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The Decentralized Generation of Public Knowledge during the COVID-19 Pandemic: Examples from Australia

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Abstract: In the early days of the COVID-19 pandemic of 2020–2022, public uncertainty about the nature of the virus, and in particular its symptoms and mode of transmission, was met by the daily briefings issued by public health departments and political leaders. They were ill-equipped to respond to emerging knowledge management demands in an agile fashion. As this paper will show, this gap was filled on a volunteer basis by personal initiative. Examples for this are contact tracing register applications, an archive of daily COVID-19 incidence numbers at local government levels and a crowdsourced site that allowed the public find rapid antigen test kits during a time of extreme shortages. Once government and professional bodies eventually caught up and supplanted these volunteer endeavours, they become obsolete and by and large forgotten. Yet it can be posited that societal angst would have been much greater without them.

Keywords: COVID-19; crowdsourcing; digital applications; knowledge dissemination; news media; personal agency

1. Introduction

Soon after COVID-19, the respiratory disease caused by the SARS-CoV-2 coronavirus [1], emerged as a public health concern in early 2020, many governments at national or state levels enacted public health measures to curb or at least slow the progress of COVID-19 from seeding into their country. Although zero-COVID policies and suppression eventually proved to be failures as COVID-19 developed into a global pandemic, the public health measures ranged from border closures [2] and ringfencing of hotspots [3], to mandating the wearing of fitted face masks [4], pop-up PCR testing sites [5] and enforcing social distancing by limiting the capacities of public venues [6].

Common to these government mandates and requirements were personal, corporate and community responses, such as the design and deployment of branded social distancing markers, the production of fitted face masks with customized designs and/or corporate logos, the design of hand sanitizing stations and stop-gap measures to combat material shortages, such as gin distilleries making hand sanitizer [7,8].

During 2020 and early 2021, numerous state governments in Australia issued public health mandates that were formally published in the respective government gazettes and widely reported in the media. While the governments were generally agile to adapt to new strains of SARS-CoV-2 and modified the relevant health advice and mandates, it was generally left to the public and individuals to make them work. Taking the mandate to wear fitted face masks as an example, the personal implementation and adherence to that mandate was not that simple, because globalized supply chains operating on an on-time demand-driven delivery model were soon overwhelmed, leading to shortages of single-use surgical-type face masks. This shortage was exacerbated by hoarding and panic buying [9]. In consequence, a cottage industry sprung up to manufacture face masks made from cotton and other cloth fabric [10,11], which, while better than no mask at all, provided a lower level of protection from SARS-CoV-2 compared to N95 or single-use surgical-type face masks.

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The mandate to register attendance in gastronomy and other venues led to a similar cottage industry of web applications (see below), while the shortages of rapid antigen tests led to the creation of public service-type websites relying on crowdsourced data.

Since the COVID-19 pandemic of 2020–2023 has proven to be a cross-cultural, cross-sectoral and transnational disruptor on a truly global scale not seen since the influenza pandemic of 1918/19, it can be posited that in the medium-term future, COVID-19 will become the focus of social history retrospectives and analyses. As argued elsewhere, now is the time to act when processes are still in place and observable, when ephemeral, physical and virtual sites can still be documented and when digital and physical artifacts are still able to be collected [12]. This paper examines some of these essentially ephemeral digital applications; their creation and use as examples of decentralized generation of public knowledge; and as examples of virtual cultural heritage [13]. Given that this paper is a deliberation, it does not follow the standard IMRAD (Introduction, Methodology, Results and Discussion) format of papers.

2. Generating Public Knowledge during the COVID-19 Pandemic

In the following, this paper will present three examples where individual initiative, often at no personal commercial gain, stepped in to provide a community service. In all cases, individuals saw that their technical expertise allowed them to develop a common-good web application that responded to a community need. The three examples are digital registers for tracing the contacts of COVID-19 positive individuals; a crowdsourced database that allowed a user to locate stores with stocks of rapid antigen tests; and a COVID data warehouse listing that reported infections at the local government level.

2.1. Digital Registers for Tracing the Contacts of COVID-19-Positive Individuals

To contain the spread of COVID-19, all public health departments engaged, at least in the early stages, in systematic epidemiological contact tracing [14], establishing the network of those with whom a COVID-19 symptomatic patient could have come into contact. To facilitate this, publicly accessible venues, such as gastronomy, sporting clubs, churches and shops were required to record contact details (name, phone number, e-mail) of customers and patrons attending their venues [15], the open nature of which posed privacy concerns [16]. Initial pen-and-paper systems soon gave way to digital solutions, activated by scanning a QR code, which allowed patrons to enter attendance data via their own smart phones.

These systems were developed either as stand-alone applications, designed by small-scale web developers, or were offered as add-on modules to hospitality software published by major IT companies. Given the administrative benefits these provided to the gastronomy venues, the uptake of these premises-based collections system was rapid.

These web-based internet applications were provided by developers with a generic interface and then "customised" by inserting the venue's name, logos or imagery (Figure 1). Larger corporations developed company-wide systems with store-specific recording [17]. These systems were unidirectional, with users not being alerted if they possibly had been exposed to patrons who at a later date tested positive to SARS-CoV-2. In late November 2020 the digital check-in became compulsory in New South Wales [18], with the state health authorities requiring the use of the standardised, state-wide Service NSW App [19–21]. Other states developed similar systems, putting an immediate end to the use of the applications developed by private providers.

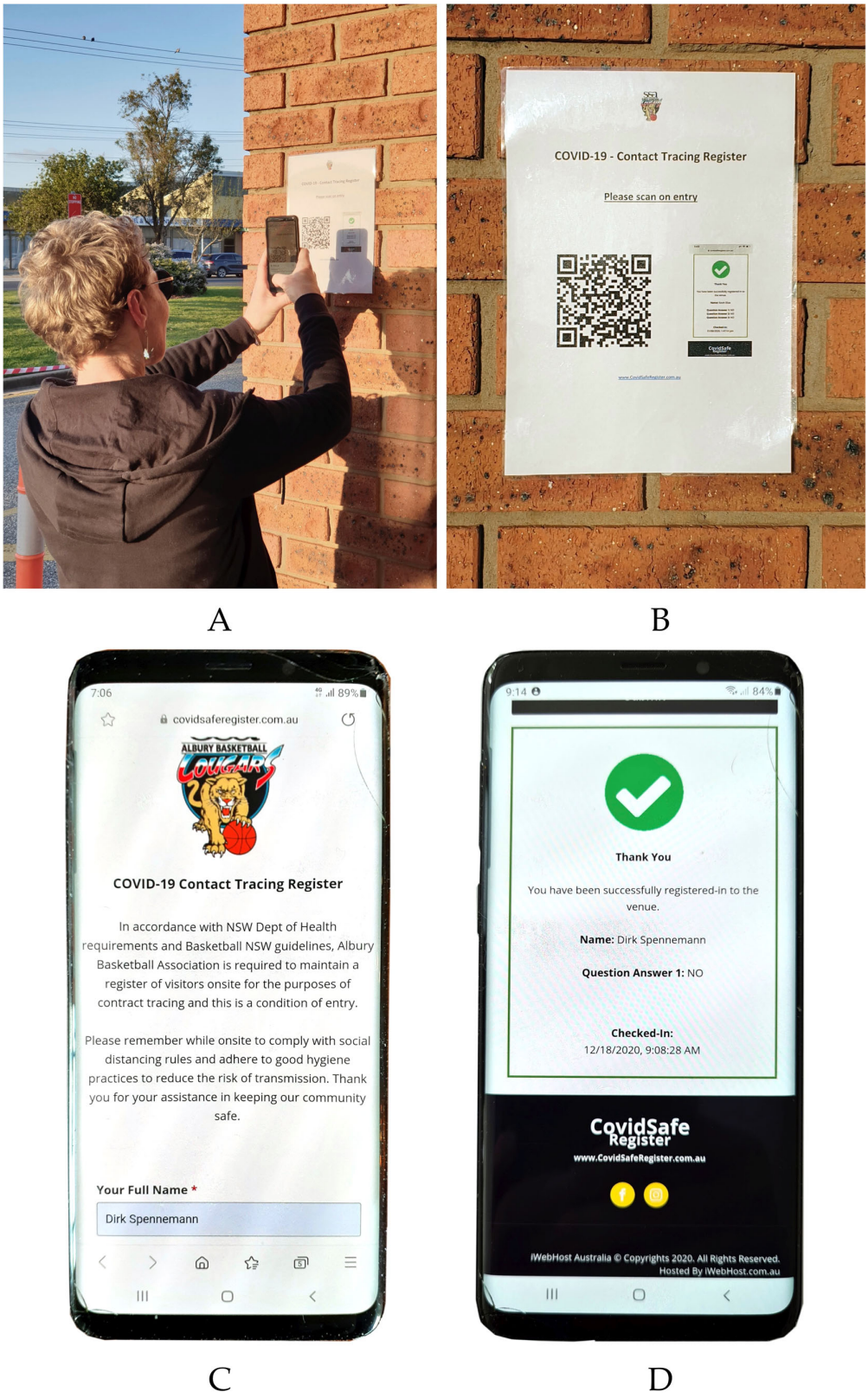


Figure 1. (**A**–**D**) Registering attendance at a community-based basketball game via a contact tracing application. COVID-19 check-in process with publicly posted QR code and resulting digital ephemera (Lauren Jackson Sports Centre, Albury, NSW, Australia, December 2020) [13].

Even though only active for four months, the privately developed applications, with the varied interfaces, had become an accepted "way of life" for the Australian public

and paved the way for the easy transition to and adoption of the government operated applications.

2.2. "Find a RAT" Website

During the last quarter of 2021, the Australian Technical Advisory Group on Immunisation, together with the Therapeutic Goods Administration, approved a number of rapid antigen tests (RAT) [22] that could be self-administered rather than having to line up for a public health administered polymerase chain reaction (PCR) test that also came with a required self-isolation period until a negative test result had been communicated. At the beginning, RATs were uncommon and only sold at chemists. Demand was low except in specialized settings, such as health care, jury selection panels (pers. obs.) and industries with a high level of customer focus.

The rise in infections caused by the Omicron variant of SARS-CoV-2 from mid-November 2021 onwards [23] saw a dramatic increase in the demand for RATs, which was further accelerated during the pre-Christmas season, which saw many end-of year office parties and other social gatherings. The familial social gatherings for Christmas itself, as well as for New Year added to the demand. That demand was initially driven by individuals concerned about their health status but was further fuelled when the high level of infections placed a strain on PCR-swab testing, with long queues (Figure 2) and long delays in the return of PCR test results, which were commonly being returned with a 72 to 96 h delay [24,25]. Governmental intervention, discouraging people from accessing PCR testing unnecessarily, increased the demand for RATs even further [26].

Figure 2. Queues at the drive-through PCR testing centre, Bondi (Sydney, NSW, Australia), 25 December 2021.

All these factors resulted in a widely reported, persistent shortage in RATs in many locations [27], which by that time were sold at chemists, newsagents, supermarkets and petrol stations. This shortage, coupled with public anxiety as people were "hunting" for RATs from one potential sales outlet to the next (pers. obs.), led to the creation of online platforms, which displayed crowdsourced information of the (temporary) availability of tests.

The first website to be developed was "Find a RAT", a crowdsourced webpage where retailers could post that they had stock and at what cost, and where the general public could post sightings of offerings (Figure 3) [28]. To prevent mischievous and misleading

posts, users had to register. In a later variation, the submission interface drew a predefined list of stores to prevent user data entry errors. Stores not listed could be entered manually but were subject to manual verification by the administrator. Retrieval of sites selling RATs could be achieved by entering a postcode, after which the locations (including store name and address) were displayed on a map, or by using a map interface. The traffic-light-coded location markers reflected the reported stock levels. Once the stock has been reported as depleted, the marker was dropped. The "Find a RAT" webservice was launched on 3 January 2022 and, not surprisingly, attracted much national and even international media attention [29–33].

The success of the "Find a RAT" service was soon emulated by a commercial provider, Finder, which provided an advertising-based, online brokerage service for goods and services. Unlike "Find a RAT", which listed brick-and-mortar stores, the "Where to buy rapid COVID test kits" website provided links to online chains as well as smaller distributors with an online shopfront (Figure 4) [34]. In response to the much publicized existence of the "Find a RAT" website, the Pharmacy Guild of Australia established its own webpage on 24 January 2022 that detailed who was eligible to receive a RAT even if supply was low, and which pharmacies had stock (Figure 5) [35]. The appeal of the latter site, which also attracted media attention [36,37], was that the Australian Government provided ten RATs at no charge to concession card holders [27]. The free-of-charge kits could only be obtained in pharmacies and chemists. The Pharmacy Guild's service, however, had severe limitations during the heyday of test kit shortages, as it only covered stock held by members of the Pharmacy Guild, which made up only a small proportion of potential sales outlets, which ranged from chemists and supermarkets to newsagents, petrol stations and retailers of work and safety gear [38].

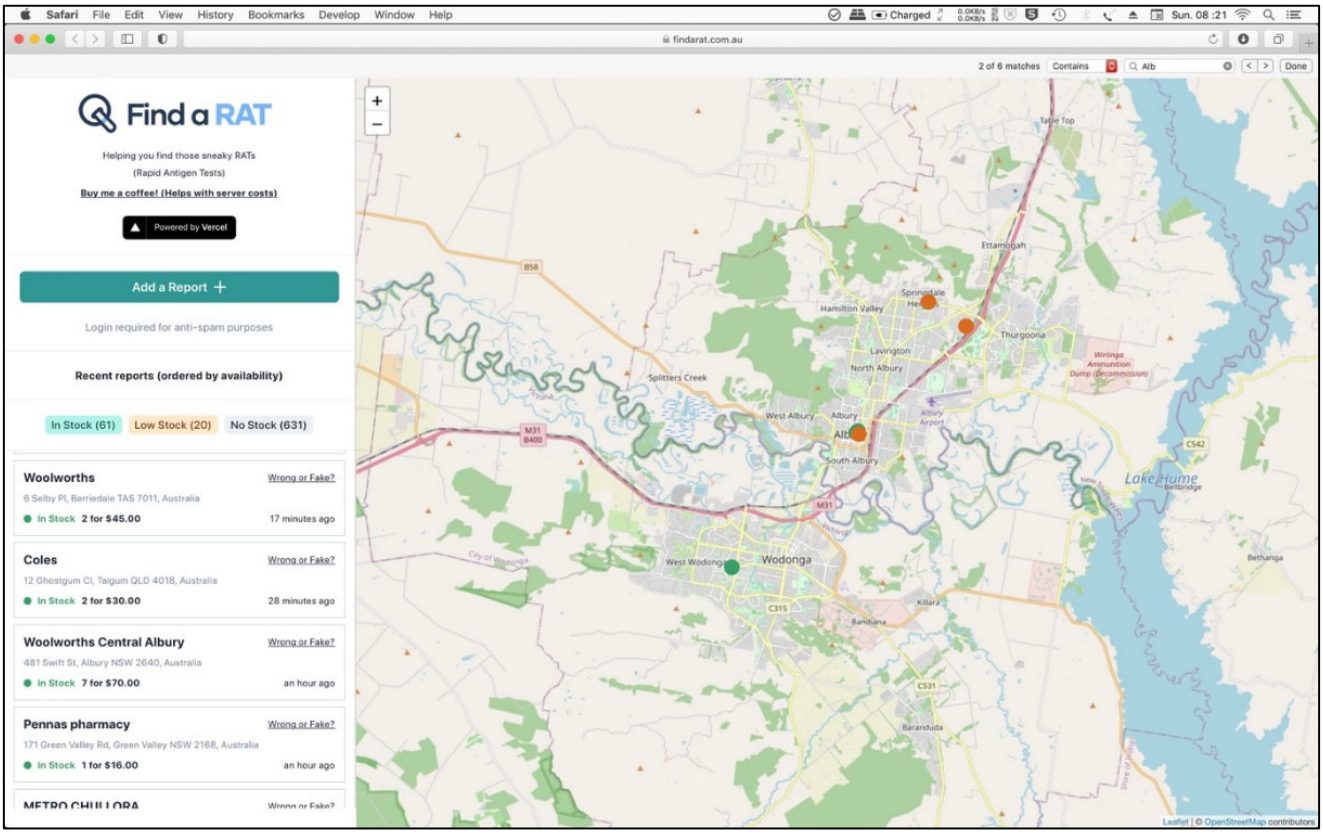


Figure 3. Screenshot of the "Where to buy rapid COVID test kits" website, taken on 18 January 2022 at 15:05 [38].

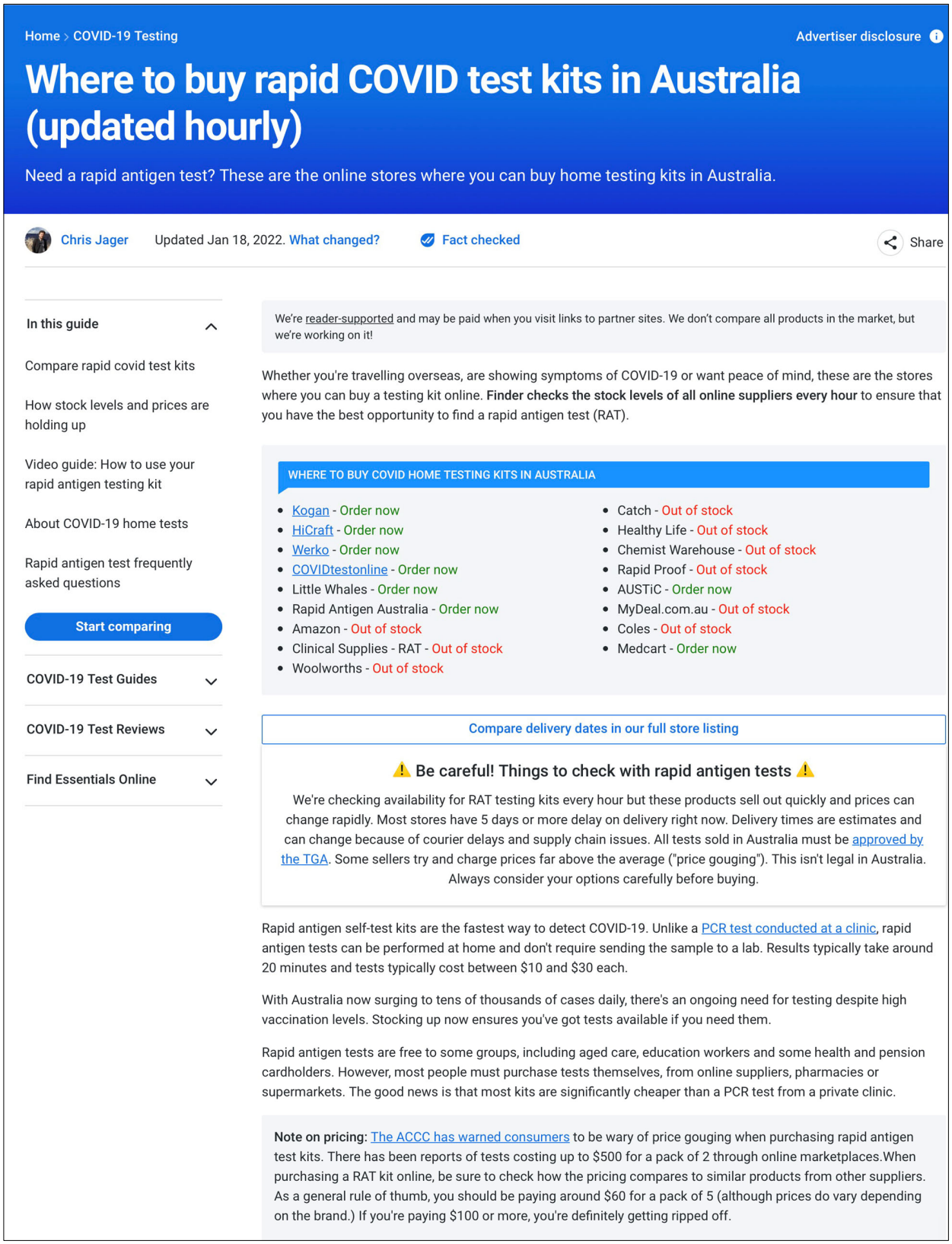


Figure 4. Screenshot of the RAT website operated by the Pharmacy Guild of Australia, taken on 31 January 2022 [38].

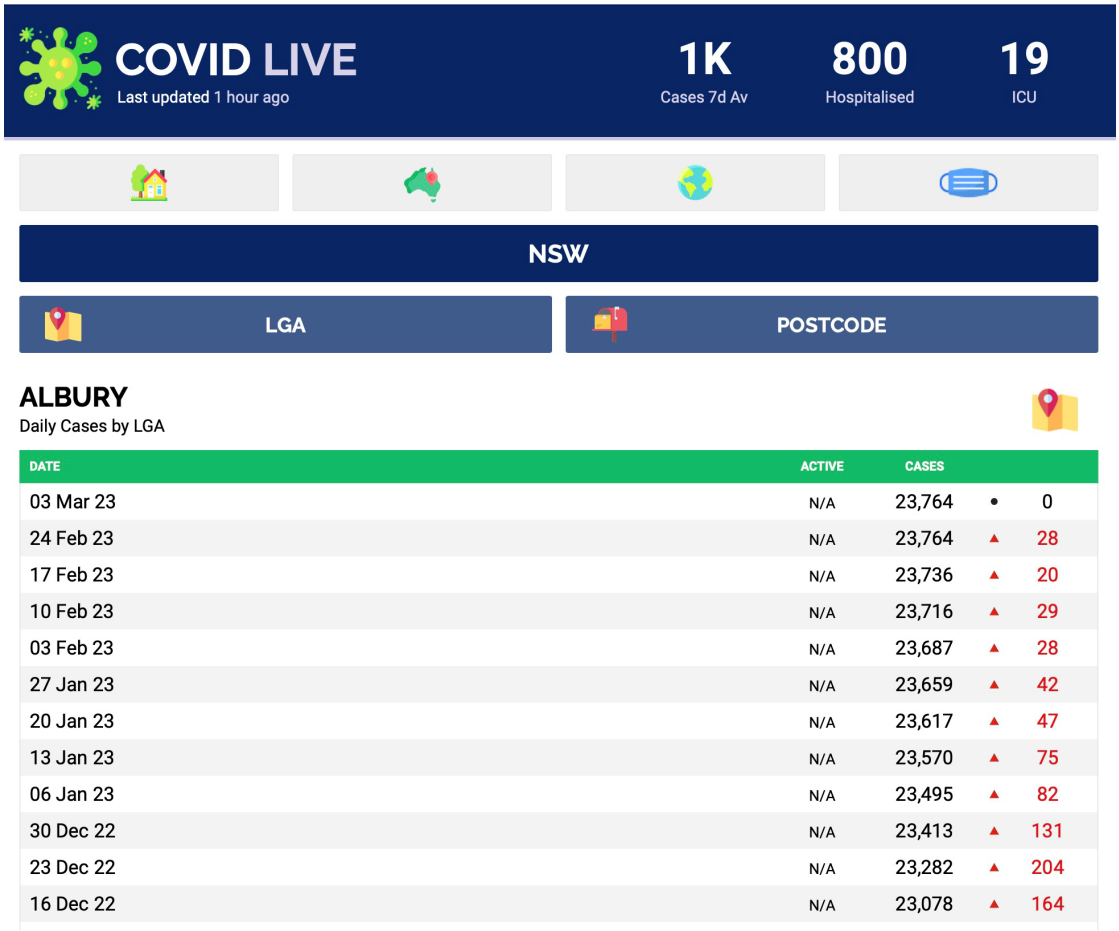
Figure 5. Screenshot of the "Find a RAT" website, taken on 9 January 2022 at 08:21 [38].

2.3. COVID Data

The seeding of the Delta variant of SARS-CoV-2 and the concomitant well-publicized rise in infections brought about considerable disquiet among the Australian population. Since the infection clusters were locally confined and new clusters continually being seeded, there was a demand by media and by the public for infection numbers at the local government area (LGA) level. While these data could be extracted from the daily health updates by the state health departments, they were effectively "buried" and not very user friendly as far as the general public was concerned.

This led to the establishment of a free data publication service, COVID Live, which commenced in late March 2020, with LGA level data published from 11 October 2021 onwards. The data of daily new infections, total daily active cases, as well as cumulative

infection numbers were presented by the state and by each LGA (Figure 6). The data were initially published on a daily basis as provided by the state public health department, and from 9 September 2022 on a weekly basis [39]. In addition, the site offered current data on hospitalizations and deaths, as well as vaccinations, but only at state-level granularity. The site was funded by wrap-around advertising banners.



DATE	ACTIVE	CASES		
03 Mar 23	N/A	23,764	•	0
24 Feb 23	N/A	23,764	▲	28
17 Feb 23	N/A	23,736	▲	20
10 Feb 23	N/A	23,716	▲	29
03 Feb 23	N/A	23,687	▲	28
27 Jan 23	N/A	23,659	▲	42
20 Jan 23	N/A	23,617	▲	47
13 Jan 23	N/A	23,570	▲	75
06 Jan 23	N/A	23,495	▲	82
30 Dec 22	N/A	23,413	▲	131
23 Dec 22	N/A	23,282	▲	204
16 Dec 22	N/A	23,078	▲	164

Figure 6. Screenshot of the data page for the Albury Local Government Area of the COVID Live website, taken on 3 March 2023 [38].

It can be posited that the "consumer-ready", intuitive nature of the site, as well as its reliably daily updates, reduced the societal angst during the Delta and Omicron infection peaks.

3. The Role of Personal Agency

During the early stages and height of the first wave of the pandemic, the Prime Minister of Australia [40], and in particular state public health officers, delivered daily media briefings summarizing infection numbers and infection trends, issued general public health advice and elaborated on public health measures that were being promulgated and amended on a continual basis to address the changing circumstances [41,42]. The State Premier of Victoria even fronted media on a daily basis for 120 days without break [43]. Amid a state of evolving knowledge about the nature and transmissibility of SARS-CoV-2, knowledge generation and then knowledge transfer was critical. At the time, the stated public health aim was suppression and eradication through contact tracing, national and regional lockdowns, the prevention of interstate travel [2,3], as well as systematic testing via pop-up drive-through testing facilities [5].

The media briefings by public health experts with clear messaging engendered public trust in the advice given [42,44–47]. In early 2020, the media provided largely measured coverage, often likening it, in their phraseology and metaphors, to war [48] and the need for community-spirited, collective action.

Changes to consumer behaviour due to lockdowns and other movement restrictions, as well as social distancing and maximum occupancy limits being enforced in stores, resulted in a downturn in advertising revenue that disproportionately affected smaller, rural and regional papers [49]. Many papers, already financially stressed due to concentration in national mastheads, caused many local and regional papers to cease publication. For their clientele, this led to a relative information vacuum on a local level, especially as local news was more likely to be trusted than national media [47]. The need for big picture information could be filled by online versions of national media, which often removed paywalls for COVID-19 articles out of national public health interest. Given their remit, these national print media (and their online sites) had no local-level granularity unless they reported on localized, large clusters. The same applied to television, where regional news bulletins had been increasingly delivered from metropolitan rather than local studios, with a concomitant loss of granularity at the local level [50].

While younger generations heavily relied on a range of social media platforms, the loss of regional newspapers and the reduced granularity of local level TV reporting affected older generations the most, as they were also the least likely to use social media [51,52].

As the pandemic wore on into 2021, the briefings by state public health officers eventually became less frequent, until the seeding of the Delta and then Omicron variant of SARS-CoV-2 in late 2021. While the frequency of briefings increased at that point, the preceding interval had somewhat dulled the receptiveness of the general public [47]. During the same period, the information needs had shifted from the big picture of rising case numbers and general public health advice to the personal level.

At the same time, news reporting, which had become more critical in late 2020 [42], now became even divisive [53]. While mainstream media in Australia always had their own audiences, with perceived biases, such as the Australian Broadcasting Corporations TV channels being regarded as "leftist" by conservative politicians and Murdoch's "The Australian" being seen as too conservative by others, public media were still broad in their coverage. Social media, on the other hand, allow for audiences to subscribe to selective "channels" that act as echo chambers, reinforcing rather than challenging perceptions and opinions [54–56]. This played out in particular in the public debate on the need for and advisability of nation-wide vaccination programs [57,58].

By and large, the public was aware that misinformation was common, not only on social media sites [46,47,59], but also in some of the mainstream media, generating a need for accuracy and validity of information [45] and a desire by news consumers to be able to verify the information presented to them [47]. Younger generations were more likely to verify the accuracy of information via cross-checking with multiple information sources than the older generation [47]. This led to a demand for high veracity information providers, providing an opportunity for near real-time, data-driven web services.

It is significant to note in this context that it was not the large media conglomerates, with their ample staffing resources, that developed common-good resources such as "Find a RAT" and "COVID Live", but the personal agency of a few concerned individuals with the relevant programming skills and server resources. These individuals generated reliable, up-to-date information sources that filled that need, as did the RAT finder site later set up by the Pharmacy Guild. The digital contact tracing registers fall into a different category, as they fulfilled the needs of both the venues for an easy way of keeping records of their patrons, and the needs of the patrons who now had an easy way of registering without the need to pick up a potentially contaminated writing instrument and without the need of having their name and contact details publicly exposed. While the common-good resources such as find a RAT" and "COVID Live" attracted media attention, the work of the web

programmers offering digital contact tracing registers and associated server space, usually free of charge, went largely unnoticed.

4. Latency and Ephemerality

Commonly, government websites are formally archived by the national archives as they form part of the public governmental record [60]. In addition, some national libraries engage in the collection of snapshots of the nation's web presence as part of that country's online publishing endeavours [61].

Private websites, however, are usually not archived unless they have been nominated to sites such as the WayBack Machine [62]. Of the sixteen venue-based electronic contact register sites documented in another paper [13], only one has been archived by the WayBack Machine. A test run at the time of writing (4 March 2023) showed that the "find a RAT" website [38] as well as the "where to buy rapid COVID test kits" website [34] were still up and running, while the RAT website operated by the Pharmacy Guild of Australia was no longer operational. All three websites had been archived by the WayBack Machine: "find a RAT" with 201 captures in 2022 and 9 in 2023; "where to buy" with 3 captures in 2022 and 11 in 2023; and the Pharmacy Guild webpage with 26 captures in 2022. The COVID Live site was the most frequently archived site, with a total of 2083 discrete archiving events between 28 March 2020 and 2 March 2023.

The discrepancy between the comparatively high volume of archiving of the three RAT webservices as well the COVID Live site and the almost total lack of archiving of the contact tracing registers rests in the fact that all bar one of the contact tracing registers were standalone, QR code-activated sites, while the URLs of the three RAT websites and the COVID Live website had been linked in media stories, blogs and social media posts.

From a digital heritage perspective, this dichotomy of such ephemeral sites is illuminating. While some services will persist by virtue of being archived by the WayBack Machine, other examples of personal initiative will perish unless they have been documented by other actors [13].

5. Conclusions

In the early days of the COVID-19 pandemic of 2020–2022, public health departments issued daily briefings to create public awareness. With the stated aim of containment and eventual suppression, there was a need to generate public knowledge about the nature of the virus and in particular its symptoms and mode of transmission. While public health departments were effective at knowledge transfer through daily, live-streamed media briefings, they were ill-equipped to respond to emerging knowledge management demands in an agile fashion.

As this paper has shown, this gap was filled by personal initiative. Examples of this were the numerous contact tracing register applications, developed ad hoc by small to medium scale web programming firms, as well as a crowdsourced site that allowed the public to find rapid antigen test kits during a time of extreme shortages. Both were widely appreciated endeavours that were eventually made obsolete, the first by state-run contact tracing register applications and the second by a site run by the Pharmacy Guild, which was an effective option as soon as the supply of RATs met the demand. The site that provided daily COVID-19 incidence numbers at local government levels is still operational and still provides accurate data for those interested.

Because the contact tracing register applications and websites were developed ad hoc by private individuals and therefore "escape" traditional archival capture, they constitute digital ephemera.

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