

A SUPPLEMENTARY MATERIAL

Table 1. Top categories of discussion in each country in different stages of the pandemic

Country	Before				During				After			
	Hashtag	#	URL	#	Hashtag	#	URL	#	Hashtag	#	URL	#
Australia	Support Business	70,066	News & Media	17,940	Support Business	420,189	News & Media	119,728	Support Business	91,748	News & Media	22,941
	Political	4,246	Social Networks	15,156	Political	28,396	Social Networks	99,852	Political	5,108	Social Networks	19,046
	PCR Testing	3,230	IT	3,276	Latest Updates	19,506	IT	19,551	Latest Updates	3,903	IT	4,031
	Latest Updates	2,982	Gov & Legal Org	2,257	PCR Testing	11,194	Gov & Legal Org	14,899	Lockdown	2,089	Gov & Legal Org	4,012
	Community Cases	2,003	Business	1,965	Community Cases	10,256	Business	12,642	Frontline Workers	1,987	Health & Wellness	2,904
India	Support Business	208,252	Social Networks	27,489	Support Business	1,145,364	Social Networks	230,476	Support Business	453,118	Social Networks	74,828
	PCR Testing	17,026	News & Media	22,388	Community Cases	118,381	News & Media	186,274	Community Cases	64,939	News & Media	74,708
	Prevent Spread	15,726	IT	4,874	Lockdown	91,813	IT	67,187	Latest Updates	33,296	IT	29,720
	Stay Home	15,454	Business	3,356	Latest Updates	86,267	Business	54,620	PCR Testing	32,409	Business	26,965
	Community Cases	12,383	Gov & Legal Org	1,905	Political	72,249	Streaming	20,285	Political	29,191	Entertainment	6,950
UK	Support Business	522,843	Social Networks	201,185	Support Business	1,848,765	Social Networks	762,958	Support Business	1,011,303	Social Networks	404,736
	Political	36,245	News & Media	107,457	Political	125,763	News & Media	418,109	Vaccination	86,625	News & Media	186,675
	Latest Updates	29,165	IT	45,378	Latest Updates	110,149	IT	180,600	Latest Updates	75,306	IT	107,818
	PCR Testing	23,542	Business	24,647	Lockdown	104,482	Business	103,520	Political	65,568	Business	65,349
	Prevent Spread	18,026	Gov & Legal Org	18,438	Frontline Workers	71,975	Gov & Legal Org	64,717	PCR Testing	46,558	Gov & Legal Org	44,459
US	Support Business	359,658	Social Networks	177,730	Support Business	586,671	Social Networks	340,671	Support Business	570,772	Social Networks	294,266
	Political	35,219	News & Media	104,524	Political	58,866	News & Media	191,389	Political	50,181	News & Media	195,409
	PCR Testing	24,294	IT	25,862	Latest Updates	34,886	IT	54,082	Latest Updates	36,058	IT	57,521
	Prevent Spread	14,478	Business	7,972	Frontline Workers	22,577	Business	20,762	Death Toll	24,549	Business	27,533
	Latest Updates	13,885	Streaming	6,830	Death Toll	19,262	Streaming	18,296	News & Media	22,136	Streaming	14,793

A.1 Data Characterisation

In Section 2.2, we perform data characterisation by discussing the trends in the URLs and hashtags of tweets. We identify the top most discussed COVID-related topics in hashtags and URLs during all the three lockdown periods. In Table 1, we provide more detailed view on data characterisation by breaking down into country level. We can clearly observe that Support Business is the most discussed hash-tagged topic among all the four countries, followed by Politics and Latest Updates topics. These topics are also common across the lockdown periods. Similarly, URLs related to News & Media and Social Networks are mostly shared among all the countries and all the periods.

A.2 Perception Analysis Toward COVID-19

In Section 3, we analyse the relation of people sentiments with infection rates (IR) and COVID restrictions in a region. In general, we try to identify if there is an impact of social media tweets in managing the pandemic. In regards to this, Figure 2 illustrates the trend in people sentiments across four countries, for all the lockdown periods. Clearly, Death Toll has received the highest negative sentiments from UK and US. In general, we observe similar trends for the topics across all the countries. For instance, topic Social Distancing has received approximately 70% positive sentiments from all the countries.

A.3 Privacy Analysis

In Section 4, we quantify privacy risks against social media tweets and reveal interesting findings about user identification from just 3 sensitive tweets. In Figure 1, we show an average privacy risk across various topics and increasing number of tweets. It is clear from the figure that COVID-19 related tweets are capable of re-identifying users with at least 94% of privacy risk. Similarly, in Table 2, we provide few examples where users are mentioning some personal identifiable information (PII) in their tweets.

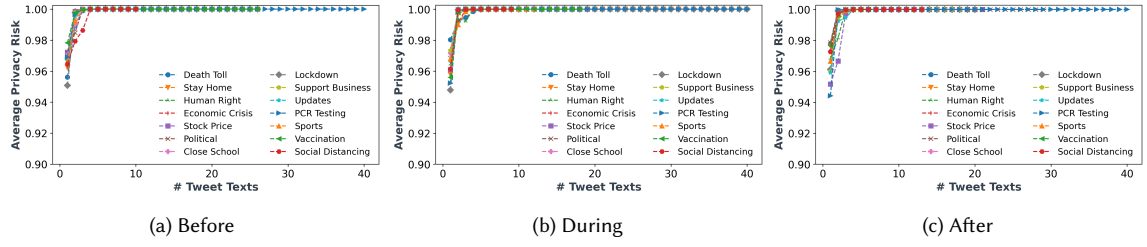


Fig. 1. Average privacy risk with the increasing number of web entries (i.e., tweets) in three different period: **Before**, **During**, and **After** lockdown.

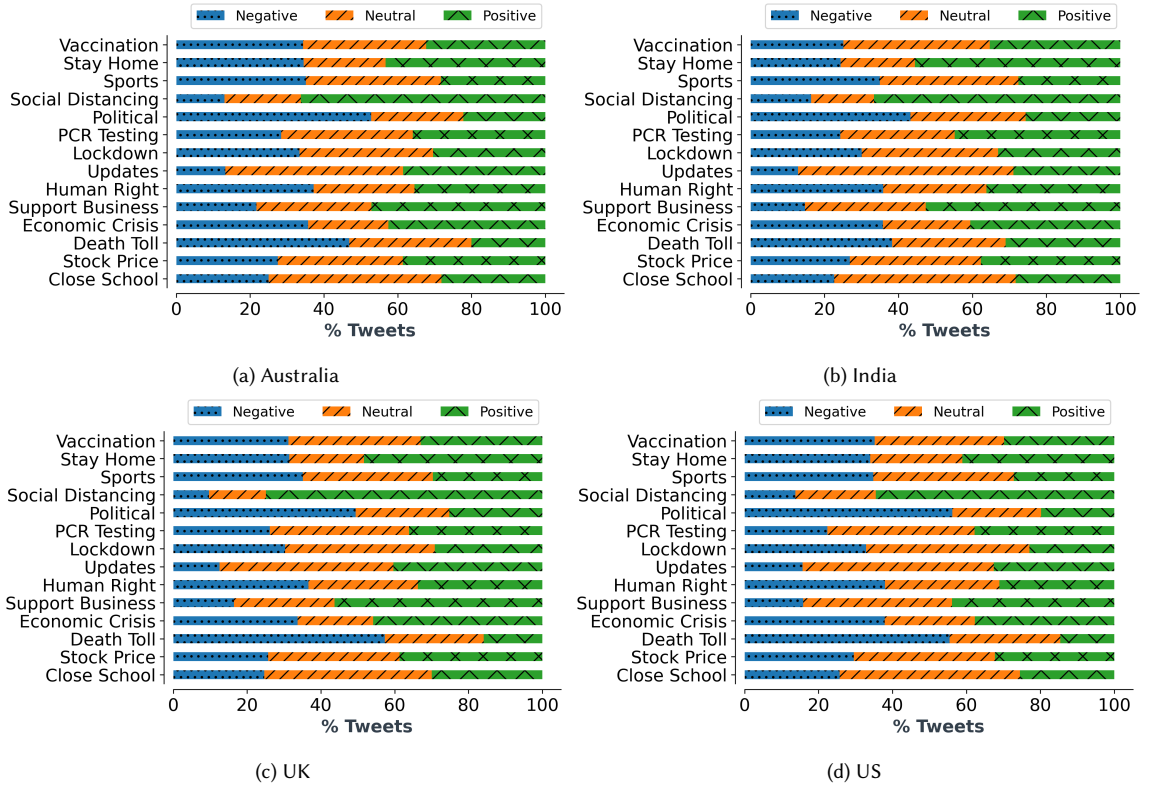


Fig. 2. User Sentiment for each Topic in Australia, India, and UK, and US, for all the lockdown periods

Table 2. Examples of tweets's tweet from all lockdown periods.

User Anonymized ID	Tweets	Topic
345767	'A friend of mine was issued a \$1,652 on-the-spot coronavirus fine this morning for entering Costco in Docklands as it was beyond the 5 km radius of her house. Sad! Be careful out there, folks.'	Stay Home (1 Tweet)
168973	'@JamesMelville Is your point that they should be worried about catching Covid-19 here? ', According to ONS data, 24.9% of people who died of covid-19 died in a care home. Versus 26.3% of people who died of covid-19 who had diabetes. It would seem a comparable blind spot. (Of course some of those may have been diabetic & also in a care home but the point still stands)', '@GOVUK But I can go to my parents with my kids whilst Im sick with coronavirus right?', '@richardhyland @jonthepon Selfishness vs altruism. I was tutted at last weekend for trying to avoid three people walking side by side! (My 6 year old daughter yelled coronavirus! at them after they passed)'	Stay Home (4 Tweets)
789654	'Im helping to fight #COVID19. We only need 164 more people on the app to get a COVID estimate for Jefferson County. Please help by taking 1 min daily to report how you feel . You also get an estimate of COVID in your area.'	DeathToll (1 Tweet)
904365	'#Lewisham up 12 #COVID19 confirmed cases', '#Bromley up 40 confirmed #COVID19 cases as of 22 Oct', '#Bromley up 46 confirmed #COVID19 cases as of 23 Oct', 'Another positive #COVID19 cases in my son's year at school.', '#Lewisham up 26 confirmed #COVID19 cases as of 3 Nov. Sadly, an increase of 1 death registered to 23 Oct'	Death Toll (4 Tweets)
167843	'@PuneCityPolice i have stuck here in pune with mom and my family at native place , so i have apply pass at covid19.mhpolice and token no is PUN05522058080679 And i have apply gujarat approval letter and medical certificate with it. Pls give me pass.'	LockDown (1 Tweet)
369225	'We got a call from a UAE-based airlines in Frankfurt that our daughter Miha has been accepted on the flight and they are bringing her to Dubai'	LockDown (1 Tweet)
666231	'My blood naturally wants to clot. (Factor V Leiden is a genetic mutation. Yes, I am "lucky" enough to have blood clotting as my mutant powers.) In addition to being old and fat, now I learn another reason 'Rona REALLY wants to kill me.'	Vaccination (1 Tweet)
541209	'OK! Now I'm really angry. The current evidence from Israel is that the single dose is only about 30% effective at best. I know you think that's plenty but you're playing with our lives and not very successfully. So listen to the real science. 2 doses. ', 'And I am still feeling the effects of *suspected* Covid19 - 6 weeks later. Very very mild. I am 99% better. But this virus lingers people (and I have an excellent immune system - despite other health issues)', 'Genetic quirk could explain how pangolins can tolerate coronaviruses'	Vaccination (3 Tweets)
905643	'@NHSBSolCCG my wife is currently 33 weeks pregnant and we are now going to hospital on a weekly basis for checks and monitoring. I am worried about giving my unborn child coronavirus due to these frequent visits. Would I now be able to get the vaccine as they are at high risk?', 'Obstetricians and Gynaecologists are recommending that women who are offered a Covid vaccine have if before they get pregnant. There is no need to delay pregnancy after the vaccine.'	Vaccination (2 Tweets)