In New South Wales, the health care system’s response to Covid-19 has been successful to date in attenuating the worst effects of the pandemic. One part of that response was the formation of a new organizational entity – the Critical Intelligence Unit (CIU) – which brought together clinical, analytic, research, organizational and policy experts to provide timely and considered advice to decision-makers. The CIU is a “versatilist” organization which is neither a decision-making authority nor an operational unit. It plays a complementary role to the frontline pandemic response teams - providing real-time, synthesized advice and options to be considered by system leaders. It is a model that is adaptable to different health care systems and pandemic stages.

The Covid-19 pandemic compelled providers to act swiftly to develop ways to contain transmission and care for infected patients across a spectrum of acuity – from mild cases managed remotely to the critically ill in intensive care units (ICUs). The expectation of surges in demand led to disruption in routine service delivery for non-Covid patients, through deferment or cancellation of scheduled care such as elective surgery; or reconfiguration of service delivery models, such as the adoption of virtual care. Patients’ health care-seeking behavior also changed significantly, with marked reductions in visits to primary care and emergency departments.

For policymakers and system leaders, the pandemic required rapid decision-making with regards to public health responses, service planning, supply chain management, safety assurance, and communication. Evidence –from research, data repositories, or experience of clinicians and patients – has taken on heightened value in guiding those decisions.
In New South Wales (NSW), one element of the Covid-19 response was to establish a Critical Intelligence Unit (CIU) to inform policy and clinical practice. Seven months on from its establishment, the CIU has made significant contributions to planning and responding. It has helped decision-makers address issues regarding personal protective equipment, and early identification and monitoring of indirect impacts of Covid-19. The CIU has also created and updated summaries of available evidence on health issues, tailored for busy executives and organizational and clinical decision-makers.

The setting

New South Wales is the most populous state in Australia with about 8 million people. At 801,000 km², it is a little larger than Texas in total area, with large swaths sparsely populated.

The publicly funded health care system, NSW Health, employs more than 140,000 people working across more than 220 public hospitals and health services around the state. In a "normal" year, there are more than 1.9 million hospitalizations and almost 3 million emergency department visits. The health system in NSW is a mix of public and private health care. Government programs fund primary care, many pharmaceuticals, and public hospital services. Private hospitals, of which there are about 200, are funded through private health insurance, individual out-of-pocket payments, or via third party insurers.

Everyone in NSW is eligible for subsidized medical treatment and free treatment as a public patient in a public hospital. It is not mandatory to have private health insurance cover. However, private health insurance does provide a choice of doctor, covers some of the cost of treatment in a private hospital, and ancillary treatments such as dental, optical and physiotherapy. Most private hospitals are funded through private insurance. During Covid-19, there was an agreement between private hospitals and the government to increase capacity for Covid-19 patients.

The Secretary of NSW Health is head of the Health Ministry and responsible for governance, oversight and control of the public health system, and the regulatory authority for privately owned and operated health facilities across the state. In March 2020, she assumed the role of Incident Controller for the Covid-19 health response. That response is widely acknowledged to have been successful in suppressing Covid-19 transmission. Through October 21, there have been 4167 cases and 55 Covid-19 deaths in NSW. Early in the pandemic, the Incident Controller established the Public Health Emergency Operations Centre (PHEOC) and the State Health Emergency Operations Centre (SHEOC), established temporary pandemic-related contractual relations with private hospitals and oversaw the formation of a Clinical Council, 30 Communities of Practice and – the primary subject of this paper - a Critical Intelligence Unit (CIU).

In NSW, the CIU reports to the head of the health department but the concept could be adapted to different contexts; for example, reporting to the CEO of a health system in the US, a health department or peak committee of a local council, state or national government in various jurisdictions. Most of the CIU’s products are available free of charge, online, for public and private operators.
A Critical Intelligence Unit

The foundations of the CIU

The CIU was established in the course of one week in late March 2020. From the outset, it was purposefully established as a non-decision-making resource focused on Covid-19. It reports directly to the Health Secretary / Incident Controller—the highest-level decision-maker in the health care system — ensuring that the unit’s advice has visibility and the ability to influence policy and practice.

“
The CIU is not involved in planning or providing care. It is at arm’s length from the operational centers, allowing it to take an objective, critical approach to problems and conduct analyses and reviews that the centers have insufficient capacity to perform."

The unit comprises experts selected for their competencies and ability to exercise rigorous but nuanced judgment. Drawn from clinical, analytic, research, organizational and policy-making backgrounds, they are the health system equivalents of “versatilists”: experts who are able to apply a depth of skill to a wide scope of situations and problems, with integrative capacity across disciplines and contexts.²

Based on the principle of “satisficing,”³ the CIU provides rapid and “good enough” advice and transparency regarding the limitations of current, and often rapidly changing, evidence. It creates living evidence repositories – leveraging, coordinating and contributing to efforts among international organizations with similar goals.

The structure

The CIU comprises (Figure 1):

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²

³
1. A small steering committee of senior executives from a range of health organizations, with a direct reporting line to the Secretary / Incident Controller.

2. A clinical intelligence group of 15 senior clinicians and clinical scientists from a range of specialty backgrounds and health care-related settings (intensive care, emergency care, primary care, geriatrics, public health, anesthetics, surgery, safety), selected for their expertise and experience in using data and evidence in a clinical and policy context. They willingly contributed their expertise to the advisory roles.

3. An evidence integration team that specializes in rapid reviews of academic literature and experiential evidence.

4. A research intelligence group comprising academics and funders of health systems research.

5. A data intelligence function that sources, integrates and reports data and resolves data governance issues.

6. An international expert advisory group that includes leaders from innovation and quality improvement agencies from Australia, New Zealand, the United Kingdom, Sweden, Canada, the USA and international organizations.
7. A stakeholder advisory group that provides regular feedback on how the unit is meeting emerging issues and information needs.

**Staffing and resources**

The staffing of CIU is lean. It is led by the chief executive of the NSW Health Agency for Clinical Innovation (ACI), one of the “pillar” organizations in NSW Health. ACI brings clinicians, patients and health care managers together to support the design and implementation of innovations, testing new ideas and generating new knowledge about clinical practice and the delivery of care.

The CIU’s steering group is drawn from senior executives of different organizations across the system, each of whom gave time and attention to the CIU in addition to their regular “day job.” Functionally, an existing team of six within the ACI transformed to deliver evidence integration and data analytic tasks. Four staff from eHealth, the NSW Health Information Technology agency, were mobilized to act as chief of staff and create a technological platform. Additional support was drawn from other agencies in response to specific requests.

**International context**

NSW is not unique in forming new organizational entities in the face of Covid-19. Across health care systems internationally, many units and functions, variously based in Ministries, Departments, quality-improvement units and academic settings, have been created or strengthened. The entities are varied in remit, structure and focus. For example, the Covid-END initiative based at McMaster University in Canada and the Centre for Evidence-Based Medicine at the University of Oxford concentrate on synthesis and dissemination of research evidence. Many jurisdictions have organizations advising or acting as exemplars in learning systems, and value-based care. Most systems have dedicated teams tracking and reporting data (for example, Johns Hopkins in the US) and performing statistical modelling. While the CIU is not unique in its various functions, we are aware of no direct equivalent to its particular combination of functions.

**What has the CIU achieved?**

Since late March, the CIU has produced regular updates to a changing evidence base and local context. It provides transparency around levels of uncertainty, and assurance to clinical leaders, system managers and policymakers that they have the most up-to-date information when making critical decisions.

“The CIU provides transparency around levels of uncertainty, and assurance to clinical leaders, system managers and policymakers that they have the most up-to-date information when making critical decisions.”

The most visible outputs from the CIU are:
Table 1. Report-based outputs from the CIU

| Output (from unit responsible for production) | Brief description | Application |
|-----------------------------------------------|------------------|-------------|
| Incident Controller Daily Report (produced by the data intelligence function)  
First release 5 April  
Total produced, as of 21 October: 200 | The peak intelligence document for a daily briefing of the Incident Controller, which has been transformed into a daily digital dashboard. This intelligence product includes updates on measures of public health, systems operations and critical inputs that require daily monitoring.† | Used to support real time decision making by the most senior executives. Catalyzed the development of reports for circulation of integrated information to stakeholders. |
| Evidence Digest (produced by the evidence integration team)  
First release: 26 March  
Total produced, as of 21 October: 150 | Released daily, this two-page product summarizes emerging evidence published in key journals or by health organizations and key topics discussed on social media, that advance understanding of Covid-19 issues. Content is reviewed by Clinical Intelligence Group prior to release. | Read by executives, clinicians, managers, and consumer groups. Provides reassurance that evidence is being monitored and decision makers will be alerted immediately to new developments. |
| Evidence Check (produced by the evidence integration team)  
First release: 20 March  
Total produced, as of 21 October: 74 | An information product comprising a one page “in brief” and tabulated evidence on a particular topic or research question. Turnaround time ranges from 1-20 days, as determined by a prioritization framework. Includes academic and grey literature. Content is reviewed by Clinical Intelligence Group prior to publication on the ACI website. Updates are produced as new evidence emerges. | Instrumental in development of clinical guidance circulated throughout the system, for example on the use of CPR in emergency departments; precautions in operating theatres, providing respiratory care, and in advising on PPE use. |
| Covid-19 Risk Monitoring Dashboard  
First release: 15 September  
Total produced as of 21 October: 7 | A synthesis of current indicators reflecting the risk of local transmission, effectiveness of the public health response and the risk of transmission in health care-settings‡ | Submitted to a decisional committee that deliberates on the current level of risk in the state. Once a risk rating is determined, this dashboard is shared with key decision-makers across the health system. |

Source: New South Wales Critical Intelligence Unit

† See excerpt, Figure 2
‡ See Figure 3

- daily integrated data reports for the Incident Controller and her teams covering public health, systems operations and critical inputs (consumables and human resources)

- daily digests of evidence emerging from scientific research and literature (including where the evidence has changed direction)

- weekly integrated data reports for all Local Health Districts

- targeted rapid reviews of available evidence on key topics (Table 1)
### Incident Controller Daily Report

**Public Health**

| Confirmed cases of COVID-19 in NSW | Total | Locally acquired | Source | Overseas or interstate acquired | Growth factor locally acquired cases |
|-----------------------------------|-------|------------------|--------|---------------------------------|-------------------------------------|
| Last 24h                          | 10    | 2                | 0      | 8                               | 0.60                                |
| 7 days to 19 Oct                  | 54    | 22               | 3      | 29                              | 1.00                                |
| 7 days to 12 Oct                  | 55    | 25               | 2      | 27                              | 2.58                                |
| Total                             | 4,167 | 1,457            | 394    | 2,816                           | N/A                                 |

| Outcomes from COVID-19 in NSW     | Total | Deceased | Confirmed | Presumed/recovered (less than 28 days since notification) | Presumed active (28 days or fewer since notification) |
|-----------------------------------|-------|----------|-----------|------------------------------------------------------------|------------------------------------------------------|
| Yesterday (19 Oct)                | 4,167 | 55       | 2,962     | 3,013                                                      | 145                                                  |
| One week prior (13 Oct)           | 4,121 | 55       | 2,961     | 994                                                        | 121                                                  |
| Two weeks prior (09 Oct)          | 4,060 | 55       | 2,943     | 955                                                        | 107                                                  |

| Tests for COVID-19 in NSW         | Total | % positive |
|-----------------------------------|-------|------------|
| Notified last 24h                 | 14,932| 0.07%      |
| Conducted                         | 88,964| 0.07%      |
| 7 days to 17 Oct                  | 88,964| 0.06%      |
| Conducted                         | 72,924| 0.06%      |
| Total                             | 2,552,385| 0.14%      |

### Comments and Insights

- Ten new cases reported in the last 24 hours – two locally acquired – known source, and eight overseas acquired.
- The growth factor for locally acquired cases has been below 1.0 for the last four days.
- 73.8% of cases are confirmed/recovered.
- The number of cases presumed active continues to increase, now at 345 compared to 121 a week ago.
- 1.4% tests in the last 24 hours (0.07% positive).

**Source:** New South Wales Critical Intelligence Unit

NEJM Catalyst (catalyst.nejm.org) © Massachusetts Medical Society
All evidence outputs are available on the CIU website.

The reporting products are supplemented by regular briefings with the Incident Controller, the State Pandemic Management Team, the Risk Escalation Committee, the Clinical Council and the 30 Communities of Practice.

Experiential evidence from the NSW Health system is collected through crowdsourcing initiatives: gathering, for example, insights about changes to practice resulting from Covid-19 and potential measures of the indirect impacts of the pandemic on health care.

The CIU has linked knowledge and forged relationships across the state’s health care system, as well as nationally and globally. Its international expert advisory group has met four times, discussing such topics as innovation and improvement work in the context of Covid-19, organizational responses, the "new normal" and opportunities for health care systems in the wake of Covid-19, and different perspectives on leadership. It became clear that themes around
opportunities to shape a “new normal” resonated across countries, despite very different patterns of disease prevalence and policy responses (Table 2).

Integrated evidence reports and recommendation briefs from the CIU catalyzed the co-development (with an academic partner) of dynamic simulation models to inform complex decisions around intensive care capacity and planning. Management of personal protective equipment, and strategy for use, was improved. Policy and management of Covid-19 in residential aged care facilities was reviewed and strengthened. Rapid expansion of virtual care was supported. In all of these areas, many players contributed to the achievement of favorable outcomes. To date there has been no shortage of ICU beds, PPE availability has been assured, and since March and April, when there were four outbreaks in residential aged care settings, NSW has recorded no multi-case outbreaks, and only four isolated cases, in aged care facilities. The CIU has played a part in these achievements, its work helping other parts of the system.

The CIU provides evidence summaries and advice to Communities of Practice – clinician groups that publish guidelines and advice to the health care system. These summaries have been an important foundation for clinical judgments, reassuring clinicians that they have the most up-to-date information. Clinician engagement, through the establishment of a Clinical Intelligence Group, enabled rapid peer review of the Unit’s products, assuring relevance and rigor of advice, and ensuring that the advice was grounded in the real world of clinical practice.

A new way of evidence-based policymaking

Health care systems are dynamic and complex. Both expertise and data are plentiful and varied, but often siloed and frequently under-utilized. Before Covid-19, data and expertise were not systematically translated into information; nor integrated from different sources to support decision-makers in a timely way. Change was often slow.

Table 2. Opportunities for a “new normal” – views from the Clinical Intelligence Group and international experts

| Source: Authors |
| In late May, the Daily Digest included a number of commentaries on opportunities to reshape health care post Covid-19 into a new normal. All highlighted the important roles of knowledge, evidence and learning in the new normal; an imperative to care for staff; the significant potential of new models of care – particularly virtual care; an opportunity for systems to address perennial inequities; and a new appreciation of the importance of resilience in health care. |
| Putting this in a local context, the Clinical Intelligence Group and International Expert Advisory Group considered these and the CIU proposed a set of seven priority areas for NSW: |
| 1. Establish rapid evidence support for key decision-makers – a unit that delivers responsive, timely and ‘good enough’ information to support clinical, managerial and policy decision-making |
| 2. Engender reflective practice with transparent information for frontline clinicians – provision of granular information about clinicians’ practice and patient outcomes |
| 3. Institutionalize a considered, clinically-led approach to low and high value care - form a clinical intelligence group to deliberate on appropriateness of procedures and treatments and deliberate on value |
| 4. Redefining place - commit to care at home, virtual care and hospital avoidance – leverage shifts in care delivery and technology to strengthen consultation, linkages, knowledge sharing within hospitals, across geographies and between patients, their families and clinicians. |
| 5. Establish whole-of-system management program to deal with surges – provide reliable information about consumable supply chains, and the ability to meet surges in demand; develop capacity for resilience and sustainability |
| 6. Rebalance resources – across sectors and focusing on under-served and the vulnerable - make choices post-COVID that move care away from hospitals; and move resources towards those who could most benefit |
| 7. Support patients to manage their health – strengthen remote monitoring and telehealth and support health literacy to build capacity and confidence of patients to know when and where to seek care. |
Before Covid-19, data and expertise were not systematically translated into information; nor integrated from different sources to support decision-makers in a timely way."

The CIU has addressed some of these difficulties and its contribution has been valued by decision-makers. It has introduced a new way of working with evidence - facilitating access to information as soon as it was available, and providing that information alongside insight from senior experts with credibility and deep knowledge of the system. Evidence is packaged into succinct and clear messages.

The establishment of the CIU has not been without challenges, however. There were defensive positions taken by some stakeholders and occasional reluctance to be transparent with data – perhaps unsurprising in the context of heightened uncertainty. This defensiveness required clarity, determination, commitment to partnership and flexibility to resolve.

One of the strengths of the CIU – its lack of decision-making authority which provided an ability to speak truth to power - is also potentially a weakness. Once evidence is provided, there is no direct control over how it is used to make decisions or policy – posing dual risks of over-valuing weak evidence or under-valuing robust evidence.

What’s next for the CIU?

The CIU is not a permanent structure. It aims to respond to the pandemic and will continue for the foreseeable future, given the current emergence of second waves in other countries. While the CIU model has worked well overall, assuring preparedness for future crises will require a formal definition of its role and its relationship with other organizational structures as part of the pandemic response plan. It has benefited from the goodwill of multiple agencies and experts, but a more permanent entity would require new, dedicated resources.

Crises are widely acknowledged to be a powerful lever for change. Covid-19 has catalyzed many innovations, some of which have great value and should be supported, sustained and promulgated. The CIU represents one of these opportunities to innovate: an organizational and operating model for informed decision making that has potential applications in other systems and for a post-pandemic future in NSW, supporting the goal of establishing learning health care systems.

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