



Global Covid-19 vaccine inequality: looking back, looking forward with Karrar Karrar, Lara Dovifat and Ken Shadlen

This is a written transcription of the podcast 'Global Covid-19 vaccine inequality with Karrar Karrar, Lara Dovifat and Ken Shadlen'

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Rory Horner So I'm delighted that we have this great panel here today. Thank you for those joining us in the room, and those joining us online. I think this is an incredibly important topic. In many ways the development and rollout of COVID-19 vaccines is an incredible achievement that has happened so quickly; that it has helped to control the pandemic in some parts of the world. But at the same time, it has been so incredibly uneven in terms of who has got access to COVID-19 vaccines. And when many countries have prioritised more vulnerable people and health workers domestically and who gets vaccines first, but those kind of narratives have not been present internationally, in that its national citizens first, especially in higher income countries, that have been prioritised over more vulnerable people in low and middle income countries.

So there's been, we're all aware that there's a significant amount of vaccine inequality, what we would like to do in today's session is have, it's over two years now since the W.H.O. declared this pandemic; it's well over a year since vaccines started to be rolled out. It's a good time to reflect on what has actually caused COVID-19 vaccine inequality. Secondly, what still needs to be done for access to COVID-19 vaccines? Where this pandemic is far from over and many people still do not have access to vaccines. And the third issue we'd like to address is what can we learn, and what needs to be done, to prevent such inequalities in the future for future pandemics and potentially for broader access to health products?

So we're going to try and have a format where we move between the different panellists and cover each of these issues. So the first question I'm going to ask each of the panellists to address is what has caused COVID-19 vaccine inequality? And I'm going to start with Ken and then move to Lara and then to Karrar on this issue first first. So thanks again Ken for joining.

Ken Shadlen Thanks, Rory. Thanks for inviting me and thanks to people who are here in person and virtually. What has caused vaccine inequality is obviously a huge, huge topic and I'm just going to focus, very briefly, on two overriding things and then let Karrar and Laura build on what I've said at their own course. The first, I think, has been an utter lack of cooperation around the production and distribution of vaccines and it starts from when the pandemic started. There is an organisation based in Norway called CEPI, which is the Coalition for Epidemic Preparedness

Innovations, which was funding a series of vaccine, a set of vaccine produced candidates then, And of course, its funding had, attached to it, access conditions says, "...if you take our money and then you were successful, you will make these vaccines widely available". And what 'widely available' meant was sell them, to provide them, to a global purchasing agency called COVAX, and we'll talk about that.

But what happened was that while CEPI was doing that, individual governments were doing the same thing. So, and the same candidates that CEPI was supporting, were the same candidates that the UK government were supporting, the same candidates that the US government was supporting and so on. And so because the US and the UK and individual governments gave the vaccine developers a lot more money, their access conditions which were 'serve us' and not 'serve global purchasing agency', they won out. So the first thing is that there was a lack of cooperation there, and the organisation that was created to address that was essentially outgunned, to put it simply.

The second then is the agency that was created to purchase vaccines, jointly, and then sell them or give them, depending on the income status of countries around the globe. Because countries, starting with wealthy countries, were buying vaccines directly this agency, which is called COVAX, didn't get vaccines. And then once it became clear that the first batches of vaccines that were going to come off the line, and no one knew at the time when they would be available, that turned out by the end of 2020, once it became clear that those first doses were going to go to the countries that bought them directly from the producers, from the vaccine developers, rather than through the international agency COVAX, than any country who had the means started to do that. And that's why, sort of, the first...that's when low income countries got really left out. A lot of middle income countries were able to get into that game of buying vaccines on their own as well. They did it late, or later than the wealthier countries did, but it took a lot longer until eventually the African Union, for example, started doing that.

I would say just before moving on to the next big thing that I think there might have been a small missed opportunity for many lower income countries in which they had a resource that I think got under exploited; which is that many of the late stage clinical trials were conducted in low income countries. And it would have not been unfeasible for a country to say "If you want access to the virus that's floating around our country, because that's what you need if you're going to run a clinical trial, then we'd better get some of the product". And I've been spending the last two years trying to see if any country actually did that, and so far I'm not able to find any country that actually, sort of, leveraged what I would call sort of it's 'virus power'. Here's another resource, the wealthier countries said "We're going to give you money, which if we don't give you the money, you can't produce your vaccines". Countries that are hosting clinical trials could have, in theory, said, "We're going to give you access to the genetic resources that you need to conduct your trials" and it does seem to me that wealthier countries played their resource differently, or more aggressively I would say, than many foreign countries did.

The second thing that I just want to say before moving on is this issue of production. It's strange, there hasn't been enough. Now, it's strange to say that there hasn't been enough. Because in a normal year before the pandemic, people have probably seen these figures, but in a normal year before the pandemic, the world produced and consumed somewhere between three and four, maybe five in a bad year, doses of vaccines. And in 2021, we produce 12 billion doses of vaccines just for COVID-19. And we still managed to produce all of the other vaccines for all of the other things that vaccines are used for.

So I do think it's hard to say with a straight face that there hasn't been enough production. But on the other hand, because there's been unprecedented, a crazy amount of production. But on the other hand, I will say with a straight face, there hasn't been enough production. And all of those distributional issues about who gets the vaccines are obviously much more intense given relative to the size of the pie.

Some of the vaccine producers have been much more active in decentralising their production, setting up partnerships with facilities around the globe. So the one that stands out the most for this is the AstraZeneca vaccine, which the Oxford AstraZeneca vaccine. They've entered into partnerships for production of this in Argentina, Brazil, Thailand, South Korea and most obviously their main partner the Serum Institute of India. Other vaccine producers have been much less reticent, much more reticent and sort of essentially kept all of their production more or less centralised. The Moderna vaccine produced by Pfizer and BioNTech, essentially, everything is within Pfizer and BioNTech. Moderna, very centralised. But the Chinese vaccines have also been very centralised. So it's not just sort of any of our neighbours. In some ways, the AstraZeneca one stands out for being the most decentralised. We need more local. We need more production. And we need more technology transfer from the originators to sort of distributed and decentralise the production on a global scale.

I think that at this point in March of 2022, there's probably not a person on the Planet Earth who doesn't say that as well. We need more technology transfer to enable local production of vaccines for more producers in more countries. The problem is it's one of those things, like many things that everybody says, that's really hard to put in action because nobody knows how to do that. It's not clear. Certainly you can't force them to share their technology. You don't know if they're going to share. It maybe, you know, you could've perhaps, we'll get to this maybe in certain ways of the future. You could have perhaps put those into the access conditions. If you want this money, you have to produce not just enough vaccines for us, but enough vaccines for the world. Or you have to share your technology with X number of companies. But again, I think that's one of those things, that I fully advocate that in principle, but again, that's one of those things that I think is easy to say and hard to do because it's not clear how you benchmark that, how you know what is enough? How you monitor how much they're doing? I don't think there's an easy solution there.

So I'm going to turn it over to Karrar and Lara. And I just wanted to say one last thing, which is that there's been, it's tempting to look at this in a very sort of certain way. We know what happened. We know what could have happened. We know if we had done this instead; we would have had an alternative outcome. There's a huge amount of contingency and in some ways there are certain things that...This all could have been a lot worse and it all could've been a lot better. It all could have been a lot worse if, as Rory said, the vaccine development wasn't as successful as it was. When the pandemic started in February-January of 2020, nobody really believed that we were going to get effective vaccines within a year. It just seemed completely unrealistic. And so it all could have been a lot worse or definitely, we could have had a lot more vaccine equality and the fact that none of us had any.

It also could have been a lot better. It would have been a lot better if the Delta Wave hadn't ravaged India a year ago, because India was the biggest supplier to COVAX, this global scheme, and once the Delta wave hit India, then all the vaccines that were produced in India for the next six months were kept in India. So a lot of the vaccine inequality is sort of a South-South inequality that was a function of really bad luck. Of course, that's also a function of the fact that production

was overly centralised. There just weren't enough producers. And in retrospect, it's too bad that basically this COVAX scheme we rely on so much on one producer in one country. But these are contingency things. I mean the Delta wave didn't have to hit India so hard in March. And if the Delta wave hasn't hit India so hard in March last year the inequality scenarios that we're looking at would have been different. So I'll leave it there just with that point that just... there's a lot of things that just happen that are totally out of our control and unknowable. And so beware of people who...beware of "If we had done this, then we wouldn't have had that outcome".

Rory Horner Thanks, Ken. Lara, if you're okay to come in next?

Lara Dovifat No problem. Now I fully agree with what Ken already shared, and I think we also have to look into the reality in countries where we work as Doctors Without Borders these days. So while in high income countries we see figures over 70 percent in vaccination rates; in countries like Chad, Burundi or the DRC, where it's like around one percent. And just maybe to add to what Ken already said, I want to look into two factors and the first one is the framing, right?

I feel like we all remember well, when this all started, we heard the leaders of high income countries talking about global solidarity, about like a global public good. When in reality, they did not a lot in the first months when the vaccine was on the market to really enable global solidarity and the global access to these public goods. Because they were not able and not willing to challenge pharmaceutical companies and instead we saw a really nationalistic approach and response to the pandemic.

And I think secondly, it's crucial to see how public and private partners came together, and I think it's important to look, follow the leaders promise global solidarity, in particular countries with mRNA originator companies like the US and Germany, did nothing to challenge the monopolies of these companies. Until today, they haven't seen one bilateral tech transfer from BioNTech, Pfizer or Moderna to an able manufacturer in a lower middle income country. And I think these are just two factors just underlining the problem with vaccine inequality, and I'm looking forward to this lecture to explore also what we can do now and also what we can do better for the next pandemic, maybe over to you now Karrar.

Karrar Karrar Yeah. I mean, Ken and Lara pretty much covered majority of this. I will probably just kind of take us back to when, I don't know if you guys recall some of the super spreader events, this guy was coming over from a chalet in Geneva or something, and I remember at that time in my head, I was thinking "Here we go again". We've heard it all before, right? We had Zika; a lot of kind of public frenzy. Nothing really came of it on a global scale. H1N1 to some extent in 2009, again, big pandemonium, the virus didn't really pay out to the extent and severity that we expected. So when COVID 19 hit, certainly in my mind I was thinking, "OK, here's the media kind of over inflating the issue and this will subside in a matter of weeks". And I think this kind of inequality happened by design in that all these kind of previous pandemics, there was an element of exceptions in that actually this was something that was always going to hit middle-income countries, whether Ebola, all the other kind of weird and wonderful neglected tropical diseases, diseases of pandemic potential. So there was this element of, "OK, we've heard this threat before, but we haven't really seen it play out, let's say in our lifetime, in our professional kind of lifetime to that extent". And so there was this element of "Yeah, OK, we are concerned". We've kind the calls of WHO and others, but we surely can't be as bad as what they say we can be. And so I think when when this thing became a reality and all of a sudden "Go and work from home two weeks" became we're going to be here for the long haul, you had a handful of countries that essentially

said, "Okay, in previous scenarios, as in this one, a pharmaceutical commodity, A.K.A a vaccine, is going to be what is going to get us out of this mess".

Now the reason why we don't have a vaccine the market already is because there are market failures in global health R&D. Because why? Essentially, when it comes to global health R&D, your clients are traditionally low middle income countries, which often don't have the ability to pay. So you tend to find diseases that are specific to lower middle income countries, or diseases whereby they're not seen as commercially viable areas to invest in, prime example antibiotic resistance, the WHO is projected as this. So even, for example, MERS and SARS, we knew these pathogens existed, the WHO has a whole list of them you can go on the website and check. But why haven't we had commodities for these R&D priorities? And the reason being is because which pharmaceutical company, if I was a pharmaceutical executive, why would I bet all my money, R&D, human resources, on a possibility? It doesn't make sense. You're more likely to put that into non communicable disease, whereby the return on investments are going to be a lot higher. This could be anything from cardiovascular diseases, whereby you have a customer base and you're going to get return on investment. So I think by the very design of the fact that we haven't had, or we didn't have, a COVID-19 vaccine, so to say...That was because, as I said, with pandemics in general, or these disease areas, they're not considered potentially viable areas for investment. And that goes back to what Ken was saying around then what was set up post-Ebola was the CEPI. So the Centre, or the Coalition for Epidemic Preparedness Innovations.

This was an agency that essentially had said, "Okay, here's the WHO's list of priority packages. We're going to attempt to kind of frontload investment to try and entice development of these weird and wonderful vaccines for these diseases", which they may never happen. But they always saw themselves as the world's insurance policy. So when the pandemic first hit, you had a lot of countries sitting on the fence thinking, "Okay, if this turns out and plays out like Zika, why would I engage in bilateral deals potentially worth millions of dollars, if not billions, for something that may not play out". And then what am I going to do? Water my grass with it? So you had essentially countries that have sat on the fence. Countries that probably had a kind of advanced scientific community. Was it luck? Is it on economic grounds? But a handful of countries said, "Okay, we need to put upfront investment at risk". And we should be willing to say that investment, if it goes south, we're willing to stand in front of our respective electorate and say, we put our hands up and say, "We've made a mistake. We've squandered X billion dollars".

And we've seen what the US, through something called Operation Warp Speed, putting this early invested that Ken was talking about, at risk knowing full well at the time some of the rhetoric around vaccine and development and nutrition, I think it was one in ten that was being cited for vaccines that will become successful. You had the likes of the US through Operation Warp Speed, investing heavily in the likes of mRNA technology by Pfizer. The UK, if you guys have look online they have something called the National Vaccine Deployment Plan, and look at the portfolio of vaccines that the UK hedged it's bets on and actually it was five or six vaccines, which range anything from 100 million doses from the likes of AstraZeneca, homegrown domestic vaccine, I think the lowest was about 70 million doses, and that was the Moderna vaccine. So when you look at their kind of population, as well as some of the vaccines they procured across the spectrum, they hedged their bets and said, "OK, if all these vaccines fail and only one succeeds. At a minimum, we should be able to cover our most vulnerable". So this was the kind of approach adopted by a select handful of countries.

Other countries stood on the fence and said, "OK, we're going to wait until this thing kind of fully plays out". At that time we've had the WHO set up this COVAX facility that Ken was talking about, and that was nothing more than an iterative design of what we saw in 2009. So in 2009, we saw something called the Vaccine Deployment Initiative. I said the pandemic hit, as it did with COVID-19, but the access piece back then was strictly a donation endeavour. So you have handful of high-income countries bought the vaccine, it quickly became evident that this wasn't going to blow up to the extent that we thought it was. And all of a sudden I've got this vaccine, which I have purchased, that I know that I'm not going to need now. And so a lot of these countries, the US, the UK and others said, "We want to donate these to low-income countries". Now, the *deja vu* in this particular scenario, as was the case back then, was that the doses arrived in the lower-middle income countries after the peak had subsided. So, you know, when you say, why are we surprised by vaccine inequality this time around? Probably not.

And I think going back to what Ken was saying around this, some kind of luck in how things played out. You have the likes of India, for example, one of the largest vaccine manufacturers by volume. Not by value, by volume. So they have got a high value, or high volume sorry, low price model. So they attempt to kind of vaccinate the world, through cheap and cheerful vaccines. And essentially with India, as Ken highlighted, they were one of the companies therein, the Serum Institute of India, was tasked with supplying the bulk of what is the WHO's mechanism, the COVAX, was going to offer vaccines. So they had two billion doses that they wanted to offer to lower-middle income countries, half of which was coming from one company. Now was it naive to potentially rely on one company? In hindsight, yes. At the time, a lot of colleagues, including MSF and others, were saying, "Why is it that we're relying on one company to supply the world's vaccine?" This was at the time the Astrazeneca vaccine. And so with India, as I said, sat on the fence, probably didn't see this play out as it did, all of a sudden it had a domestic company that was producing huge volumes for export. And what do they do when they realised actually you know what hit the fan, they adopted a blunt instrument of an export control.

And so that was probably the achilles heel of COVAX and probably had it not been for that the rhetoric, would you have seen the COVAX heads get the Nobel Peace prize? I mean if they did, I think there was some kind of rumours or mumurs of that, we would have seen this play out very differently. In that I think the access piece would have been expedited relative to what we saw play out now.

And so, you know, I think there was the kind of, to sum up very quickly, I think this was inevitable in that this is human nature. You put on your own oxygen mask before putting on the oxygen mask of others. And actually how infuriated would we have been in the UK had, for example, the UK government said, "OK, we've vaccinated our health care workers. We're going to redirect all this supply to lower-middle income countries". At the end of the day this is a tax funded, or tax backed, purchase. And as a result, you can argue each government is only responsible for its people, essentially. So, you know, whether you call it a kind of rising populism or kind of nationalism, your job, first and foremost as a government, is to protect your own. Now the irony is, with an infectious disease such as this, you're only as safe, or you only as strong, as your weakest link. And that's something that epidemiologists and the global community has been trying to drum home. But essentially, I mean when you kind of fear the NHS is on the brink of collapse. When you see the kind of pandemonium in the streets, you're going to say "Okay, i've protected the most vulnerable". And then, in the UK for example, priority groups one to nine, or one to five, they account for about 30 million doses or 30 million individuals, sorry. So we reached that milestone fairly quickly once the kind of vaccination campaign started.

Then you could argue thereafter everything should be directed globally. But then bear in mind the twin objectives of the vaccine are what? First and foremost to protect individuals. And secondly, to minimise the kind of the virus in your body, to minimise community transmission. And so you can argue, once high income countries have protected their most vulnerable, in line with what the WHO have said, did they get greedy? Did they kind of see the economic impacts start that way? And as a result, they said, "Actually, you know what? We're going to pursue community transmission, and as a result, we're going to vaccinate healthy 30 year olds". And you guys probably recall when you guys were offered the vaccine, a lot of my friends certainly were like, 'actually if all the messages I've been hearing is i'm fit and healthy, I don't need this. Why is it all of a sudden I'm being offered this vaccine when we've been told it's technically something that affects the elderly, or the most clinically vulnerable.

So I think to sum up, there was an element of inevitability. And this luck that Ken was talking about. Yeah, had the COVAX facilitated the doses they had contracted played out, maybe we would not have seen the divergence that we're seeing now. But just to say, so far, 40 percent of people in low income countries have received one dose. We know that 57 percent of countries are off track for reaching the WHO's 70 percent global target, which was supposed to hit in three months time. So that would be all from me.

Rory Horner Just picking up then Karrar on that point you ended with. We still have considerable amount of vaccine inequality. So our next question is what needs to happen now, still, to fight and combat COVID-19 vaccine inequality? Lara, are you okay to start on this question?

Lara Dovifat Sure, I'm happy to. Can you hear me this time?

Rory Horner Yes, perfect.

Lara Dovifat Wonderful. No, I get this question quite a lot also, when I speak to like politicians and policy decision makers in high income countries. And I find it quite outstanding that even after two years in the pandemic, they still pretend this is some kind of like natural disaster. They feel very sorry about it and they think it's very unfortunate, that they can't really do much about. And I think this is a point where we have to look a bit closer because this is simply not true, right? We're still pretending, "well, vaccines are being first produced in Europe and this is the way things are". And so it continues. And I think this is extremely dangerous when we're not going to change it now also for like future pandemics and other health emergencies like tuberculosis, for example.

So what we did at the MSF access campaign is we looked actually what happened in Europe and North America? So BioNTech, Pfizer and Moderna, they did not build factories from scratch to start their mRNA production facility. They actually transferred their technology and their knowledge, how to produce an mRNA vaccine, to able and existing manufacturers. And the beauty of the mRNA technology is that you don't need a traditional vaccine manufacturer, right? And so you just have a bigger group of manufacturers to employ and to look at [it].

And what we saw, for example, in Europe, is that Moderna worked together with Rovi, a Spanish based company, with no prior experience in vaccine manufacturing, but instead they're working on injectables. So you can actually also work with producers of injectable medicines to then start mRNA production. And I think this is just something where we have to acknowledge that this is not exclusively done in Europe or North America, but this could be done in lots of middle income

countries. So in our report of the MSF access campaign, and other actors in global health, we looked in particular at these manufacturers in, for example, African countries, in India, in Indonesia, in South America, and we found more than one hundred companies able to start producing mRNA vaccines; if one of the originators, speaking about Moderna, BioNTech and Pfizer, would share the technology. And I think this is something we all have to keep in mind because COVID-19 is not, probably, unfortunately not the last pandemic we will face. And also we have to keep in mind the potential of the mRNA technology for other health issues like tuberculosis, malaria and so on and so forth. And I think if we are not able to now start and set up this more sustainable infrastructure, we will be in a very similar situation again and again and again.

And maybe just to finish on that. Now a year with the vaccine on the market, I think some leaders of high income countries are extremely proud that they're now donating doses. And I agree it's better to donate doses than throwing them away. However, this is clearly not sustainable, and I think we have all seen the reports in the news that, like some doses were donated to African countries without any announcement. And then also we found out that there were extremely close to expiry date. And so some people say, "Well, the low take up of vaccines in African countries is because these people don't want the vaccine". And I think this is an extremely tricky argument because just for one second let us imagine that the vaccination campaign against COVID-19 in Europe or in the US, would have been based on donation, where no one would know when they would arrive, what kind of product you would see, and what would be the follow donations. So I think just to be fair here, if everyone would have access to the vaccine on a similar level, I think also the vaccination take up in African countries would be different. I think that's it from me on that. Over to you guys again.

Rory Horner Thank-you Lara. Karrar, are you okay to step in?

Karrar Karrar Yeah. OK. So I guess as we stand today, where do we go from here? I would probably use the four 'd's' as a kind of framing, and these are: doses, dollars, domestic vaccine manufacturing and domestic health systems.

On the first one of doses we know, as Lara mentioned, the current initiative is based heavily on donations. It wasn't meant to be, it was supposed to be a COVAX procuring and COVAX delivering, but you know, nevertheless, after high-income countries have had their fill, they're now saying, we want to donate these doses. These pledges were made a while ago. However, 30 percent of the doses pledged by high-income countries have yet to be delivered. So the first and foremost, if you've made a pledge to donate, given the supply may still be a constraint in some areas, donate the doses you said you're going to donate.

The second one would be the deliveries to COVAX. So as I said, COVAX essentially had its own pot of money, went to market, as did high-income countries, and attempted to buy its own vaccines. However, being a global kind of health initiative, and being an initiative that probably secured slightly lower prices than their high-income country counterparts, at market, you can argue the pharmaceutical industry has somewhat deprioritized this client of the WHO, the global health community. So the COVAX contracted doses, we know, and I think the stat was 33 percent, of the COVAX contracted doses have been delivered. So a third of the doses that the pharmaceutical industry has said they will deliver to the WHO and COVAX have been delivered. Now if this was any kind of interaction between a client and customer, there would be ramifications of that. That's a side story. When it comes to the African Vaccine Acquisition Trust, and as Ken mentioned, at apan-African level the African Union got together and said actually, "You know what, we can't rely

on this global health initiative". So they got together, organised financing and bought vaccines for the African Union. So this was called the AVAT, or the African Vaccine Acquisition Trust. And 20 percent of the doses that they've purchased have been delivered. Now this could be due to the fact that actually it's first come first served, and that these companies are sequentially fulfilling orders. So that's the first one on doses.

The second one on dollars, we know the ACT-A, so the Access to COVID-19's Tools Accelerator, this macro level structure within which the vaccines pillars sits, so the vaccine pillar of the ACT-A, is also the COVAX. These terms are synonymous. With this kind of ACT-A, the financing ask, that is still live as we speak, is around 48 billion US dollars. Of that, the COVAX facility, so this initiative is being run by WHO, GAVI, The Vaccine Alliance and others, they have an outstanding ask as we speak today of 5.2 billion US dollars. They have an upcoming financing pledge that will be coming up at the end of the month. And so the donors, the international community, international financial institutions such as the World Bank, the IMF, etc., we need to find a way to come up with this sort of financing. So the second one of dollars, 48 billion outstanding ask for ACT-A more widely. ACT-A more widely covers wider than vaccines. So we're talking about diagnostics, therapeutics and vaccines, as well as the auxiliary tools that will be needed, so PPE, etc...

The third one is domestic vaccine manufacturing. So as Ken mentioned, pre-pandemic our global manufacturing capacity stood at around five billion doses. All of a sudden COVID-19 hits, we could potentially have needed 15 billion doses for COVID-19 vaccine alone. So, we potentially at the time needed to quadruple our global vaccine manufacturing to account for this newly demand of a COVID-19 vaccine, without disrupting routine essential vaccines for measles, for the whole BCG, the whole host of other routine immunisations for childhood programmes.

So in my mind, we need to have used all the tools at our disposal to kind of realise something that was operationally out of the realm of possibility. Or at least it seemed so at the time. And some of the initiatives that will be set up to expand domestic vaccine manufacturing were what? Intellectual property waiver, that the likes of MSF and others have been championing. And this basically says that the intellectual property model of; you produce something and then you get exclusivity for a period of 20 years or so, that is not fit for purpose in the middle of a pandemic.

The second one was on flexible use of intellectual property through technology transfer that Ken was referring to. And this is where me as an innovator gives a third party the ability to manufacture my product under licence; to serve whatever markets, and I get a return or a royalty as a result. We've seen companies quite reluctant to do this in an open manner and have instead decided to do this more kind of bilaterally, on an exclusive basis. So that means me, AstraZeneca or me Pfizer, goes out and figures out which contract manufacturing organisations I can solicit or I can engage in to manufacture my product, but on my terms. So the two kind of initiatives for domestic vaccine manufacturing, the IP waivers or the flexible management of intellectual property, as well as the flexible open licencing of technology transfer, the two modalities have been proposed; the Seed-up or the COVID-19 technology access pool, nothing has been offered to that. That was a voluntary mechanism set by the WHO. And they basically went out and said, "If you are a manufacturer, why don't you offer us the licence? And we will then go out and seek quality assured generic manufacturers to produce this product on your behalf". But again, in true fashion, we haven't seen a single company come up and offer something, to seek that or this COVID-19 technology access pool.

And actually on the one hand, you can argue, if you are Pfizer and you make 38 billion US dollars for one product, this is a cash cow you're not going to want to let up. So, you know, we have to also acknowledge that this is, there is huge money at stake here and this global piece, inevitably affects the bottom line of companies. So that's the third, domestic manufacturing.

The fourth one is the domestic health systems and the absorption piece that Lara was talking about. The very systems that we're expecting to deliver COVID-19 vaccines, is a system that has traditionally been used to delivering about, I think at the time, about 200 million doses. These are all to lower-income countries within the COVAX collective who have delivered about 200 million doses, pre-COVID, for routine immunisation. So this is Yellow Fever, you know, your routine childhood immunisations. All of a sudden, we're saying these very systems have to deliver five folds as many doses. Now, add this to the complexity of, this is a donation endeavour where you do not know where these doses are coming from, if I was a lower-middle income country, my own home country of Sudan for example, and I was the Minister of health, why would I divert resources to something, and whip up frenzy and the demand for something, that a) I do not have visibility of what is coming, if indeed it is coming. And secondly, if I have a whole host of other priorities and you know, let's take the African continent for example, the average age is about 18 years of age. So this is a disease that predominantly affects a slightly elderly or more clinically vulnerable, then you can say "Actually, from a priority-setting perspective, for me, it's not the biggest deal I've got going on right now". So all this stuff has meant that actually the health systems that we need to deliver these COVID-19 tools are very, very fragile. And as a result, when the doses do arrive, a lot of the times the kind of, the logistics and the health care workers and the infrastructure is not braced to absorb these doses at the pace which will be needed to. And the fourth 'd' I would say, or the kind of last one is this pandemic preparedness. And essentially going forward, I think we need to use the momentum of where we're going right now, to figure out actually what would it look like if we to recreate this model. If this was to play out again, look at all the lessons learnt that we have now, what would this look like in terms of an optimal design of a future kind of pandemic preparedness piece. And I guess that's probably jumping a step forward. But, yeah.

Rory Horner We'll come back to that. First, Ken. Anything you'd like to add on what should happen now?

Ken Shadlen Yeah, three things. One is, and this first one I think builds on something that Lara said and I think Karrar might have touched on it as well, is that, I'm going to call it 'dose donations' or sharing, whatever you want to call it. It needs to be much more systematic and done in a transparent way so that countries aren't receiving doses just before they're about to expire. Remember that there was a huge amount of vaccines purchased by largely wealthy countries, not just because they were being selfish, but because they had the resources to hedge their bets. They didn't know what was going to work, so they had these advance contracts with five different suppliers thinking that probably none of them are going to work, but maybe at best one of them will and we want to basically buy enough lottery tickets that we might win the lottery. It turns out that all their lottery tickets paid off, or most of them did. So they've got a ton of doses. But then the actual process of transferring those doses has been horrible. It's been chaotic. It's been delayed. It's been bad. It's been chaotic and it's has been delayed and some countries don't know what they're going to get and when they're to get it. It builds on the point Lara made.

The second thing is fund COVAX, because what we haven't talked about is that there are a bunch more vaccines that are just getting approved now. We're not going to be, we're not just talking

about the same four or five vaccines anymore. There's a new vaccine by Novavax, which just got approved. There's a couple of vaccines being produced by producers in India that are now approved. There's this, there's just a whole series of vaccines that are finishing or have already finished their phase three clinical trials. And what we need to do is get those vaccines to have their authorisation by the W.H.O. so that COVAX can purchase them, and provide COVAX with enough money to purchase a lot of those. So that will greatly relax the supply constraint.

And the third thing is with the technology transfer. We need more of it. I agree completely we need more of it. Lara refers to the project that MSF did where they identify a hundred and twenty something companies that could be making mRNA vaccines if only the originators would work with them, share the technology. I actually think Lara, that your hundred and twenty one is low, that there are a lot more than that. I mean from the research I've done on Latin America, there's a lot of Latin American countries that could do it if there was technology transfer that aren't on that list. I don't think there's any shortage of firms that could make vaccines if the originators were to engage with them. I think we've always known that actually. The problem is the originators don't want to do. Except for, I mean AstraZeneca seems to be the only one that is actively doing that. As Lara said, there is no, none of the...neither Moderna nor Pfizer/BioNTech have been willing to do that with partners in low or middle income countries. So how to get them to want to do that?

Yes, we've seen that just asking them to do it isn't working. We've also seen that just telling them to do it isn't working. The U.S. government have been telling Moderna to do it for a year and it's not working. One way you can actually get them to want to do that is basically, buy a tonne. So late 2021, the U.S. government said they were going to buy 500 million doses of the Pfizer vaccine for global distribution. Well Pfizer can make that. What if the US government said instead of buying five hundred million doses, we're going to buy five billion doses. Pfizer couldn't make that unless they found producers. They would then basically get involved in technology transfer. Because they know who those 121 firms are. They know the firms that are out there. They just don't want to do it. They don't need to do it. One way to make them need to do it is basically say, if you do it, you're going to make a, you know, you're making what, thirty eight billion, whatever they make, well make three hundred eighty billion. I mean, if it's worth it, do it. And so you basically make the prize big enough, they will then find more partners, licensees, and engage in technology transfer. They might say we can't do five billion, you come and do three, but the point is that if you make it big enough they will find partners, transmit the technology. They will do what they need to do to supply, the purchase that they've agreed to. And you could do that with Pfizer and you could do that with Moderna, and that might actually make the technology transfer problem. That might actually allow the technology transfer to happen.

Rory Horner Thanks, Ken. So our third question then is, what lessons can be learnt to prevent such inequalities in the future in relation to future pandemics, but also maybe in relation to broader access to health products? And Karrar you started touching at the end, but you also mentioned earlier that there was a sense of inevitability when COVID-19 hit that there would be these inequalities. So what, and CEPI and these other initiatives were almost put in place as an attempt to learn from them, but clearly they haven't necessarily managed to prevent the inequalities we've seen. So what kind of things do we need to see happening now that will when the next pandemic or big health issue emerges, make it not seem inevitable that it's going to play out in the same way?

Karrar Karrar Yeah. Well, I mean, I guess with the pandemic preparedness piece, you have the kind of international health measures covers something more widely. So this covers everything

from when the WHO declared a pandemic, to what member states ought to do. But I guess for my kind of particular area, it's the pharmaceuticals piece and pandemic preparedness. And I think looking at it from a kind of R&D production and deployment. From an R&D perspective, this kind of world's insurance policy, so this product development partnership that I mentioned was being set up to cover some of the market failures in global health R&D, that had an investment case that was out of 3.5 billion U.S. dollars. So COVID-19 was the perfect advert for a product development partnerships such as CEPI. Where you take front loaded public investment, multiple partners across the private sector, to come up with commodities and navigate some of the challenges in R&D for this kind of subsector.

Now, one would think that the COVID-19 was the best advert and that this PDP, or product development partnership, when it goes out asking for money from donors, this will fund itself. 8th March, which is what a week ago? CEPI launches investment case of about 3.5 billion US dollars, which in the grand scheme of things, with some of the money that has been pumped around, even from a kind of domestic fiscal response from a kind of social protection perspective, or from covering the furlough scheme, or whatever you want to call it, globally some of the money that's been unleashed are kind of ludicrous figures. So this world's insurance policy against future pandemics has run out and asked donors for three point five billion dollars. You can guess....a question to the group, do you reckon that was kind of fulfilled, by donors? No. We got 1.5 billion.

And so, you know, if the pandemic, well we're still in the middle of it, wasn't enough to get everyone kind of waking up and saying "Actually this is a piece that we've got to get right", yeah I'm not sure what will. So from an R&D piece, CEPI, which is a central world insurance policy that hasn't been fully funded and that's got an active kind of ask as we speak.

I guess from a kind of production piece, and that's a piece that probably kind of either Rory or Ken's scholarly work kind of covers, the global production piece all of a sudden has become front and centre and more of a national security agenda. As I said, I think there's been an acknowledgement that, you know, does a globalisation piece actually work in the short term? It may have achieved a race to the bottom prices in terms of the big manufacturers that made it possible by supplying the majority of the world's global health needs, but I think even the African continent has probably realised that actually hold on, we need to kind of engage in some kind of industrial policy or self-sufficient endeavour. And what do we see them do? They started something called the partnership for African vaccine manufacturing. Where they basically said, "Ok, hold on. We cannot have this happen to us again. It happened in 2009. It happened in 2019. And you can be rest assured that the same thing is going to happen in the next pandemic". So they then got very high level political will translate into a kind of tangible initiative to expand domestic vaccine production, from one percent as it currently is, and I can't remember what the threshold they set for 2050 is, 60 percent or something to that effect. So the domestic vaccine manufacturing or this diversified global network of vaccine manufacturers, I think that's something a lot of countries have realised. We need to engage either in bilateral partnerships with intellectual property manufacturers, whereby we go into the likes of Pfizer and we say, "Listen, we're willing to de-risk your investment. You don't have to build and have boots on the ground. Here's all the paperwork that we can provide for you. We're a quality assured domestic vaccine manufacturer, give us the intellectual property and the tech transfer so we know how to do manufacture, and we will produce and give you a return on sales. If you think about it, it's almost like a franchise model, call it Nando's, call it McDonalds. There is very little to lose for the franchise-er, and the franchise-ee essentially takes up all the risk because you're the one pumping the money, all you need is the recipe, essentially.

So I think this pandemic has made a lot of countries and a lot of regions, at an individual country level or regional level realise, we need to kind of invest in domestic vaccine manufacturing so that when this thing hits, once the gene sequence is out there, once the kind of the pathogen, genetic or genomic sequence has been released, we can get our domestic manufacturers or domestic researchers quickly to try to manufacture this thing locally. So that's on the development.

Lastly, on the deployment piece, and I would say this is where the pooled procurement piece comes in. Bear in mind, if you were to go to market and ask a vendor as one entity for any particular product, you're not going to get essentially the best price. And that's why, because you're not achieving the economies of scale that often comes with pool procurement. What we've seen with this pandemic is the likes of COVAX procuring vaccines on behalf of 92 low-middle income countries. Now that's kind of quite a hefty clientele they're procuring for, and the idea is that actually you will get this kind of lower pricing through a high volume-low priced model because at the end of the day with pharmaceutical companies the equation is basic. Expenditure or revenue is a function of price times by volume. So the money you're making is either you jack up the price and sell a handful a products. Similar sort of model would be like Mac computers, you sell a handful at \$1000 each. Or you adopt the Windows model of high volume, low price. This is the Indian generic vaccine manufacturers, or the low-middle income countries or the developing country vaccine manufacturers. So the other one would be the pool procurement. And I would say for the first time, we've seen countries get together and collaborate at a level which we never thought was possible. And I remember going to a meeting in South Africa, where we were trying to encourage middle-income African countries to get together and procure vaccines for their run of the mill routine immunisation programme. And all these kind of hurdles were put in place. It's not feasible. Pharmaceutical companies often get countries to sign confidentiality agreements. So when I sell you one vaccine, you can't disclose the price I give you to any other country, otherwise you're breaking contractual agreements. For this pandemic what are we seeing? The EU started procuring vaccines as a bloc, so you imagine all of a sudden you have monopoly power whereby you are able to negotiate as one entity. The African Union again was able to kind of initiate joint procurement and contracting as one entity. So for me, across R&D, across development, and across pool procurement, I think there are lessons that can be kind of implemented and cemented, god forbid in the next pandemic, these policy responses come into play all of a sudden. So your kind of collaboration and a kind of pan-African, or as a kind of bloc, the expanded global manufacturing already exist. Hopefully those seeds have been planted in non wartime. And the R&D that we were referring to, the likes of CEPI, are fully funded with access conditions strictly embedded in those contracts. To say that if you receive funding from us, there is an expectation that you're going to do X,Y, Z. So these are three areas I would say going forward we probably ought to to kind of have, hopefully fully cemented now that this has been quite a bitter pill to swallow for the most part.

Rory Horner Thanks Karrar, Ken?

Ken Shadlen So, as Karrar says, I think we can have a more and better strings attached to funding for innovation for subsequent, from future vaccines. And likewise, as I was was saying before, the prizes sort of, what we offer to by, and come up with it, can be made bigger. So in some ways, I would say one of the beauties we got lucky with...The world actually, we got lucky from Operation Warp Speed, but it wasn't big enough. So one lesson is we needed an Operation Warp Speed for the world.

The local production agenda has certainly taken off, as Karrar says everybody's excited about it now, but this will have the issue of, there'll be a lot of idle capacity. There's going to be periods in which there's going to be factories that are producing a lot of vaccines. And so figuring out a way to keep those going and you know the budget, who's going to pay to keep those going and who's going to pay to keep the room sterile, who's going to keep people employed? I think it's a lot more complicated than people think; building building local capacity for the next pandemic. The next pandemic might come in 10 years. It might come in 10 weeks, 10 months. It might not come for 40 years. And so it's not clear what all that capacity is going to do in the meanwhile. And so this is, as Rory could talk about probably more than any of us, sort of local production agenda has come and gone in sort of cycles over the last 20 years, and this might just...it struggled to succeed.

The last thing I want to say is I think we could, and this is a bit out of the box, but I think that we need for future pandemics, I think we need to think more about the regulatory side of this. And you might ask, like, why don't vaccine producers around...why are there not just more companies just making these vaccines? And it's not because they're worried about getting sued for intellectual property infringements. It's largely because they can't make them without the help of the originator. But even if they could make them without the help of the originator because their vaccines, they'd have to run their own clinical trials. And so it would take a long time and cost a fortune. And that's just different, than drugs. The pills that we take...if a company can reverse engineer it, which they are easier to reverse engineer, but we have regulatory pathways that allow generic drug purchasers to enter the market without running massive clinical trials. It's much more difficult for biologic drugs, and it's almost nonexistent for vaccines. And so even if you can reverse engineer the vaccine on your own, which is actually happening now in South Africa at this mRNA vaccine hub. I mean it's a tiny bit, microliters, that's not even enough to put into a person. But they'd be able to do it. They're going to have to run their own trials. And thinking creatively about, well asking the question about why regulatory barriers are so much different and so much higher in the case of vaccines than other pharmaceutical products and how to perhaps, they'll never be the same as generic drugs, but how to make them less daunting is, I think, something that the world needs to be thinking seriously about. And I know that Lara and their colleagues are thinking about that and for future pandemics, not for this one, but for future ones.

Rory Horner Lara, that seems a good place to bring you in for our final set of panelist comments before we open up for Q&A. So would you like to continue there?

Lara Dovifat Yeah, and while I think it's super exciting to look into pandemic preparedness, I just want for a second to stick with COVID-19 because it's not over yet, right? And I think it's important again, even though I know this lecture is about vaccine inequality, to also look into treatments and diagnostics, right?

We see that specially treatments are becoming the next access bottleneck. So they're not available in many countries where they're needed, especially in countries with low vaccination rates, especially in countries that are extremely important where there is not a like high level intensive care available. And I think also today, and probably most of you, as some of you follow the nerdy discussion around like intellectual property rights at the World Trade Organisation today, some countries came forward with a proposal where instead of like excluding intellectual property rights for all COVID-19 medical tools, this new proposal only suggesting to do it for vaccines. And I think this is extremely important to see again why they're doing it and what's the outcome, because in particular, intellectual property barriers, access for diagnostics and treatments. So this is something we should keep in mind.

Secondly, I fully agree with what the others already said on creating sustainable infrastructure. And I think we have to be careful what's happening at the moment, and what kind of details are in contract, for example, with the biontaneer idea from BioNTech. I think some of you heard about the futuristic containers being produced in Germany, then being shipped to African countries to then at some point in the future, produce around 50 million mRNA vaccines in the year. This sounds extremely exciting and I think also for countries where there's really no manufacturing capacity like Rwanda, for example, this is clearly not the fastest way to go, right? And I think this is to some extent also a manoeuvre from BioNTech and others to just shift the attention and just have them again in a sentence saying like, "Well, look at us. We're bringing containers to Africa and so we're saving the world". When instead they could create more sustainable ways of having production and manufacturing capacity.

And lastly, I would like to follow up on a point I think Karrar you mentioned global health security. And this is like my personal wish for the future and for pandemic preparedness going forward that I hope the world learns from COVID-19. And I really hope that we can maintain some of the attention we have now seen in high income countries on COVID-19, also for other health emergencies such as malaria, such as tuberculosis, such as snakebites. Because the pandemic had a very devastating impact also on like normal health infrastructure in many countries where we work, and I think it's important to strengthen health care systems and to also make sure that this market failure we touched on earlier is getting closer and that we see more R&D and more strings attached to public funding also for neglected diseases. So basically more change and not so much charity.

Rory Horner Thank you so much, Lara. And thank you to all three panellists for a really, really rich set of contributions.