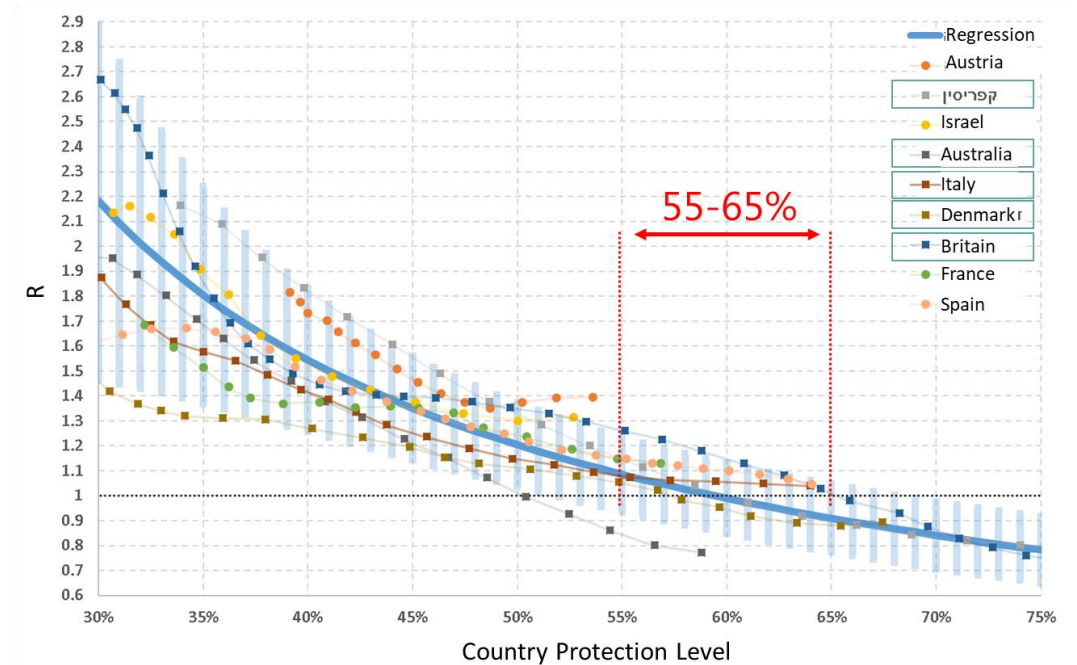
11.2021

Israel total immunity VS. daily cases



- recovered (PCR) not vaccinated
- recovered (IHME) not vaccinated
- recovered + vaccinated (PCR+IHME)
- first dose only (not recovered)
- second dose only (not recovered)
- booster (not recovered)

Protection Threshold against Omicron (BA.1): 55-65%



16 Researchers

This work promoted the 2nd booster

And when we can't rely on others – We Do it ourselves

International Travel Tests

International Travel Tests (ITT) Goals

- Prevention
- Survey:
 - Vaccine wanning – national and international
 - International prevalence of covid
 - Variant tracking – National & International

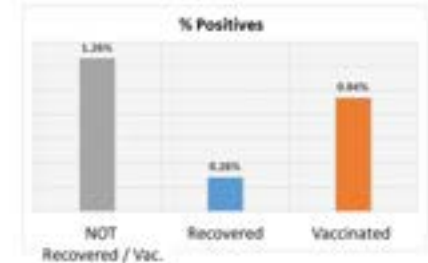
ITT as a Monitor for Vaccine Wanning

11.2021

All Entries



Specific Country

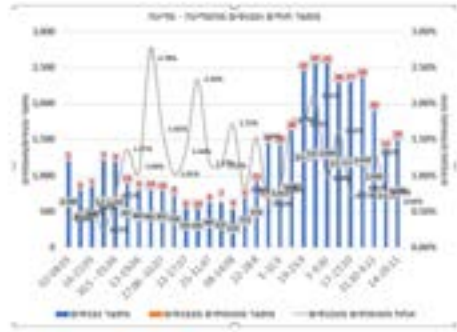


ITT as a Monitor for International Prevalence

All Entries



Specific Country



ITT as a Monitor for Variant Tracking

Test Case – AY.1 in country with insufficient data

GISAID Data

Variant	Count	Percentage
AY.1	6	38.46%
AY.1.1	4	30.77%
AY.1.1.1	3	23.08%
AY.1.1.1.1	1	7.69%
Reference	-	-



Incoming Data – AY.1 Variant can be spotted



Vaccines

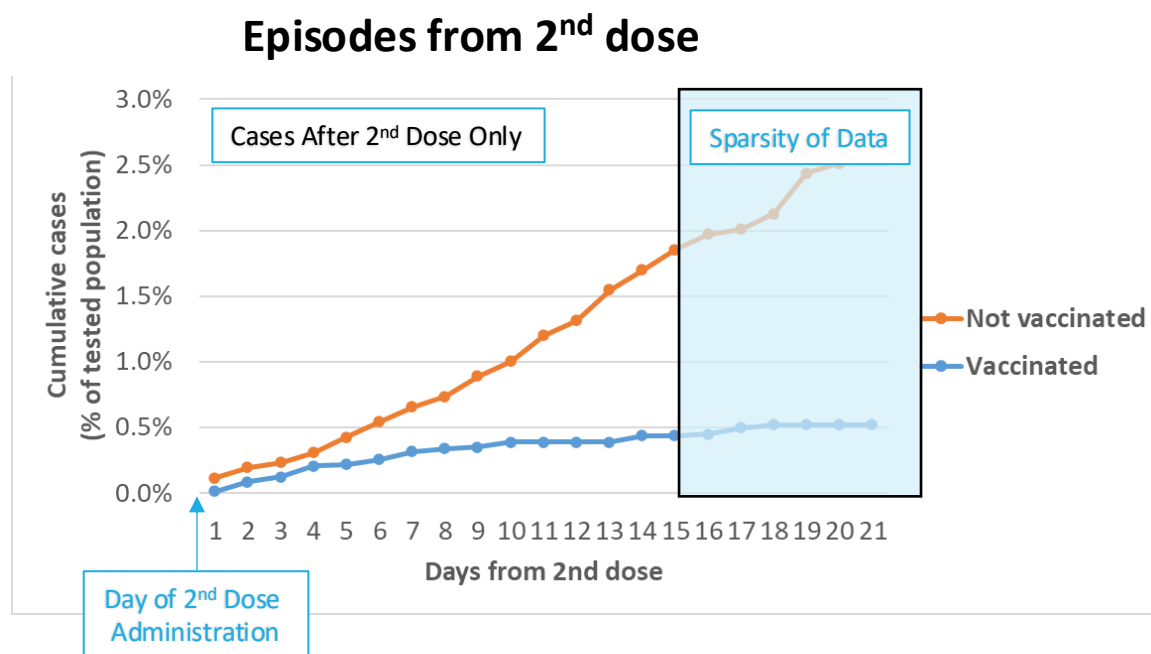
We were “leading the fleet”

- Effectiveness against a-symptomatic infections
- Vaccine Waning
- 3rd Dose Effectiveness

Vaccines (1) – Effectiveness Against Infections (not only symptomatic)

- 2nd Vaccination dose in Israel
 - LTC facilities ~ Jan 30th

2.2021



Days from 2 nd dose	PFE* (CI 95%)
7-14 days	88% (76%, 94%)
7+ days	90% (83%, 94%)

* PFE – Prevented Fraction in Exposed

* Data extracted on Feb 14th; Vaccination operation of 2nd dose amassed in LTC facilities on end of Jan 2021

Fast and crude analysis → feedback & verification

2.2021

2 Weeks

- 2nd Vaccination dose in Israel
 - LTC facilities ~ Jan 23rd

Presentation to Israel Policy Makers - Feb. 3rd



Vaccination Effectiveness
against Acquisitions of SARS-COV-2 Virus based on
Routine Staff Tests in Long Term Care Facilities

Presentation to the effectiveness and safety of Covid-19 Vaccines

Ami Mizrahi
Omri Bodenheimer

3.2.2021

5 Weeks

Presentation to ECDC - March 5th



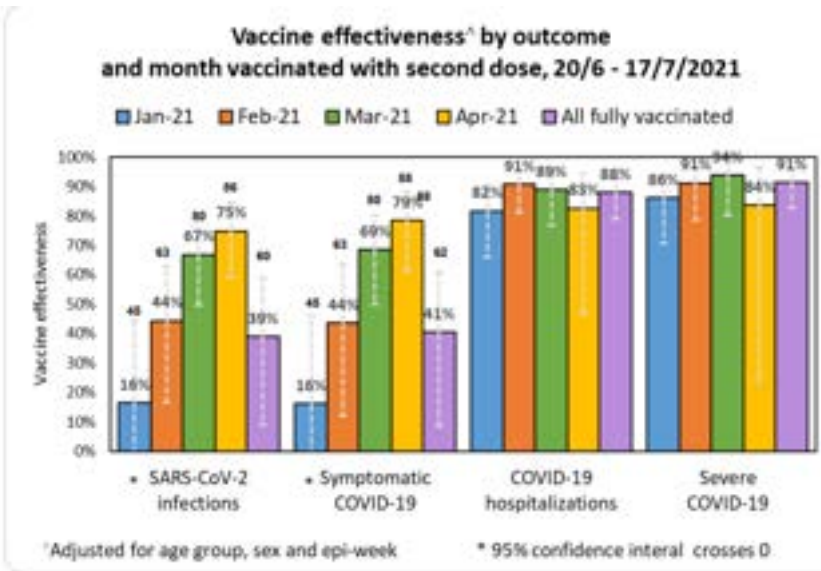
BNT162b2 Vaccination Effectiveness
Against Acquisitions of SARS-COV-2 Virus
Based on Routine Staff Tests in Long Term Care Facilities

Israel Corona CCC / Operations Research Group
M.Sc. Omri Bodenheimer, M.Sc. Ami Mizrahi, M.A. Avner Kantor

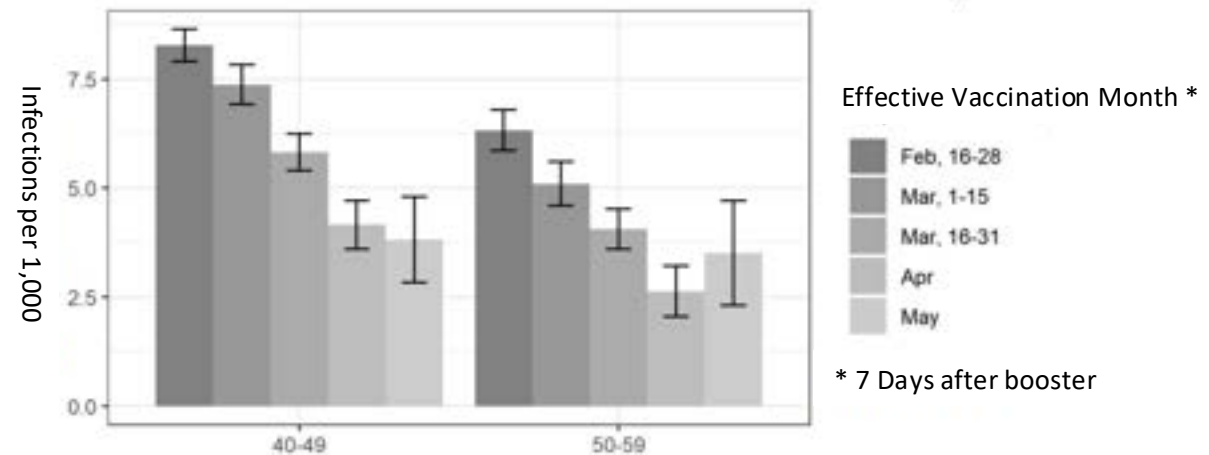
Presentation to ECDC/NITAG
March 5th, 2021

Vaccine (2) - Waning uncoordinated results can be harmful

6.2021



Detected Infections vs. Date of Vaccination



1st Presentation to Israeli Advisory Committee for Epidemics - July 15th
 3 meetings later, 28th Jul. – booster approved for ages 60+

2 different groups

5 Researchers

Different analyses, same conclusions, similar but not identical results, delayed decision for weeks

Vaccine (3) - Booster

Coordinate all research groups proved effective when the need for a booster came



8.2021

BNT162b2 vaccine booster dose protection: A nationwide study from Israel

Yinon M. Bar-On¹, Yair Goldberg^{12*}, Micha Mandel¹³, Omri Bodenheimer⁴, Laurence Freedman⁵, Nir Kalkstein⁶, Barak Mizrahi⁶, Sharon Alroy-Preis⁴, Nachman Ash⁴, Ron Milo^{8,1}, Amit Huppert^{8,5,7}

https://www.gov.il/BlobFolder/reports/vaccine-efficacy-safety-follow-up-committee/he/files_publications_corona_booster-fdp.27082021

Waning immunity of the BNT162b2 vaccine: A nationwide study from Israel

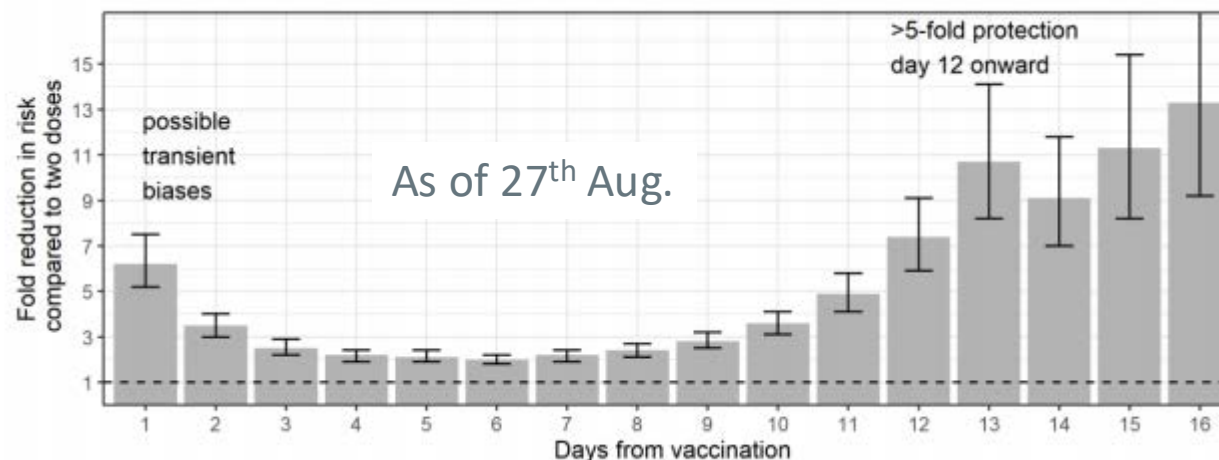
Yair Goldberg^{11*}, Micha Mandel¹², Yinon M. Bar-On³, Omri Bodenheimer⁴, Laurence Freedman⁵, Eric J. Haas^{4,7}, Ron Milo³, Sharon Alroy-Preis^{8,4}, Nachman Ash^{8,4}, Amit Huppert^{8,5,6}

https://www.gov.il/BlobFolder/reports/vaccine-efficacy-safety-follow-up-committee/he/files_publications_corona_immunity-waning-fdp.082021

NEJM Publication - World Class Research

Booster Efficacy

8.2021



Aug. 12th - booster approved for ages 50+
Aug. 19th - booster approved for all eligible ages

Empirical data proved booster efficacy; growing infection rates
→ prompted expanding the booster to other age groups

Takeaways

Takeaways

- Setting up a OR group is challenging
 - Learn fast and deep
 - Earn trust
 - Coordinate –
 - know the other groups, have peer reviews, create partnerships, dissolve differences
 - Create Personal relations with decision makers
 - Get “screen time” – official and unofficial, direct and indirect
 - Get results in time to impact decisions
- What helped (besides the general sense of emergency):
 - Access to people
 - Enjoy what **My Unit** has to offer - world, data, scientific reviews
 - Connect to **Other Units** – provide them with deep and data-based insights
 - Increase **research capacity** - universities, ad-hoc researchers (not a simple task)
 - Access to data
 - Understand and double-check it, Talk to the users
 - Use outside sources of data (but carefully)
 - Always try to find the missing data and potential biases