Domestic context
In response to the COVID-19 pandemic, the NZ government implemented an alert system to manage, suppress and eliminate community transmission (Ministry of Health, 2020). The call-signs corresponding to the four levels are: Prepare (1), Reduce (2), Restrict (3), and Lockdown (4), see Table 1. Official communications adopted the terminology ‘bubble’ for a small set of people isolating together; thus, it is a ‘safe unit’ that could be mobile, as long as it did not interact with other bubbles.

On March 21st 2020 the Alert Level was set to 2 and increased to Level 3 on March 23rd. All public institutions, e.g., Otago Museum, needed to close on that day. The country moved to a nationwide lockdown (Level 4) on March 26th. The daily spread of COVID-19, the major public-health actions, and their implications on the Otago Museum are shown in Figure 1.

The country remained in effective lockdown (Level 4 then 3) until May 13th 2020. In Level 2, public institutions were allowed to re-open, albeit operating within a set of regulations including that businesses (i) comply with hygiene, physical distancing and customer tracking regulations, and (ii) control the number of customers on premises. Eventually, on June 9th NZ shifted to Alert Level 1 with no restrictions on business activities, gathering sizes nor distancing, although borders remained closed.

Re-opening the Otago Museum
Otago Museum has a reputation domestically as a leader in the area of science communication and engagement, attracting over 340,000 visitors annually. It operates the Perpetual Guardian Planetarium, and its Tūhura Science Centre, which form its science precinct. Science Centres, being interactive, pose a higher risk for harbouring and transmitting infectious agents compared with traditional museum or gallery spaces. It was important to produce a strategy and risk-mitigation plan to bring these science centre areas back to full operation.

Table 1: New Zealand’s Alert Levels (New Zealand Government, 2020).

<table>
<thead>
<tr>
<th>Alert Level</th>
<th>Risk assessment</th>
<th>Rules (excerpt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Prepare</td>
<td>Disease is contained</td>
<td>Uncontrolled spread overseas; Isolated transmission in NZ</td>
</tr>
<tr>
<td>2 – Reduce</td>
<td>Disease is contained, Risk of community transmission</td>
<td>Household transmission could be occurring; Single or isolated cluster outbreaks</td>
</tr>
<tr>
<td>3 – Restrict</td>
<td>High risk the disease is not contained</td>
<td>Community transmission may be happening; New clusters may emerge but controlled via testing and contact tracing</td>
</tr>
<tr>
<td>4 – Lockdown</td>
<td>The disease is not contained</td>
<td>Community transmission; Outbreaks and new clusters</td>
</tr>
</tbody>
</table>
Alert Level 4 (lockdown) activities
The lead into lockdown was rapid, as was similar around the globe (see Blühm 2020, Christiansen, 2020; Verdon & Art, 2020; Ou, 2020; Potts, 2020). Only staff securing facilities or supporting the flora and fauna within its living environments had access to buildings. Others worked from home, developed online content, and maintained virtual engagement with the public (Otago Museum, 2020). We followed government and expert advice: (i) decommissioned air driers in bathrooms to reduce the spread of aerosol; (ii) cancelled or postponed public events; (iii) introduced stringent cleaning regimes; and (iv) displayed signage about hygiene and physical distancing (Lammers, et al., 2020), see Figures 2a, 3a and 3c. Simultaneously a guideline was developed establishing a governance and operational framework for activities happening during and after lockdown. The main principles were:

**Safety first**  All government-mandated guidelines to be followed; If such advice is insufficient, seek advice from experts.

**Instil confidence**  The Museum (i) distributed ample signage; (ii) installed sanitising stations; and (iii) made cleaning regimes apparent.

**Encourage visitation**  The Museum developed programmes attracting locals and reassuring visitors of safe visitation.

Alert Level 3 and 2 activities
Public venues have mandates to enhance community cohesion. The Museum invited all families of essential workers to Tūhura/Planetarium for free during Alert Level 2. The initiative acknowledged their sacrifices while keeping our community safe, it also provided us with a gradual test of operational processes. Essential workers were already attuned to elevated protocols and provided constructive feedback.

Alert Level 2 came into force on May 14th 2020 and the Museum reopened on May 16th. It has been shown that a disproportionately large reduction in infection rate can be achieved with a small reduction in the number of simultaneous visitors (Chang, et al., 2020). In order to keep the number of visitors below 100, a staff member was stationed at the entrance behind a protective shield, registering and counting visitors, Figure 3b and 3d. Once the limit was reached, visitors were assigned a letter from A–Z and their group size was recorded. As soon as the next group could be accommodated, the staff made an announcement call and invited the group in, thereby avoiding queuing visitors. In the Planetarium, Tūhura and in the café, constant counting was required due to a limited number of seats, and number restrictions on single venues.

Before re-opening two members of our team (M. McC and M. Q-M) assessed each interactive item by the risk of contamination, risk of transmission and how viable it was to clean them between use. Two categories were identified. Items with high risk of contamination were the first category, e.g., ‘Sound Bite’, where visitors bite on a straw-covered bar and hear sounds transmitted through the bar, which they cannot hear otherwise. The second category contained items that could not practically be cleaned, e.g., substrates, such as sand in the ‘Topography Table’ in which visitors shape landforms out of sand, Figure 2b and 2c. Based on the risk assessment all high-risk items were decommissioned.

Additionally, the level of sanitisation was increased, and cleaning and protective equipment for staff and visitors were provided. Signage, as in Figure 3f, reminded visitors of physical distancing and their personal responsibilities. The schedule of planetarium shows and staff rosters were adjusted to accommodate frequent cleaning, and additional casual staff were recruited to suit modified operations.

The cleaning inspired a new activity called the ‘Science of Cleaning’, where science communication staff engaged in depth with a single visitor or bubble and discussed how ethanol, or soap and water work to inactivate viruses (WHO, 2020; CDC, 2020). This proved to be an effective means of breaking the ice with visitors and reassuring them that all the cleaning they were witnessing was part of a professional precautionary strategy.

Sanitation stations, e.g., Figure 3e, were installed in all zones and were spot-lit. The fountain spout designed for drinking out of directly was decommissioned, leaving just one for filling drink bottles. Drinking cups were removed too, but visitors still had access to cups if they requested them.
Physical barriers were also introduced to encourage one-way visitor flow, e.g., into Tūhura’s Tropical Forest. In order to maintain government-mandated physical distancing of one meter between bubbles, vinyl signage on the floor helped to convey the message such as in Figure 2a. This policy, however, had substantial impact on the visitor numbers. Firstly, the restriction allowed only a single bubble for an interactive item. Secondly it demanded two spare seats between each ‘bubble’ in a row within the Planetarium together with leaving a gap behind any bubble between rows. These restrictions reduced the Planetarium capacity from 51 to 20 seats. In addition, only 2D shows were scheduled to avoid using 3D glasses. The overall schedule was also reduced to allow for time between shows for cleaning the seats. Thirdly, we postponed all public programmes and events that would otherwise encourage bubbles to come together.

Encouraging visitation of the Science Centre while simultaneously reducing its number of interactive items, seemed to be a hard task for the management. As a temporary measure the Museum, therefore, offered Tūhura visitors a free Planetarium ‘taster’ show, compensating for this reduced offering and to help introduce them to the planetarium experience. This proved very popular and we have continued to provide this free show at Level 1 at the end of our normal Planetarium schedule to encourage visitation to Tūhura later in the day.

**Conclusions**

The current COVID-19 pandemic demonstrated that countries are very much connected to each other via international travel, hence local outbursts of infectious diseases can quickly affect all countries around the globe. Since COVID-19 represented an unknown illness, no reliable protocol was available to health officials and practitioners to follow. Instead governments opted to choose very different avenues to tackle both the public health and the economic aspect of the pandemic, considering their priorities, geographical and geopolitical positions. The consequences of this variability are currently trickling...
down in every country to state or regional levels, and even further down to individual legal entities, such as companies and Museums. Hence, it seems a logical and not too far-reaching conclusion that the governmental public health response highly impacts companies and public venues and their recovery options and strategies.

Initially the NZ Government followed standard, generic, epidemiological protocols, e.g., all general practitioners had to report any suspected cases, however, after scientific modelling and predictions became available (Ministry of Health, 2020), the approach changed. The aim was suppression and elimination of COVID-19. The rapid action, based on scientific advice, seemed to be working; within two months the country could return to nearly normal operation. In the Otago Museum we followed a similar path; developed a re-opening strategy based on scientific advice. Researchers classified interactive display items and advised how to mitigate the risk of transmission via each of these items.

We communicated to Tūhura Annual Pass holders at Level 2 to welcome them back and extend their passes for an additional two months. This campaign was effective...
in alerting them of the reopening. We also introduced a range of interventions ensuring that visitors complied with tracing physical distancing. In Level 2, 43% of science centre visitors were essential workers and their families. Their feedback was exceedingly positive. They took the time to view the wider galleries and spend time and money in the Museum’s café and shop. Our ‘Thank You Essential Services’ initiative provided a great morale lift for visitors and staff alike.

The safety interventions, spearheaded by essential services, and then, at Alert Level 1, a full array of public programmes served effectively to return visitation to a pre-lockdown level, despite the absence of international tourists. Otago Museum quickly became known locally as a safe and still engaging place to visit.

We believe that the analytical scientific approach taken proved to be highly beneficial in selecting actions both at the country level and, through our example, at the level of an individual museum in the current pandemic. A more systematic comparative study of governmental approaches would be highly valuable in preparing for the spread of similarly contagious diseases in the future.

Competing Interests
The authors have no competing interests to declare.

References


