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Elective surgery, waiting lists , and the COVID-19 Pandemic. Studies from the Australian health system

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ELECTIVE SURGERY, WAITING LISTS, AND THE COVID-19 PANDEMIC.

STUDIES FROM THE AUSTRALIAN HEALTH SYSTEM

by

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of the degree of
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ABBREVIATIONS USED IN THE DISSERTATION

ABS	Australian Bureau of Statistics
ACHI	Australian Classification of Health and Illness
ACSQHC	Australian Commission for Safety and Quality in Health Care
AIHW	Australian Institute of Health and Welfare
AMA	Australian Medical Association
ANZCA	Australian and New Zealand College of Surgeons
APHA	Australian Private Hospitals Association
APRA	Australian Prudential Regulation Authority
BMA	British Medical Association
BPH	Benign Prostatic Hypertrophy
CABG	Coronary Artery Bypass Graft
COAG	Coalition of Australian Governments
COM	Chronic otitis media
CW	Choosing Wisely
DALY	Disability-Adjusted Life Year
DoHAC	Department of Health and Aged Care
DW	Disability Weight
ENT	Ear Nose and Throat
GP	General Practitioner
HA	Hearing Aid
HIC	High Income Countries
HRQoL	Health-Related Quality of Life
ICD	International Classification of Diseases
ICER	Incremental Cost-Effectiveness Ratio
ICU	Intensive Care Unit
IEO	Index of Education and Occupation
IER	Index of Economic Resources
IRSAD	Index of Relative Social Advantage and Disadvantage
IRSD	Index of Relative Socio-economic Disadvantage
Km	Kilometre

LMIC	Low- and Middle-Income Countries
MMM	Modified Monash Model
NHS	National Health System
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
PC	Productivity Commission
PFP	Private for-Profit
PHII	Private Health Insurance Incentives
PNFP	Private Not-for-Profit
QALY	Quality-Adjusted Life Year
QoL	Quality of Life
RACS	Royal Australasian College of Surgeons
RANZCO	Royal Australian and New Zealand College of Ophthalmologists
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
SE	Socio-Economic
SEIFA	Socio-Economic Indices for Areas
SES	Socio-Economic Status
THA	Total Hip Arthroplasty
THR	Total Hip Replacement
TKA	Total Knee Arthroplasty
TKR	Total Knee Replacement
UK	United Kingdom
US	United States
WA	Western Australia
WHO	World Health Organisation
YLD	Years Lived with Disability
YLL	Years of Life Lost

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ABSTRACT

BACKGROUND

The global COVID-19 pandemic has had profound effects on access to health care globally. Of these effects, disruption to planned (elective) surgery has been particularly prominent. In high-income countries with universal health systems, such as the United Kingdom (UK) and Australia, waiting lists for surgery act as a non-price rationing mechanism to manage health system resources. As health systems recover from the pandemic shock it is appropriate to evaluate the lessons inherent in the response and understand how to manage the historically large number of patients now awaiting planned surgery.

AIM

To understand some of the factors affecting access to and waiting times for planned surgery, and to develop a clear picture of the effects of the pandemic on planned surgery in the Australian health care system.

METHODS

A number of studies were conducted and are described in this thesis. The first examined the effect of socioeconomic status (SES) on access to specialist surgeons. To do this, data were obtained from Medicare Australia – the government body that finances medical consultations in the Australian health care system – regarding the postcode of residence of patients who claim for a surgical consultation along with age, gender, and the subspecialty of the surgeon. The postcode of residence was used to estimate the patients' SES and rurality (a major factor affecting health care access in Australia) and correlate this with rates of first visit with a surgeon. Data were stratified by age, gender, and surgical specialty and analysis performed in Genstat.

The second study examined SES and rates of surgery for high- and low-value procedures using data from the Australian Institute of Health and Welfare (AIHW). The data were analysed with age stratification and gende,r and analysis performed to graph any potential SES gradient.

The third study used data from the Australian National Surgical Waiting List Dataset – which contains data on every operation performed in Australian Public Hospitals – obtained from the AIHW to quantify the effects of the pandemic on performance of planned surgery in Australian public hospitals. Data were analysed and regressions performed in Excel and Genstat.

The fourth and final study examined the effects of gender on access to planned surgery during the pandemic using the Australian National Inpatient Procedural Database curated by the AIHW. Again, data were stratified by age and gender and regression models developed in Excel and Genstat.

RESULTS

Results from the first study showed that in young Australians aged less than 20 years, the rate of surgical visits showed a gradient with reduced rates associated with decreasing SES. For this group, rurality was influential but manifest an inverse-U curve. Most concerning was lack of access by Indigenous children to ENT care with concomitant impacts on education and future life opportunities. For adults there were age and gender gradients confirming an effect of SES, but for several specialties the results were inverse compared to children and adolescents. These findings confirm the correlation between SES, rurality, and access to care although the findings were complex and would benefit from further study.

Results from the second study showed confirmed an inverse gradient – with higher SES associated with lower rates of surgery – in both the high- and low-value procedures. Since low-value surgery is undesirable, identifying and reducing the use of low-value procedures has the potential to improve surgical access in a time of crisis.

Modelling in the third study showed that waiting times for, and the proportion of patients who waited longer than clinically recommended for, planned surgery increased across all key procedures and have not returned to pre-pandemic levels. An estimate of the number of planned procedures not performed during the pandemic yielded a range between 216,000 and 412,000 procedures. Australia also had state-based pandemic public health responses to the pandemic: tight border controls in Western Australia; intermittent prolonged lockdowns in Victoria; and, a *laissez faire* approach in New South Wales. The effects on waiting lists for surgery using these three approaches revealed increases in waiting times for surgery and high levels of inter-hospital variation with no obviously superior approach.

Results from the final study revealed that for every procedure studied, females were less likely to have undergone surgery than males, suggesting an inherent gender bias in access to, and uptake of, planned surgery.

CONCLUSION

Taken together, these studies suggest that in the Australian health system there is considerable inherent inequality of access and update across SES, rurality, and gender, affecting access to planned surgery in public hospitals. Reducing these inequalities would be expected to improve access to and outcomes from health care in future.

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DECLARATION

Yr wyf drwy hyn yn datgan mai canlyniad fy ymchwil fy hun yw'r thesis hwn, ac eithrio lle nodir yn wahanol. Caiff ffynonellau eraill eu cydnabod gan droednodiadau yn rhoi cyfeiriadau eglur. Nid yw sylwedd y gwaith hwn wedi cael ei dderbyn o'r blaen ar gyfer unrhyw radd, ac nid yw'n cael ei gyflwyno ar yr un pryd mewn ymgeisiaeth am unrhyw radd oni bai ei fod, fel y cytunwyd gan y Brifysgol, am gymwysterau deuol cymeradwy.

I hereby declare that this thesis is the results of my own investigations, except where otherwise stated. All other sources are acknowledged by bibliographic references. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree unless, as agreed by the University, for approved dual awards.

Stephen James Robson

June, 2024

CHAPTER 1

INTRODUCTION: SURGERY, QUALITY OF LIFE, AND SURGICAL WAITING LISTS

> "The pandemic is exposing and exaggerating longstanding inequalities in health and wealth. It will worsen the inequalities between black and white, between the more and the less educated, and between ordinary people and the well off. This pandemic, like other pandemics before it, lights up anew the fault lines in society. Inequalities that we knew about, like racial and ethnic inequalities, are more starkly visible. The pandemic may turn tolerable inequalities into intolerable inequalities."
>
> \- Sir Angus Deaton[1]

1.1 Health and the economy

As the COVID-19 pandemic has revealed in no uncertain terms, it is impossible to have a healthy economy without a healthy population. A 2019 paper for the Australian Treasury, *Why Health Matters*[2], states the following:

> "Economists have increasingly recognised that good health across the whole population significantly contributes to labour and human capital to achieve economic growth. Through higher participation and productivity, good health contributes to economic performance and is positive for individual well-being. Good health enables individuals to participate in a range of activities and to engage socially with family and friends and their communities. Good health also allows individuals to be more productive physically and mentally by enabling them to learn more effectively and retain

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[1] Sir Angus Deaton. *Testimony to the Congressional House Budget Committee*, June 23rd, 2020. Accessible at: https://budget.house.gov/sites/democrats.budget.house.gov/files/documents/Deaton_Testimony.pdf

[2] Australian Treasury, 2019. Accessible at: https://treasury.gov.au/sites/default/files/2019-03/05_Why_health_matters.rtf

> knowledge. Good health also reduces uncertainty, which allows individuals to plan for the whole of life."

San Francisco-based economist Jaana Remes and her colleagues, writing for the *Brookings Institution* in 2021[3], state that "investment decisions around health have too often been evaluated purely as a cost, not as an investment with an economic return. This is a mistake because improving health is necessary for prosperity. Healthier people are more productive in their prime working years." There is strong economic evidence that good health allows communities and countries to thrive both economically and socially. The American Medical Association[4] puts it this way:

> "Health is the greatest social capital a nation can have. Without a healthy, productive citizenship, a country can't be economically stable. Addressing the social determinants of health is crucial to building a strong economic foundation, and eliminating health disparities is something… physicians should continue to work toward."

Similarly, the European Union publication *The contribution of health to the economy in the European Union*[5] states that:

> "There is a sound theoretical and empirical basis to the argument that human capital contributes to economic growth. Since human capital matters for economic outcomes

[3] Brookings Institute Commentary, July 2020. Accessible at: https://www.brookings.edu/articles/how-investing-in-health-has-a-significant-economic-payoff-for-developing-economies/

[4] American Medical Association Blog, 2015. Accessible at: https://www.ama-assn.org/delivering-care/patient-support-advocacy/healthy-population-equals-healthy-economy

[5] European Union, August 2005: The contribution of health to the economy of the European Union. Accessible at: https://ec.europa.eu/health/archive/ph_overview/documents/health_economy_en.pdf

> and since health is an important component of human capital, health matters for economic outcomes. At the same time, economic outcomes also matter for health. A recurring theme throughout this book is the existence of feedback loops offering the scope for mutually reinforcing improvements in health and wealth."

Similar sentiments have been published in the *British Medical Journal:*

> "As well as being valued in their own right, health outcomes produced by the health sector contribute indirectly to other sectors, most notably but not exclusively, education and economic productivity. For example, by preventing and alleviating the consequences of disability, health systems can help people have longer, more productive working lives and reduce the fiscal and social costs of dependency in older age." (Cylus & Smith, 2020)

The COVID-19 pandemic constitutes the greatest public health crisis in over a century. The measures taken to control it to date have been found to significantly reduce its death toll but at a steep economic cost. This has led many to conclude that the pandemic involves an inevitable trade-off between limiting the public health effects of the virus and preventing an economic collapse (Lesschaeve, Glaurdić & Mochtak, 2021). The pandemic has created an unpreceded global strain on healthcare systems, the crisis exacerbating already existing tensions within hospital systems which need to balance costs, quality of care, capacity and efficiency. Staffing, medications and equipment including ventilators are all finite resources (Brüggemann *et al.*, 2021). One major consequence of the pandemic on hospital function has been a suspension of planned surgery in hospitals across the globe (Carr *et al.,* 2021).

1.2 Surgery and health

Surgery is fundamental to human healthcare and there is no prospect of this ever changing. In the United Kingdom (UK) alone almost 8 million surgical procedures are performed each year, accounting for one third of all hospital admissions (Abbott *et al.*, 2017). At a global level, it has been estimated that almost 250 million operations are performed every year (Kushner *et al.*, 2010). Despite this, billions of people in low- and middle-income countries (LMICs) do not have access to essential surgical care (Grant *et al.*, 2020). While there is a paucity of data to inform discussion about the burden of surgical conditions and unmet need for surgical care at a global level, recent estimates suggest that the global shortfall may be as many as 143 million surgical procedures (Bickler *et al.*, 2010).

Surgery plays a fundamental role in healthcare globally. Rose and colleagues (2014) have estimated that surgery is performed in more than one quarter of all hospital admissions in high-income countries (HICs). At a global level, almost a quarter of a billion major operations are performed each year, and that between 11% and 15% of the global disease burden is amenable to surgical treatment. Disruption to surgery resulting from the pandemic shock has led to avoidable pain and disability to people who already need treatment to be healthy and productive. Søreide and colleagues (2020), writing in the *British Journal of Surgery*, warned that:

> "The ongoing pandemic is having a collateral health effect on delivery of surgical care to millions of patients|…|As regions with the highest volume of operations per capita are being hit, an unprecedented number of operations are being cancelled or deferred. No major stakeholder seems to have considered how a pandemic deprives patients with a surgical condition of resources, with patients disproportionally affected owing to the

> nature of treatment (use of anaesthesia, operating rooms, protective equipment, physical invasion and need for perioperative care). No recommendations exist regarding how to reopen surgical delivery|…|Patients are being deprived of surgical access, with uncertain loss of function and risk of adverse prognosis as a collateral effect of the pandemic. Surgical services need a contingency plan for maintaining surgical care in an ongoing or post-pandemic phase."

1.3 Waiting lists for surgery – theoretical frameworks

Waiting is an inevitable part of healthcare. Even in health systems where a high proportion of care is provided by private practitioners – where the time available in private hospital operating theatres is generally elastic and commonly driven by demand – there inevitably are waiting times between referral to a surgical specialist and actually having a consultation that might lead to surgery. In health systems, or areas of health systems, where procedural care is provided in public hospitals, some form of waiting list is typically used as a non-price rationing mechanism. Before examining the effects of the pandemic health shock on Australian public hospitals as a particular example, it is important to understand the broad principles of access to publicly funded surgery in health systems. This literature review in informed by a systematic review conducted in concert with Mr Jacob Davies and Professor Rhiannon Tudor Edwards (attachment 1)

Virtually all modern healthcare systems will incorporate some provision for public involvement either in the financing or provision of services, or at the very least in regulation (Tynkkynen & Vrangbæk, 2018). This situation represents a response to the issues articulated in Arrow's classic paper detailing the ways in which healthcare markets violate the characteristics of a perfect market (Arrow, 1963). Arrow pointed out that healthcare consumers faced high levels of information asymmetry – to the point of sometimes not knowing whether healthcare was actually needed, and certainly what alternatives were available. Further, externalities rarely were part of decision-making and that in the event of things going wrong, catastrophic losses were possible. When market interventions are imposed in the form of private health insurance arrangements, there again is the potential for market distortions through effects such as adverse selection and moral hazard. The complexities of the market and over-riding need for healthcare have driven provision of at least some form of publicly funded healthcare in almost all countries. These market interventions typically will be structured around some combination of private and public services and actors (Tynkkynen & Vrangbæk, 2018).

Since, at least in middle- and high-income countries, healthcare is delivered in often highly regulated markets, the theoretical constructs underpinning health financing systems can be complex. From a competition perspective, the argument can be made that even though healthcare markets are imperfect, competition between private providers and the public sector can be beneficia (Domberger & Jensen, 1997). Administrative and, indeed, political pressures can improve efficiencies and resource allocation, and even survival of the organisation itself, when private providers enter the market. Further, private providers can be considered in two separate groups – private not-for-profit (PNFP) and private for-profit (PFP). Tynkkynen and Vrangbæk (2018) undertook a systematic review of the pre-pandemic performance of the various hospital models in Europe and reached somewhat counter-intuitive conclusions. In terms of efficiency measures, they found that in overall terms public hospitals performed better both than PNFP and PFP hospitals. Thus, at least in a European setting, private ownership is not necessarily associated with higher efficiency, even technical efficiency. Importantly, the authors found no evidence that one form of ownership was superior to another in terms of quality of care. This is despite selection advantages available to PNFP and PFP who, theoretically at least, can choose to treat a lower-risk cohort. The studies did confirm that public hospitals treated a patient population that was older, had lower SES, and a greater burden of co-morbidities.

Elective (planned) surgery is a fundamental part of modern healthcare. Notwithstanding disagreements about what surgical operations and procedures are 'high' and 'low' value (Ingvarsson *et al.*, 2022), across countries that are part of the Organization for Economic Cooperation and Development (OECD), the existence of long waiting lists and high waiting times for surgery is a chronic issue. The complexity of systems required to provide elective surgery in health systems is obvious. The pathway extends from primary care physicians who recognise medical conditions potentially requiring surgery, referral to and further assessment by specialist surgeons, access to diagnostic tests such as imaging and pathology, administrative systems to facilitate hospital admission, and the complexity of providing not only the surgery but perioperative care including rehabilitation or intensive care facilities at time. For these reasons, there is no single explanation for waiting times. However, investigation of possible reasons for delay in the provision of surgery is critical to understanding how to manage and best triage and prioritise surgical care.

While unacceptably long waiting lists are a major problem for individual patients, their families, even politicians responsible for healthcare, the use of 'reasonable' waiting lists as a non-price mechanism allows the efficient use of scarce health resources. Mitigating the negative effects of waiting for surgery – worsening of physical and mental health (Oudhoff *et al.*, 2004) as well as lost productivity for the patient and the economy (Johar *et al.*, 2011) – where patient quality of life (QoL) is diminished over time, must be balanced with the system benefits of having a rationing mechanism in place.

The modelling of waiting lists is challenging both on the demand and supply side, and best corresponds to the market situation in which there is no price mechanism to equate supply with demand: the principle that the resources required to meet demand are not allocated at the current price of the good (Vissers, Van Der Bij & Kusters, 2001). Demand in healthcare is different from most other markets in that it is stochastic in nature and not steady (Arrow, 1963). Typically the demand for healthcare is unpredictable and commonly episodic, making it difficult to increase the capacity of the system to allow supply to meet demand in an equilibrium. Indeed, Street and Duckett (1996) explain that, "it is not possible to operate at full capacity any system subject to random fluctuations in demand without a queue developing, and by maintaining a pool of patients the potential for under utilization of hospital resources is reduced."

From the demand side, it has been argued that the 'delay' in provision of services – consultations, tests, surgery, and other treatments – acts in itself as the 'price' on the demand side, since it may discourage some patients from seeking care (Lindsay & Feigenbaum, 1984). In that paper, Lindsay and Feigenbaum (1984) delineate dual theoretical frameworks to understand the formation of queues in healthcare. In the first instance, and noting the stochastic nature in both the demand and supply sides of the 'market', they posit that such a situation creates issues both of the determination of optimal capacity and of an equilibrium price. A second framework is based on the situation where 'price' is below or above the market clearing level, leading to queues of demanders forming to ration the available supply. These theories are based on two important assumptions: that delay in receiving the 'good' (healthcare) tends to lower its value to demanders; and, individual demand itself is inherently unpredictable.

Using these two assumptions, they assert that "the effect of both the discount rate and diminishing demand may be expressed in exponential form… [which] we will express their combined effect by an exponential demand decay rate *g*" (Lindsay & Feigenbaum, 1984, p. 407). This allows aggregation of individual behaviour by the market to describe the sensitivity of the rate at which individuals join the waiting list to the expected time line on delivery of care. In this approach, demand is measured by the rate at which patients join a waiting list queue, with their key argument of the demand function being the anticipated delay in delivery of the treatment or operation. The authors' theory then suggests a relationship that includes the rate of joining (addition to the waiting list), the anticipated duration of the waiting time, the decay rate, and the 'value' of the service provided.

The demand side obviously is related to the supply side, and Lindsay and Feigenbaum (1984) explain that their theory "implies that the rate of joining will be negatively related to expected delay in supply and the rate at which demand diminishes over time. Supply, on the other hand, was hypothesized to respond positively to expected delay" (p. 417). The authors' obvious focus on the demand side is predicated by their main assumption that delay in the receipt of a good is likely to lower its value to the demander (patient) and, as a result, this diminution leads to the convergence to an equilibrium between demand and supply. They write their demand and supply functions in the following expressions:

Demand: $j = j\,(t, g, v)$ (Lindsay & Feigenbaum, 1984, p. 413)

Supply: $s_h = s_h\,(\hat{w}, t)$ (Lindsay & Feigenbaum, 1984, p. 409)

In these models, t is the expected waiting time, g is the rate of decay, v is the value of the service, s_h is the service rate at time h, j is the joining rate, and $\hat{w}$ is a vector of unknown determinants. Determination of t implies that "the rate of change in the numbers in the queue in any period h is therefore given by $Q_h = j_h(t_h) - s_h(t_h)$" (Lindsay & Feigenbaum, 1984, p. 409). The authors then derive the expected waiting time in a period h by taking the total number of patients in the queue Q_h and dividing this number by the service rate, yielding $t_h = Q_h/s_h$ with the resulting equilibrium t^* given by the expression $t_h = t_{h+1}$. Using this, the equilibrium will correspond to an equality $j(t^*) = s(t^*)$ meaning that the market equilibrium permits a convergence of the value of the expected waiting time to the equilibrium value at which the rate of joining equates to the rate of supply.

While Lindsay and Feigenbaum's focus is clearly on the demand side, Iversen (1993) takes a different theoretical approach by examining the supply side in healthcare, and extends this to the relationship between hospitals and funders (the government, in the case of public hospitals). In Iversen's model, hospital utility becomes a function of expected waiting time (t), and the anticipated volume of patients admitted to the waiting list (λ) during a given period of time. The hospital would be expected to maximise its utility function with an amount of resources (s) as the obvious constraint. His model of the hospital's maximisation of utility is:

$$\text{Max}U = U(t, \lambda) \quad s.t\ s(t, \lambda) = s. \text{ (Iversen, 1993, p. 61)}$$

Iversen then explains that the budget (resources available), the waiting time for care, and the volume (number of admissions) result from interactions between the government and hospital. This is important, because we can assume that the objectives and their decision variables differ between hospital and its funder, the government. Thus, the government's choice variable is s, while the hospital's will be t and λ. The level of s, then, is determined by budget decision-making.

However, the government's willingness to fund and provide resources will be a function of the waiting time (for political reasons) and the expected number of patients admitted to waiting lists, $w(t, \lambda)$. Iversen derives the government's objective function as:

$$\text{Max } V(\text{t}, \lambda) = w(\text{t}, \lambda) - s(\text{t}, \lambda)$$ (Iversen, 1993, p. 61)

In this model, t is the waiting time publicised by the hospital. In such a context any reduction in waiting time will depend upon the interaction between the 'sponsor' (the government) and the hospital. Iversen goes further and invokes game theory, distinguishing between two separation interaction types – a 'non-cooperative game' and a 'bargaining' approach – and analyses these in the context of a Nash equilibrium[6] and a Stackelberg equilibrium[7]. The non-cooperative game scenario assumes there is no contract or engagement between the two 'players' in the budgetary sense – the hospital can revise budgets at will, and the hospital is free to achieve any specific waiting time. In contrast, the 'bargaining' approach is underpinned by contractually specified budget and waiting times.

Iversen's approach takes account of the fact that managing waiting lists requires resources. There is administrative work required to book patients and keep the booking system

[6] In the *Nash equilibrium*, the assumption is made that the government and the hospital make their decision simultaneously.

[7] A *Stackelberg equilibrium* assumes an oligopoly market model and a non-cooperative strategic game where the "leader" is first to move and decides how much to produce, while the "followers" must decide how much to produce afterwards.

contemporaneous, to prioritise patients, handle inquiries and complaints, and manage the doctors and hospital resourcing. He also notes that hospitals that have a high-capacity utilisation typically have a high probability of cancelling planned surgery due to the intrusion of emergency surgical procedures, thus increasing the costs for elective patients as their number increases. These resources he refers to as 'A' resources. A second and separate set of resources is required specifically to provide the healthcare itself – the surgery and other procedures (referred to as 'B' resources).

The relative importance of components A and B is related to queue discipline. When a 'first-in, first-out' approach is taken then few resources are required for waiting list administration. The problem with this approach, according to Iversen, is that such a system does not allow distinguishing between patients waiting in the queue with respect to the probability of changes in their health status. For this reason, the B approach requires sophisticated queue discipline because more resources are needed to prioritise patients for care. Because the resources allocated to administration of the waiting list have a potential alternative use – actually providing the care patients are queued and waiting for – increases in the number of patients on the waiting list will Increase the waiting time as well. This increases the administrative burden but also, because of the potential for patients' conditions to deteriorate, increases burden in the B component as well. Thus, an increase in waiting time draws resources away from treatment itself and directs them to tasks related to maintaining the waiting list, decreasing the capacity and number of treatments. Iversen shows this effect diagrammatically in his **Figure 1.1** (Iversen, 1993, p. 58) redrawn below. This is a production possibility curve which describes the combinations of admissions and waiting time compatible with a fixed total capacity, with the maximum number of admissions corresponding to point M: all points to the right of M – m will constitute "excessive waits."

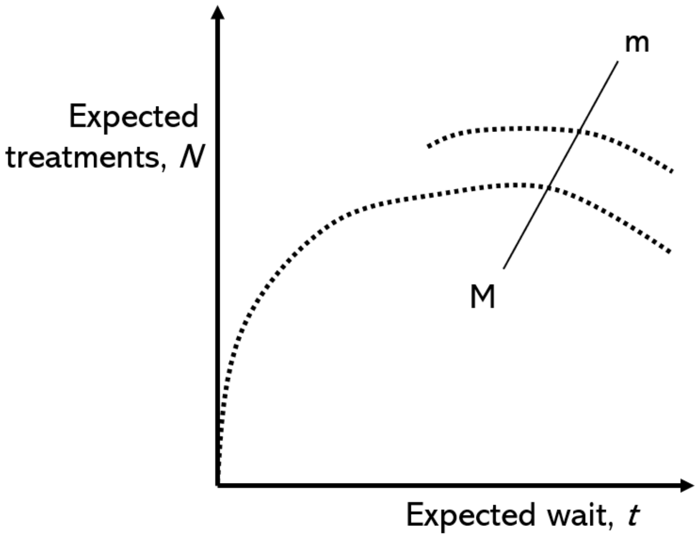

Figure 1.1 Production possibility curves for hospital waiting lists, based on Iversen (1993).

The role that doctors play in waiting lists has been examined by Worthington (1991). He makes the important point that while patients decide whether to seek consultation from doctors with their health conditions, all other consumption acts are decided by doctors. This leads to the clear distinction between two phases in waiting lists – the duration between General Practitioner (GP) consultation and surgical specialist consultation, and then from surgeon to surgery. Worthington argues that waiting lists will decrease if the rate of service in both phases exceeds the demand and uses queueing theory to investigate the relationship between demand for service and changes in duration of waiting times.

Taking a middle ground between the approaches of Lindsay and Feigenbaum (1984) and Iversen (1993), a hybrid model was developed by Martin and Smith (1999) in which the National Health Service (NHS) was treated as a single server with a single queue. Typically, service capacity (μ) and a demand side statistic (arrival rate, λ) are assumed to be constant and independent of the duration of the waiting time in standard queueing theory. Martin and Smith, however, build a model in which μ and λ are dependent on waiting time. To do this, their model consists of three equations (demand, supply, and an equilibrium condition) and two endogenous variables (waiting times and utilisation). Assuming that the net gain to a patient who is to undergo treatment decreases as that treatment is delayed, then the value of the treatment is expressed by an exponential decay function, with the further assumption that the utility function is a linear combination of its components:

$$U\,(V, g, t, P, C) = Ve^{-gt} - P - C$$ (Martin & Smith, 1999, p. 144)

In this model, P represents the cost of care in the private system, t is the waiting time, g is the decay factor, V is the patient's valuation of the health gain from treatment, and C is a fixed cost of seeking care that the patient will face whether care is provided in the NHS or privately. Martin and Smith account for three potential options: being put on an NHS waiting list, having the procedure performed privately, or choosing to have no treatment.

Their supply side model is based on Iversen (1993) and assumes that hospital managers seek to maximise the utility function:

$$W = W\,(t_1, \eta\,, N)$$ (Martin & Smith, 1999, pp. 146-147)

This model is subject to the constraint that $S + N = B$, and where t_1 represents the projected period 1 waiting time, η is the level of efficiency, N is the resources devoted to non-surgical activity, S is resources devoted to surgery, and B is a total budget constraint. Using this approach, Martin and Smith find that a 10% increase in bed supply is associated with a 2.4% reduction in mean waiting time across the NHS. In their modelling, the decision to join a waiting list depended on waiting time, income, and the price of private treatment. Ultimately, they conclude that waiting times are the result of a somewhat complicated interaction between supply and demand variables.

In summary, the key question about surgical waiting lists addressed by the theoretical literature is that of how increases in supply that are intended to reduce waiting times would, over the long term, lead to additional demand. Perhaps the most important lesson from the theoretical overview is that modelling of elective surgery waiting lists shows that they result from complex and intricate interactions between supply and demand. Ultimately, then, waiting times for patients depend on the variables that would be expected to shift both the demand and supply curves, including productivity and efficiency.

1.4 Past approaches to prioritisation of patients on a surgical waiting list

Concerns about the length and nature of surgical waiting lists in the UK reached something of a crescendo in the lead-up to the new millennium, leading the British Medical Association (BMA) to formulate and release new guidance on the management of NHS waiting lists (Fricker, 1999). The health economic perspective on waiting list management was also addressed from the Government side by Edwards (Edwards, 1997; 1999) and I provide a *précis* of that work below.

The BMA and other professional medical groups in the UK had expressed concern that the British government's emphasis on the number of people on waiting lists, and the time they spend there, was obscuring the principle of treating patients according to clinical urgency. In particular, the BMA warned that additional funds earmarked for reducing NHS waiting lists and waiting times could, instead, provide a perverse incentive to operate on large numbers of minor cases, leaving more urgent cases and potentially cost-effective treatments to wait. The obvious risk was that short-term funding injections would provide only temporary benefits and would not address the underlying problem of ensuring that waiting lists operate as an efficient and equitable non-price rationing mechanism.

At the time, local authorities in the UK were using ‘priority scoring systems’ to guide allocation of public housing. Prioritisation for housing was based on the candidates’ current housing conditions, overcrowding, presence of dependent children, and medical or welfare circumstances. However, as Edwards pointed out, such systems were inconsistently applied across the UK by different local authorities leading to differences in waiting times for families in similar circumstances (Edwards, 1999). Pilot programs of similar priority scoring systems were being undertaken at units in the UK. At Guy’s Hospital in London, for example, conditions on a general surgical waiting list were ranked according to their expected net quality-adjusted life year (QALY) gain per unit of bed and theatre resource (Lack & Smith, 1995). The underlying rationale for moving to points systems was the introduction of transparency: that the criteria by which priority is given is explicit. The lingering problem, though, was how to determine the clinical criteria underpinning points systems.

Edwards had published a more detailed analysis of the issues facing the NHS in a monograph published by the UK Office of Health Economics in 1997. That paper approached the issue of surgical waiting lists as a ‘microcosm’ of the NHS functions overall – about the prioritisation of care as a general principle, since such choices ultimately governed what services were to be available under the NHS. At that time NHS waiting lists did not reflect generalised delays in the treatment of each and every patient: rather, they are accounted for by a few clinical specialities, and within these a relatively small number of conditions (Frankel, 1989). Those conditions included hernia, varicose veins and haemorrhoids, and conditions particularly affecting an older cohort such as joint replacement. Edwards (1999) framed the issue not such much as how many patients were facing unacceptably long waiting times, but instead as "who is waiting for what and how much sacrifice they make as a result of having to wait."

In an economic sense, Edwards pointed out that waiting lists did not exist within the neo-classical economic model of a competitive market because instantaneous price adjustments eliminated any difference in quantities demanded or supplied in a given period. Instead, waiting lists arose where prices fail to adjust quickly enough to dispel excess demand, or where supply is stochastic and unpredictable over time: the absence of a market price, together with the nature of healthcare as a good, was leading to the persistence of waiting lists in public healthcare systems. Patients were facing an apparently zero price for healthcare and encouragement on the supply side by a medical rather than an economic concept of efficiency, medical advance and the consequent rapidly increasing range of medical interventions which can provide some benefit to patients irrespective of cost (a moral hazard). In contrast to the classical demand and supply curves, where more care is demanded as price falls, with the NHS the supply curve might be almost vertical indicating that supply of publicly funded healthcare is set by government and that there is hence no relationship between price and the quantity supplied. In reality though, the variables that determine supply and demand can be assumed to be independent of each other. In the monograph, Edwards (1997) points out the 'special' nature of healthcare as a good, and the complex links between supply and demand, not least in the role of the doctor as supplier of medical services and the patient's advocate.

Edwards (1997) reached a number of conclusions, among the most important that a sole focus on waiting times rather than on the composition of NHS waiting lists was flawed. Instead, a recommendation was made to move away from a single maximum waiting time for all patients to a gradient of clinically appropriate waiting times. To enhance public acceptance of such a change, it was clear that patient expectations would need to adjust:

> "Within a cash limited public health service, patients cannot expect the right to receive all treatments within a maximum guaranteed waiting time; rather, patients can expect to receive treatments which have been proved clinically effective and relatively cost effective, within a clinically appropriate time for their condition. Patients will have to accept that those requiring less urgent treatments may have to wait longer than those requiring more urgent treatment." (Edwards, 1997, p. 33)

The resources necessary to provide healthcare to a community are limited and there are well-recognised inefficiencies in the delivery of healthcare (Mosadeghrad, 2014). The achievement of allocative efficiency in use of healthcare resources should maximise patient coverage, the quality of care, and patient satisfaction. In virtually all settings, and especially after the global economic and health shocks of the ongoing COVID-19 pandemic, this will involve priority setting and rationing. Srinivas and colleagues (2021) point out that in most developed countries social goods draw funding from a common source that includes healthcare, education, defence, infrastructure. While the need for public goods is potentially infinite, the resources available for supply are limited. Rationing, by definition, is required and in the time of shocks – such as the COVID-19 pandemic – is a mechanism to ensuring that scarce resources reach the maximum number of people in need. "Without a clear ethical framework and an understanding of the decision-making process, decisions may not be readily accepted either by healthcare workers or by other members of an affected community" (Srinivas *et al.*, p. 4).

In countries such as the UK and Australia, where a large proportion of the population have no private health insurance and thus rely on government-funded public hospitals for care, waiting lists exist as a non-price rationing mechanism for planned surgery. Valente and colleagues (2021) have pointed out that the reduction in capacity to perform non-emergency surgery during the COVID-19 pandemic has had severe consequences for waiting lists. As a result, the planning and scheduling of surgery becomes a complex problem due not only to technical and resource/capacity issues but also on clinical and ethical grounds. Because of the enormous volume of surgery required in all countries, the level and distribution of patient waiting times for elective treatment is a major concern for publicly funded healthcare systems. Waiting times for surgery are a key determinant of satisfaction with public health services and a perceived indicator of public sector efficiency (Nikolova, Sinko, & Sutton, 2015). In addition, delays in treatment can have negative health consequences for individuals on waiting lists. In a study of patients on waiting lists for elective surgery in Western Canada, Sutherland and colleagues (2016) found that longer waiting times for elective surgery were associated with deteriorations in the health of patients who were waiting.

Tinghög (2011) makes the following observation:

> "All healthcare systems must decide how to set limits, explicitly or implicitly, efficiently or inefficiently, fairly or unfairly…traditionally it has been difficult to get decision-makers to explicitly acknowledge the inevitable need to ration healthcare." (Tinghög, 2011, p. 9)

There is often a perceived tension between a positive economic perspective – how to allocate scarce resources as *efficiently* as possible – and a normative economic perspective – how to allocate scarce resources as *fairly* as possible. This 'tension,' as Tinghög (2011) puts it, is often termed the 'equity-efficiency trade-off' (Sandiford *et al.*, 2018). The 'equity-efficiency trade-off' describes the tension between the almost limitless potential demand for healthcare and the fact that resources are limited. While the principle of *efficiency* seeks to maximise the total population health given the resource constraints, the notion of *equity* concerns fairness in distributing health and healthcare aimed at minimising any differences amongst population groups. Health systems across the world have two broad objectives then–- efficiency and equity–- which tend to have a counter effect on each other (Asamani *et al.*, 2021). Policymakers have to navigate an appropriate balance in the pursuit of these potentially contradictory objectives.

Whitehead (1991) points out the importance of striving for equity in health, citing data regarding the differentials in mortality, burden of disease, and experience of illness and QoL across the spectrum of advantage and disadvantage:

> "[These] examples of differences in accessibility and quality of health services | … | show that those most in need of medical care, including preventive care, are least likely to receive a high standard of service. So, from the practical point of view of designing effective and efficient health policies, differences on such a large and persistent scale have to be taken seriously and provision made for reducing them. From an economic standpoint can any country afford to have the talent and performance of sizeable sections of the population stunted to such an extent? Above all, on humanitarian grounds

> national health policies designed for an entire population cannot claim to be concerned about the health of all the people if the heavier burden of ill health carried by the most vulnerable sections of society is not addressed. The bias against these social groups in the provision of healthcare also offends many people's sense of fairness and justice once they learn of its existence." (Whitehead, 1991)

Efficiency is the allocation of available resource inputs in such a way that provides the best outcomes for the community. It is attained when the community's well-being is maximised given the resources available (Fraser, Encinosa & Glied, 2008). Measuring efficiency in healthcare is not so easy, as there are considerable difficulties in measuring the outputs the health system produces, or in translating these into the health outcomes that matter most to the community. In many areas data are scant or non-existent and it may only be possible to assess cost-effectiveness: the extent to which the inputs used to produce a given output are minimised (productive efficiency). In themselves such measures of efficiency do not indicate whether the right mix of health service outputs is being produced (allocative efficiency), or whether the right decisions are being made about how to use resources to maximise health and well-being over time (dynamic efficiency).

However, there is debate about the validity of such a term. For example, Reidpath and colleagues (2012), for example, make the following observation:

> "What is more important, a health system that delivers equitable health outcomes of an efficient health system? This meaningless question lies at the heart of the 'equity-efficiency trade off'|…| A more appropriate question would be, 'what is more important for the population, a health system that delivers equitable (fairly distributed) health

> outcomes of a health system that maximises health gains?'|…| The problem with trying to establish a trade off between a potential outcome, output, or goal of a health system such as health equity against efficiency, is that efficiency is not an outcome… (it) describes a functional relationship between inputs (such as money) and outputs (such as health gains)."

We can define 'healthcare rationing' as 'the controlled distribution of scarce resources'. Efficient and fair rationing seeks to create opportunities to meet more healthcare needs than would otherwise be possible (Moosa & Luyckx, 2021). However, "healthcare rationing is a topic that commonly triggers our moral intuitions. For instance, most individuals have a strong moral intuition that it is wrong to deny medical assistance to someone in need" (Tinghög, 2011).

Tinghög differentiates between three types of healthcare rationing:

- Rationing by **denial**: Excluding certain types of healthcare services, for example cosmetic surgery.
- Rationing by **dilution**: Partially meeting healthcare demand, for example supplying 10 mental health visits rather than the 20 required by a patient.
- Rationing by **delay**: Waiting longer for a particular treatment but ultimately receiving it.

It is important to understand the difference between rationing as 'priority-setting' or *prioritisation* of healthcare. Prioritisation is the process of ranking different services for defined groups and putting some ahead of others – it is choosing what *to* do (Mitton & Donaldson, 2004). In contrast, rationing tends to involve choosing what *not* to do.

Tinghög (2011) identifies four major considerations (‘problems’) when healthcare rationing is contemplated. The first is the ‘aggregation’ problem: should society allow the aggregation of modest benefits to a large number of people at the expense of significant benefits to a small number of people? Next is the ‘priorities’ problem: how much priority should be given to treating the sickest or those with the greatest health need? Third is the so-called ‘fair chances versus best outcome’ problem: should we strive for the best outcome for some, or a reasonable outcome for more? Lastly, there is the ‘democracy’ problem: should the public decide the prioritisation, or should this be left to experts?

One normative approach to healthcare rationing is the use of QALYs with allocation of available resources in a way that maximises the number of QALYs gained. This approach can introduce conflict with the general preference for directing health resources toward individuals who have poor health states, thus sacrificing QALYs. Also, taking a QALY approach may be perceived as unfair to the elderly with pre-existing disabilities and health conditions. Irrespective of the approach to rationing in health systems decisions should be transparent, with an evidence base, and should be fair-minded. As Tinghög (2011) points out:

> “Various mechanisms cane be used to ration healthcare, the most common of which is price. Demand is constrained by monetary price, which the patient faces at the point of demand. In public systems where care is often free or priced well below market-clearing level, demand and supply must be reconciled through other rationing mechanisms. Hence, publicly funded systems commonly rely on waiting lists as a mechanism to limit availability, while still trying to maintain that persons in equal need are treated equally.”

1.5 Surgery and the measurement of 'Quality of Life'

Decisions about the allocation and prioritisation of healthcare resources must take into account not only the costs and inputs, but also health outcomes. While the measurement of costs and resource inputs is quantitative, the outputs – improvements in health – require a different approach. Outcomes such as survival or complication rates, or pain-free days, are difficult to compare across studies making it difficult to determine where healthcare resources should be most efficiently directed. A common measure is needed. The QALY is considered the cornerstone of economic analysis since it combines morbidity gains with the mortality impact of treatment (Whitehead & Ali, 2010). While QALYs do not take into account all dimensions of health benefits, their use of utilities provides an important aid in decision-making when attempting to prioritise limited resources. In their review (on which this section is based), Whitehead and Ali (2010) discuss the use of health utilities in the generation of QALYs. QALYs are designed to combine the effects of mortality and morbidity in a single index. The utilities are measured in a cardinal scale of 0 to 1, where 0 indicates death and 1 indicates full health. The interval scale means that a change from 0.2 to 0.3 is equivalent to a change from 0.8 to 0.9 (**Figure 1.2**). QALYs are calculated by multiplying the duration of time spent in a health state by the health-related quality of life (HRQoL) weight (utility score) associated with the health state. Importantly, QALYs can be aggregated across individuals – that is, a QALY is a QALY no matter who gains or loses it. QALYs that occur in the future are discounted to current values, to incorporate the idea that people generally prefer to receive health benefits now rather than in the future.

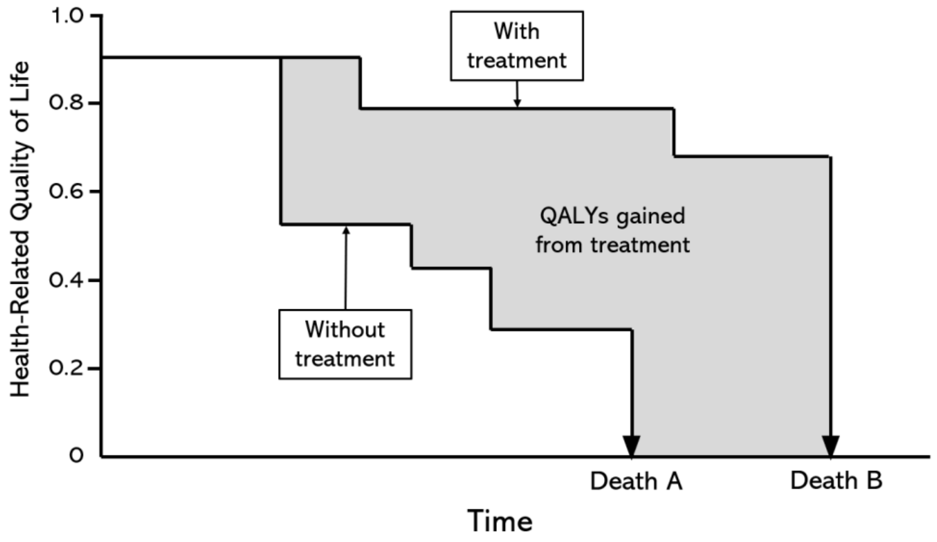

Figure 1.2 Diagrammatic representation of QALYs.

The disability-adjusted life year (DALY) model has been used in health economics for three decades and aims to provide a universally applicable measure that integrates morbidity *and* mortality (Solberg *et al.*, 2020). The morbidity component is measured by assigning *disability weights* (DWs) to health conditions, where 0 represents the absence of disability and 1 is the highest possible DW, defined as a loss 'equivalent to death.' After a condition has been assigned its DW, the *years lived with disability* (YLDs) metric is calculated as the product of the condition's duration and its DW, which account for morbidity. *Years of life lost* (YLLs), relative to a reference life expectancy, account for mortality. Finally, YLDs + YLLs = DALYs = disease burden (**Figure 1.3**).

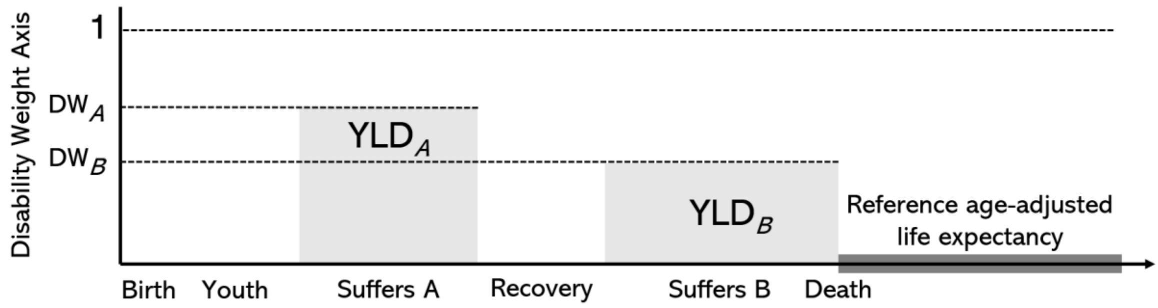

Figure 1.3 Diagrammatic representation of DALYs

Grosse and colleagues (2009) have expressed concern that DALYs are incorrectly used to measure the magnitude, burden, or causes of disability, arguing that DALYs measure the perceived desirability of different health states and not disability as the term is used in public health practice. In particular, YLD (associated with nonfatal injuries and disease) is calculated as the discounted present value of years lived in a condition multiplied by a disability or severity weight for that condition assigned on a scale from 0 (representing perfect health) to 1 (representing death). Weights closer to 1 imply that a year spent in that condition is perceived as being more equivalent to death than to a state of health. Because YLD is based on perceived desirability rather than measures of activity limitations, Grosse and colleagues (2009) argue that DALYs do not meaningfully measure disability.

1.6 Surgery in the Australian healthcare system

Australia has a health system that is fundamentally different from the UK's NHS-based system. The Australian system is complex and consists of (*i*) public hospitals that are almost exclusively managed by state and territory governments, (*ii*) individual general and specialist medical practices where the great majority of consultations occur, and (*iii*) private hospitals and day care facilities. The funding pathways for this system are complex with three funding levels (see **Figure 1.4**). Public hospitals are funded by contributions from both the Federal and State governments. Consultations at medical practices commonly involve out-of-pocket costs to patients but are heavily subsidised by the Federal government. Surgery and procedures in private facilities are subsidised by private health insurers, both for- and not-for-profit but with a contribution from the Federal Medical Benefits Scheme. The Federal government provides financial incentives (both cash transfers and tax incentives) for individuals to maintain private health insurance.

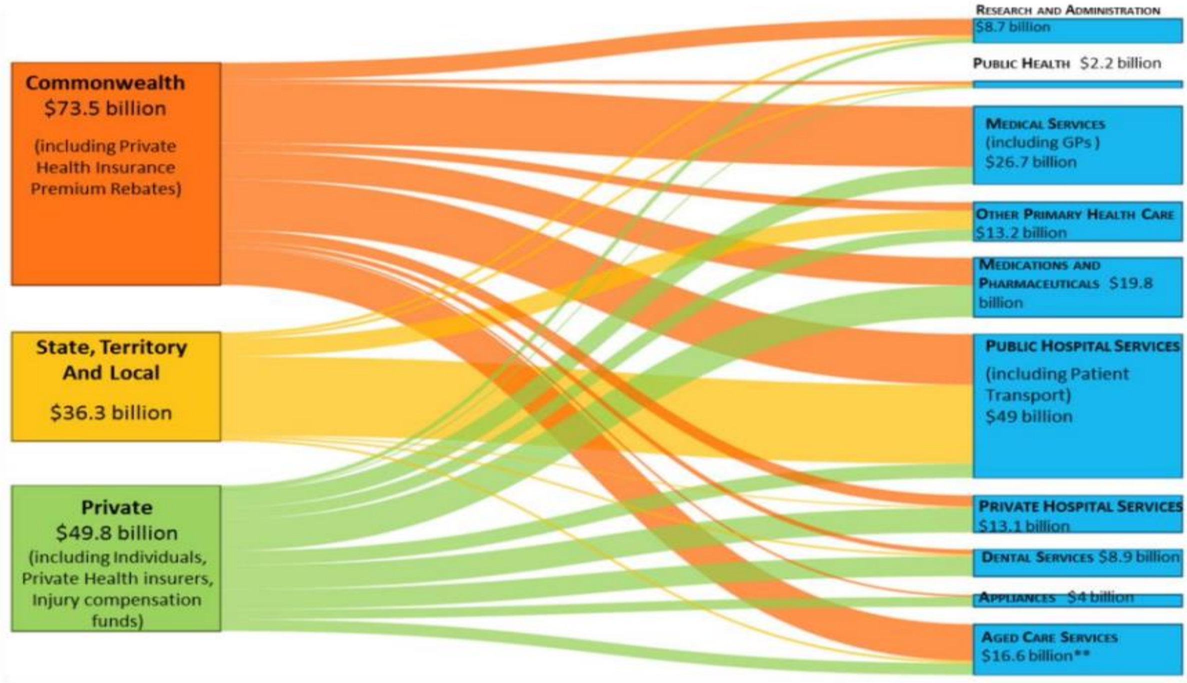

Figure 1.4 Funding pathways for Australian healthcare expenditure 2016. Source: Australian Government Health Department.[8]

Whether an Australian citizen has private health insurance or not they are entitled to care at no cost in public hospitals. A recent but pre-pandemic study found that, despite having private health insurance, 40% of Australian citizens receive inpatient services exclusively in public hospitals (Khoo, Hasan & Eagar, 2021). Only 62% of overnight hospital admissions were claimed on private health insurance and 66% of people received services in public hospitals for surgical admissions. The system was at capacity before the pandemic. Data published by the

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[8] Australian Institute of Health and Welfare (AIHW) webpage. Accessible at: https://www.aihw.gov.au/reports/australias-health/australias-health-2016/contents/summary

Australian Institute of Health and Welfare (AIHW)[9] reported that, during the financial year 2017–18, there were 11.3 million episodes of admitted patient care in Australia's public and private hospitals: 60% of these occurred in public hospitals. Private hospitals accounted for 59% of surgical episodes of admitted patient care and of the 2.3 million episodes of admitted patient care involving elective surgery, 34% were in public hospitals and 66% in private hospitals.

As occurs in the UK, GPs act as the 'gatekeepers' to specialist care: Australian patients cannot claim a financial benefit for the cost of surgical consultations or operations without a valid instrument of referral from a GP. The system by which patients move from experiencing a health problem, to consulting a GP, to assessment by a surgeon, to undergoing surgery are summarised in **Figures 1.5, 1.6, and 1.7**.

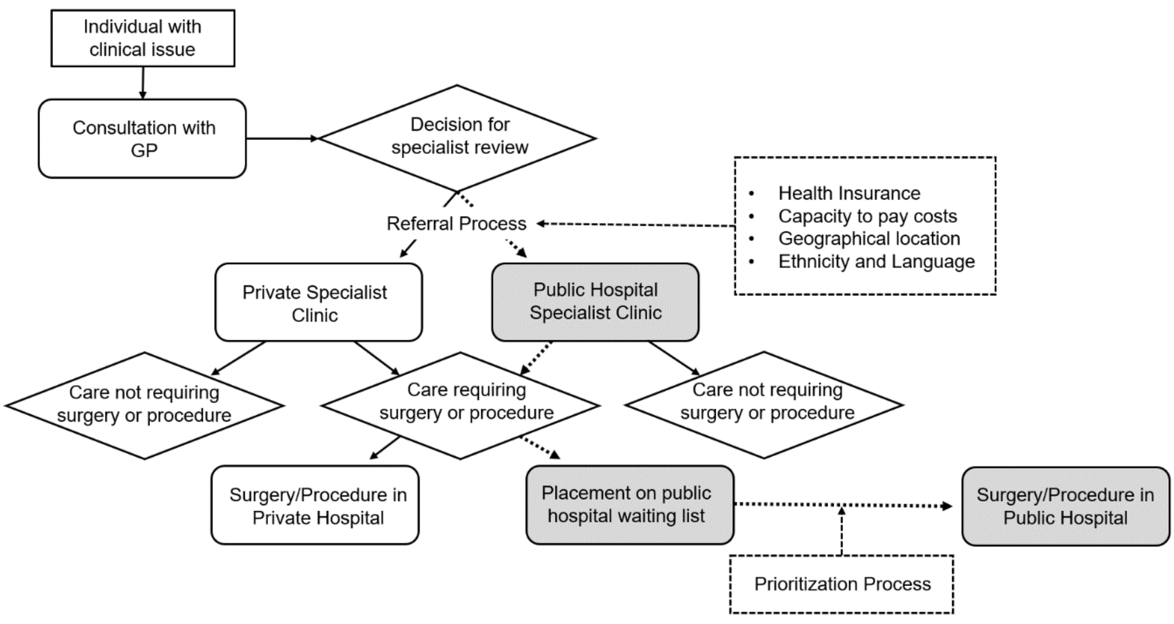

Figure 1.5 Pathways to planned surgery in the Australian health system.

[9] AIHW: Admitted Patient Care 2017-18. Hospital Statistics. Accessible at: https://www.aihw.gov.au/getmedia/df0abd15-5dd8-4a56-94fa-c9ab68690e18/aihw-hse-225.pdf

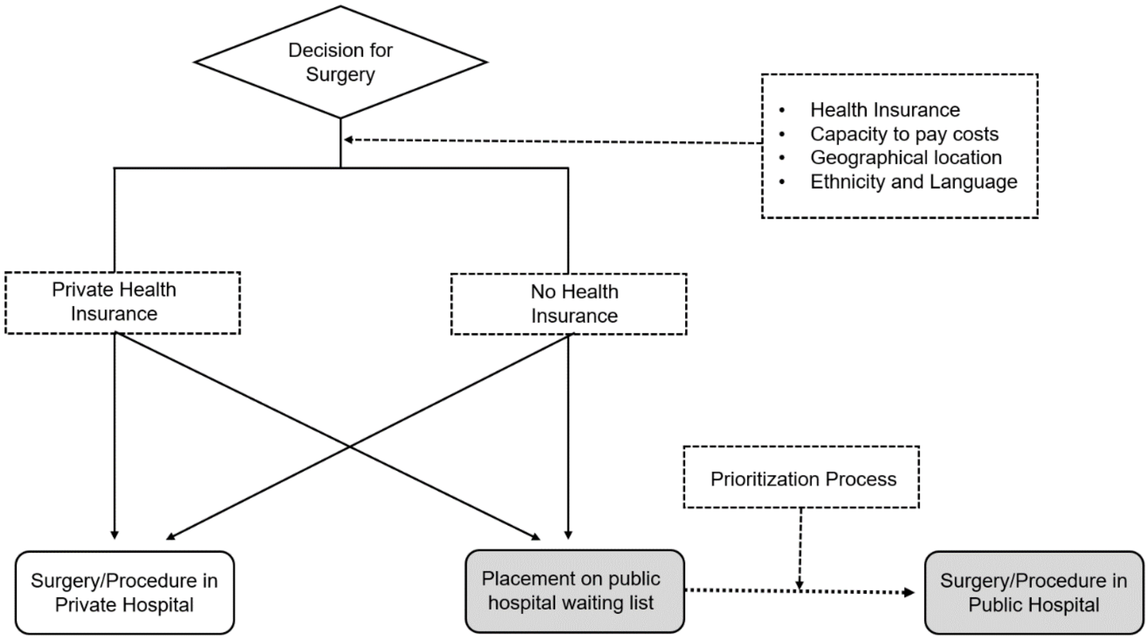

Figure 1.6 Process by which patients undergo planned surgical procedures in the Australian health system.

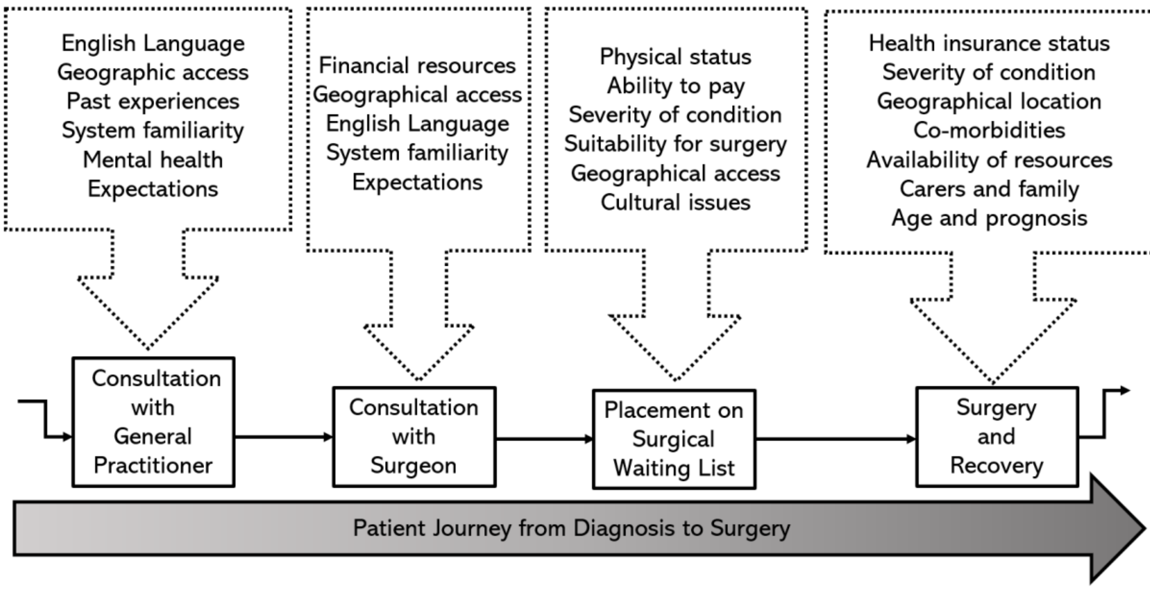

Figure 1.7 Factors affecting access to planned surgery in the Australian health system.

As in the UK, Australia now has to deal not only with the background inflow of newly-diagnosed patients to waiting lists for planned surgery, but with an enormous and growing backlog of patients who have been unable to access surgery during the pandemic – many of whom have experienced deteriorations in their clinical condition due to the delays in treatment. The pre-pandemic algorithm for public hospital waiting lists in Australia was like this (**Figure 1.8**):

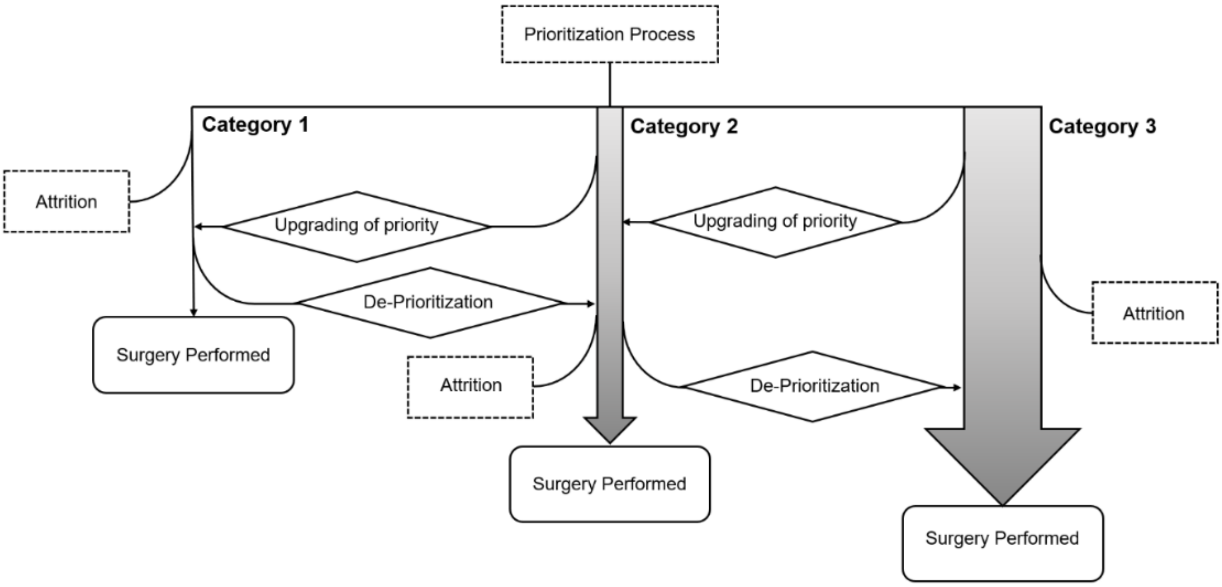

Figure 1.8 Algorithm 1: Waiting list prioritisation pre-pandemic.

… but now, following the pandemic shock, looks like this (**Figure 1.9**):

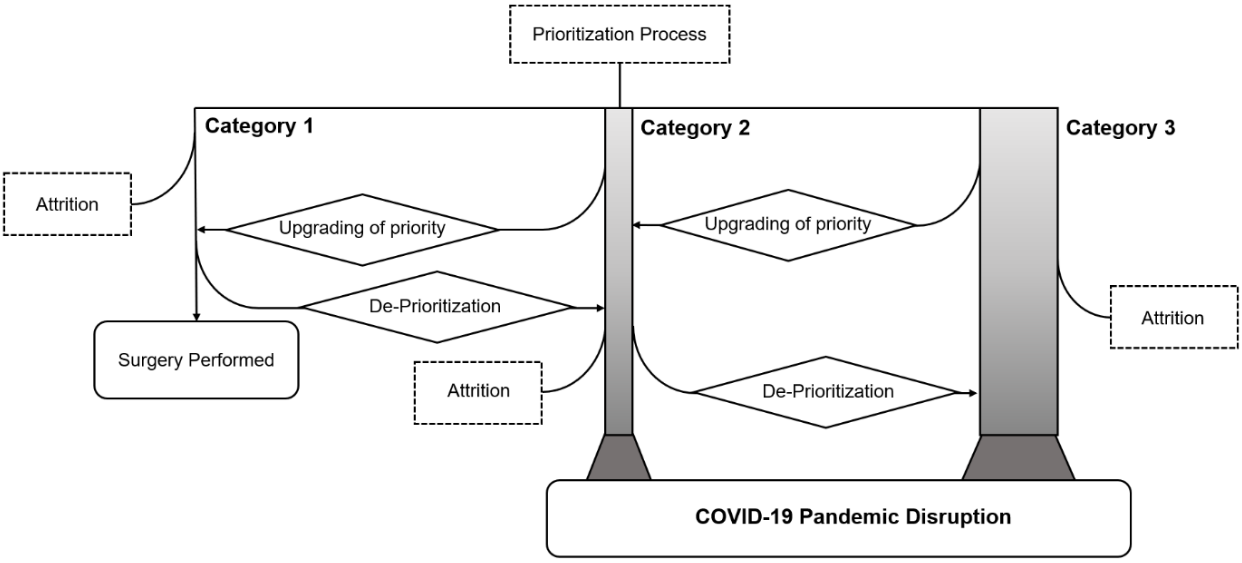

Figure 1.9 Algorithm 2: Waiting list prioritisation post-pandemic.

1.7 Prioritisation of surgical cases in Australia

The current system for surgical prioritisation in Australia's public hospitals was established in 2014; prior to this, access to elective surgery had been the subject of community discussion, media commentary, and political pressure for many years. Surgical waiting lists were also the subject of national performance reporting, with waiting times information reported on a regular basis through the AIHW's *Australia Hospital Statistics* series of reports, through the Council of Australian Governments (COAG) *Reform Council's National Healthcare Agreement Performance Report* series, and on the *MyHospitals* website. Waiting times information had then, as now, been used locally in the management of elective surgery.

National data on elective surgery waiting times includes data on the *clinical urgency* of the patient, that is, on how quickly the patient should have surgery. This information is designed to be used to plan and assess access to surgery dependent on the clinically assessed condition of the patient. However, by 2014 it had become apparent that large inconsistencies existed in clinical urgency categorisation among Australia's states and territories. Recent national reporting of comparable elective surgery waiting times data has not used the national data on clinical urgency category. For these reasons a nationally agreed and standardised system of clinical urgency categorisation was developed and enacted.[10] The stated aims for the new system were to facilitate access to elective surgery for patients according to clinical need while "maximising equity of access and minimising harm associate with delayed access." Further, the categorisation aimed to:

- Support an appropriate balance between consistency of practice and clinical decision-making when assigning an urgency category.
- Support consistent and transparent reporting of elective surgery waiting times performance.
- Enhance overall elective surgery waiting list management with benefits for
  - Individual patients and their families
  - Clinicians
  - Elective surgery service managers, *and*
  - Policy makers.

The National Categorisation categories are:

Category 1 Procedures that are clinically indicated within 30 days

Category 2 Procedures that are clinically indicated within 90 days

Category 3 Procedures that are clinically indicated within 365 days

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[10] Australian Institute of Health and Welfare (2013): *National definitions for elective surgery urgency categories*. Accessible at: https://www.aihw.gov.au/getmedia/509f8a18-73c9-416c-92a5-f5073201df46/15778.pdf.aspx?inline=true

Key points and *Principles of Use of the National Categorisation* system are summarised in **Figure 1.10**. Some examples of the Australian national categorisations of urgency – in general and orthopaedic surgery – are shown in **Figures 1.11** and **1.12**.

SUMMARY OF KEY POINTS

- The purpose of the guideline is to promote national consistency and comparability in urgency categorisation and improve equity of access for patients undergoing elective surgery.
- The guideline acts as a reference for treating clinicians when assigning an urgency category for elective surgery procedures listed in the guideline.
- The nominated 'usual urgency category' is provided as a guide only for categorising selected procedures.
- In all circumstances the urgency category should be appropriate to the patient and their clinical situation and not influenced by the availability of hospital or surgeon resources.
- Where multiple procedures are being performed on one patient, the urgency category should be allocated to the primary procedure.
- The guideline does not overrule State or Territory policies or directives and should be used and interpreted in conjunction with any such policies and directives.
- Where a discrepancy between the guideline and local policy occurs, local State or Territory policy will always take priority.

Guiding Principles

- In all circumstances it is the responsibility of the treating surgeon to assign the urgency category.
- The urgency category should be appropriate to the patient and their clinical situation and not influenced by the availability of hospital or surgeon resources.
- The usual urgency category listed in this guide should be used to assign an urgency category unless a patient's clinical indications require earlier treatment.
- If a patient's clinical indications require the allocation of an alternative category to the usual urgency category listed in the guideline the treating surgeon should follow the escalation principles outlined in their respective State or Territory elective surgery policy.
- Where multiple procedures are being performed, urgency category should be allocated to the primary procedure.
- Patients with a malignant condition are usually considered to require treatment within 30 days (category 1).
- The National Guideline does not attempt to cover every surgical procedure.
- The National Guideline does not overrule State or Territory policies or directives and should be used and interpreted in conjunction with any such policies and directives.
- Treat in turn principle is to be applied when booking elective surgery patients. That is, patients are treated in accordance with their urgency category.

Figure 1.10 *Key Points* and *Guiding Principles* of the Australian National Categorisation of Elective Surgery.

GENERAL SURGERY

SELECTED COMMON PROCEDURES	USUAL URGENCY CATEGORY
Anal fissure – surgery for	2
Axillary node dissection	1
Breast lump – excision and/or biopsy	1
Cholecystectomy (open/laparoscopic)	3
Cholecystectomy (open/laparoscopic) with biliary pancreatitis	1
Cholecystectomy (open/laparoscopic) with potential common bile duct stone or severe frequent attacks (two within 90 days)	2
Colectomy/anterior resection/large bowel resection	1
Fundoplication for reflux disease	3
Hemorroidectomy	3
Herniorrhaphy – femoral/inguinal/incisional/umbilical	3
Lipoma – excision of	3
Malignant skin lesion – excision of +/- grafting	1
Mastectomy	1
Obstructing hiatus hernia (para-oesophageal hernia)	2
Parotidectomy /submandibular gland – excision of	2
Parathyroidectomy	2
Pilonidal sinus surgery	3
Skin lesions (not malignant) – excision of	3
Thyroidectomy/hemi-thyroidectomy	2

Figure 1.11 Guidance on categorisation of clinical urgency for general surgical procedures in Australian public hospitals.

ORTHOPAEDIC SURGERY

SELECTED COMMON PROCEDURES	USUAL URGENCY CATEGORY
Anterior cruciate ligament reconstruction	3
Acromioplasty	3
Arthrodesis	3
Arthroplasty – revision of	2
Arthroscopy	3
Arthroscopy shoulder / sub acromial decompression	3
Bunion (hallux valgus) – removal of	3
Dupytrens contracture release	3
Exostosis – excision of	3
Fracture non-union – treatment of	2
Ganglion – excision of	3
Hammer/claw/mallet toe – correction of	3
Meniscectomy	3
Muscle or tendon length – change of	3
Nerve decompression	2
Osteotomy	3
Rotator cuff – repair of	3
Shoulder joint replacement	3
Shoulder reconstruction	3
Tendon release	3
Tenotomy of hip	2
Total hip replacement	3
Total knee replacement	3

Figure 1.12 Guidance on categorisation of clinical urgency for orthopaedic surgical procedures in Australian public hospitals.

This introductory chapter has examined a number of key concepts:

- The role of planned surgery in population health.
- Resource allocation to the provision of planned surgery.
- Rationing mechanisms for planned surgery in health systems, and the specific systems and mechanisms used in Australia.
- Factors affecting the provision of planned surgery in a universal health system.
- The effect of the COVID-19 pandemic health shock on planned surgery queueing and rationing mechanisms.

1.8 Aim of this dissertation

The overarching aim of this dissertation is to understand some of the factors affecting access to, and waiting times for, planned surgery and to develop a clear picture of the effects of the pandemic on planned surgery in the Australian healthcare system. Management of the large number of patients who now await planned surgical procedures in Australian public hospitals will present an unprecedented challenge for the country. It also will offer the opportunity to re-examine the systems and processes in place to manage public hospital waiting lists and, potentially, refine these to increase efficiency and improve health outcomes moving forward.

In view of these objectives the work presented in this dissertation deals with a number of issues known to affect access to planned surgery. The research questions for this body of work are as follows. (1) With respect to the specialist surgeons who can diagnose and place patients on waiting lists for planned surgery: how much of a role do factors such as geographical proximity and socioeconomic status affect access? (2) The second objective focuses on the nature of the surgery itself: assuming that not all surgical procedures provide equal benefit to patients, is it possible to gain a deeper understanding of factors affecting access to surgical procedures of higher value? (3) Thirdly, because the effects of the COVID-19 pandemic on the health system in Australia were of such magnitude – and the number of patients whose surgery was delayed so great – what types of surgical procedures were most affected and how can this information help guide efforts to deal with the volume of delayed procedures. (4) Lastly, and in a sense most importantly, are there particular groups of patients who have been most greatly affected by the delays? In particular, what effect has the pandemic had on surgery planned for women?

1.8.1 Chapter outline

Chapter 2 of this dissertation examines the relationship between socioeconomic status (SES) and rurality and referral to specialist surgeons in Australia in the last pre-pandemic year. Using data from the Australian Department of Health and Aged Care (DoHAC) regarding place of residence of the patient, and population statistics from the Australian Bureau of Statistics (ABS), it has been possible to examination the relationship between age, gender, SES, and rurality for each of the surgical specialties.

Chapter 3 makes an in-depth examination of surgical procedures of ‘high’ and ‘low’ value. Using a dataset from the Australian Institute of Health and Welfare (AIHW), the incidence rates of a number of high-volume key procedures of ‘high’ and ‘low’ value are examined to determine the effect of SES.

Chapter 4 sets out a detailed examination of the effects of the pandemic on planned surgical procedures in Australia. These data are reviewed by the nature of the surgery performed, and allow estimated of the shortfall in procedures that likely were not undertaken during the early years of the pandemic. As well, the results of a natural experiment between three Australian states with different approaches to pandemic control – New South Wales (NSW) with the most *laissez-faire* approach, Victoria with the strictest lockdowns and protections, and Western Australia with a 'hard border' – has allowed an analysis of the effects of these differing population-level approaches on planned surgery.

Chapter 5 examines the effect of gender on planned surgery during the pandemic. Using a longitudinal comprehensive Australian dataset from the AIHW, modelling allows predictions of surgical procedures and the effects of the pandemic according to gender, to allow an estimation of whether the effects were the same for both genders, or whether one gender was affected more than the other.

Chapter 6 provides a synthesis and summary of the findings from the studies describes in chapters 2 through to 5, and aims to review the findings and the lessons from these studies with a view to policy change both in dealing with the large number of patients whose surgery was delayed during the pandemic, and in shaping equitable policy for waiting list management in Australian public hospitals in the future.

CHAPTER 2

FRAMING VARIATION – SOCIOECONOMIC STATUS AND REFERRAL FOR PLANNED SURGERY IN AUSTRALIA

> "Poorer people die younger and are sicker than richer people; indeed, mortality and morbidity rates are inversely related to many correlates of socioeconomic status such as income, wealth, education, or social class.…Many people find it unjust that people should not only be unequal in the amount of goods and services they receive but also in the length and quality of their lives. They believe that addressing these income-related inequalities in health is an urgent task of health policy."
>
> Sir Angus Deaton[11]

2.1 Chapter introduction

This chapter sets out a comprehensive study of factors that have influenced access to planned surgery in Australia in the era immediately before the disruptions of the COVID-19 pandemic. In particular, how a patient's SES and geographical remoteness from surgical services (rurality) affect the rates of referral to specialist surgeons. It will examine not only high-level population data but take into account age and gender of patients, and the surgical speciality to which the referral is made. In the first instance, a review of the literature is undertaken, and an explanation of the special nature of Australia's healthcare system – with its complex inter-relationship between the public and private health systems – is made. The project then is described and the findings reviewed. The implications of the findings regarding access are examined and discussion is made of potential policy responses is undertaken.

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[11] Deaton, A. (2002) 'Policy implications of the gradient of health and wealth', *Health Affairs*, **21**(2), 13-30.

2.2 Equity of access to healthcare

In chapter one the equity-efficiency trade-off was discussed: this current chapter will examine some aspects of the equity side of the trade-off in more detail. McIntyre and Chow (2020) have conducted a systematic review and point out that "This review also affirms … the relationship between SES [socioeconomic status] and waiting time. This is particularly concerning in publicly funded health systems where service delivery is intended to be dependent on need rather than the ability to pay." Braveman and Gruskin (2003) make the following comments about the definition of equity as it applies to health:

> "Equity means social justice or fairness; it is an ethical concept, grounded in principles of distributive justice. Equity in health can be — and has widely been — defined as *the absence of socially unjust or unfair health disparities*. However, because social justice and fairness can be interpreted differently by different people in different settings, a definition is needed that can be operationalised based on measurable criteria. For the purposes of operationalisation and measurement, equity in health can be defined as 'the absence of systematic disparities in health (or in the major social determinants of health) between social groups who have different levels of underlying social advantage/disadvantage' — that is, different positions in a social hierarchy. Inequities in health systematically put groups of people who are already socially disadvantaged (for example, by virtue of being poor, female, and/or members of a disenfranchised racial, ethnic, or religious group) at further disadvantage with respect to their health; health is essential to well-being and to overcoming other effects of social disadvantage.

> Health represents both physical and mental well-being, not just the absence of disease. Key social determinants of health include household living conditions, conditions in communities and workplaces, and healthcare, along with policies and programmes affecting any of these factors."

The relationship between socioeconomic disadvantage and poorer health is well recognised. Individuals at socioeconomic disadvantage face both greater risks of ill health and barriers in accessing healthcare. Access to material and social resources is important for maintaining health and people in lower socioeconomic groups have higher rates of illness, disability, and death.

Van Lenthe and Mackenbach (2021) have reviewed the literature regarding disadvantage and health status and have classified the influential factors as material, psychosocial, and behavioural. For example, smoking is a significant material risk to health and is more prevalent among those in the lowest income group despite the cost of cigarettes. Other material risk factors that are more prevalent in lower socioeconomic groups include occupational health risks (exposure to accident risks, performing physically strenuous work), health risks related to housing (crowding, dampness, accident risks), and environmental health risks (air pollution, traffic noise). Some of these factors have been shown to make important contributions to the explanation of health inequalities.

The review also reported that psychosocial factors are more likely to play a role in those at greatest risk of socioeconomic disadvantage: they may be exposed to more psychosocial stressors in the form of negative life events, and an 'effort–reward imbalance' (high levels of effort without appropriate material and immaterial rewards), and a combination of high demands and low control both in the workplace and beyond (Van Lenthe & Mackenbach, 2021). At the same time, they also tend to have lower levels of social support and a weaker sense of control over their life and living conditions. This combination of a higher exposure to psychosocial stressors and less capacity to remove or buffer these exposures may explain part of the higher frequency of health problems in the lower socioeconomic groups. This has been best documented for psychosocial factors related to work organisation, such as job strain, which have been shown to play a role in the explanation of socioeconomic inequalities in cardiovascular health.

The final group of risk factors identified by the review are health-related behaviours such as smoking, inadequate diet, excessive alcohol consumption, and lack of physical exercise (Van Lenthe & Mackenbach, 2021). In many developed countries one or more of these 'lifestyle' factors are more prevalent in the lower socioeconomic groups. Other behavioural risk factors include alcohol use, unhealthy diet, and patterns of exercise: these are closely linked to obesity which is, obviously, also closely linked to health.

Socioeconomic disadvantage also influences access to healthcare, both preventive and curative. In the UK, where primary care is delivered largely by GPs, the evidence suggests that while more disadvantaged individuals have similar numbers of visits to GPs they still have worse health outcomes (Cookson *et al.*, 2016). Those authors found that patients at socioeconomic disadvantage had fewer occasions related to preventive care (such as vaccination or disease screening) and presented at a later stage of their disease. Very similar findings were reported from Canada, another developed country with a mature universal healthcare system (Veugelers & Yip, 2003). Studies from Australia – another country with a universal health system – report similar findings: preventive measures such as immunisations and cervical screening are less common with lower SES, as are pathology tests and referrals to specialists (Valenti *et al.*, 2016).

2.2 Socioeconomic status and surgery

A review undertaken for the *Lancet Commission on Global Surgery* published in 2015 concluded that, globally:

> "Five billion people do not have access to safe, affordable surgical and anaesthesia care when needed. Access is worst in low-income and lower-middle-income countries, where nine of ten people cannot access basic surgical care." (Meara & Greenberg, 2015)

Unmet need for surgical care is, primarily, a feature of health systems in LMICs as it is for other forms of preventive and curative healthcare. Lack of access to surgery manifests, at a population level, in two phenomena that are not mutually exclusive: population groups may have lower rates of surgery (operations performed per capita); or, they may have longer waiting times to have surgery performed. Zafar and colleagues (2013) have pointed out that inadequate access to surgery in LMICs "contributes to significant preventable morbidity and death. Physical access to surgical facilities, especially in rural areas and for those with low [community development indices], is an important concern and should be prioritised in any forthcoming national policies."

There is strong evidence that SES is closely associated with access to, and resulting rates of, surgery (Shortt & Shaw, 2003; Edwards, *et al.*, 2021) and this inequity is particularly evident in the United States (US) (Csikesz *et al.*, 2009). Likewise in Australia, the evidence points to an association between SES and rates at which surgical procedures are undertaken. One example is with major joint replacement surgery – hip and knee arthroplasty – which is undertaken, most commonly, to manage chronic arthritis with resulting alleviation of pain and enhancement of mobility. Population-level studies report that rates of major joint replacement are lower in patients of lower SES both for knee (Brennan *et al.*, 2014) and hip surgery (Dixon *et al.*, 2011). Overall, access to planned orthopaedic surgery in Australia is negatively correlated with SES. (Ackerman & Busija, 2012) As well as orthopaedic surgery aiming to enhance mobility, access to vision- and hearing-enhancing surgery have negative correlations with SES in Australia. For example, rates of cochlear implantation for deafness are lower in those of lower SES (Cheung *et al.*, 2023). Similarly, rates of sight-saving procedures such as cataract surgery are correlated with SES in the Australian setting (Xiao *et al.*, 2022). Beyond elective procedures, rates of more urgent procedures – such as breast reconstruction as part of care for breast cancer – also are correlated with SES with more disadvantaged women having lower rates of the procedure (Hall & Holman, 2003). A similar trend has been noted for kidney transplant surgery (Grace *et al.*, 2013).

The second aspect of access – the duration of waiting times for patients to undergo planned surgery – is a phenomenon that has been studied extensively in many health systems. The reason for this interest and inquiry is that "waiting times for planned surgery represent an important marker of the efficiency of health services" (Willcox *et al.,* 2007). Law and colleagues (2022) point out that, "even in high-income countries with universal health systems, patients of lower SES may face challenges such as lack of transportation, difficulties with obtaining childcare, unavailability of caregivers for postoperative care, or receiving inadequate sick leave entitlements required for surgery."

McIntyre and Chow (2020) conducted a systematic review and comment specifically on lack of data dealing with surgical specialist access and factors affecting it. The evidence is somewhat mixed with different health systems, and different queueing methods for surgery, across different countries and jurisdictions. In Norway, a Scandinavian country with universal health coverage funded, primarily, through general taxes and payroll contributions, there is little evidence of a gradient in waiting times for planned surgery at a population level (Arnesen, Erikssen & Stavem, 2002; Kaarboe & Carlsen, 2014). Similar findings have been noted in other high-income countries with universal health systems, such as Canada (Szynkaruk *et al.*, 2014; Law, Stephens & Wright, 2022) and Sweden (Löfvendahl *et al.*, 2005). In other health systems, where provision of healthcare is underpinned by a universal system but mixed with private care providers, the results tend to differ. For example, in Italy there is evidence not only of longer waiting times for major joint replacement affecting patients of lower SES, but also of an increased rate of adverse outcomes of surgery in these groups (Petrelli *et al.*, 2012; Petrelli *et al.*, 2018). Of note, data from Italy attribute part of the delay in undergoing surgery to "excessive waiting times for diagnostic and specialist visits" for patients of lower SES (Landi, Ivaldi & Testi, 2018). Similarly, data from Spain show that patients of higher SES have shorter waiting periods for elective procedures including hip replacement, cataract surgery, and hysterectomy (Bosque-Marcader *et al.*, 2023). Surprisingly, data from the UK regarding SES and surgery are somewhat limited. However, an important trend seems to be emerging. Older studies – from the turn of the millennium – reported low levels of effect from SES on surgical waiting times for planned cataract or orthopaedic surgery (Hacker & Stanistreet, 2004). However, more recent studies have reported an increasing effect of SES on waiting times across the UK. There is evidence of an overall trend to increased gradients in access to planned surgery across SES divides (Laudicella, Siciliani & Cookson, 2012) with specific disparities reported in vascular surgery (Tong *et al.*, 2023) and joint replacement surgery (Marques *et al.*, 2014).

2.2.1 Pathways – Referral for surgery in the Australian health system

For a patient to be placed on a surgical waiting list in Australia, as also occurs in the UK, referral to a consultant surgeon is required, and valid referral is facilitated almost exclusively by GPs. This is a government-mandated situation in Australia – at least, patients are unable to claim government or private insurance rebates for consultation costs without a valid and in-date referral from a GP (referrals are valid for 12 months and must fulfill strict criteria to attract government Medicare rebates[12]). Because details of the referral that include the name and a numerical identifier (the 'provider number'[13]) of the referring doctor and the date of the referral, and the referral details must be submitted to Services Australia to obtain the rebate, this allows data on referral for each surgical service provided (consultations and, where performed, procedures) to be obtained. Older studies conducted within the Australian system suggested that patients were less likely to receive a referral for specialist care overall (with no data available on whether the specialist was surgical or non-surgical) if they were of lower 46axilla46 (Van Doorslaer *et al.*, 2008; Korda *et al.*, 2009).

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[12] Services Australia: Referring and requesting Medicare services for health professionals. Accessible at: https://www.servicesaustralia.gov.au/referring-and-requesting-medicare-services-for-health-professionals?context=20#:~:text=A%20referral%20from%20a%20general,or%20for%20an%20indefinite%20period.

[13] Services Australia: Medicare provider number guidelines. Accessible at: https://www.servicesaustralia.gov.au/how-to-apply-for-provider-number-if-youre-health-professional?context=34076#:~:text=A%20Medicare%20provider%20number%20uniquely,requirements%20for%20your%20health%20profession.

2.3 *Measuring socioeconomic advantage and disadvantage in Australia*

The most widely used and validated metric for assigning area-level estimates of SES in Australia is the *Socio-Economic Indexes for Areas* (SEIFA) produced by the Australian Bureau of Statistics (ABS). The SEIFA ranks areas in Australia according to relative socio-economic advantage and disadvantage (Kerr *et al.*, 2021). It is generated based on information from the five-yearly Australian *Census of Population and Housing*.[14] It consists of four individual indices: the Index of Relative Socio-economic Disadvantage (IRSD); the Index of Relative Socio-economic Advantage and Disadvantage (IRSAD); the Index of Education and Occupation (IEO); and, the Index of Economic Resources (IER). Each of these indices is a summary of a different subset of Census variables and focuses on a different aspect of socio-economic advantage and disadvantage.

The IRSAD is the most extensively used and validated instrument in health-related studies in Australia (Zhao *et al.*, 2013; Ayer *et al.*, 2020). The IRSAD summarises information about the economic and social conditions of people and households within an area, including both relative advantage and disadvantage measures. A low score indicates relatively greater disadvantage and a lack of advantage in general. For example, an area could have a low score if there are: many households with low incomes, or many people in unskilled occupations, and few households with high incomes, or few people in skilled occupations. A high score indicates a relative lack of disadvantage and greater advantage in general. For example, an area may have a high score if there are: many households with high incomes, or many people in skilled occupations, and few households with low incomes, or few people in unskilled occupations. The IRSAD is recommended in situations where the user wants a general measure of advantage

[14] https://www.abs.gov.au/websitedbs/censushome.nsf/4a256353001af3ed4b2562bb00121564/census

and disadvantage in their particular analysis and is not looking at only disadvantage and lack of disadvantage but also wants advantage to offset disadvantage in their analysis. For example, IRSAD may be applicable when a user believes the topic being analysed is likely to be affected by both advantage and disadvantage. A map of Australia broken into IRSAD deciles is shown in **Figure 2.1**, and a higher detail map of the city of Sydney is shown in **Figure 2.2**.

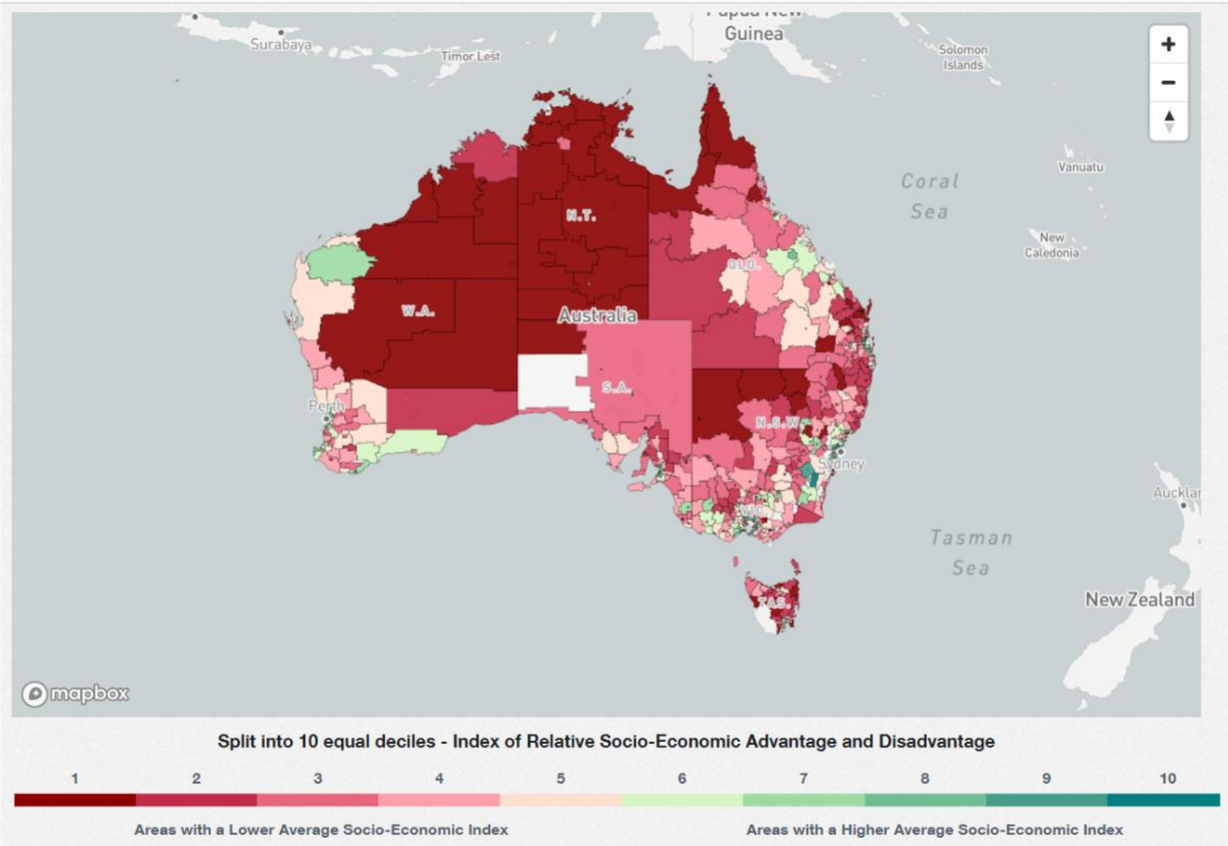

Figure 2.1 Map of Australia in 2020 with geographical distribution of IRSAD in deciles.[15]

[15] https://www.sbs.com.au/topics/voices/how-advantaged-or-disadvantaged-is-my-suburb

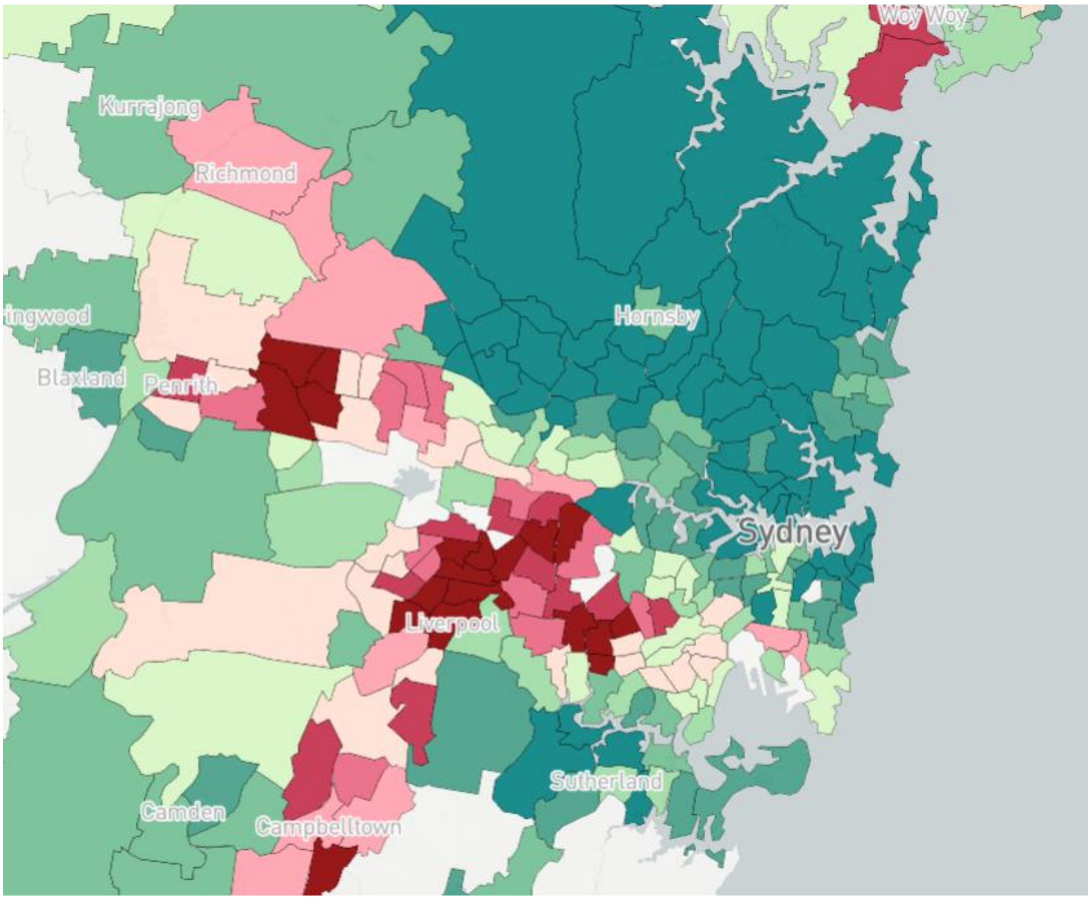

Figure 2.2 Detail of the Sydney metropolitan area according to IRSAD deciles.[16]

2.4 Rurality and health in Australia

In Australia there is strong evidence that, at a population level, health status worsens with increasing rurality (reviewed by Phillips, 2009). In part, this situation reflects the increasing number of First Nations (Aboriginal and Torres Strait Islander) Australians, proportionally, as remoteness increases: First Nations Australians have poorer overall health outcomes (O'Brien *et al.*, 2021). Poorer health outcomes are associated with, and result from, an increasing prevalence of risk factors, lower incomes compared to urban centres, and lower levels of educational access. As well, challenges in physical and financial access to health services, and

[16] https://www.sbs.com.au/voices/article/how-advantaged-or-disadvantaged-is-my-suburb/glerj1tlf

greater occupational and environmental risks are present (Humphreys, 1999). Similarly, there is a strong correlation between increasing rurality and prevalence of mental health conditions, particularly in younger Australians (Boyd *et al.*, 2006; Campbell, Manoff & Caffrey, 2006; Amos & Coleman, 2023). A greater burden of mental health conditions – including higher rates of suicide – affect non-urban Australians. Overall, the 'social determinants of health' are less conducive with increasing rurality, leading to rural health disadvantage (Dixon & Welch, 2000).

In the Australian population, increased rurality correlates closely with an increasing prevalence of eye conditions, such as cataract, glaucoma, and pterygium – all of which benefit from surgical treatment (Madden *et al.*, 2002). The combination of increased population-level morbidity and remoteness is reflected in access to surgical treatment. For example, planned surgery for cataracts – so-called 'sight-saving' surgery – is less common in rural and regional areas of Australia. A study from Western Australia revealed that urban dwellers were 9% more likely to undergo planned cataract surgery than those living in non-urban areas and that the disparity is increasing (Ng, Morlet & Semmens, 2006). Studies of other non-emergency surgical procedures, such as hip and knee joint replacement (Brennan *et al.*, 2014) show similar rurality-based gradients. This disparity also extends to more urgent types of surgery, such as bowel surgery for malignancy (Tham, Skandarajah & Hayes, 2022). The most urgent surgical treatments – cardiothoracic surgery, for example – are much less likely to be performed for patients in regional and remote areas of Australia (Korda, Clements & Kelman, 2009).

2.5 Measuring rurality in the Australian setting

In Australia the accepted method of quantifying rurality is the *Modified Monash Model* (MMM). This model is the standard used by the Australian Department of Health and Aged Care (DoHAC) in all of its planning, including workforce and resource allocation for healthcare.[17] The MMM defines whether a location is metropolitan, rural, remote, or very remote: it measures remoteness and population size on a scale of categories MM 1 to MM 7, where MM 1 is a major city and MM 7 is very remote (**Figure 2.3**). The seven MMM classifications are as follows:

MM 1 **Metropolitan areas**: major cities accounting for 70% of Australia's population.

MM 2 **Regional centres**: areas that are in, or within 20 Km road distance, of a town with a population of greater than 50,000.

MM 3 **Large rural towns**: areas that are in, or within 15 Km road distance, of a town with a population of between 15,000 and 50,000.

MM 4 **Medium rural towns**: areas that are in, or within 10 Km road distance, of a town with a population of between 5,000 and 15,000.

MM 5 **Small rural towns.**

MM 6 **Remote communities**: All other areas and islands that are separated from the mainland by less than 5 Km.

MM 7 **Very remote communities**, and populated islands separated from the mainland by more than 5 Km.

[17] Australian Department of Health and Aged Care. Modified Monash Model. Accessible at: https://www.health.gov.au/topics/rural-health-workforce/classifications/mmm

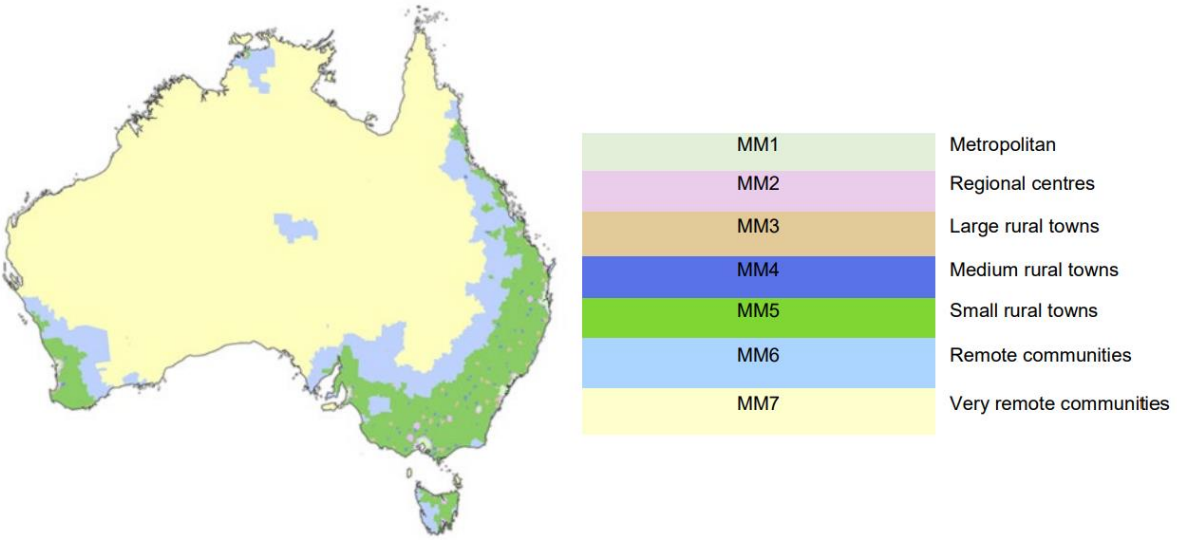

Figure 2.3 Map of rurality in Australia as expressed by the Modified Monash Model.[18]

The MMM classification is the fundamental metric used for health workforce planning in Australia (Versace *et al.*, 2021) and as the marker of rurality in population-based studies of morbidity (for example, see: Baxter, Tooth & Mishra, 2021; and, Galbally *et al.*, 2023)

2.6 Socioeconomic status and referral to a consultant surgeon

Since a requirement for surgery in Australia, whether in a public hospital or private setting, is a consultation with a surgeon, then one potential cause for a gradient in access surgery might be inequity in referral to surgeons. Because of the nature of the Australian Medicare system and its regulation it is possible to study patterns of referral to consultant surgeons. This enables assessment of the population-level rates of referral to surgeons based on the presumptive SES of the patient. The hypothesis to be tested in this study was: “Patients at lower SES have lower

[18] https://www.health.gov.au/topics/rural-health-workforce/classifications/mmm

rates of referral to specialist surgeons that patients at higher SES." The study described here received prospective approval from the Human Research Ethics Committee of the Australian National University of which I am a faculty member and, as a matter of contract, must obtain primary ethics approval for any research that I undertake (protocol 2022-165). This approval was forwarded to Bangor University.

2.6.1 Data sources

Because the COVID-19 pandemic had a profound effect on healthcare in Australia, we used the last pandemic calendar year 2019 for our study. The Australian Government data custodian for medical consultation claims is the Department of Human Services (DHS). A substantial amount of de-identified data are available for download from the DHS website (www.ServicesAustralia.gov.au). Bespoke data requests are considered on a case-by-case basis and, for research projects, require evidence either of approval of an approved ethics committee or evidence that ethical approval is not required. Data are shared as Excel™ files and the only condition for use is that DHS are notified of any publications arising from analysis of the data.

For every first consultation with consultant surgeon rebates are based on Medicare item number (code) 104 – this code is specific to the first consultation for a given condition and all subsequent consultations after this are coded 105, no matter the number. The dataset was based on the postcode of the primary residence for individual patients. For every postcode in Australia, the total number of 104 (first visit) consultations was recorded by gender and age of patients (in five year age bands) and specialty of the surgeon. These specialties were (**Box 2.1**):

032 – General Surgery

033 – Cardiothoracic Surgery

034 – Neurosurgery

035 – Orthopaedic Surgery

036 – Paediatric Surgery

037 – Plastic and Reconstructive Surgery

039 – Vascular Surgery

055 – Otolaryngology – Head and Neck Surgery

062 – Oral and Maxillofacial Surgery

Box 2.1 MBS codes for individual surgical subspecialties

To avoid any potential for inadvertent patient identification, postcodes where fewer than five consultation items were claimed (but not zero) were censored for data. Assuming an even distribution of case numbers at a population level (1, 2, 3 or 4) a value of 2.5 was assigned for all postcodes where a non-zero number of referrals had been claimed but the value was less than five.

To provide the population denominators necessary for the calculation of incidence rates, data were obtained from the Australian Bureau of Statistics (ABS) regarding point estimates of the population, by gender and age, for each postcode as of June, 2019. An estimate of SES for each patient was obtained by using the ABS IRSAD stratification for the postcode of residence of the patient referred. This is the standard method of assigning population-level SES in Australian studies (for examples, see Mnatzaganian *et al.*, 2018, and Juonala *et al.*, 2019) The ABS publishes a dataset with estimates from the SEIFA of IRSAD sociodemographic scores for postcodes.[19] Data were obtained from this ABS dataset allowing assignment of an estimate of SES for each patient referral. Data regarding the MMM rurality index was obtained from the Australian Government (see footnote 18) and assigned to each postcode.

2.6.2 Analysis

The dataset was compiled in *Excel*™ and comprised data for every Australian postcode with the IRSAD score, MMM rating, population data, number of claimed referrals, and the individual subspecialty of the surgeon consulted. The data were stratified by IRSAD deciles and rates calculated according to the accepted expression:

$$Rate_{\text{SurgCons}} = \sum_{t}^{1} \frac{n_{\text{ConsPostcode1}} + n_{\text{ConsPostcode2}} + \ldots + n_{\text{ConsPostcode}t}}{Pop_{\text{ConsPostcode1}} + Pop_{\text{ConsPostcode2}} + \ldots + Pop_{\text{ConsPostcode}t}}$$

For each of the IRSAD deciles the rate of surgical consultations ($Rate_{\text{SurgCons}}$) was calculated with the sum of the age-stratified populations ($Pop_{\text{ConsPostcode}}$) as the denominator and the numerator summing the number of age-stratified consultations claimed ($n_{\text{ConsPostcode}}$) across t postcodes within each IRSAD decile.

[19]Australian Bureau of Statistics. 2033.0.55.001 - Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016. Accessible at: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~Data~2

2.6.3 Results

2.6.3.1 Surgical consultations for children and adolescents

Interrogation of the AIHW procedural dataset revealed the numbers of inpatient surgical procedures according to age group and gender (**Figure 2.4**). During the calendar year 2019 a total of 276916 claims were made for first consultations with a surgical specialist for a total population under 20 years of 6268534, yielding an overall rate of 441.8/10000 over the year. Of these, the greatest proportion were for otorhinolaryngologists (ENT surgeons) comprising 47.6% of all referrals in the age group. Next was orthopaedic surgery (22.5% of all referrals), followed by general paediatric surgeons (9.9%).

The population distribution of young Australians (age less than 20 years) is uneven between IRSAD deciles with a greater population in higher socioeconomic groups. (**Figure 2.5**) Approximately one quarter of young Australians are in the top two deciles with the lowest three deciles covering only 20% of the young population. When the overall distribution of consultation rates with all surgical specialists combined was considered, there was clear evidence of a socioeconomic gradient with an inverse relationship between SES and rates of surgical consultation (**Figure 2.6**). To allow for the obvious 'broken stick' nature of the data series, analysis was undertaken in GenStat™[20] with segmented regression. (Taljaard *et al*, 2014; Schober & Vetter, 2021) Segmented regression can be used when independent variables cluster into discrete and different groups, where they exhibit different variable relationships – the group boundaries are termed breakpoints. In such cases, identification of the breakpoints allows for segmented linear regressions to be performed. The breakpoints represent a threshold value

[20] VSNI Genstat: https://vsni.co.uk/software/genstat

beyond which a different effect (Y_r) occurs in response to an influential factor (x). Breakpoints are analogous to identification of 'knots' in natural splines. (Perperoglou *et al*, 2019)

Table 2.1 shows the slope estimates from the segmented regression, showing the strength of association changes across socioeconomic deciles. For each of the surgical subspecialties it was observed that as SES decreases, the rate of referral increased significantly with the strongest association in the three highest SES groups.

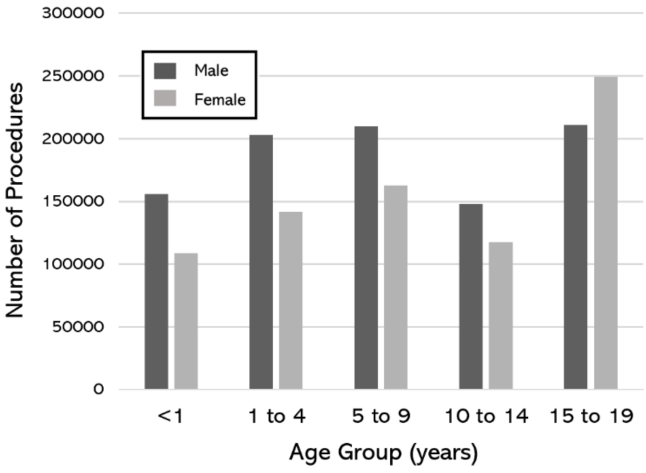

Figure 2.4. Total numbers of procedures performed in Australian hospitals during 2019, by age group and gender.

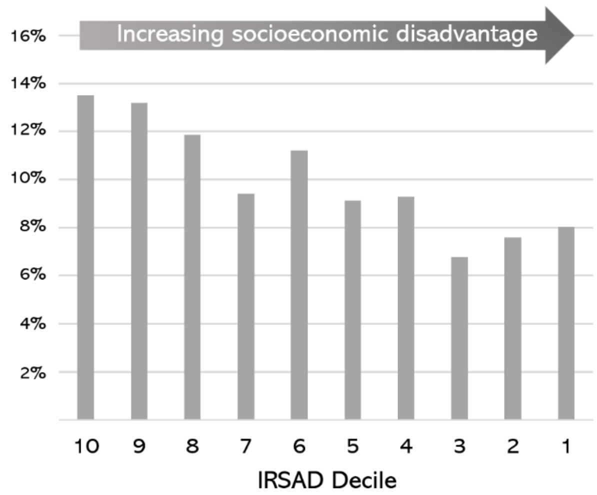

Figure 2.5 Population distribution of Australians aged less than 20 years in 2019 according to IRSAD of postcode of residence.

Surgical referral per 10000		Estimate	S.E.	t score	P value
All types	Before 8.7 decile	6.814	2.567	2.654	0.0181*
	After 8.7 decile	72.713	23.5340	3.090	0.0075*
Ear, nose and Throat	Before 2.4 decile	2.870	0.971	2.955	0.0098*
	After 2.4 decile	0.613	0.105	5.782	<0.0001*
Orthopaedic	Before 8.7 decile	1.529	1.0198	1.4994	0.155
	After 8.7 decile	40.109	9.3464	4.2914	0.0006*
Paediatric	Before 8.3 decile	1.6436	0.5399	3.0445	0.0082*
	After 8.3 decile	-1.6225	4.9488	-0.3279	0.7482

Table 2.1 Estimates of effect, standard errors (S.E.), t statistic scores and P values for surgical referrals per 10000 young Australians against the socioeconomic deciles from segmented regression. The statistical significant effect is marked with * at 5% significance level.

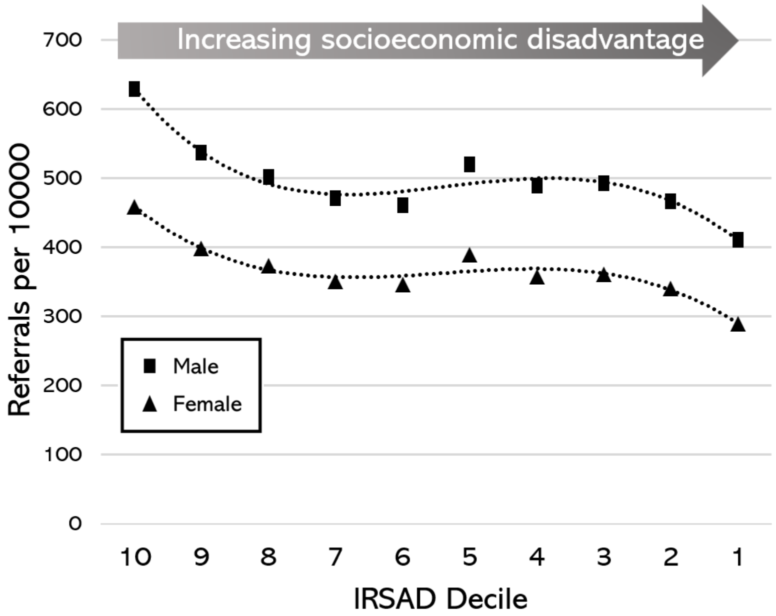

Figure 2.6 Rate of first consultation (consultations per 10000) with any surgeon (except gynaecologist) in Australia during the calendar year 2019 for male (■) and female (▲) patients aged less than 20 years according to IRSAD decile of residence.

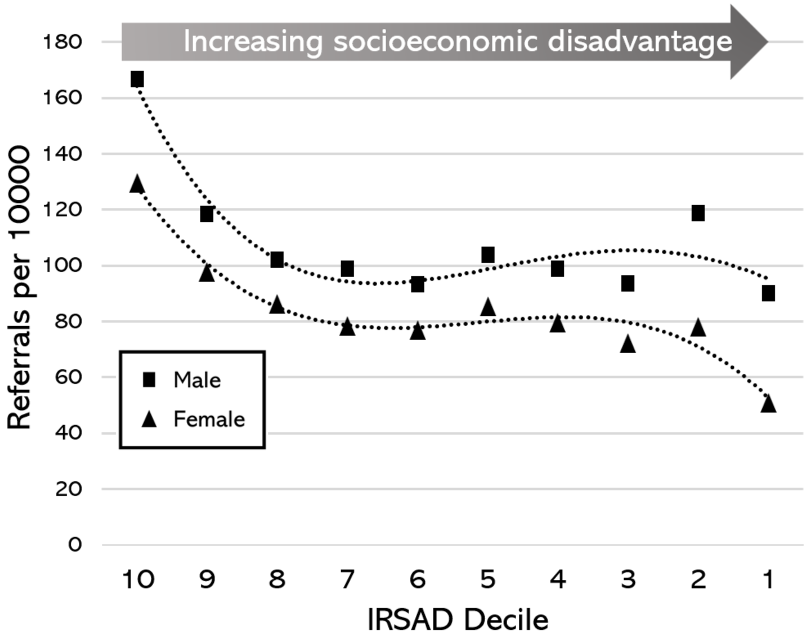

Figure 2.7. Rate of first consultation (consultations per 10000) with an ear nose and throat surgeon (otorhinolaryngologist) in Australia during the calendar year 2019 for male (■) and female (▲) patients aged less than 20 years according to IRSAD decile of residence.

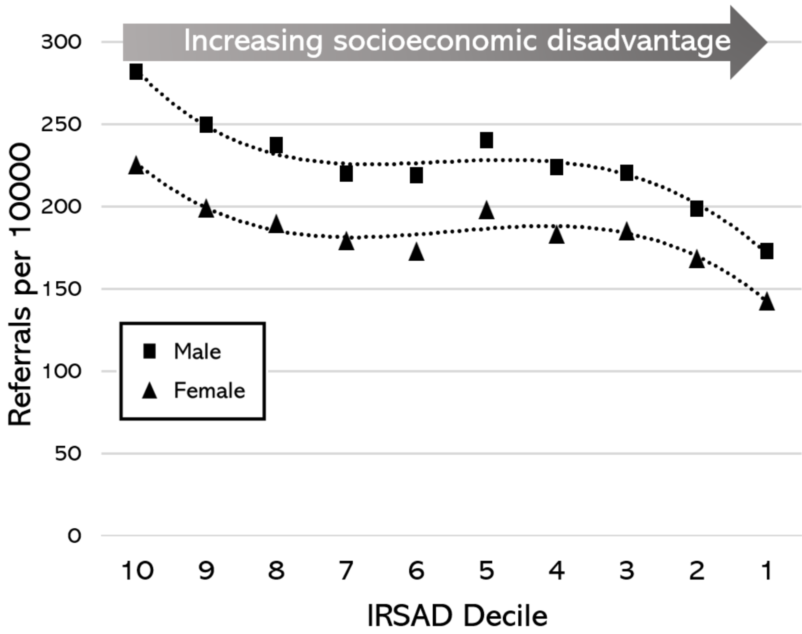

Figure 2.8. Rate of first consultation (consultations per 10000) with an orthopaedic surgeon in Australia during the calendar year 2019 for male (■) and female (▲) patients aged less than 20 years according to IRSAD decile of residence.

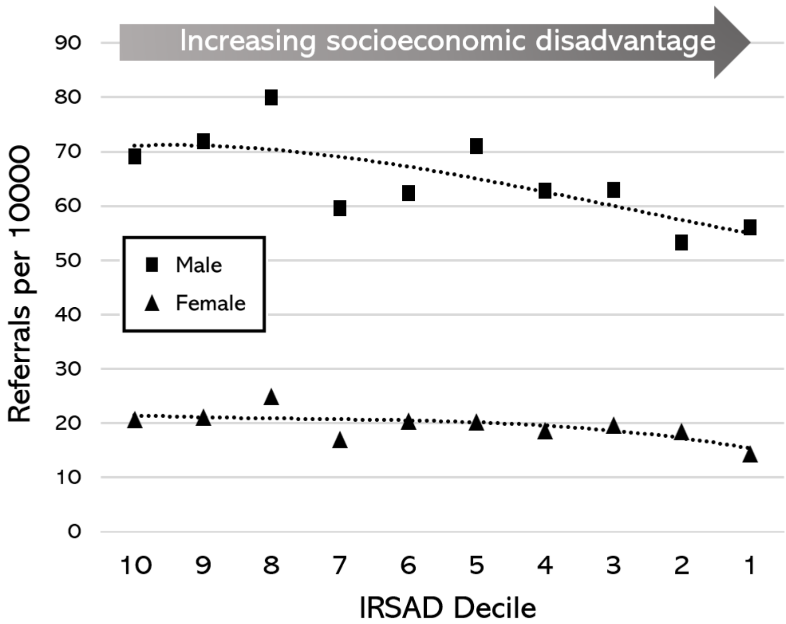

Figure 2.9. Rate of first consultation (consultations per 10000) with a paediatric surgeon in Australia during the calendar year 2019 for male (■) and female (▲) patients aged less than 20 years according to IRSAD decile of residence.

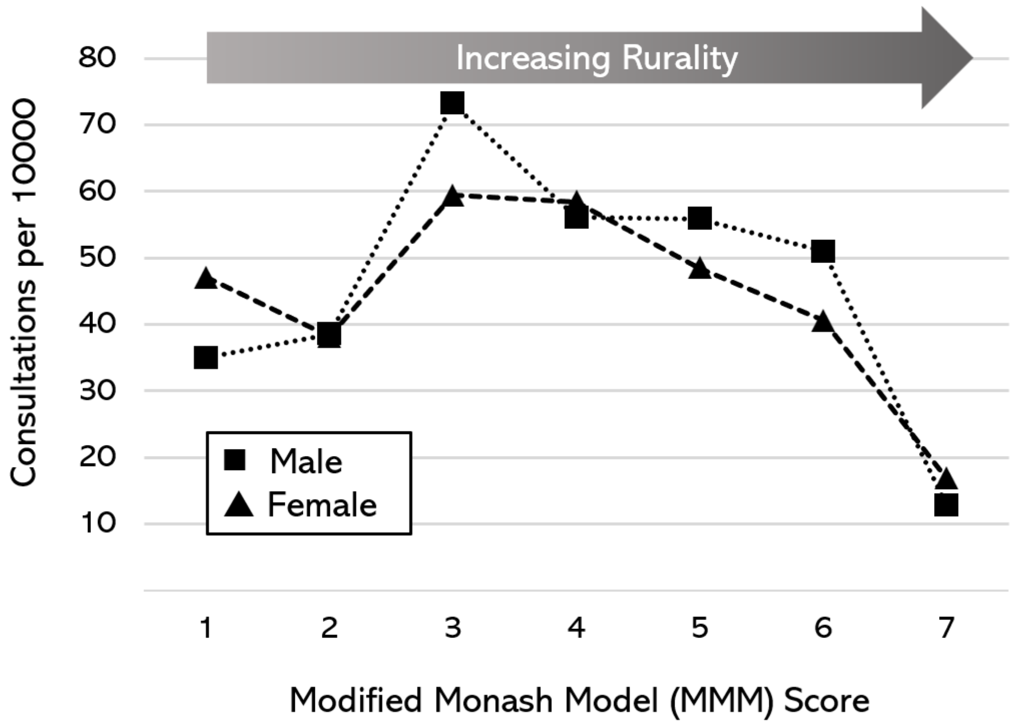

Figure 2.10 Rate of consultation (consultations per 10000) for Australians aged less than 20 years, by gender, according to rurality.

2.6.3.2 Surgical consultations for adults

When the rate of consultation with surgeons was considered for adult patients, the findings contrasted with those of young patients. As anticipated, the rate of surgical consultations was higher for older adults (50 to 79 years) than for younger adults (20-49 years) across all surgical groups. **Tables 2.2** and **2.3** show the slope estimates from the segmented regression, showing the strength of association changes across socioeconomic deciles. For general surgery, decreasing SES was associated with increased rates of surgical consultation (**Figure 2.11**). The association did not hold for ENT (**Figure 2.12**) and orthopaedic surgery (**Figure 2.13**), but was present for all other surgeons as a combined group (**Figure 2.14**). Rurality, as it did in young Australians, was associated with rates of referral but, again, in an inverse-U configuration (**Figure 2.15**).

Surgical referral per 10000		Estimate	S.E.	t score	P value
General surgery	Before 3.3 decile	117.83	15.94	7.39	<0.005*
	After 3.3 decile	36.8	7.9	4.66	0.63
Ear, nose and Throat	Before 7.8 decile	24.5	2.99	8.19	0.85
	After 7.8 decile	23.7	4.86	4.88	0.03*
Orthopaedic	Before 3.1 decile	40.8	4.76	8.57	0.13
	After 3.1 decile	44.1	10.44	4.22	0.15
Other combined	Before 3.2 decile	116.7	15.8	7.39	<0.005*
	After 3.2 decile	43.4	9.34	4.65	0.44

Table 2.2 Estimates of effect, standard errors (S.E.), t statistic scores and P values for surgical referrals per 10000 Australians aged 20-49 years (young group) against the socioeconomic deciles from segmented regression. The statistical significant effect is marked with * at 5% significance level.

Surgical referral per 10000		Estimate	S.E.	t score	P value
General surgery	Before 3.3 decile	253.5	37.19	6.82	<0.005*
	After 3.3 decile	168.7	39.2	4.3	0.31
Ear, nose and Throat	Before 7.8 decile	51.6	5.62	9.18	0.048*
	After 7.8 decile	54.7	11.18	4.89	0.06
Orthopaedic	Before 3.1 decile	81.8	9.06	9.03	0.99
	After 3.1 decile	144.9	33.7	4.3	0.17
Other combined	Before 3.2 decile	208.8	32.7	6.39	<0.005*
	After 3.2 decile	173	41.5	4.17	0.18

Table 2.3 Estimates of effect, standard errors (S.E.), t statistic scores and P values for surgical referrals per 10000 Australians aged 50-79 years (young group) against the socioeconomic deciles from segmented regression. The statistical significant effect is marked with * at 5% significance level.

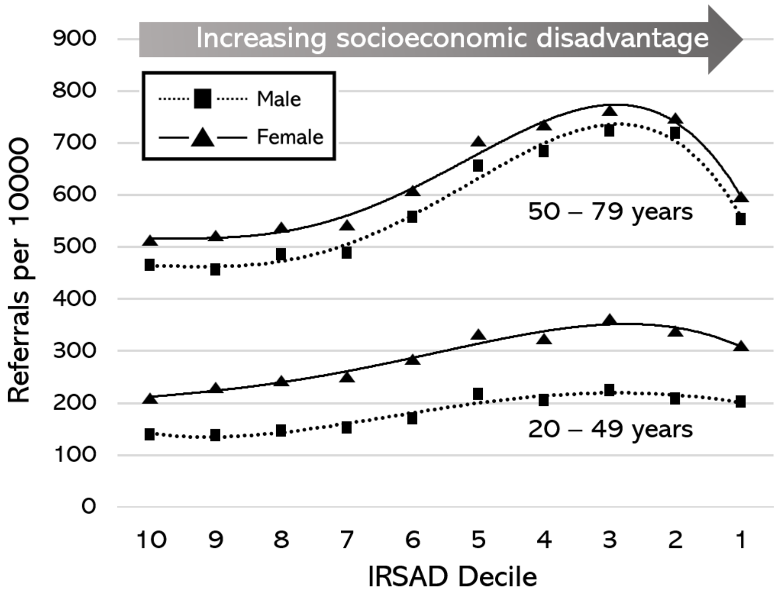

Figure 2.11. Rate of first consultation (consultations per 10000) with **a general surgeon** in Australia during the calendar year 2019 for male (■) and female (▲) patients, age stratified (20 to 49 years inclusive, 50 to 79 years inclusive) according to IRSAD decile of residence.

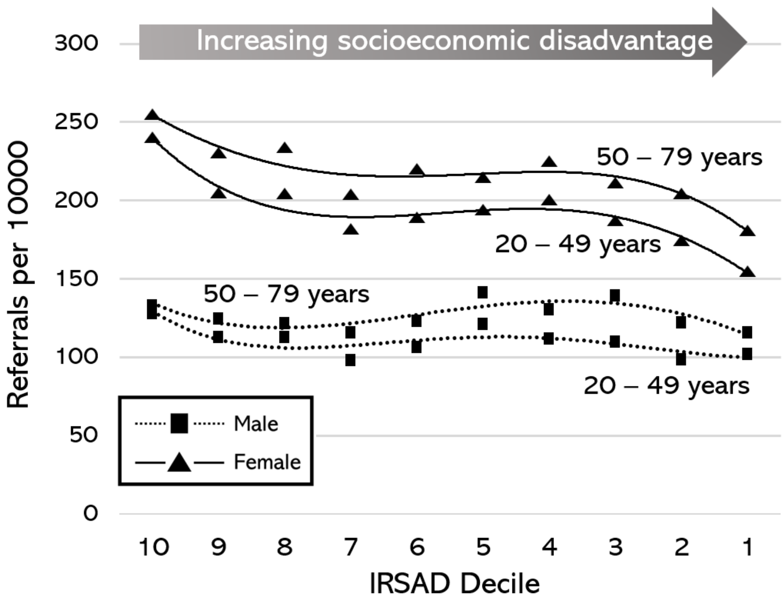

Figure 2.12. Rate of first consultation (consultations per 10000) with **an ear nose and throat surgeon (otorhinolaryngologist)** in Australia during the calendar year 2019 for male (■) and female (▲) patients, age stratified (20 to 49 years inclusive, 50 to 79 years inclusive) according to IRSAD decile of residence.

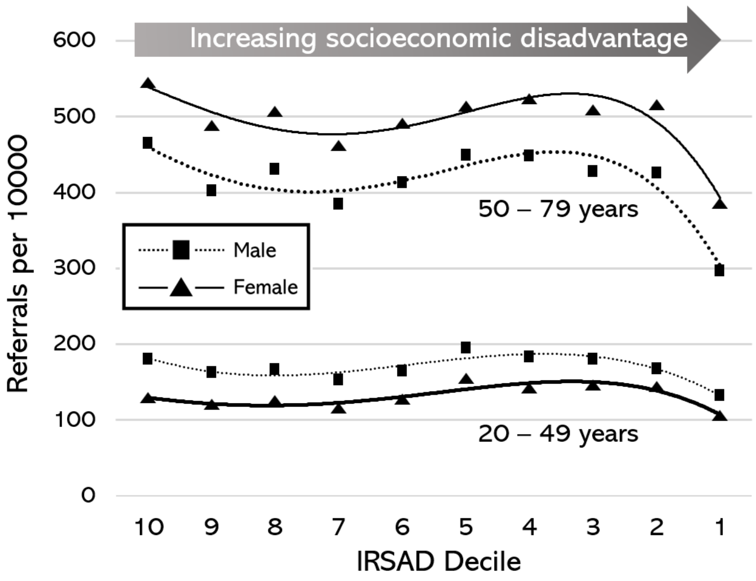

Figure 2.13. Rate of first consultation (consultations per 10000) with **an orthopaedic surgeon** in Australia during the calendar year 2019 for male (■) and female (▲) patients, age stratified (20 to 49 years inclusive, 50 to 79 years inclusive) according to IRSAD decile of residence.

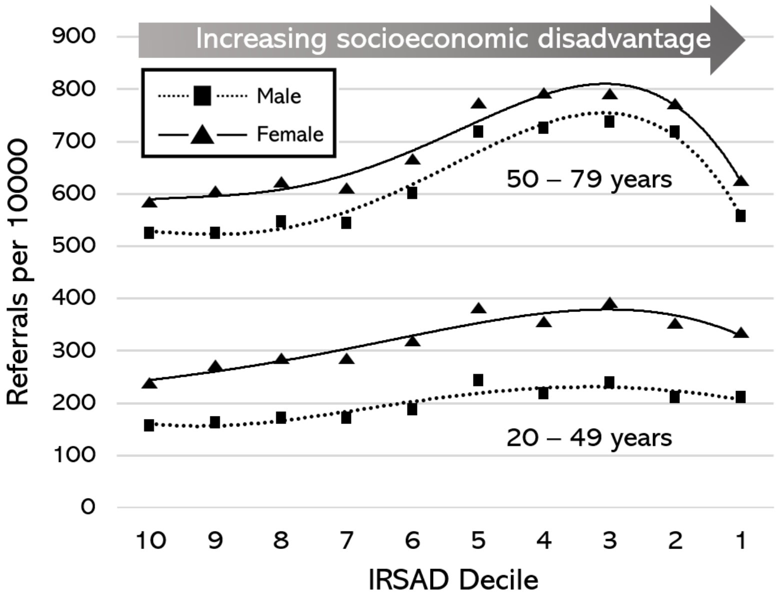

Figure 2.14. Rate of first consultation (consultations per 10000) with **another surgeon*** in Australia during the calendar year 2019 for male (■) and female (▲) patients, age stratified (20 to 49 years inclusive, 50 to 79 years inclusive) according to IRSAD decile of residence.

*Cardiothoracic, neurosurgery, plastic surgery, vascular surgery and 64axilla-facial surgery

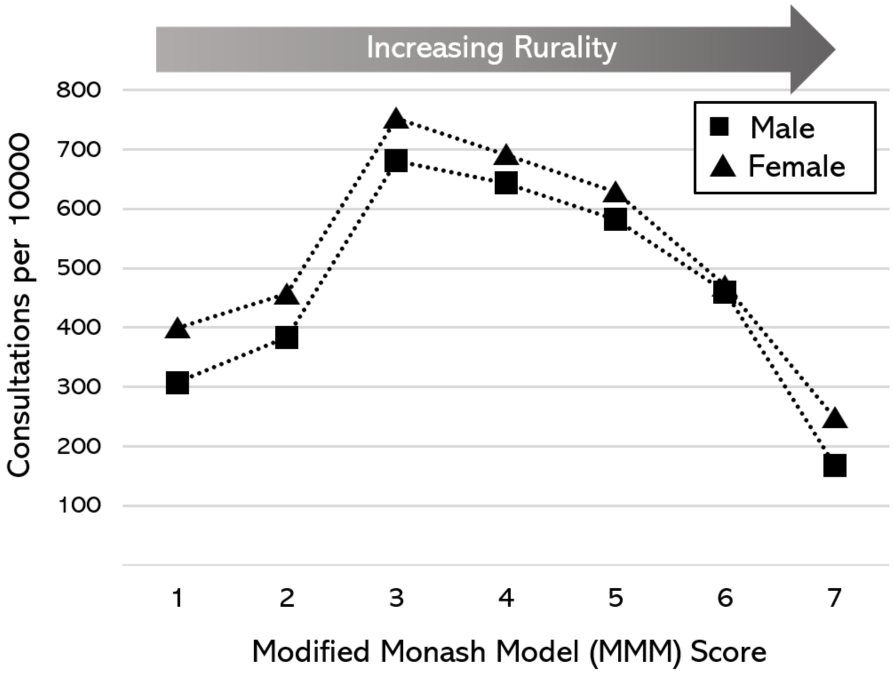

Figure 2.15 Rate of consultation (consultations per 10000) for Australians aged 20 years and older, by gender, according to rurality.

2.6.4 Discussion

Timely access to appropriate surgery is fundamental to healthcare and one of the consequences of the pandemic shock has been a severe constraint on access to surgery globally. To deal with the volume of patients now awaiting surgery, and to improve access moving forward, understanding of the factors affecting waiting list dynamics is important. While Australia has a universal health system there are important geographical and socio-demographic challenges for many Australians wishing to access to care. The studies described above have examined both socioeconomic and geographical factors and how they might influence access to planned surgical care in the pre-pandemic period at a national population level in Australia.

In the first instance children and adolescents were studied and, across all of the major surgical specialty groups, a substantial socioeconomic gradient in rates of consultation with a specialist surgeon was identified. The gradient was most pronounced for otorhinolaryngology (ear nose and throat surgery) and this has important implications for the long term health and development of children. One of the commonest procedures performed in this setting is drainage of chronic otitis media with effusions – myringotomy and placement of tympanostomy tubes. Indigenous Australian children are particularly prone to the condition and, according to the AIHW[21]:

> "Ear disease and associated hearing loss are significant health problems for Indigenous children, and also contribute to poor educational achievement, higher unemployment, and, as a consequence, greater contact with the criminal justice system later in life. Thus, preventing ear disease in Indigenous children is a high priority."

The data from this study, thus, are particularly concerning with geographical isolation and lower SES both negatively correlated with access to an ear, nose and throat surgeon. It is likely that other important childhood conditions with implications for adult health and development are affected by reduced access to surgical specialists.

With respect to adult Australians the findings of the study are of particular note. In the first instance, rurality of residence clearly played a major role in access to surgery. However, the relationship was not linear but unexpectedly showed an inverted-U curve. In areas with the greatest access to surgeons – metropolitan and large regional centres – the rates of consultation were markedly lower than more regional areas, with the exception of the most remote areas of

[21] Australian Institute of Health and Welfare (2014): Ear disease in Aboriginal and Torres Strait Islander Children. Accessible at: https://www.aihw.gov.au/reports/indigenous-australians/ear-disease-in-aboriginal-and-torres-strait-island/summary

Australia. There are two key potential explanations for this: either the burden of surgical morbidity is lower in larger centres, or there is a substitution of specialist care for primary (GP) care in non-urban areas. It is worth examining the evidence for both of these propositions.

In the first instance Phillips (2009) has documented a gradient in health status according to rurality, however there is little evidence to suggest this would translate to surgical need and the magnitude of differences would not explain the large differences found between MMM areas 1 and 2 compared to areas 3 to 6. Of potentially greater importance as an explanation is the interaction between primary care and referral for surgical care. There is a large and well-documented shortage of GPs in rural and remote areas in Australia. (Young *et al.,* 2019) It is possible that patients with potential surgical conditions might have higher rates of referral for surgical opinions because access to emergency care is a greater challenge and there is a high level of proactive practice and referral patterns. It has been estimated that while up to 33% of Australians live in rural or regional areas, only 14.8% of surgeons work in a rural or regional area. (Bappayya *et al.,* 2019) Thus, the finding of higher rates of consultation is counter-intuitive and suggests a strong underlying force or forces. Perhaps the most intuitive likely explanation is that a much more limited workforce of general practitioners with more restricted clinical support capacity promotes early referral to either local or, more likely, urban surgical specialists. (Shaddock & Smith, 2022)

With respect to SES in adults the data show that older Australians have higher levels of surgical referral, a finding that is unsurprising as age is closely related to individual burden of morbidity. However, the often inverse relationship between SES and rates of consultation with a surgeon contrast with the findings in young Australians. Two potential reasons for this finding are plausible. The first is that lower SES is associated with an increased burden of surgical conditions, the second that referral patterns by GPs differ with a higher rate of surgical referral for Australians of lower SES – or that patients of higher SES are less likely to accept a surgical referral.

With respect to the first proposition, there is evidence that patients of lower SES wait longer for planned surgery (Law *et al.*, 2022) and when they do undergo surgery, the rate of adverse outcomes they suffer tends to be higher. (Mehaffey et al., 2020) However the evidence that people with lower SES are more likely to have a condition requiring surgery is, at best, indirect. (Adler & Newman, 2002) Overall it seems likely that the burden of disease associated with lower SES in not incompatible with a greater need for surgery. (McMaughan *et al.*, 2020)

The second proposition – that patients of lower SES in Australia are more likely to receive a specialist referral from their GP – could result from the dynamics of general practice consultation in Australia. Low SES is associated with seeing a so-called "bulk billing GP" in the Australian health system, where the GP will accept the Medibank rebate for a consultation as full payment for the service. The practice of bulk billing by GPs has a much higher prevalence in lower socioeconomic areas – GP consultations in higher SES locations typically have an out-of-pocket ("gap payment") component. (Day *et al.*, 2005; Graham *et al.*, 2023) Consultations with a gap payment tend to be of longer duration and it is possible that the short consultations with a GP in a lower SES bulk-billing practice promote specialist referral due to time constraints where the GP takes less time to evaluation individual patients. (Hopkins & Speed, 2005) It would be a serious concern if funding models were providing an incentive for GPs to refer patients to surgeons and other specialists (where costs both to patients and to the health system overall are greater) due to time constraints associated with poor remuneration per unit of time.

Whatever the reasons for these findings, both are of fundamental importance to the Australian health system. If these results point to an embedded perverse incentive for high-throughput GPs to write specialist referrals rather than spend time on patient evaluation then this, potentially, has major implications for the operation of the health system. If a high-income country with a universal health system such as Australia has such a gradient in health status that it is reflected in the need for surgery then that surely represents a failure in preventive care. Concerns about the low prioritisation of preventive healthcare in Australia have already been expressed and the data from this study would further strengthen the case for a renewed focus on preventive care. (Putrik *et al.*, 2021)

CHAPTER 3

ADDITIONAL CONSIDERATIONS – “VALUE” IN SURGICAL PROCEDURES: SOCIOECONOMIC STATUS AND ACCESS TO SURGERY IN AUSTRALIA

> “The widespread occurrence of low value care helps explain why the carbon footprint of Australian healthcare is so large, representing almost half that of the entire construction sector (residential and non-residential).”
>
> - Barratt *et al.*, 2022

3.1 Chapter Introduction

In Australia each year more than two million surgical procedures are performed, across public and private hospitals.[22] Obviously not all of these procedures will provide equal benefit for patients, and there is a range of resources required to provide these procedures. This chapter will use data provided by the Australian Institute of Health and Welfare (AIHW) to examine the concept of ‘high’ and ‘low’ value surgical care, and how socioeconomic status (SES) affects access to the different types of surgery, using some key indicator procedures. In the first instance the concept of ‘value’ in health care in general, and surgery in particular, is examined. The study and its results are presented, then detailed discussion is provided as to the potential implications of the findings.

3.2 ‘High’ and ‘low’ value healthcare

It seems intuitive that the healthcare provided to patients should have ‘value.’ While a strict definition of *value* in healthcare would pertain to a ‘measured improvement in a patient’s health outcomes for the cost of achieving that improvement,’ the goal of ‘value-based’ in the health

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[22] Australian Institute of Health and Welfare (AIHW). Procedures data cubes. Accessible at: https://www.aihw.gov.au/reports/hospitals/procedures-data-cubes/contents/summary

economic literature is not cost reduction *per se* but the improvement of health outcomes as part of the value proposition. (Teisberg, Wallace & O'Hara, 2020) As an extension of this the assessment of value in healthcare is related to, but separate from, considerations of 'quality' which often presents a focus on inputs and process compliance and is not necessarily to improvement in health outcomes. Value also goes beyond systems and processes ensuring compliance with the evidence base in care – 'the goal of value-based healthcare is better health outcomes.' (Porter, 2010) Through improvements in health outcomes, it is theorised, will result reductions in spending and a decrease in the need for ongoing care. Teisberg and colleagues (2020) explain thus: "By improving patients' health outcomes, value-based healthcare reduces the compounding complexity and disease progression that drive the need for more care. A patient whose diabetes does not progress to kidney failure, blindness, and neuropathy is, over time, dramatically less expensive to care for than a patient whose condition continually worsens. Value-based healthcare is a path to achieving the aspirational goals of the 'triple aim'—improving the patient experience of care, improving the health of populations, and reducing the per capita cost of healthcare."

The extension of the concept of value in healthcare – that of 'low-value' care – has been defined, broadly, as "services that provide no benefit to patients or can even cause harm." (de Vries *et al.*, 2016) The usual definition used in the Australian healthcare setting is: "Use of an intervention where evidence suggests it confers no or very little benefit on patients, or risk of harm exceeds likely benefit, or, more broadly, the added costs of the intervention do not provide proportional added benefits." (Scott & Duckett, 2015) Reducing the use of low-value care would thus be expected to contribute to cost containment and increases in efficiency in healthcare, with resulting reductions in expenditure that should not harm health outcomes. Such reductions, in turn, would be expected to stimulate the reallocation of resources to 'high-value' services. The concept that the identification and elimination of low-value healthcare has led to international initiatives such as the Choosing Wisely (CW) campaign in the US and similar initiatives in Australia, the UK, Canada and European countries. (Levinson *et al.*, 2015) The CW campaign involves specialty societies generating lists of recommendations that are to be discussed in the doctor's office, as for example, 'don't order diagnostic tests at regular intervals (such as every day), but rather in response to specific clinical questions' Ideally, these lists of recommendations would meet the overarching CW criteria:

- That the services identified fall within the specialty's purview.
- That each of the services is frequently used or costly.
- That each of the recommendations identified is based on sufficient evidence.
- That the process for developing the recommendation list is documented and is publicly available for scrutiny.

The recommendations generated in response to the CW campaigns aim to increase awareness among both doctors and patients and, as a result, subsequently influence the decision whether, or not, to use a specific treatment or course of care. (de Vries *et al.*, 2016)

While research regarding the quality and cost of care has been performed for decades, a very specific emphasis on value is more recent. Researchers now seek to understand barriers and enablers of high value care and have hypothesised that a wide range of factors – including financial incentives, health system structures, geographical factors, population demographics, medical education of doctors and other healthcare workers, and patient involvement – all contribute to healthcare value. (Landon, Padikkala & Horwitz, 2022) Each of these factors must be optimised to facilitate high-value care: as a consequence a substantial amount of work has been done so as to identify and decrease the utilisation of low-value services. For obvious reasons, then, reducing the use of low-value care and promoting instead the uptake of high-value care requires a thorough understanding of the factors driving care uptake at multiple levels, including system-level factors (such as healthcare policies and remuneration systems), hospital-level factors (such as treatment protocols and guidelines), doctor- or practice-level factors (patterns of practice), and patient-level factors (health literacy).

While CW and other initiatives that aim to address quality, harms, and benefits in healthcare continue, questions are raised regarding the definition of low-value care. It is important to ensure that the perspective brought to the paradigm of value-based healthcare is broad enough to encompass not only immediate health outcomes and underlying expenditures on care, but other factors. Over what time frame are the outcomes being considered? Are costs or resources being shifted, for example from health service to patients or other payers? Are patient expectations and perspectives being taken into account? More broadly, does achieving high-value care require more than simply eliminating low-value services? (Landon, Padikkala & Horwitz, 2021) There are potential risks in the misidentification of low-value care that include the underuse of clinically indicated services or treatments, incorrect patient selection, and even damage to the doctor-patient relationship. Major knowledge gaps remain in realm of value-based healthcare promotion, not least of which include the methodologies that underpin and ensure that identification of low-value treatments is robust and rigorous. (Baker *et al.,* 2013)

3.3 Healthcare value in surgery

While the CW campaign has had strong support in high-income countries, and what is considered as 'modest' success – with over 600 low-value services identified – most of the care identified as low-value involves imaging and laboratory tests with some non-surgical treatments. (Rosenberg *et al.*, 2015) However, only about one in 20 recommendations associated with CW and similar initiatives related to surgical procedures. (Antunez, Telem & Dossett, 2019) While it might seem logical that avoiding surgical procedures that impart little or no gain for patients – and that carry potential risk – it has been shown that de-implementation of such care is not always easily achievable. (Rosenberg *et al.*, 2015) A well-recognised example of this phenomenon is the use of knee arthroscopy in cases of uncomplicated osteoarthritis, meniscal injury, and knee pain. The continued use of knee arthroscopy in these clinical situations occurs despite a number of high-quality studies having shown no benefit. (Howard, 2018) Indeed, the use of knee arthroscopy is so well recognised as a marker of potential low value care that the Australian Commission on Safety and Quality in Healthcare (ACSQHC) publishes an online 'atlas' of variation in the procedure.[23] Low value care also carries a potential for individual harm. In a study from Australian public hospitals, the use of low value procedures was associated with adverse outcomes beyond those of associated burden, discomfort, and cost. (Badgery-Parker *et al.*, 2019) The authors concluded that:

> "Further research should also consider the consequences for the healthcare system of providing low-value care, including the financial costs of both the low-value care and

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[23] Australian Commission on Safety and Quality in Healthcare (ACSQHC). *Atlas of Clinical Variation*. Knee arthroscopy hospital admissions 55 years and over. Accessible at: https://www.safetyandquality.gov.au/sites/default/files/migrated/SAQ201_04_Chapter3_v6_FILM_tagged_merged_3-1.pdf

> any subsequent admissions and issues such as waiting lists being lengthened by including patients who are not expected to benefit. Finally, more work must be done to measure harm resulting from low-value care to the degree it affects patients financially, psychologically, and psychosocially."

The reasons for the persistence of low-value surgical procedures (virtually all of which are considerably more expensive and resource-intensive than many other tests and treatments identified by the CW and related initiatives) are likely to be multiple and multilevel. These include supply-side drivers such as individual surgeons' habits and training, the well-recognised financial drivers of supplier-induced demand, 'overtreatment' related to concerns about litigation, and industry influences. There also are likely to be demand-side drivers related to information asymmetries and patient perceptions. (Berlin *et al.*, 2020)

An important contributor to the uptake of low-value surgery is the pathway through which surgical procedures are introduced into practice. New medications and therapeutics undergo efficacy-based scrutiny prior to clinical use and, in universal health systems like those in Australia, before government subsidy or other funding is approved. These types of processes are surprisingly uncommon for surgical procedures: new operations are often subject to early adoption and entrenched practice before their efficacy or value is known. Further, surgeons may be reluctant to accept emerging evidence of limited efficacy or value in favour of their anecdotal personal experiences with the procedure. (Berlin *et al.*, 2020) An example of this is provided by the rapid uptake of robotic surgical procedures. The number of operations performed with the assistance of surgical robots has increased rapidly despite very limited evidence of the superiority of outcomes over traditional and less-expensive existing alternative operations. (Sheetz & Dimick, 2019)

The reasons that surgeons – of which I, admittedly, am one – are resistant to changing practice in the face of evidence are complex. One important factor lies in the interpretation of clinical trials and studies. When a drug or other treatment is studied, the outcomes are attributable to the medication in question. However, when surgery is studies, there is a professional perception that the surgeon as an individual, and their performance, is the key driver of outcomes. There is a well-understood tendency among surgeons to overestimate their own abilities compared to those of colleagues. This is compounded by the fact that performance, itself, is difficult to measure objectively and may change from day to day, something that does not occur with medications or other independent treatments. Thus, surgeons commonly believe that an operation they are familiar with and feel comfortable performing leads to better outcomes 'in their hands.' (Kruger, 1999)

Another well recognised barrier to de-implementation of low-value surgery is fee-for-service payment arrangements. Such arrangements tend to provide an incentive for surgeons to operate without a clear requirement for value. This is in contrast to case-based funding arrangements, where the complexity of the patient's situation drives reimbursement and there is no specific incentive to, for example, prescribe a drug or other treatment except to facilitate effective management of the patient. Berlin and colleagues (2020) point out that, "a surgeon seeing a patient with an asymptomatic inguinal hernia is financially incentivised to offer surgical repair in favour of a watch-and-wait strategy. While de-implementation of low-value surgery may have secondary effects of increasing access for higher value surgery or reducing surgeon burnout, in our current payment system they are generally perceived as negatively impacting the bottom line of surgeons and hospitals."

While there are recognised strategies for de-implementation of non-surgical treatments and services – pharmacy restrictions for medications, or decision-support tools to facilitate imaging requests – few strategies have been implemented to guide surgical practice. As Berlin and colleagues (2020) conclude, “the ability of … strategies to reduce the use of low-value surgery is simply unknown.” Adding to this is the phenomenon in competitive healthcare markets, such as Australia, of ‘surgeon shopping’ by patients demanding a low-value procedure. (Sansone & Sansone, 2012) As Berlin and colleagues (2020) point out, “to design and employ effective strategies for de-implementation of low-value surgery, we must first understand the factors influencing its utilization.” In view of the work described in Chapter 2 of this dissertation, we set out to determine whether SES might be a driver of the uptake of low-value surgery. Specifically, we now aimed to test the hypothesis that: “patients of higher SES are more likely to undergo low-value surgical procedures,” since they would be expected to have greater resources for ‘surgeon-shopping’ and capacity to pay for private care.

The use of low-value surgical procedures has a number of important potential consequences for surgical waiting lists. (Malik *et al.*, 2018) In the first instance, the presence of patients awaiting low-value operations and procedures will increase the size of waiting lists and, thus, reduce access for patients awaiting high-value care. Secondly, resources used for performing low-value operations will be introduce competition for the same resources that could be used for high-value surgery. Thirdly, complications and adverse outcomes resulting from low-value procedures will further require use of resources that could otherwise be used for high-value care. In particular, those complications and adverse outcomes that require further surgery will compete for operating time that could be devoted to high-value care. For all of these reasons, with hospitals and healthcare facilities dealing with high levels of demand resulting from pandemic restrictions, information about the impact of low-value care on access to healthcare is more important than ever to allow processes to occur prioritising care for patients who are in a queue for surgery.

For this study, the aim was to test the hypothesis that: **That adult Australians of low SES are less likely to undergo low value surgery**. To select representative surgical procedures to allow the hypothesis to be tested, reference was made to the paper of Chalmers and colleagues (2019) who undertook an extensive literature survey and analysis to identify 21 low-value surgical operations performed in Australian public hospitals. The full list and rationale for selection of these procedures is accessible at: bmjopen-2018-024142supp001.pdf From this evidence-based list were selected two commonly performed low value procedures (knee arthroscopy in men and women; abdominal hysterectomy for women aged less than 50 years) and two high commonly performed high value procedures (cholecystectomy in men and women; inguinal hernia repair in men).

3.4 Data sources

The AIHW curates a dataset of every admitted patient procedure performed in any Australian hospital or day surgery centre. These data are tagged with demographic information about the patient that includes age of the patient and, based on the residential address, each patient's SEIFA quintile as a marker of their SES.[24] A data request was put to the AIHW asking for total numbers of Australians – whether in public or private surgical settings – who underwent the procedures in the last full pre-pandemic year (calendar year 2019) as follows:

[24] Australian Bureau of Statistics. Socio-Economic Indices for Areas (SEIFA): https://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa

High value procedures:

- Cholecystectomy for males and females aged 30 to 74 years.
- Inguinal hernia repair for males aged 30 to 74 years.

Low value procedures:

- Knee arthroscopy for males and females aged 25 to 74 years.
- Abdominal hysterectomy for females aged 30 to 54 years.

To provide age-stratified population denominators, data were obtained from the Australian Bureau of Statistics (ABS) showing point estimates in each SEIFA quintile in Australia by gender and year of age. These were used to calculate incidence rates for the procedures (procedures performed in the year per 1000 of population, age stratified).

3.5 Results

3.5.1 High value surgery

In the first instance the high value surgical procedures were considered. Unexpectedly, the incidence rates for cholecystectomy in adults showed a strong negative socioeconomic gradient across both genders with higher SES associated with lower rates of surgery (**Figure 3.1**). A similar finding was observed with inguinal hernia repair, a procedure overwhelmingly performed for males (**Figure 3.2**).

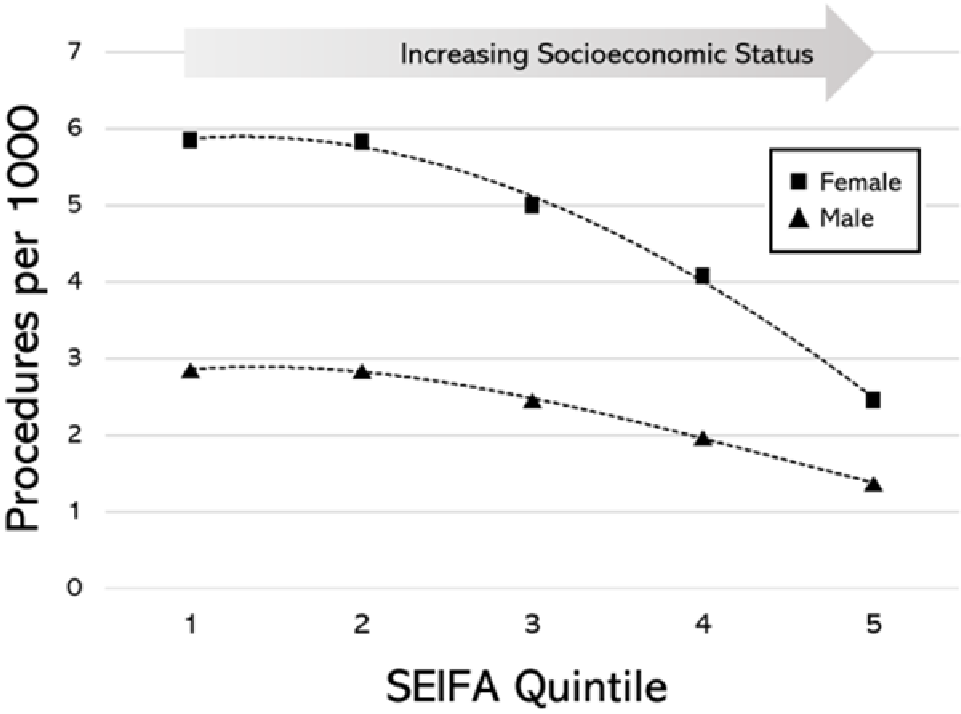

Figure 3.1 Incidence rates (procedures per 1000, age stratified) of cholecystectomy for males and females aged 30 to 74 years in Australia, 2018-19.

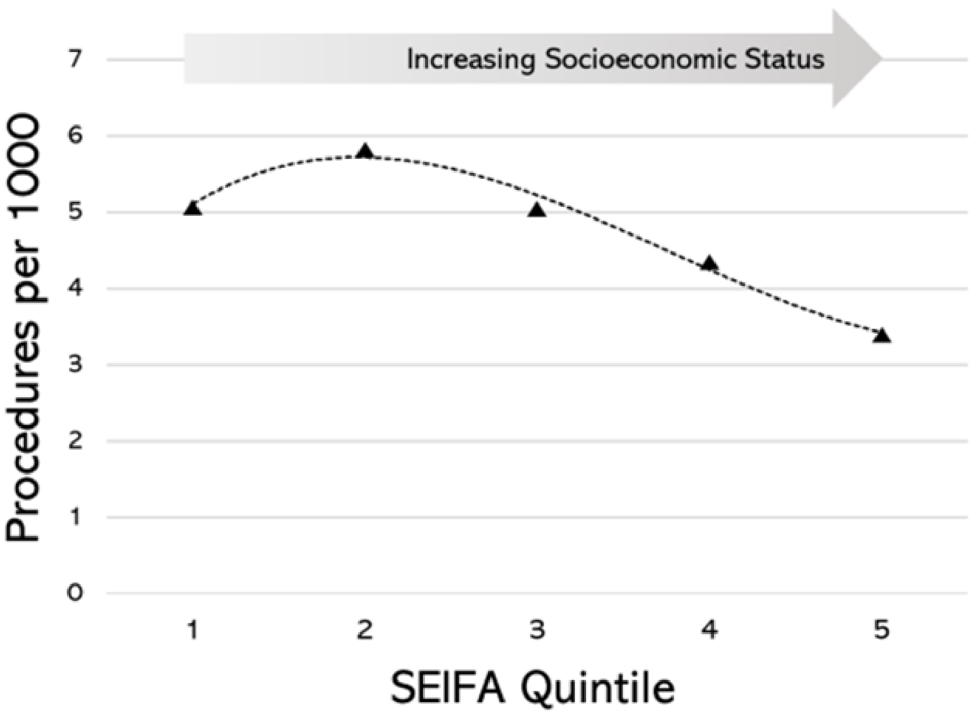

Figure 3.2 Incidence rates (procedures per 1000, age stratified) of inguinal hernia repair in males ages 30 to 74 years in Australia, 2018-19.

3.5.2 Low value surgery

Low value surgical procedures then were considered. Again, the data showed a negative SES gradient in both procedures and in both genders, with a reduction in the incidence rate of procedures in both procedures and across genders for knee arthroscopy (**Figure 3.3**) and abdominal hysterectomy in pre-menopausal women (**Figure 3.4**).

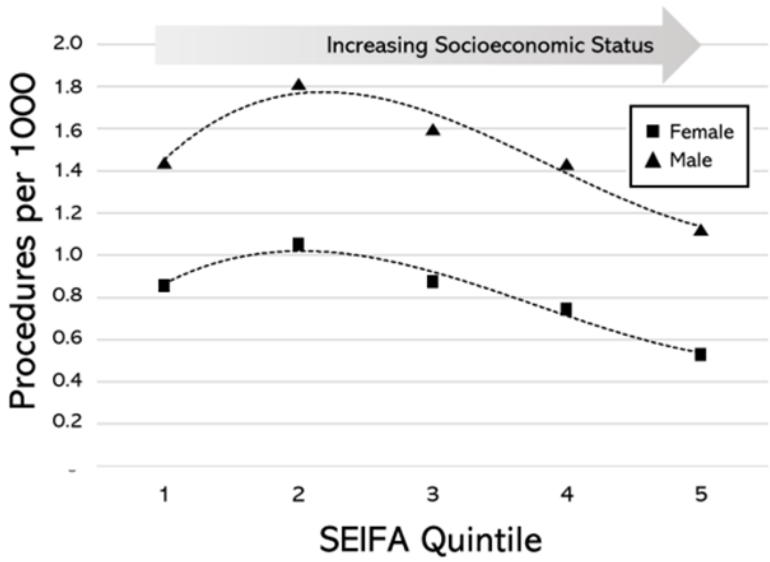

Figure 3.3 Incidence rates (procedures per 1000, age stratified) of knee arthroscopy males and females aged 25 to 74 years in Australia, 2018-19.

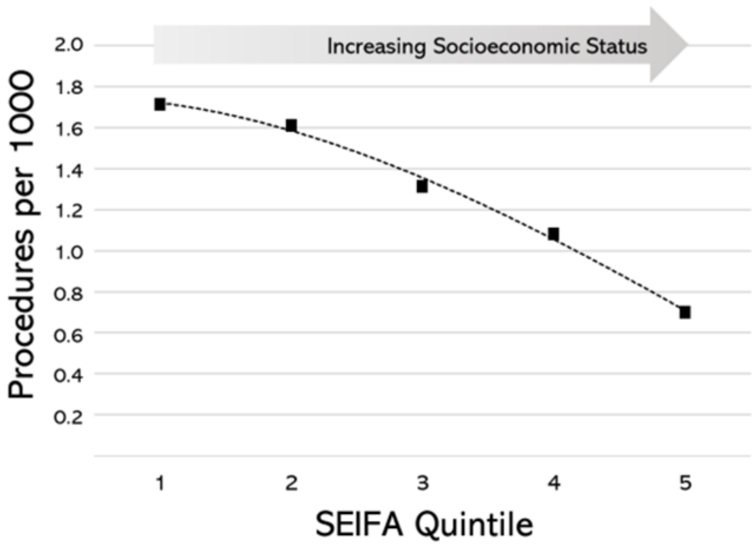

Figure 3.4 Incidence rates (procedures per 1000, age stratified) of abdominal hysterectomy for females aged 30 to 54 years in Australia, 2018-19.

3.6 Discussion

This study has revealed an unexpected and somewhat counter-intuitive finding: that both for high-volume representative high- and low-value surgical procedures, the socioeconomic gradient is negative and strong. The higher the SES, the lower the rate of the procedures performed at a national level, prior to the pandemic. The underlying assumption – supported by systematic reviews (see: Lueckmann *et al.,* 2021) – is that SES is related to a patient's access to resources and ability to afford a surgical procedure, and access to a surgeon and surgical facilities, whether through private health insurance or through a capacity to afford the time necessary for the procedure and recovery from a procedure. However, at a national population level in Australia, the opposite was found for these common indicator procedures.

There are a number of implications arising from these findings. In the first instance, the negative relationship held both for high- and low-value surgery: this would suggest that information asymmetry played a role in surgical choice. Information asymmetry between health consumers (patients) and suppliers (in this case, surgeons and the GPs who provide surgical referrals) is a well-recognised market failure in healthcare. (Campbell *et al.,* 2018) As information sources have become more readily available it might be anticipated that some of the supply-side information weighting and potential supplier-induced demand would be diminished. (Seyedin *et al.,* 2021) However, there now is strong evidence that increased availability of health information – even in high-income countries – does not translate to high levels of population health literacy. An excellent example is provided by a recent study from Denmark that reported a high prevalence of 'inadequate health literacy' that was 'strongly associated with a low socioeconomic status.' (Svendsen *et al.,* 2020)

While it is likely that Australians at socioeconomic disadvantage have differing levels of surgical morbidity it seems much less likely that conditions such as gallstones or inguinal hernia have a distribution of prevalences that would explain such a gradient in the surgery required to treat them. A more plausible explanation for these findings is that patients with 'borderline' symptoms were more likely to undergo surgery if they had lower levels of health literacy, reflecting their increased vulnerability to information asymmetry and supplier-induced demand and influencing their decision-making about care. (Schwesinger & Diehl,1996) Another potential explanation for the observed gradient in hernia surgery rates might reflect the individual patients' personal circumstances: while a minimally-symptomatic inguinal hernia might not be an issue for a person with a professional and less physically-demanding occupation, patients at socioeconomic disadvantage could be more likely to have a physically-demanding occupation for which an inguinal hernia would have a more adverse effect. (Fujishiro, Xu & Gong, 2010) In their systematic review of the evidence, Svendson and colleagues (2013) found no evidence that occupation was related to hernia prevalence.

The findings of this study have important implications for healthcare resourcing and waiting list management. In the current situation, where historically high volumes of patients are waiting for planned surgery that has been delayed by the pandemic, the identification of patients who have been placed on waiting lists for common but 'low value' surgery and who have borderline levels of morbidity could help reduce demand. While dealing with this once a patient has been placed on a waiting list for surgery is likely to be difficult, putting in place mechanisms where low-value procedures are flagged and require additional patient counselling or, perhaps for selected procedures, a requirement for a 'second opinion' could prove valuable.

CHAPTER 4

ESTIMATING EFFECTS – THE COVID-19 PANDEMIC ON ACCESS TO PLANNED SURGERY IN AUSTRALIAN PUBLIC HOSPITALS

> "Elective surgery waiting lists have long been a sensitive political issue. Reducing the increased backlog and waiting times caused by COVID-19 pandemic-related restrictions on elective surgery will be a major health priority during the next three to five years."
>
> - Aitken & Watters, 2022

4.1 Chapter introduction

It is well recognised that the COVID-19 pandemic has had a profound effect on healthcare systems globally, and on the performance of planned surgical procedures in particular. In many high-income countries like Australia, the pandemic-associated disruptions to planned surgery have left unprecedented number of patients on surgical waiting lists. To manage the demand for surgery moving forward, it is important to have a clear understanding of *how* surgery was affected. Australia's network of public hospitals ranges from large tertiary surgical hospitals located in the major cities, to small regional and rural hospitals. Developing a clear understanding of the effects on planned surgery thus requires a detailed analysis of effects at all of these levels. Further, there are surgical procedures across the different specialties – ranging from sight-saving surgery such as cataract extraction, to movement-enhancing surgery such as hip and knee replacement – that involve different groups of patients and different groups of surgeons. Any analysis of the effects of the pandemic will need to take into account the effects of how long patients waited for these procedures, the likely effect on their quality of life (QoL), and what groups of hospitals were most affected. To add to the complexity of such an analysis there was no national approach to pandemic mitigations: different Australian states used different public health approaches at different times, with differing effects.

This chapter uses a comprehensive and richly-detailed Australian national dataset of surgical procedures provided by the Australian Institute of Health and Welfare (AIHW) in an attempt to provide an analysis of the pandemic and its effects, and draw lessons applicable to moving forward in the aftermath of the pandemic.

4.2 Planned surgery in Australian public hospitals prior to the pandemic

In the Australian health system, the majority of planned (elective) surgery is performed in private hospitals and day procedure centres, either private for-profit (PFP) or private not-for-profit (PNFP), the latter typically faith-based hospitals such as those of Catholic Health Australia.[25] Collectively, private hospitals are represented by Australian Private Hospitals Association (APHA)[26] which undertakes advocacy activity for the private hospital sector. According to the Australian Institute of Health and Welfare (AIHW) annual report, during the final pre-pandemic year 2018-19 a total of $16.3 billion was spent on private hospitals, of which $11.6 billion (71%) was funded by the non-government sector including private health insurance providers ($8.2 billion, 50%), the Australian Federal Government ($3.8 billion, 23%), Australian state and territory governments ($1.0 billion, 6%) with the remainder by individuals ($2.2 billion, 13%) and non-government organisations ($1.2 billion, 7.6%).[27] The report shows

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[25] Catholic Health Australia. See website: https://cha.org.au/

[26] Australian Private Hospitals Association. See website: https://apha.org.au/

[27]Australian Institute of Health and Welfare (AIHW). *Australia's Hospitals at a Glance 2018-19*. Accessible at: https://www.aihw.gov.au/getmedia/c14c8e7f-70a3-4b00-918c-1f56d0bd9414/aihw-hse-247.pdf

that over the same year a total of 1.6 million surgical procedures were performed in private hospitals compared to 1.1 million in Australian public hospitals. To facilitate care in private hospitals the Australia Federal Government has a series of cash incentives and tax rebates designed to encourage individuals and families to take out private health insurance. These are driven by three policy tools:

A. *The Private Health Insurance Incentives (PHII) Act 1998* which introduced a 30% private health insurance rebate (PHIR). The rebate for persons aged 65 – 69 years increases to 35% and for those aged 70 years and older is 40%.

B. The Medicare Levy Surcharge introduced in 1997 that represents a tax penalty of 1% of taxable income payable by single individuals with taxable incomes in excess of $70000 annually (or $140000 for couples) if they do not hold private health insurance.

C. Lifetime Health Cover introduced in 2000 which represents an age penalty (a yearly increase of 2%) imposed on individuals who first purchased private health insurance after age 30 years. By enrolling early and maintaining membership, individuals thus will pay lower premiums that those who delayed obtaining private health insurance.

The introduction of these policy tools has been associated with increased take up of private health insurance in Australia, although the economic effects have long been debated. (Bilgrami *et al.*, 2021) For these reasons, the public hospital system in Australia performs the minority of planned surgical procedures. However, there is evidence that the procedures performed in

Australia's public hospitals are of higher complexity and that the patients treated have a greater burden of co-morbidity. (Schmueli & Savage, 2014)

One of the key performance indicators of Australia's public hospitals has been waiting lists. Data releases regarding waiting times for surgical care typically receive a great deal of media attention and draw commentary from peak health bodies such as the Australian Medical Association (AMA).[28] While Bradfield (2008) notes that health service performance indicators are essential to ensure that quality and access are not compromised by cost controls, he cautions that they tend to "engender defensiveness… which may compromise quality." The risk he points out is that "ill-considered [policy responses] to rapidly reduce waiting list length can lead to people with equal need having unequal access to surgery because easier and shorter operations are scheduled first. Patients left remaining are usually the most complicated cases that have already waited the longest." He concludes that, "waiting lists can never represent definitive judgements about the quality or safety of health services because that is not their primary purpose. Instead, they are tools to prompt and guide additional inquiry and investigation. This must be recognised by politicians, patients, health professionals and policymakers."

Public concern and commentary regarding surgical waiting lists is hardly unique to Australia. Canadian surgeon Dr Jeffrey Barkun (2002) made similar comments about his own health system:

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[28] Australian Medical Assocation (AMA). *Public Hospital Report Card*. Accessible at: https://www.ama.com.au/clear-the-hospital-logjam/phrc

> "Surgical waiting lists are seen by many as epitomising the short-comings of our public healthcare system. Yet, they can also be interpreted as being the result of a societal compromise between the founders' promise of universal access to care and the reality of currently committed resources. Regardless of one's perception, the debate about the "appropriate length" of surgical waiting lists has, arguable, become a fixture of everyday Canadian life."

The above statements seem mild compared to the almost existential concern expressed in a pre-pandemic editorial regarding the NHS in the journal *Lancet Oncology*[29]:

> "Just over 75 years have passed since Sir William Beveridge published his report outlining the parameters for a social welfare state for the UK, which crucially included 'comprehensive health and rehabilitation services for prevention and cure of disease.' Beveridge's report inspired Labour Minister of Health Aneurin Bevan to establish the National Health Service (NHS). Although the vision of Beveridge and Bevan—to provide free, adequate, and equally accessible healthcare for all—remains in high regard today, the execution and delivery of their goal is currently falling short… In response to the provision in the 2017 autumn budget, NHS England issued a damning statement — it would have to ignore waiting time limits … which would breach the NHS constitution. In response, Health Secretary Jeremy Hunt insisted that the NHS adhere to waiting time limits. This response is unhelpful and does not address the broader picture of ongoing system-wide failures."

[29] *The Lancet Oncology*. The NHS: failing to deliver on Beveridge's promise? Lancet Oncol. 2018 Jan;19(1):1.

4.2 The pandemic and disruptions to planned surgery in Australia – an overview

Australia has a mixed public and private hospital system. Australian data are released by the AIHW in financial years - from July to June – and in the last pre-pandemic year a total of 2 300 628 elective surgical procedures were performed across all of Australia's hospitals. Of those procedures, 1 523 000 operations were performed in private hospitals (66%) compared to 778 000 in public hospitals over 2018-19. The Australian Productivity Commission (PC) has identified the duration of waiting times for elective surgery as one of the indicators of government performance (**Figure 4.1**). For this reason, data regarding the number of elective operations performed, number of patients on surgical waiting lists, and duration of waiting times for indicator procedures are collected and published by the AIHW. As has occurred globally, the pandemic has had an adverse effect on these procedures across Australia.

Interruptions to elective surgery – and the resulting backlog of patient waiting for care – have been the subject of enormous public interest. A typical news item in response to the release of AIHW data, reflecting the lay media narrative, reads as follows:

> "Thousands of Australians are suffering pain and discomfort as they wait for elective surgery delayed by the pandemic, with new data showing the number of patients waiting more than a year has nearly tripled.
>
> "The Australian Institute of Health and Welfare's elective surgery report, to be published on Tuesday, shows 7.6 per cent of public patients – about 57,300 – waited more than 365 days for their operation in 2020-21, up from 19,264 or 2.8 per cent the previous year.

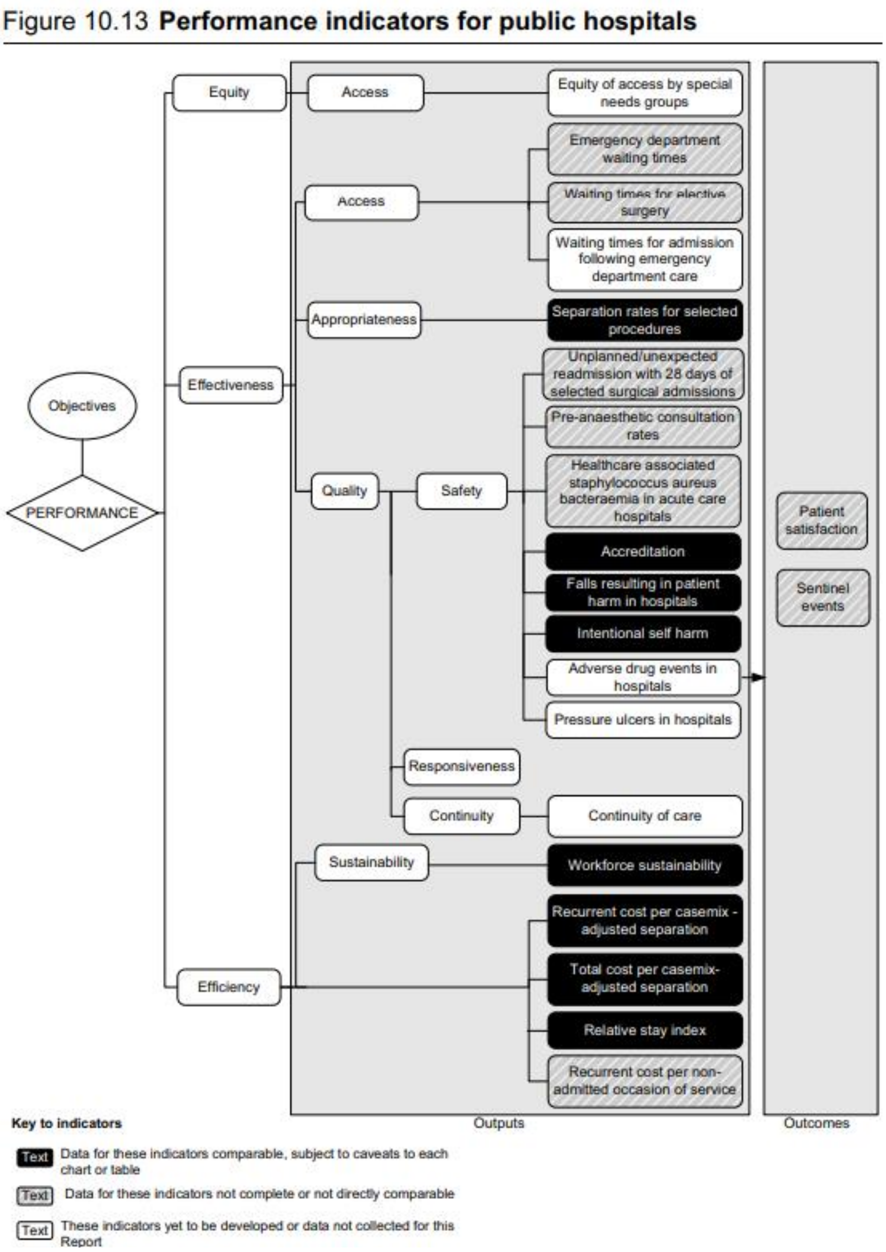

Figure 4.1 The Australian Productive Commission table of key performance indicators of Australian Public Hospitals.[30]

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[30] Australian Productivity Commission: *Report on Government Services*. Accessible at: https://www.pc.gov.au/ongoing/report-on-government-services/2020/health/public-hospitals

> "The large increase came despite efforts to tackle the waitlists that blew out in the first wave of the pandemic, with the total number of surgeries up 10 per cent in 2020-21, and could blow out further after NSW and Victoria both imposed elective surgery restrictions again during the Omicron wave."[31]

The issue of dealing with pandemic-associated elective surgery backlogs similarly has been a high priority in the Australian medical literature.

> "Elective surgery waiting lists have long been a sensitive political issue. Reducing the increased backlog and waiting times caused by … pandemic-related restrictions on elective surgery will be a major health priority during the next three to five years." (Watters & Aitken, 2022)

In the first phase of the pandemic, in the absence of effective treatments or vaccines, strict prevention and control methods were required to minimise community spread. It became obvious early that COVID-19 had the potential to overrun the capacity of healthcare systems since a significant number of infected patients required hospitalisation and critical care. In response to these risks the Australian Government Department of Health enacted health management plans to support an integrated and co-ordinated response and ensure the appropriate allocation of resources. During the early phases of preparation and actions, there was a focus on ensuring healthcare services were organised to manage increased demand,

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[31] Sydney Morning Herald. Number of patients waiting over a year for surgery has almost tripled. Published January 25th, 2022. Accessible at: https://www.smh.com.au/politics/federal/number-of-patients-waiting-over-a-year-for-surgery-has-almost-tripled-20220124-p59qqh.html

particularly for scarce resources such as intensive care, and to protect healthcare workers from infection: these contingencies required priority-setting, rationing, and triage. (Babidge *et al.*, 2020) In response, and at the combined urging of the Royal Australasian College of Surgeons (RACS), the Australian and New Zealand College of Anaesthetists (ANZCA), the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), and the Royal Australian and New Zealand College of Ophthalmologists (RANZCO), the Australian Government issued initial directives regarding elective surgery. The advice was to either postpone surgery or, for those that could not wait, redirect it from public to private providers, if necessary, due to a potential lack of capacity in the public healthcare system. The intention of these directives was to protect surgical teams and patients from infection, and to preserve medical supplies and vital equipment needed for the anticipated surge in COVID-19 patients requiring high-acuity care. RACS and the specialty surgical societies produced guidelines to dispel uncertainty around patient and procedure classifications and support decision-making for the postponement of surgery. (Babidge *et al.*, 2020)

In Australia's largest state, New South Wales (NSW), local triage processes allowed performance rates of urgent procedures to remain relatively stable with small surges in the months after slowdowns and suspensions. (Watson *et al.*, 2022) There was general state-wide consensus to prioritise surgery for category one patients and those assigned to category two but who were at risk of significant deterioration. General restrictions on surgery for patients waitlisted in categories two and three saw the evolving size of waiting lists impacted both by pandemic-related changes in activity, and also in the rate at which new patients are added. Watson and colleagues (2022) have proposed multiple potential reasons for this reduction in waiting list additions, including altered clinical decision-making (e.g., hesitancy to add patients to the list), changed clinical work practices (e.g., reduced hours due to furlough or safety concerns), disruption of general practice referral patterns (e.g., primary care network focus on vaccination or reduced surgical outpatient volume due to COVID safe practices), changes in patients' healthcare seeking behaviours (e.g., increased fear of accessing care due to high community prevalence of COVID-19) and general pandemic public policy consequences (e.g. stay at home orders). Almost identical patterns of change were noted in Australia's other two major states, Victoria (Watters, Brown & Hardidge, 2020) and Queensland. (Fowler *et al.*, 2021) Across the country, major changes in the way surgical care was delivered were taken up, including remote modalities for assessment such as telehealth. (Smith *et al.,* 2021)

From the outset there was the concern that a rigid adherence to restrictions in elective cases may create the unintended consequence of a surge in surgery following the first wave of COVID-19, potentially overwhelming and compromising healthcare across the country. Fisher and colleagues (2020) have described these early processes as follows:

> "In the setting of the COVID-19 pandemic, and despite the best efforts and intentions of those involved in the decision-making processes, it became necessary to determine how many non-COVID patients requiring general medical, surgical and ICU management have not been able to access care, due to social distancing rules, reduction in services and closure of clinics or outpatient medical practices. Of particular note are those patients whose surgery mandates post-operative care in the intensive care environment, who by virtue of the COVID-19 pandemic restrictions endured delays in treatment as ICU beds were reserved. Examples include patients requiring urgent coronary artery bypass surgery or those with a 'window of opportunity' for cancer resection after neoadjuvant therapy. Given that space and ventilators in ICU are a finite resource, it [did] not seem unreasonable to discuss the relative outcomes of patients

> requiring these resources in a time of scarcity, indeed we would argue that it is necessary."

Particular concerns were expressed for disciplines with a need for perioperative critical care resources, in particular cardiothoracic surgery. Wynne and Smith (2021) have documented the Australian situation, in comparison to other countries, as follows:

> "There were unprecedented multidisciplinary changes in health service delivery in response to the influx of COVID positive patients requiring hospitalisation and critical care. Scaled staff redeployment for medical and nursing teams was a key feature of strategies to accommodate surge demand for ICU beds and potential increases in urgent cases as a consequence of the cardiopulmonary sequelae of COVID-19. Fortunately, the Australian experience was in stark contrast to that of our international counterparts. Our initial lockdown in 2020 was relatively short-lived and, until recently, there had been relatively low numbers of COVID-19 cases. [There was] no change in surgical acuity and an overall reduction of only 21% in total caseload when 2020 cases during the 4-month period were compared to those in 2019 at their COVID-19 nominated centre."

Audits of the case load in vascular surgery noted a reduction in planned surgical procedures but an associated increase in emergency procedures. (Cai, Fisher & Loa, 2021) In addition, increased rates of potentially preventable adverse perioperative outcomes – including amputation – were noted, particularly in older, frail patients. (Aitken *et al.*, 2022) Rates of organ transplantation were affected with a documented negative effect on kidney and other organ transplants. (Chadban *et al.*, 2020) At the other end of the urgency scale, eye surgery was impacted heavily with the likely result of an increase in falls due to eyesight compromise. (Huang-Lung *et al.,* 2022) Importantly, surgery for malignant disease – in which often there is a short window of opportunity associated with improvements in mortality outcome – were negatively affected by surgical access restrictions. For example, Kirk and colleagues (2023) reported that restrictions were associated with a significant increase in pathological upstaging – with a flow-on effect on mortality risk - with the greatest effect immediately after the introduction of COVID-restrictions. Similarly, Williams and colleagues (2021) reported that pandemic restrictions had "measurably negative effects on the diagnosis and management of colorectal cancer" despite the fact that Australia, at least in the initial phases of the pandemic, had relatively low numbers of cases. They expressed concern that, "the long-term effects on survival and recurrence are yet to be known but could be significant."

In addition to the direct effects that pandemic-associated surgical access barriers had on patient care, complications, and prognosis, there were additional important long-term system effects. The training of medical students – the next generation of potential surgeons, anaesthetists and critical-care specialists – was severely impacted. (Savage, Jain & Ng, 2020) The lack of elective surgery, in particular, affected the procedural experience of surgical trainees who require a large volume of cases to develop mastery of their craft. (Grills *et al.,* 2022) At a human level, McBride and colleagues (2020) described how:

> "The disruption caused by COVID-19 extends to having a detrimental impact on the well-being of surgical staff at all levels and across all disciplines. This includes widespread distress and heightened anxiety being felt for a range of personal and organisational related reasons. Larger surgical units, such as upper gastrointestinal and colorectal surgery, have subdivided medical staff into smaller and strictly isolated teams

> in order to reduce the risk of an entire department becoming unwell or requiring home isolation at once, which whilst prudent has been difficult on staff. Local efforts to boost staff morale and encourage solidarity are being made through numerous innovative activities and close monitoring of staff welfare will need to continue throughout the crisis."

It often goes unspoken how the well-being of staff affects clinical outcomes for patients (Robson & Cukierman, 2019) and how, in the longer term, this affects career choices and can have a substantial effect, in the long term, on the medical workforce available to staff our health systems and provide care. (Orr & Leider, 2023; Smallwood, Bismark & Willis, 2023)

4.3 Quantifying the effects of the pandemic on planned surgery in Australia

4.3.1 Data source

The aim of this study was to examine pandemic-associated effects on elective surgery in Australia from two perspectives: the number of cases undertaken (volume); and, the duration of waiting times for the surgery in Australian public hospitals. To do this, we obtained waiting list data from the AIHW online data portal.[32] The datasets are grouped by Australian financial year (1st July to 30th June) and available for most individual hospitals from financial year (FY) 2011-12 until the most recent release for FY21-22. For every public hospital in Australia data are available that are summarised in **Box 4.1**.

[32] The portal web address is: https://www.aihw.gov.au/reports-data/myhospitals/sectors/elective-surgery

Hospital Name and Location (State)

Peer Group Data

Hospital type: Small, Medium, Large, Major

Hospital Location: Metropolitan, Regional

Category of urgency (1, 2, 3)

Number of operations performed within urgency category

Median waiting time + Peer group median waiting time

Proportion (%) of operations performed within clinically-indicated waiting time

Peer group average waiting times

Specialty of surgeon

Key indicator procedures (eg, cholecystectomy)

Box 4.1 Data points available in AIHW Surgical Waiting List dataset

At the time of the pandemic Australia hds 259 public hospitals that provide elective surgery. An overview of the hospital types and performance of elective surgery by category of clinical urgency is provided in **Table 4.1**.

Hospital Type (*n*)		Category 1 2018-19	Category 1 2020-21	Category 1 △ (%)	Category 2 2018-19	Category 2 2020-21	Category 2 △ (%)	Category 3 2018-19	Category 3 2020-21	Category 3 △ (%)	Total △ (%)
Major	31	94724	102822	*+8.5*	99769	94257	*-5.5*	65428	61648	*-5.8*	+0.46
Large Metro	34	41458	50696	*+22.3*	62321	61268	*-1.7*	52335	52929	*+1.1*	-5.6
Medium Metro	28	20322	19271	*-5.2*	36666	32142	*-12.3*	29415	27925	*-5.1*	+8.2
Large Regional	26	28742	29905	*+4.0*	36760	35705	*-2.9*	35017	32832	*-6.2*	+2.1
Medium Regional	21	7458	8875	*+19.0*	12890	14164	*+10.8*	17199	16901	*-1.7*	-6.7
Small	100	6477	7805	*+20.5*	18077	18044	*-0.2*	28929	29195	*+0.9*	-2.9
Children's	6	2831	9184	*+21.9*	15917	15987	*+0.4*	12631	10945	*-13.3*	+22.1
Specialized	13	4140	5046	*+21.9*	7401	5685	*-23.2*	16814	11361	*-32.4*	-15.1

Table 4.1 Overview of Australian public hospital elective surgery performance in the pre-pandemic year (2018-19) and peak pandemic year (2020-21). Data are presented for each hospital type as total number of elective procedures performed (excludes emergency surgery) by category of urgency and change in surgical volume between the two time periods (△).

4.3.2 Assumptions

With over 750000 elective surgical procedures across multiple surgical disciplines performed in Australia's public hospitals in the year prior to the pandemic we assumed that a general equilibrium would be present if elective surgery was treated as a market. For that reason, we did not use an aggregated approach but modelled for each of the surgical disciplines. Development of regression models must be underpinned by robust assumptions. With respect modelling surgical capacity in the Australian public hospital system the key variables taken to influence system capacity were:

- Number of inpatient hospital beds (N_{beds})
- Emergency admissions competing for elective surgery operating time (N_{emerg})
- Potential leakage of surgical cases from public hospitals to private hospitals (N_{priv})
- Changes in treatment approach with potential abandonment or uptake of surgical procedures ($\triangle_{surg}$)
- Referral capacity of general practitioners (GPs) to consultant surgeons (N_{ref})
- Funding capacity of Australian state and territory governments (F_{cap})

Thus, a general function for surgical capacity would, then, have the overall form:

$$F(x) \sim N_{beds}, N_{emerg}, N_{priv}, \triangle_{surg}, N_{ref}, F_{cap}$$

4.3.2.1 Number of inpatient hospital beds

Data regarding the existing and projected numbers of Australian public hospital inpatient beds are published annually: AIHW data confirm that the inpatient bed capacity of Australian public hospitals had been stable at approximately 2.5 per 1000 of population since 2013.[33]

4.3.2.2 Emergency admissions competing for elective surgery operating time

The capacity of a public hospital to provide resources for planned surgery is related to competition for resources by emergency admissions of patients requiring unplanned surgery. A number of studies have confirmed a relationship between elasticity of supply of elective surgery with Australian public hospital emergency department activity (Johar & Savage, 2010; Stavrunova & Yerokhin, 2011; Johar, Jones & Savage,2013). AIHW data confirmed a steady rate of increase in emergency department activity since 2011.[34] These data are plotted below (**Figure 4.2**) and show strong linearity with both the linear and polynomial regressions of best fit having R^2 values of 0.98.

[33] AIHW. Australia's Hospitals web report: https://www.aihw.gov.au/getmedia/71d19036-8c1e-485d-9d93-6618780346ae/Australia-s-hospitals-at-a-glance.pdf?inline=true

[34] AIHW. Emergency Department Care: https://www.aihw.gov.au/reports-data/myhospitals/sectors/emergency-department-care

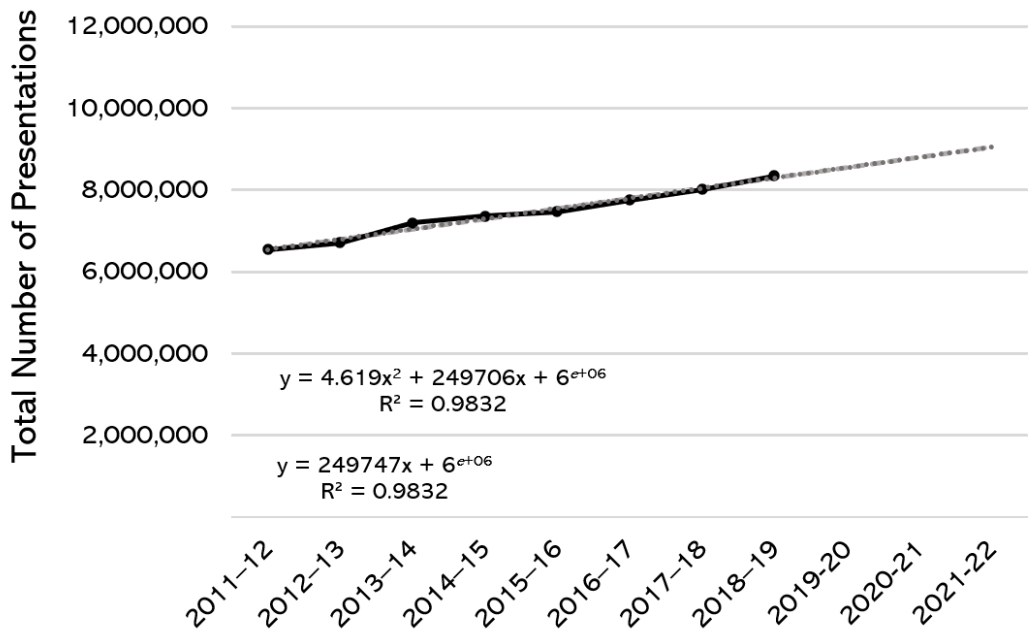

Figure 4.2 Total number of annual presentations to emergency departments in Australian public hospitals 2011-22.

4.3.2.3 Potential leakage of surgical cases from public hospitals to private hospitals

In Australia, 66% of all elective surgery procedures are undertaken in private hospitals, and this proportion is associated with the proportion of the Australian population holding private health insurance with hospital cover. Data released by the Australian Prudential Regulation Authority (APRA)[35] reveal that the number of Australians holding private health insurance with hospital cover has undergone non-linear change over the decade prior to the pandemic, with polynomial regressions consistent with both increases and decreases in uptake (**Figure 4.3**). However, if the five years preceding the pandemic are modelled separately (**Figure 4.4**) the regressions offer a sufficiently narrow confidence interval to assume fixed effects.

[35] Australian Prudential Regulation Authority (APRA): Quarterly private health insurance statistics. Accessible at: https://www.apra.gov.au/sites/default/files/2020-02/Quarterly%20private%20health%20insurance%20statistics%20December%202019.pdf

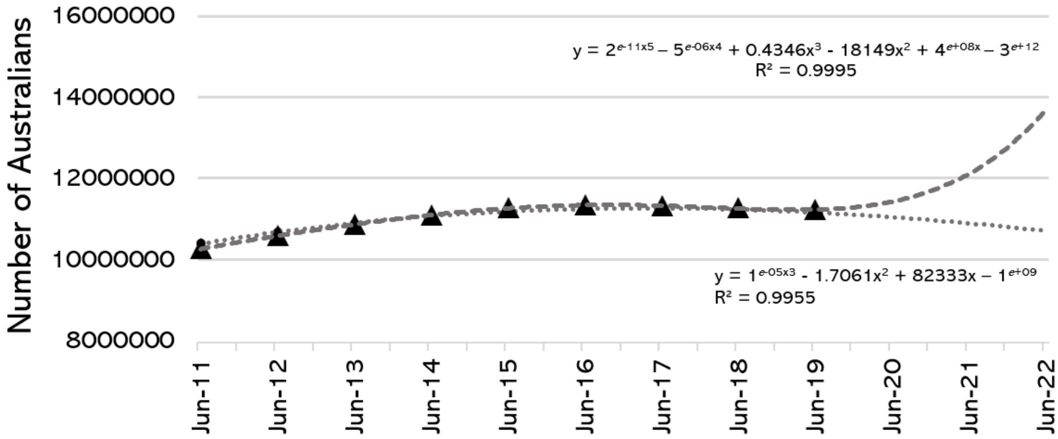

Figure 4.3 The number of Australians holding private health insurance with hospital cover during the pre-pandemic period 2011 to 2019, with polynomial regressions for the pandemic period.

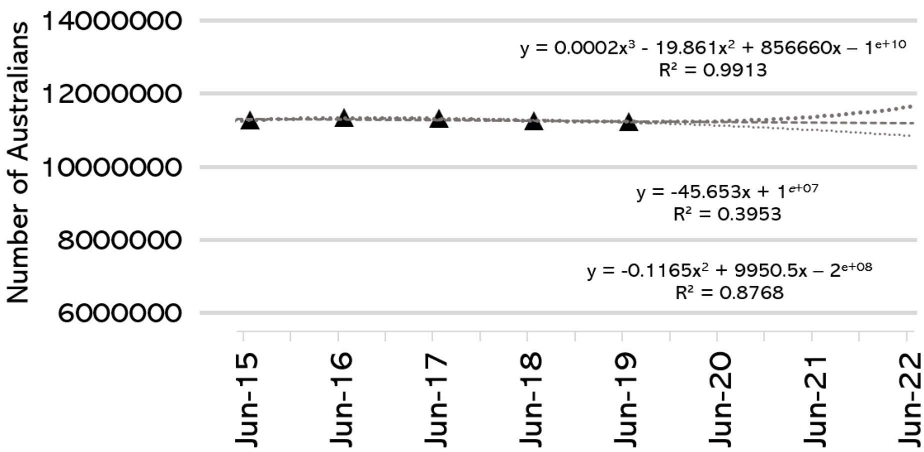

Figure 4.4 The number of Australians holding private health insurance with hospital cover limited to the immediate pre-pandemic period 2015 to 2019, with the linear and polynomial regressions for the pandemic period.

4.3.2.4 Changes in treatment approach with potential abandonment or uptake of surgical procedures

Change in clinical practice is a fundamental aspect of healthcare and relates to surgery just as it does to other aspects of healthcare. The dynamics of surgical practice are well recognised. In women's health, for example, there has been a trend to abandonment of larger operations such as hysterectomy. (Rawlings, Ding & Robson, 2017; de Cure & Robson, 2018) In contrast, surgery for cataracts is becoming more commonly performed in Australia. (Zhu *et al.*, 2022) For this reason each separate surgical discipline was treated as a separate and independent market and aggregation was not used for the estimations.

4.3.2.5 Referral capacity of GPs to consultant surgeons

In Australia, planned treatment by a specialist surgeon requires a valid referral from a GP as is the case in the UK. For this reason, access to GP consultations will be a variable to consider when predicting demand for surgery. Data were obtained from the Australian Bureau of Statistics regarding GP consultations over the study period.[36] These data are shown in **Figure 4.5**.

[36] Australian Bureau of Statistics (ABS): Patient Experiences. Accessible at: https://www.abs.gov.au/statistics/health/health-services/patient-experiences/latest-release#data-downloads

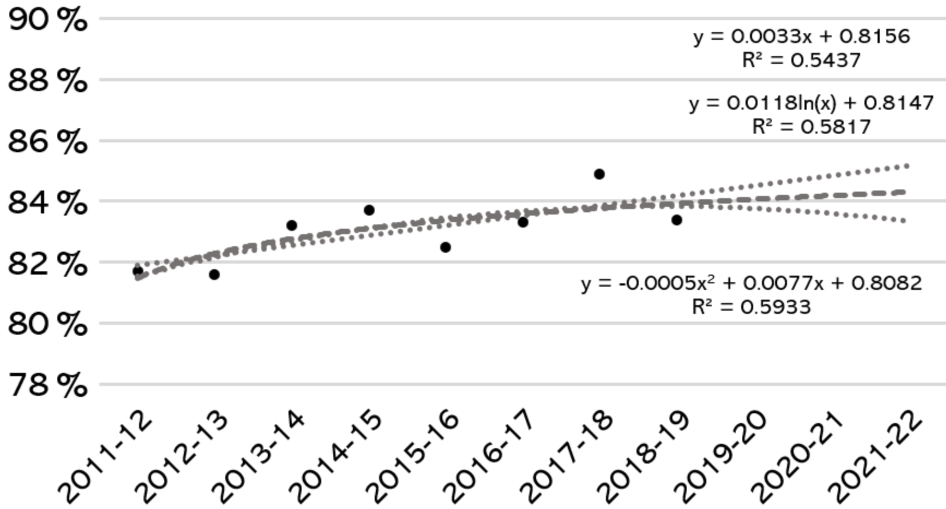

Figure 4.5 The proportion of Australians having one or more consultations with a GP each year over the pre-pandemic period 2011-2019 with projections for the pandemic period.

4.3.2.6 Funding capacity of Australian state and territory governments

In Australia, public hospitals are funded according to the National Health Agreement with a 45% Commonwealth contribution and 55% state or territory contribution. Expenditure data are available from the Australian Institute of Health and Welfare (AIHW).[37] The combined Commonwealth-State/Territory annual expenditure on public hospitals over the study period is shown in **Figure 4.6**: this includes recurrent and capital expenditure and is shown in both nominal and real terms (adjusted for inflation using the online *Reserve Bank of Australia inflation calculator*).[38]

[37] Australian Institute of Health and Welfare (AIHW): Health Expenditure Australia. Accessible at: https://www.aihw.gov.au/reports/health-welfare-expenditure/health-expenditure-australia-2020-21/data
[38] Reserve Bank of Australia: Inflation Calculator. Accessible at: https://www.rba.gov.au/calculator/

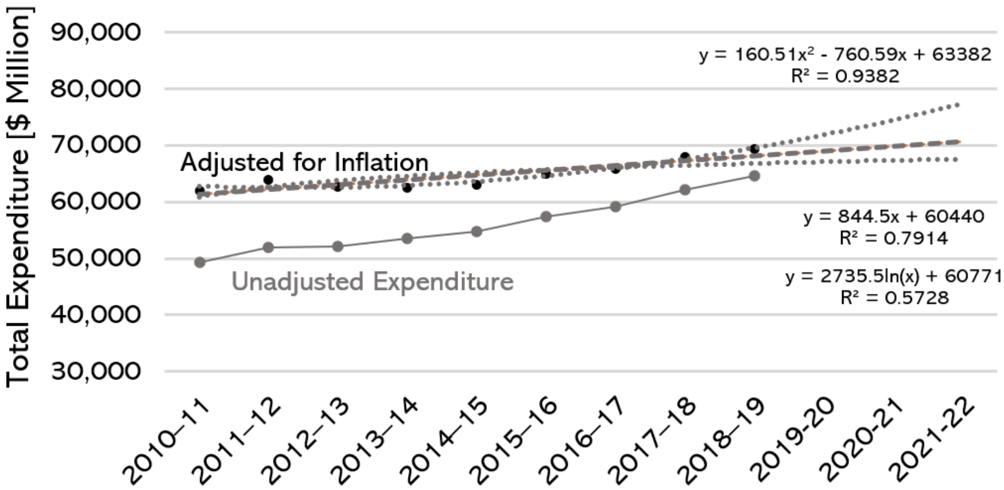

Figure 4.6 Annual combined expenditure (Commonwealth and State/Territory) on public hospitals in Australia during the pre-pandemic period 2011-2019, showing both nominal (unadjusted) expenditure and real (adjusted for inflation) expenditure, with projections covering the pandemic period.

4.3.3 Data: Volume of elective surgery performed in Australian public hospitals

In the first instance, the number of elective surgical cases performed in Australian public hospitals was determined for the period including the pandemic to 30th June, 2022. These data are presented according to the surgical specialty in **Figures 4.7** and **4.8**. These data show, as anticipated, reductions in the number of cases performed in the first year of the pandemic when pressures on the health system were greatest, followed by recovery, then a second fall in the final year for which data are available (2021-22),

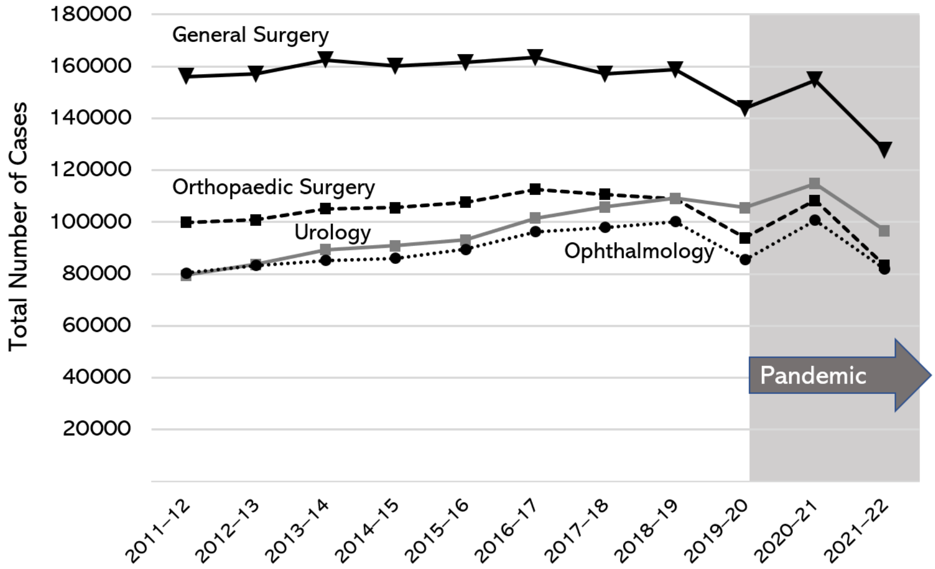

Figure 4.7 Total volume of planned (elective) surgery cases in Australian public hospitals by specialty of surgeon, 2011 to 2022 inclusive: highest volume specialties.

General surgery (—▼—), Orthopaedic surgery (- - ■ - -), Urology (—■—), Ophthalmology (···●···).

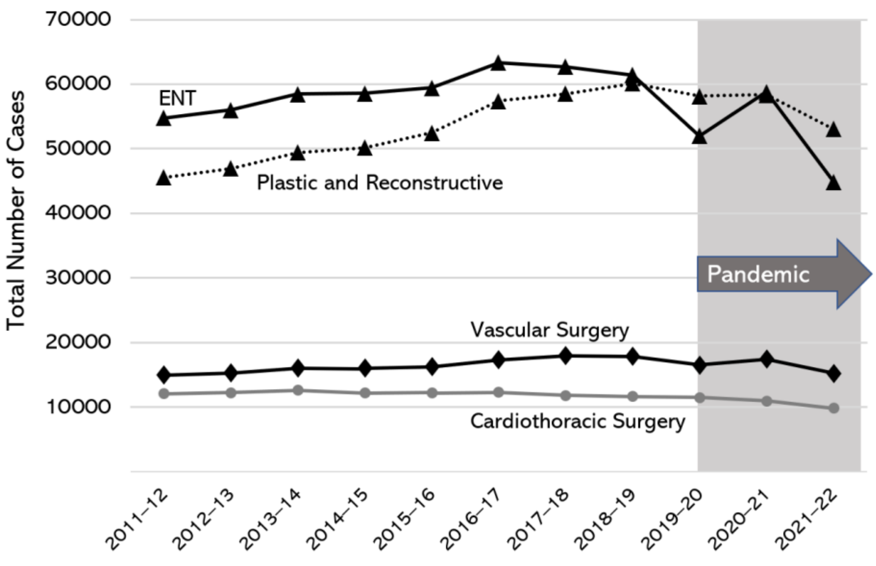

Figure 4.8 Total volume of planned (elective) surgery cases in Australian public hospitals by specialty of surgeon, 2011 to 2022 inclusive: lowest volume specialties.

Otorhinolaryngology (ENT) (—▲—), Vascular surgery (—♦—), Cardiothoracic surgery (—●—), and Plastic and reconstructive surgery (···▲···).

For each of the individual specialty groups, regressions were undertaken to estimate a range (low to high, 95% confidence) of surgical procedures that would have occurred had the observed trends for the eight year period covering financial years 2011-12 to 2018-19 continued without the pandemic shock. These results are shown in **Tables 4.2** and **4.3** and pooled estimates of the predicted range, compared with the observed figures, are presented in **Figure 4.9**. Using this approach the estimate of overall shortfall associated with the pandemic shock is a range of between 260375 and 412806 surgical cases across Australian public hospitals over the pandemic period to June 2022.

		Predicted range	Observed	Shortfall Range	Shortfall Totals
General surgery	2019-20	160773 – 162001	143778	16995 – 18223	
	2020-21	161040 – 172124	154677	6363 – 17447	
	2021-22	161307 – 194297	127733	33574 – 66564	**56932 – 102234**
Orthopaedic surgery	2019-20	109851 – 113856	93915	15936 – 19941	
	2020-21	108826 – 115503	108360	466 – 7143	
	2021-22	107266 – 117150	83198	24068 – 33952	**40570 – 61036**
Urology	2019-20	113274 – 115495	105556	7718 – 9903	
	2020-21	117523 – 121571	121571	2703 – 6717	
	2021-22	121772 – 128299	128299	25128 – 31655	**35349 – 48275**
Ophthalmology	2019-20	102271 – 103178	85475	16796 – 17703	
	2020-21	102710 – 106145	100653	2057 – 5492	
	2021-22	101488 – 109112	81904	19584 – 27208	**38437 – 50403**
					171288 – 261948

Table 4.2 Estimates of the shortfall in elective (planned) surgery in Australian public hospitals over the first three years of the pandemic for the four highest-volume surgical specialties.

		Predicted range	Observed	Shortfall Range	Shortfall Totals
Otorhinolaryngology (ENT)	2019-20	62390 – 64466	52025	10365 – 12441	
	2020-21	62145 – 65605	58776	3369 – 6829	
	2021-22	61747 – 66744	44894	16852 – 21850	**30586 – 41120**
Plastic and Reconstructive	2019-20	62535 – 63443	58151	4384 – 5292	
	2020-21	64746 – 66443	58350	6369 – 8093	
	2021-22	66957 – 69469	53067	13890 – 16402	**24643 – 29787**
Vascular Surgery	2019-20	18329 – 18512	16551	1778 – 1961	
	2020-21	18456 – 18961	17471	985 – 1490	
	2021-22	18399 – 19410	15252	3147 – 4158	**5910 – 7609**
Cardiothoracic Surgery	2019-20	11182 – 11817	11499	-317 – 318	
	2020-21	10508 – 11743	10993	-485 – 750	
	2021-22	9507 – 11669	9507	-327 – 1835	**-1129 – 2903**
					60010 – 81419

Table 4.3 Estimates of the shortfall in elective (planned) surgery in Australian public hospitals over the first three years of the pandemic for the four lower-volume surgical specialties.

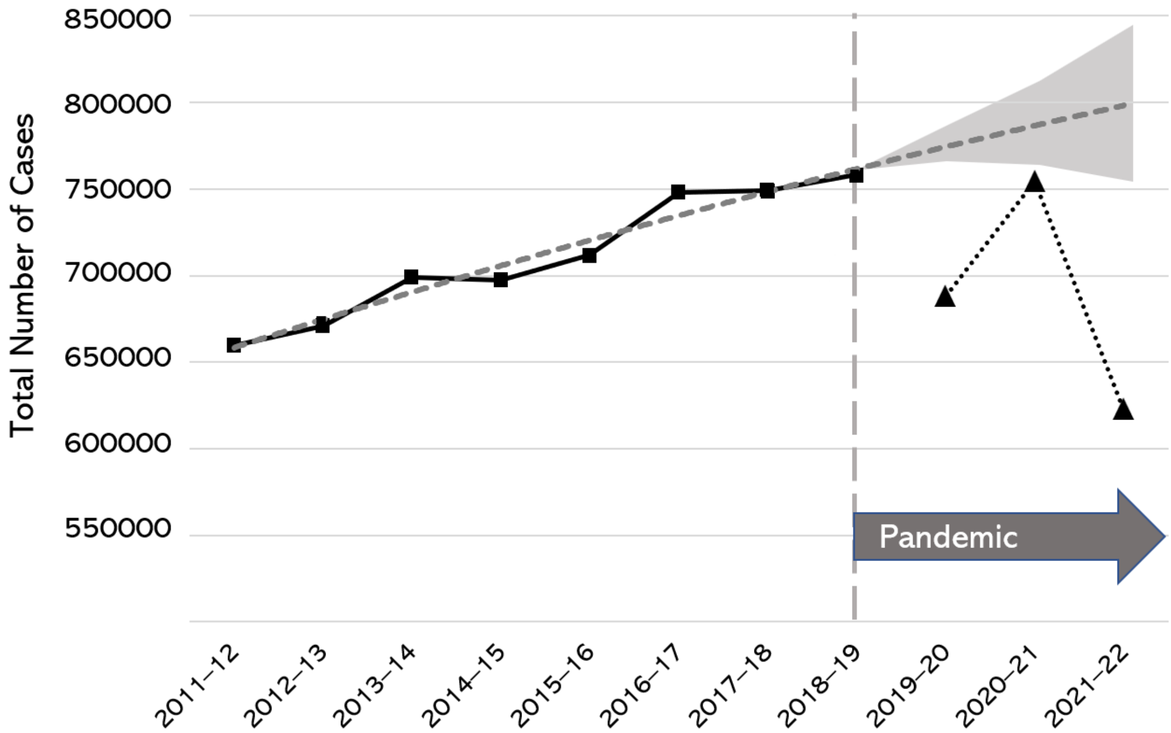

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Figure 4.9 Total number of elective surgical cases across all surgical specialties (including gynaecological surgery) in Australian public hospitals 2011 to 2022, showing predicted range of cases (shaded) and observed numbers (▲) during the pandemic period.

4.3.4 Waiting times for elective surgery in Australian public hospitals

While reductions in the total number of surgical cases performed as a result of pandemic restrictions were observed, so too were changes in the waiting times for elective surgery. Data from the AIHW waiting list dataset showing median waiting times were plotted by each of the eight major surgical subspecialty groups and are shown in **Figure 4.10**. While these, as expected, showed increases in the median waiting time across all surgical specialties, of particular note the waiting times had not returned to pre-pandemic levels for ophthalmology, otorhinolaryngology (ENT), and orthopaedic surgery. When data regarding the number of patients who waited longer than clinically recommended for elective surgery were examined

(**Figure 4.11**) increases occurred across all surgical specialties with, again, the greatest deteriorations in ophthalmology, ENT, and orthopaedic surgery. None of the surgical specialties showed a return to pre-pandemic levels by the end of 2021-22.

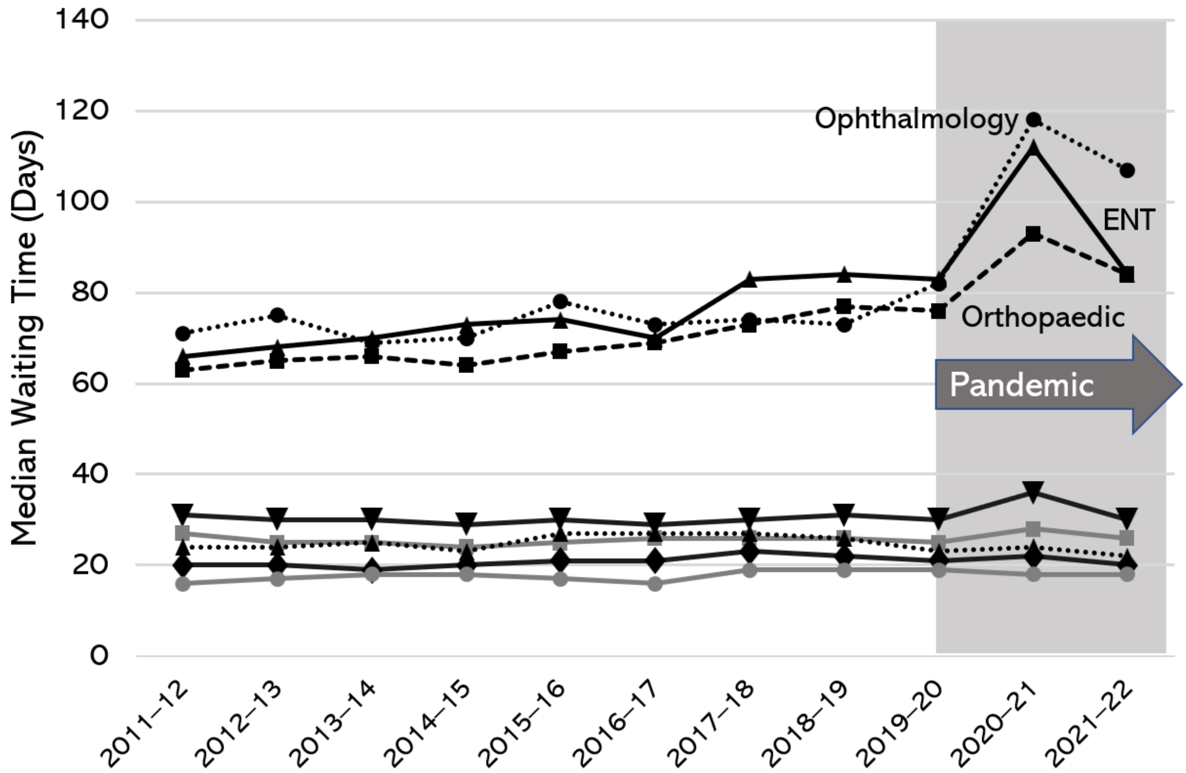

Figure 4.10 Median waiting times (days) for planned (elective) surgery in Australian public hospitals by specialty of surgeon, 2011 to 2022 inclusive.

General surgery (—▼—), Orthopaedic surgery (- - ■ - -), Urology (—■—), Ophthalmology (···●···), Otorhinolaryngology (ENT) (—▲—), Vascular surgery (—♦—), Cardiothoracic surgery (—●—), and Plastic and reconstructive surgery (···▲···).

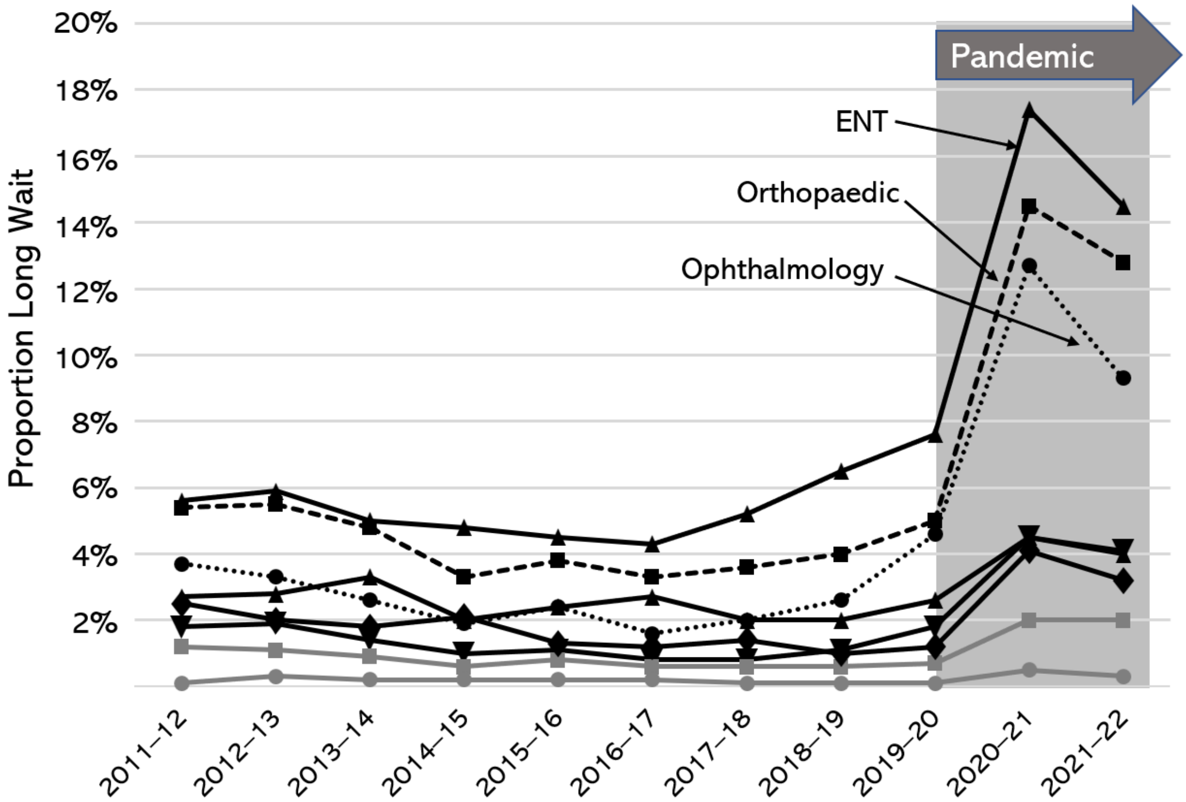

Figure 4.11 Proportion of patients (%) waiting longer than clinically indicated for planned (elective) surgery in Australian public hospitals by specialty of surgeon, 2011 to 2022 inclusive.

General surgery (—▼—), Orthopaedic surgery (- - ■ - -), Urology (—■—), Ophthalmology (···●···), Otorhinolaryngology (ENT) (—▲—), Vascular surgery (—♦—), Cardiothoracic surgery (—●—), and Plastic and reconstructive surgery (···▲···).

4.4 Pandemic effects on key indicator surgical procedures

The AIHW uses a number of key surgical procedures as 'indicator procedures' of surgical performance for Australian public hospitals.[39] Due to their prominence and relevance to benchmarking and performance, analysis is provided here of these indicator procedures.

4.4.1 Cholecystectomy

Cholecystectomy is removal of the gallbladder, and the major indication for the procedure is the presence of gallstones and associated biliary pain. Gallstones are common, with estimates suggesting that up to 15% of the adult population are affected. While, in most cases, gallstones cause no symptoms, about 20% of individuals with gallstones will eventually develop clinically significant symptoms. The most common symptom is pain, and this can be severe. Presentations to emergency departments and other healthcare facilities can be frequent and effects on affected patients' lives can be significant. The accepted management of symptomatic gallstones is laparoscopic cholecystectomy. (Ibrahim *et al.*, 2018)

One of the first instances in which consideration of the economic aspects of surgery was presented to a general surgical audience, rather than an health economic or administrative audience, was a paper published by John Brazier (a health economist) and Alan Johnson (a surgeon) in the *Lancet* in 2001. (Brazier and Johnson, 2001) The paper, titled 'Economics of surgery,' used the common example of cholecystectomy as the exemplar of such decision making. The paper began:

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[39] Australian Institute of Health and Welfare. Elective Surgery Data. Accessible at: https://www.aihw.gov.au/reports-data/myhospitals/sectors/elective-surgery

"The time has come to subject surgery to the same rigours of economic assessment that other healthcare sectors are already receiving – namely, the comparative assessment of costs and benefits. The surgical management of gallstones provides a good example of the role of economics in surgery. Gallstone disease is common and patients are usually referred to a surgeon, but the threshold for intervention is not agreed and varies widely, with considerable implications for resources. Gallstone removal has been subject to much innovation over the past ten years, yet economic assessment of laparoscopic and [open] cholecystectomy and of gallstone lithotripsy [a non-surgical alternative] is rare, despite the fact that operation rates have increased by up to 50% in some countries. For surgery to compete with other interventions, economic assessment of new surgical techniques will be increasingly important. This assessment should be based on well-conducted clinical trials in which interventions are provided in a routine service setting, and in which benefits are assessed among other things on the basis of the patient's perceived quality of life. Economic assessment often needs data beyond those collected in a clinical trial, however pragmatic the trial design, so modelling will often be required, incorporating a range of sources of evidence. Finally, evidence alone will not be enough to promote cost-effective practices. The take-up of surgical techniques will always be affected by the way hospitals and surgeons are remunerated. Affecting practice requires a realistic system of reimbursement that reflects evidence on cost effectiveness."

Brazier and Johnson stepped the surgical audience through a clinical decision-making tree that captured the trade-offs needing to be considered at each step. I have generalised their approach to surgical analysis in **Figure 4.12**, based on their cholecystectomy-specific approach.

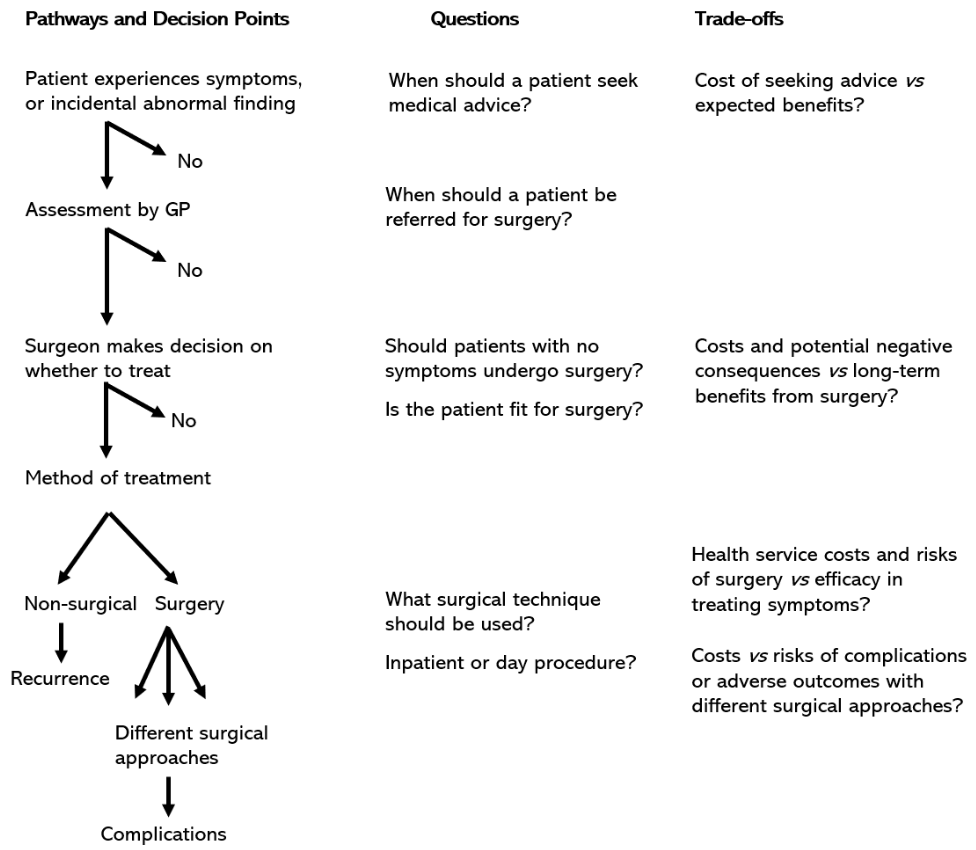

Figure 4.12 Clinical decision-making tree for cholecystectomy capturing trade-offs requiring consideration at each step. Based on Brazier and Johnson (2001).

Using the example of a very common surgical procedure – cholecystectomy – they step surgeons through the health economic considerations inherent in the procedure. They begin with the step at which the surgeon encounters the patient known to have gallstones, pointing out that – in 2000 – "prophylactic cholecystectomy… to prevent possible complications, is not justified." They then point out that, "where treatment is indicated, there is uncertainty about which treatment." To develop the exposition they explain that, "these decisions – who, when, and how? – are made very day and they have important cost implications and important consequences for the health and well-being of patients. Here, we examine how trade-offs can be addressed by economic assessment."

Brazier and Johnson pointed out for the surgical audience that the costs of surgery extend "well beyond the operating theatre" and include the use of beds and other resources in the health system, as well as those in the community and in primary care. They then pointed out that, beyond the obvious, there will be effects on a patient's productivity, on travel costs, and time off work associated with each of the treatment options – surgical or non-surgical. The provided an example of why these broader considerations have an economic impact: while open cholecystectomy is less expensive than its laparoscopic equivalent, open surgery has a greater community cost due to time off work and lost productivity.

They pointed out that that, from a patient's perspective, what mattered most were the occurrence of symptoms and quality of life (QoL). Because of the likelihood of conflict between the different outcomes and costs, they introduced the importance of QALYs to allow outcome comparisons between different treatments in terms of incremental costs per QALY gained. Brazier and Johnson noted that, despite the fact that QALY assessments could combine all consequences in a single measure, they were not widely used in surgery. They also made some note regarding the effect of reimbursement policies in surgery, putting it thus:

"Could the method and amount of payment to a surgeon or institution affect the decisions? A surgeon being paid a fee for every procedure cold lead to a different threshold for operating compared with a surgeon being paid the same salary however many cholecystectomies her or she [performs] every week. This effect could partly explain the far greater operation rate for gallstones in the USA than in the UK."

Yet despite the intentions and aspirations of Brazier and Johnson's 2001 paper, and despite high prevalence of gallstones (Ibrahim *et al.*, 2018), few economic studies of cholecystectomy were performed. Sutherland and colleagues (2020) reported that, almost twenty years later, "there is little understanding of [cholecystectomy's] effect on the gain in patients' health relative to its cost." They conducted a study in the Canadian health system using a standardised health state questionnaire (the EQ-5D-3L) pre- and post-operatively to calculate the QALYs attributable to cholecystectomy. Cost points were estimated using hospital resource costs and surgeons' fees, allowing calculation of cost per QALY for the patient groups. The reported a mean gain in QALYs of 1.743, corresponding to an average cost per QALY of $2102. The authors noted that older patients had, on average, less gain in QALYs than younger patients. Overall, laparoscopic cholecystectomy was found to be "inexpensive relative to the gains in health" afforded patients. Parmar and colleagues (2014) undertook specific modelling in older patients – those over 65 years of age – and reported that, when compared to observation in the age cohort, cholecystectomy was associated with lower effectiveness (-0.10 QALYs) with an increased cost of over $3000 per patient at two years of follow-up after the initial assessment. However, when a specific subgroup with frequent recurrence of symptoms was considered, cholecystectomy became the more effective option. These studies, combined, present strong evidence for an individualised approach based on, among other factors, age and severity of symptoms experienced by the patient. The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for surgery and the proportion of patients who waited longer than clinically recommended for the surgery with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.13**).

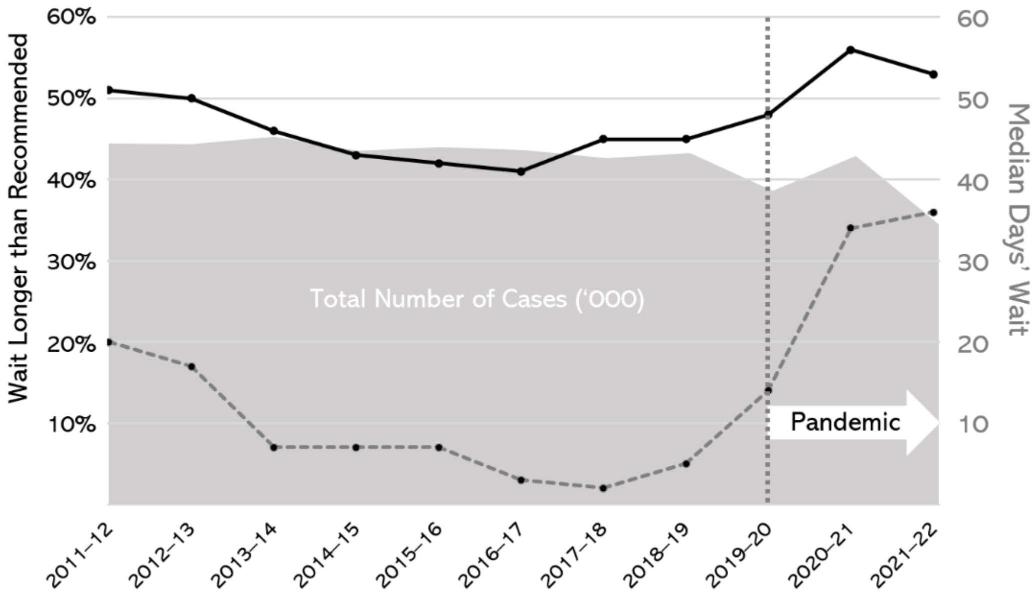

Figure 4.13 Cholecystectomy (laparoscopic or open) in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.4.2 Hysterectomy

Hysterectomy – removal of the uterus – is a common procedure in women's health in high-income countries. The most common indications for the operation include heavy menstrual bleeding, uterine fibroids, endometriosis, and prolapse. These conditions have the potential for a major adverse effect on women's lives. (Falcone & Walters, 2008) In their major review of heavy menstrual bleeding, Roberts and colleagues (2011) point out:

> "Heavy menstrual bleeding places a heavy burden on the health system, prompting one in 20 women of reproductive age to consult her general practitioner and accounting for 20% of all referrals to gynaecology outpatients. Heavy menstrual bleeding can cause

> considerable distress to women by affecting their performance at work as well as social activities and leads to a measurable reduction in quality of life. Traditionally, the definitive treatment [has been] surgery: in the past, by the age of 55 one in five women in the United Kingdom had had a hysterectomy, over half of which were for heavy menstrual bleeding."

Pynnä and colleagues attempted to address the cost-effectiveness of hysterectomy when performed for benign disease. The most common indication for the procedure was as part of the management of isolated heavy menstrual bleeding. Of all of the treatment approaches, surgical and non-surgical, hysterectomy was the most effective at alleviating the symptoms. They estimated a cost per QALY of £1440, which they noted to be well within the limits of costs accepted by the National Health Service. More granular data regarding the different routes of hysterectomy – as an open operation *versus* a purely vaginal approach *versus* a laparoscopic component to the surgery – were more difficult to assess. What was apparent was that the cost-effectiveness of treating a younger woman (age less than 50 years) was greater than that of surgery for older patients. However, the most cost-effective indication was treatment of birth-associated vaginal prolapse. The authors noted that the results of cost-effectiveness analysis were highly influenced by the utility values used in the analysis, and even these often did not capture anxieties such as concerns about loss of fertility in younger women. Their overall conclusion was that:

> "Relatively little original data has been published on the cost-effectiveness of hysterectomy, and overall conclusions on the cost-effectiveness are difficult to draw due to the heterogeneity of the studies and differences in study designs, treatment indications, follow-up times and HRQoL instruments used. Of the different techniques,

laparoscopic hysterectomy seems to be least cost-effective. We need more HRQoL data from patient cohorts with a long-term follow-up for proper assessment of cost-effectiveness of hysterectomy for benign gynecological conditions."

The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for hysterectomy and the proportion of patients who waited longer than clinically recommended for the surgery with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.14**).

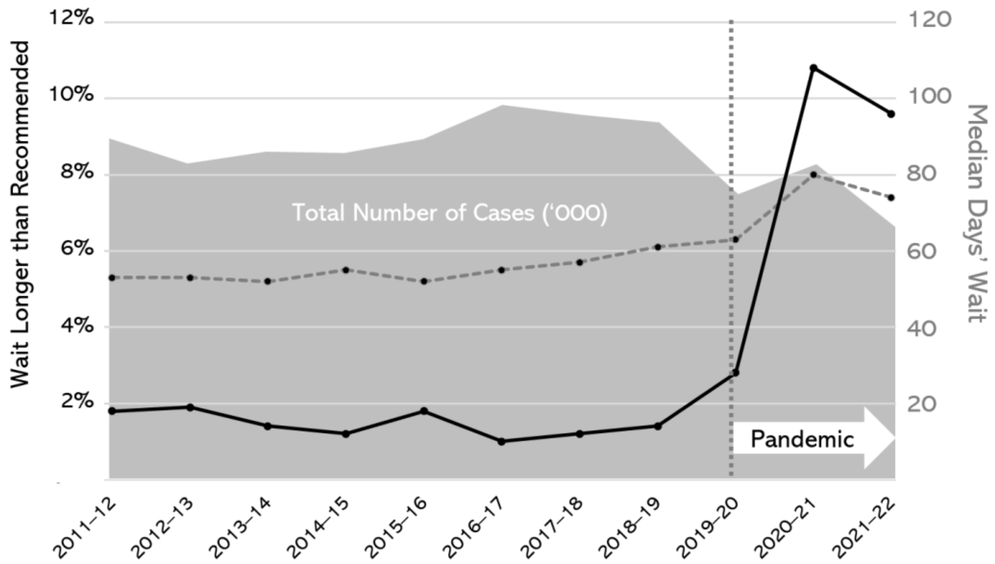

Figure 4.14 Hysterectomy (laparoscopic or open) in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.4.3 Inguinal hernia repair

Inguinal hernia is the most common surgical condition in adults, affecting as many as one in four adults, mostly male. (Shakil *et al.,* 2020) For this reason, in most high-income countries inguinal hernia repair is the most common major surgical procedure. Although most inguinal hernias present a low risk of serious complications, they can be uncomfortable and impose restrictions on physical activity with implications for occupation and leisure pursuits. A recent comprehensive review of the evidence for assessment and surgical management of inguinal hernia, in part, concluded:

> "Symptomatic groin hernias should be treated surgically. Asymptomatic or minimally symptomatic male… patients may be managed with 'watchful waiting' since their risk of hernia-related emergencies is low. The majority of these individuals will eventually require surgery; therefore, surgical risks and the watchful waiting strategy should be discussed with patients. Surgical treatment should be tailored to the surgeon's expertise, patient- and hernia-related characteristics and local/national resources. Furthermore, patient health-related, lifestyle and social factors should all influence the shared decision-making process leading up to hernia management." (Simons et al., 2018)

Inguinal hernia surgery in Australia is very common with over 48200 procedures performed in Australia 2018-19 (across both private and public hospital), 89% of the operations performed in males. Sharma and colleagues (2015) have noted that different surgical approaches to inguinal hernia repair – open *versus* laparoscopic, use or not of surgical mesh – all have similar rates of recurrence, and the principal difference appeared to be with respect to incidence rates of longer-term pain after the operation. To address these important data gaps for one of the most commonly performed surgical procedures, they performed a systematic review of randomised trials with a meta-analysis, then used Markov models to assess the cost-effectiveness of the different procedures within the NHS funding model over a 25 year horizon. The findings revealed that surgery involving the use of mesh was associated with earlier return to work and normal activities with no significant difference in reported pain scores, incidence rate of surgical complications, or rate of recurrence. Their economic analysis reported that open mesh repair was less costly and was associated with improved health outcomes by 0.04 QALYs with the findings robust to a range of sensitivity analyses. Thus, of the range of surgical options for inguinal hernia repair procedures, the open mesh repair was a safe, efficacious, and cost-effective. Coronini-Cronberg and colleagues (2013) had similarly used NHS data to calculate the mean change in QALYs following elective hernia repair surgery as 0.826, compared to no treatment. The reported that patients undergoing laparoscopic surgery showed a greater gain in HRQoL with their estimate of the gain of 0.923 QALYs compared to the estimate for open repair of 0.817 QALYs. Using the NHS cost estimates, they calculated the mean cost per QALY of £1880, with the mean cost of laparoscopic and open surgery per QALY being equivocal (£1421 *vs.* £1426 respectively). The concluded that elective inguinal hernia surgery "offers value-for-money" with laparoscopic repair being more clinically effective and generating higher cost-utility than open operations.

The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for surgery and the proportion of patients who waited longer than clinically recommended for inguinal hernia repair with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.15**).

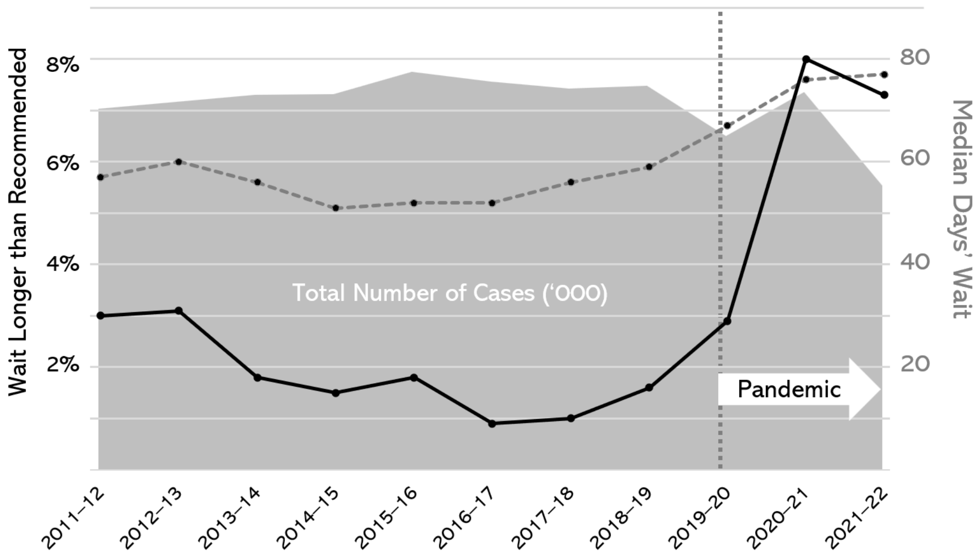

Figure 4.15 Inguinal hernia repair (unilateral or bilateral) in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.4.4 Myringotomy

Infection of the middle ear (otitis media, OM) is common in children. For the majority of children in middle- and high-income countries, OM is a benign and self-limiting condition. However, a small proportion of children will develop repeated and ongoing middle ear infections – chronic otitis media (COM) – and this condition is an important cause of preventable hearing loss, especially in Indigenous populations (**Figure 4.16**). The condition has the potential for adverse long term sequelae including communication problems, delayed language development, auditory processing and cognitive development. (Morris & Leach, 2009) All of these issues, in turn, have important potential to negatively affect educational progress and achievement. (Monasta *et al.*, 2012) Further, in high-income countries hearing loss is known to be the third most prevalent chronic condition in older adults (after hypertension and osteoarthritis) and has considerable implications for both physical and mental health. (Yueh *et al.*, 2003) For this reason, early management of COM in children is important to reduce its health, social, and resulting economic burden. The value of myringotomy and insertion of tympanostomy tubes “grommets” has long been recognised and it, comparatively, simple surgery. (Rimmer, Giddings & Weir, 2020)

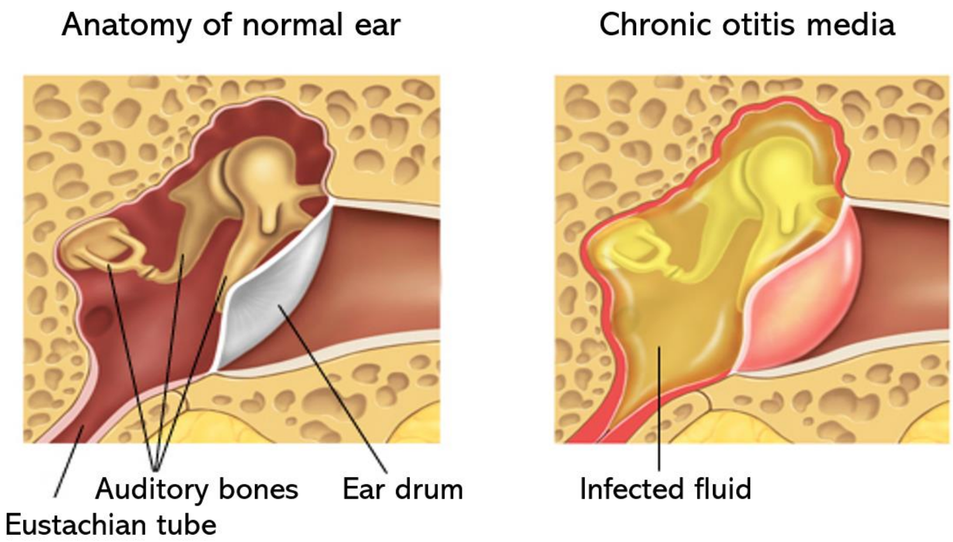

Figure 4.16 Typical anatomy of the ear (left) and changes associated with chronic otitis media (right). From the Australian National University collection, with permission

Mohiuddin and colleagues (2014) have noted that, while surgery and insertion of grommets for the management of chronic OM is one of the commonest operations performed, there had been little consideration of cost-effectiveness. The alternative to performing surgery is the use of hearing aids (HAs) for children while awaiting the OM to resolve over time. The authors noted, however, that parents did not consider the use of HAs and surgery to be equivalent procedures. Their time horizon was to age 12 years in the child, as at this age growth and anatomical change meant that spontaneous improvement was likely. They found that, while surgery was the more costly procedure, it was associated with greater QALY gains.

The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for surgery and the proportion of young patients who waited longer than clinically recommended for myringotomy with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.17**).

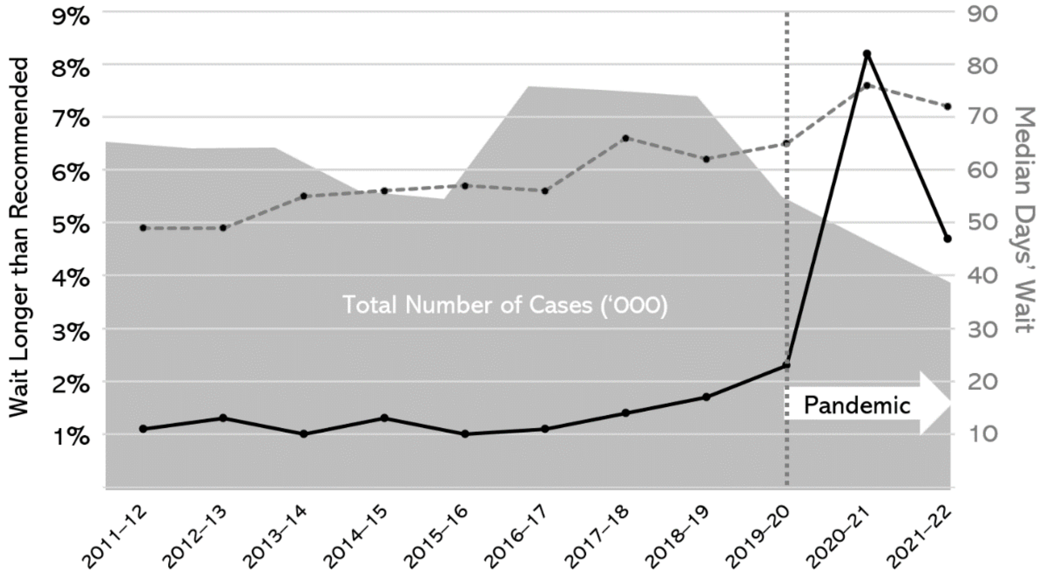

Figure 4.17 Myringotomy (unilateral or bilateral) in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.4.5 Prostatectomy

Benign prostatic hyperplasia (BPH) is one of the most common conditions affecting older men, and is a major cause of morbidity. (Vuichoud & Loughlin, 2015) It has been estimated that, globally, BPH was responsible for almost 2500000 years lived with disability (YLD) in 2017, three times greater than the next most common urological condition: prostate cancer. (Launer *et al.*, 2021) The urinary symptoms and complications attributable to BPH have a significant negative effect on quality of life (QoL) including reduced psychological well-being and leave affected men facing increased healthcare costs. Without treatment, BPH can lead to complications such as urinary retention, and even renal insufficiency and renal failure.

Chughtai and colleagues (2022) have noted that, until recently and despite the large number of men affected by symptoms attributable to benign prostatic hypertrophy and the common nature of surgery for the condition, analysis of cost-effectiveness of surgery had not been published. They found that published studies had not captured the HRQoL impact of surgical treatment. As such, they aimed to evaluate both short- and long-term cost-effectiveness evidence supporting treatment for moderate-to-severe prostatic symptoms. They chose a five-year time horizon for their analysis for men aged 65 years and older. Cost inputs were based in US Medicare reimbursements in 2021. They found that surgical treatment – prostatectomy – was associated with greater QALY gains than other non-surgical treatments with estimated costs of US$ 64500 per QALY gained in the US setting.

The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for surgery and the proportion of patients who waited longer than clinically recommended for prostatectomy with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.18**).

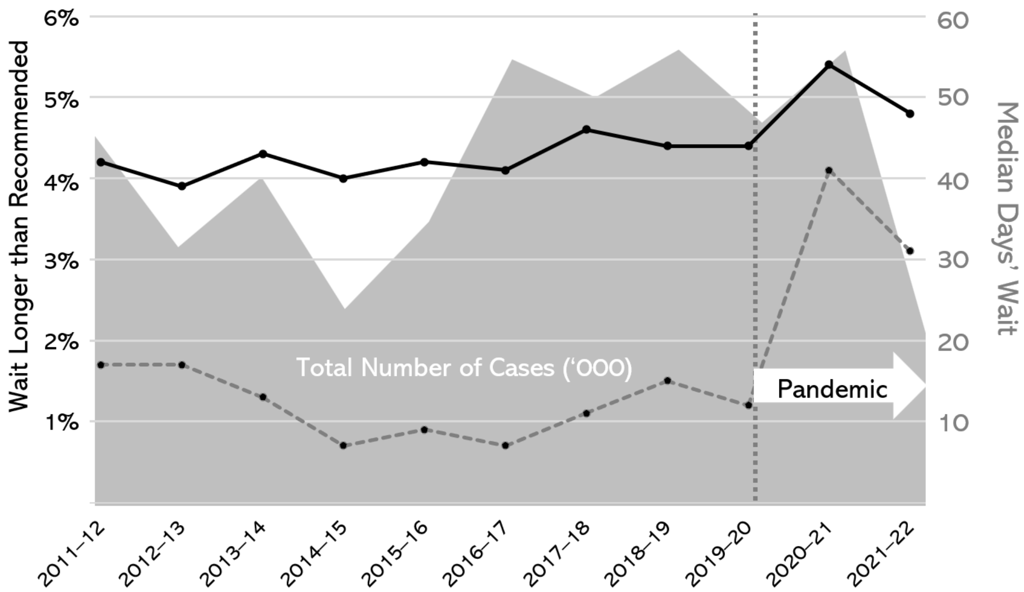

Figure 4.18 Prostatectomy in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.4.6 Tonsillectomy

Removal of the tonsils and adenoids is a common operation in Australia, and the evidence underpinning the procedure continues to evolve. Randall (2020) has reviewed the current evidence and has found evidence of a 'modest' benefit for children who suffer recurrent tonsillitis. However, there is considerable heterogeneity in the evidence base and many studies provide outcome data for only one or two years post-procedure. However, Randall was able to identify strong evidence for parental satisfaction with the procedure which, presumably, is an important factor in decision-making for surgeons and the general practitioners who refer to them. In Australia in the last pre-pandemic year 2018-19, a total of 59500 tonsillectomy procedures were performed, with 78.5% of those in patients under the age of 20 years.

Lock and Colleagues (2010) performed clinical and cost-effectiveness analyses of tonsillectomy in children aged four to 15 years in comparison to non-surgical managements using data from England and Scotland. They took into account sore-throat related GP consultations and other clinical outcomes. The study reported that tonsillectomy was clinically effective in reducing episodes of sore throat over the time horizon, and estimated the ICER at £260 per episode of sore throat avoided and estimated the incremental cost per QALY at between £3130 and £6900 per QALY gained, well below the parental willingness-to-pay threshold with a mean of just over £8000. The authors noted that both children and their parents exhibited a strong preference for surgical treatment, hence the popularity of the operation.

The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for surgery and the proportion of children who waited longer than clinically recommended for tonsillectomy with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.19**).

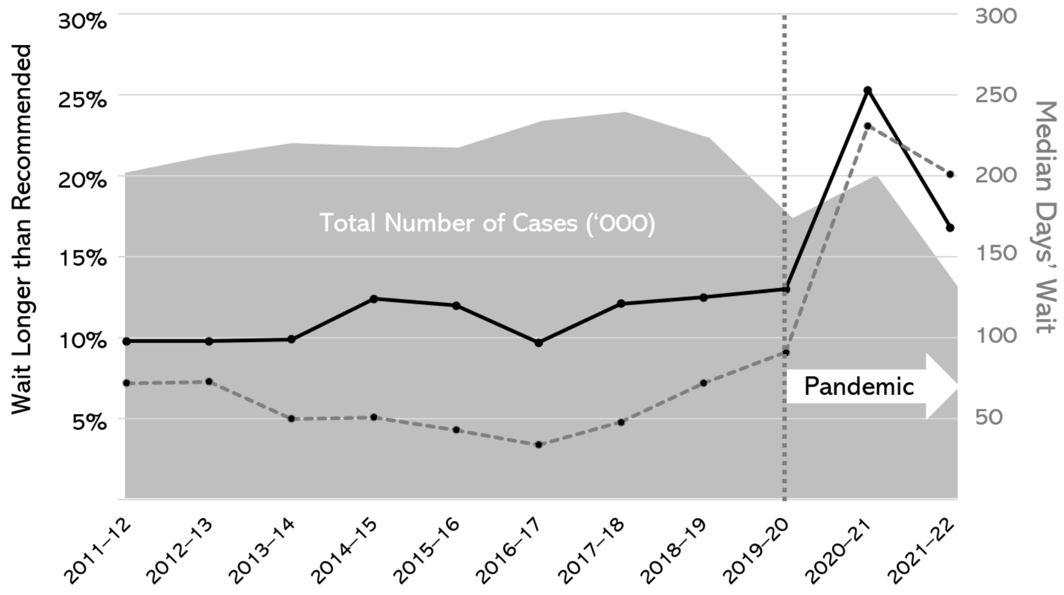

Figure 4.19 Tonsillectomy in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.4.7 Arthroplasty: total hip and total knee replacement

The introduction of total hip replacement (THR) in the 1960s was said to have 'revolutionised' the management of elderly patient who, previously, had been crippled by hip arthritis. (Learmonth, Young & Rorabeck, 2007) Longitudinal studies have confirmed that THR delivers sustained improvements in QoL (Petris et al., 2015): in Australia in the year 2018-18, 41700 total hip replacement (THR) procedures were performed – either uni- or bilaterally – 55% of those in women (**Figure 4.20**). Konopka and colleagues (2018) undertook a study of cost-effectiveness of both hip and knee arthroplasty. They found that, obviously, severe hip and knee arthritis had a major negative effect on individuals' QoL, comparable to other major medical conditions. Both knee and hip replacement procedures were associated with large increases in QoL. Indeed, after primary procedures the typical HRQoL reported by patients was similar to the values reported for healthy patients without osteoarthritis. The authors estimated annual QALY gains of 0.25 after primary THA and 0.17 yearly after TKA. For non-primary procedures – repeat arthroplasty after a previous primary procedure – the revision procedures were still associated with positive gains in annual QALYs, although the gains were lower than those following primary surgery. With a range of QALY gains, they found that pre-operative HRQoL was the strongest predictor of QALY gain after both hip and knee replacement: the lower the pre-operative utility, the higher the anticipated QALY gain.

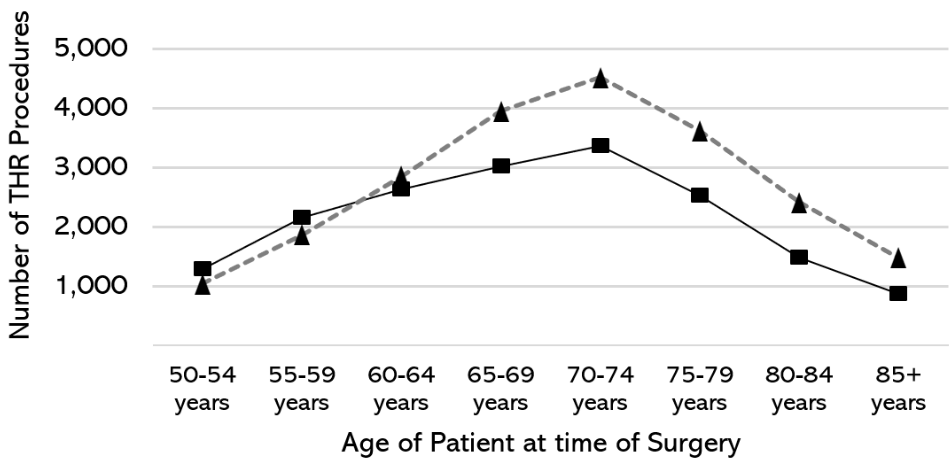

Figure 4.20 Age distribution of patients at the time of total hip replacement (THR) in Australia during the final pre-pandemic year 2018-19. Male patients (■) and female patients (▲).

With respect specifically to hip surgery, Lavernia and colleagues (2015) estimated the costs of QALY gains according to the severity of the disease being treated. Their study had a time horizon of 4 years. They found the highest mean cost-effectiveness (US$ 8250 per QALY gained) was achieved in the patients with the lowest disease severity. As well, with patient age increasing the cost-effectiveness of total hip arthroplasty decreased: they calculated cost-effectiveness at US$26000 per QALY gained for patients aged 75 years or older. They concluded that total hip arthroplasty was "a very cost-effective intervention" but that waiting for a patient to deteriorate reduces the cost-effectiveness of the procedure.

The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for surgery and the proportion of patients who waited longer than clinically recommended for total hip replacement with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.21**).

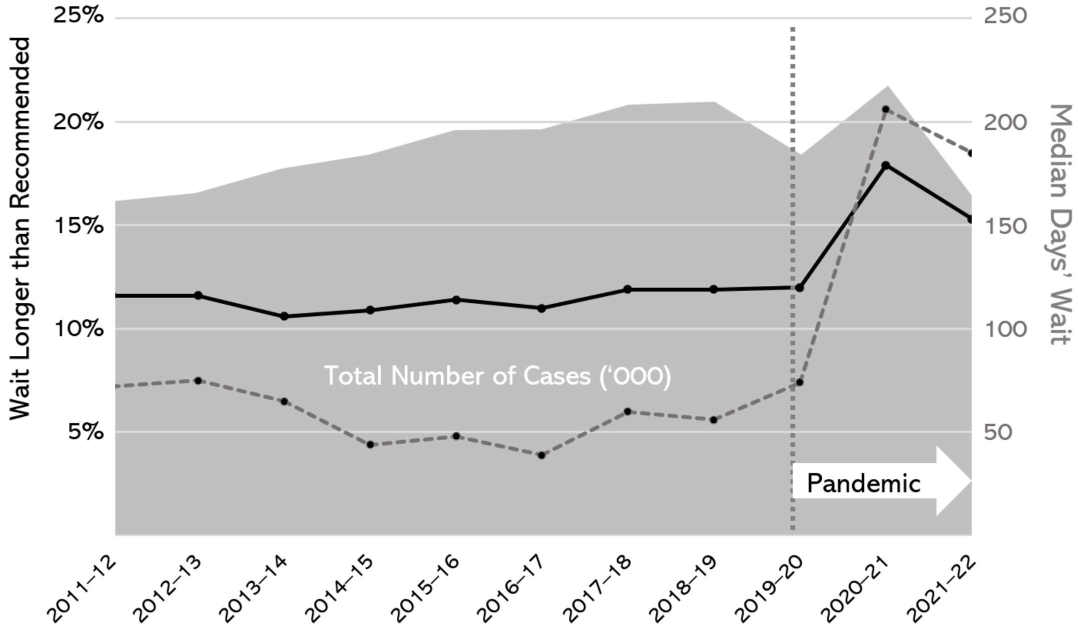

Figure 4.21 Total hip replacement in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded ▇), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.4.8 Total knee replacement

Total knee replacement (TKR) is a common surgical procedure in Australia, with AIHW data revealing that a total of 53,845, either in one or both knees, were performed across public and private hospitals in Australia in the final pre-pandemic year 2018-19.[40] Of these, a majority (55.2%) are performed for women. The main indication for TKR is osteoarthritis: with increasing age and rates of overweight and obesity in the Australian community, demand is likely to increase. (Gademan et al., 2016) Canovas and Dagneaux (2018) have reviewed quality of life (QoL) measures following total knee arthroplasty. They found that TKR is associated with significant improvements in knee function and resulting QoL, with the greatest impact measured in the first year after the procedure is performed. The authors found that the best outcomes are found in young male patients with a normal body mass index (BMI) which is a small group: the AIHW data show that only 437 male patients under the age of 50 years underwent the procedure in 2018-19, or 0.8% of all patients undergoing the procedure. It is likely that about one third of patients aged under 75 years undergoing TKR are able to return to sports. However, the best QoL improvements are achieved in patients aged 80 years or older and in Australia in 2018-19, only 11% of all TKRs were performed in this good-prognosis age group.

Kamaraj and collegues (2020) noted that, again, despite the large number of knee replacements performed, there had been no specific systematic reviews of the cost-effectiveness of total knee replacement. This was in the face of a large body of literature addressing other areas of orthopaedic surgery. They noted that the cost-effectiveness analyses were conducted across

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[40] Australian Institute of Health and Welfare (AIHW): Procedures data cubes 2018-19. Accessible at: https://www.aihw.gov.au/reports/hospitals/procedures-data-cubes/contents/summary

different countries, with different techniques and implant types, resulting in major issues with the generalisability, and so transferability, of the economic analyses across healthcare settings.

The data show the pandemic shock has been associated with a reduction in surgical volume and increases in median waiting time for surgery and the proportion of patients who waited longer than clinically recommended for total knee replacement with none of these values returning to pre-pandemic levels by the end of the study period. (**Figure 4.22**).

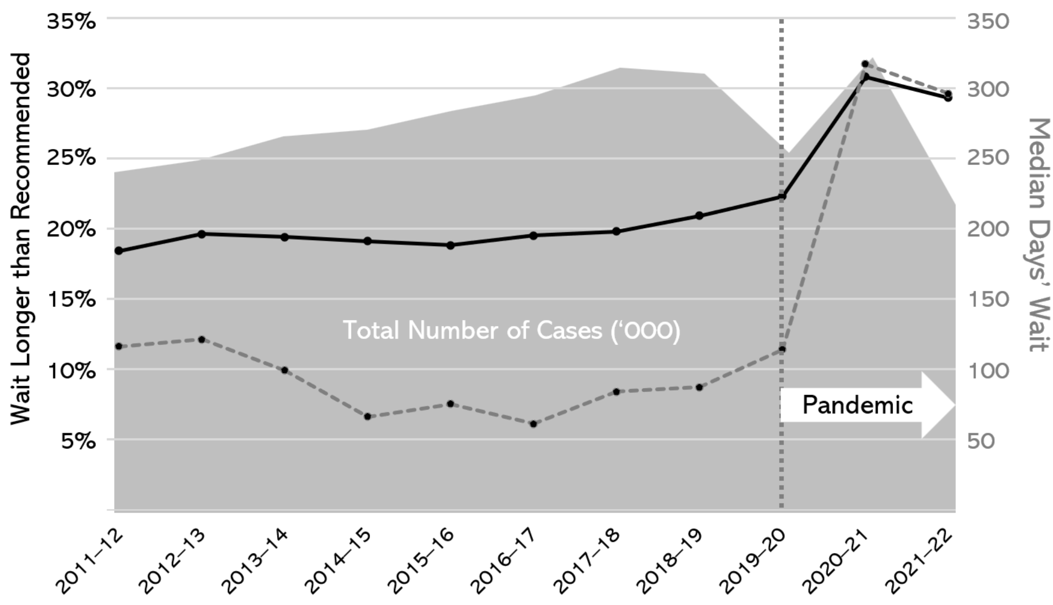

Figure 4.22 Total knee replacement in Australian public hospitals for the period 2011 to 2022. Total number of cases performed (shaded), with the median number of days' waiting time (- - - -) and the proportion of patients waiting longer than clinically recommended (——).

4.5 QALY effects of delayed surgery on Australian patients

Data from Australian public hospitals show that the pandemic has been associated with major effects on elective surgery with reductions in the number of procedures performed, and increases in waiting times for surgery and in the proportion of patients waiting longer than clinically recommended for care. These changes were observed for all of the AIHW key performance indicators both in children and adults. As the previous discussion has shown, these surgical procedures are associated with significant QALY gains and so pandemic-associated disruptions to surgery will have increased the burden on ill health and debility over and above other direct and indirect effects of the pandemic.

As has been discussed at length above waiting lists for planned surgery, while one solution as a non-price rationing mechanism for healthcare, are associated with potentially harmful delay and have the potential to introduce high levels of inequity into the health systems of high-income countries such as Australia and the UK. McIntyre and Chow (2020), in their narrative review, put it this way: "As health is a human right, addressing the further inequity from poorer healthcare access experienced by the most vulnerable in our system must be a policy and implementation priority." They continue:

> "Worsening waiting times have been shown to be associated with patient dissatisfaction, delayed access to treatments, poorer clinical outcomes, increased costs, inequality, and patient anxiety. For patients with chronic health conditions, there may be a cumulative burden from waiting time. Patients with chronic disease may spend more time out of the workforce, which may contribute to worsening socioeconomic position. Socioeconomic deprivation is known to be associated with an increased burden

of disease that increases healthcare resource utilisation. Considering that waiting time should be allocated such that those in most clinical need experience the shortest waiting time, studies suggesting the socioeconomically disadvantaged wait for the longest time are particularly concerning.

> “Despite significant reductions between the 1990s and early 2000s in some countries, the time patients wait to receive care has either increased or remained unchanged over the last 5 to 10 years. For elective surgery, waiting times of greater than a month from referral are the norm … This review highlights that waiting for healthcare is likely to be a substantial burden affecting many people and aspects of our healthcare systems. The increasing prevalence of chronic disease globally suggests this burden will likely increase, affecting a larger patient population each day. If waiting is an unavoidable part of healthcare, we need to innovate to address whether it can be decreased or utilised to better effect.”

The data from the Australian public hospital system demonstrate that the pandemic has led to reductions in the number of procedures performed with associated increases in waiting times. These are likely to have had the effects described by McIntyre and Chow (2020), adding to the burden of surgical and other morbidity across the country.

4.6 Differing jurisdictional responses to the pandemic responses and associated effects on elective surgery in public hospitals

The WHO declared the COVID-19 pandemic on 11th March of 2020, and Australia's international borders were closed one week later, on 18th March. Subsequent to this, Australian states each enacted different public health responses to the pandemic, offering a natural experiment to help assess the efficacy of these postures on the states' public hospital systems. A comprehensive analysis of the Australian response to the COVID-19 pandemic was undertaken by a partnership between the Blavatnik School of Government, the University of Oxford, and the Australian National University, the report of which was published in June of 2022. (Edwards *et al.*, 2022) The findings of this analysis are summarised here to inform the subsequent surgery data reporting in this dissertation. Edwards and colleagues' report makes it clear that Australian governments' responses to the pandemic exhibited significant 'nuance and heterogeneity.' Moreover, like any policy intervention, the effects of these responses were highly contingent on local political and social contexts.

In their analysis, Edwards and colleagues detail how the pandemic led to policy responses across all levels of the Australian government, aiming first to eliminate and later to mitigate the pandemic spreading across the country. A human biosecurity emergency was declared by the Federal Government on 18th March 2020 and, since Australia is an island nation, borders were closed by the Federal Government to all non-residents two days later on March 20, 2020. Returning residents were required to quarantine for two weeks before entering Australia. Beginning March 18, 2020, the Federal and the State and Territory governments (the 'National Cabinet') agreed that each jurisdiction would implement legislation restricting indoor gatherings of greater than 100 people.

Australia is a highly decentralised federation and, as such, permits each state and territory to enact policies that respond to local context. Health policies are typically a state and territorial responsibility, and most of the COVID-19 pandemic policy restrictions have been introduced by state and territory governments and health officials. The federal government focused on responsibilities that fall within its purview including international travel restrictions (although excluding quarantine arrangements), healthcare funding, economic stimulus, employment insurance, and vaccine procurement. The federal government led Australia's economic response to the pandemic including the provision of cash transfers for those whose employment was affected and for those infected who were unable to work.

The first wave of cases was initially concentrated in the most populous states of New South Wales and Victoria. In response, interstate border restrictions were first introduced in the least populous states of Tasmania on March 19, 2020, and Northern Territory on March 21, 2020, to protect their populations against the rising COVID-19 infections in Victoria and NSW. The COVID-19 pandemic led to the establishment of the 'National Cabinet,' an intergovernmental decision-making forum composed of the Prime Minister and state and territory leaders with the purpose of negotiating COVID-19 related policies. The decisions arising from the National Cabinet were implemented by the individual Commonwealth and state and territory governments and sometimes resulted in divergent policy responses.

Australian states and territories policy responses were mostly consistent during the beginning of the pandemic. The National Cabinet agreed to close non-essential businesses across Australia on March 25 in response to a sharp rise in COVID-19 cases particularly from the over 600 infected people that returned home from a cruise ship that had docked in Sydney. Of the states, Victoria had the most consistently stringent policies during 2021, most notably with six periods of stay-at-home orders and long periods of school closure for Melbourne, more than any other state/territory and totalling over 170 days in total. These lockdowns in Victoria were seen as temporary measures to limit outbreaks to certain areas in hope to stop the spread of COVID-19 and limit the burden on the healthcare system while the procurement of COVID-19 vaccines in Australia were delayed. In contrast, NSW had similar periods of significant outbreaks but the state government was hesitant to implement as stringent policy measures out of concern for the impact on the economy and small businesses.

During 2020 and until July 2021 all Australian jurisdictions were attempting to maintain a covid-zero approach by introducing “snap lockdowns” to limit the spread of COVID-19, typically around the capital city areas. For some states such as Victoria and NSW these lockdowns continued for several weeks to limit the transmission. By the beginning of 2022, all jurisdictions except WA decreased most of their closure and containment policies, even though case numbers were at an all-time. The reasoning was that the nation reached high vaccination rates and that the omicron strain was revealed to be less fatal and was associated with lower hospitalisation rates.

Moving into 2022, the only state that maintained a similar approach to managing the pandemic as in 2021 was WA. The WA Government aimed to maintain an elimination approach to COVID-19. Parts of WA went into lockdown at the beginning of 2022 and the state was the final state to relax its hard state border allowing triple vaccinated travellers quarantine-free entry from March 3, 2022.

4.6.1 New South Wales

New South Wales is the most populous state in Australia. Of the eight million residents in NSW, about 64.5% live in Greater Sydney. On March 31, 2020, NSW entered a lockdown: residents were not allowed to leave their homes unless necessary and gatherings were limited to two people. Non-essential travel from metropolitan to regional NSW towns and remote communities were urged to be cancelled. These initial restrictions were relaxed at the end of April 2020. Easing continued throughout May and June 2020, as case numbers remained low. The number of people allowed at gatherings increased gradually, students returned to classrooms in Term 2 and Term 3, and businesses reopened with capacity limits in place.

Restrictions were tightened again in July 2020 due to an increase in case numbers before being eased in October 2020. Case numbers were low in the first half of 2021 however the Delta strain outbreak saw Greater Sydney, the Blue Mountains, Central Coast and Wollongong enter lockdown for two weeks from June 26, 2021. This stay-at-home order for Greater Sydney was extended multiple times before being lifted in September 2021. People in regions other than Greater Sydney were not initially required to stay at home, with restrictions focusing on the number of people allowed in non-residential premises. However, starting from August 14, 2021, all regional NSW entered lockdown.

Two travellers who arrived in Sydney on November 27, 2021, tested positive for the new Omicron variant. They were the first known cases of the new strain in the country. Daily case numbers rapidly increased in December around the holiday period. Despite the rapid increase in case numbers, measures eased as planned on December 15, 2021. There were no more density limits, QR code check-ins were no longer required other than for high-risk settings and face masks were no longer required at many indoor areas. However, policies were tightened again very soon due to the increasing case numbers. From December 24, 2021, masks were again made be compulsory in all indoor non-residential settings, and from December 27, 2021, QR code check-ins were also required, and hospitality venues restored a density limit of one person per two square metres.

The period from December 2021 to January 2022 was the period in which NSW experienced the greatest and sharpest increase in case numbers. The COVID-19 vaccination roll-out had commenced in 2021 and from February 22, 2021, three vaccination hubs started to operate in NSW. The very first phase of the national vaccination rollout commenced on March 8, 2021. The vaccine was available to frontline healthcare workers, quarantine and border workers, workers and residents in aged care and disability care facilities. The next phase started on March 22, extending eligibility to those aged 70 years and over, other healthcare workers, Aboriginal and Torres Strait Islander people over 55 years old, adults with an underlying medical condition, including those with a disability, critical and high-risk workers. Subsequent phases, starting on May 4, gradually extended vaccination eligibility to other groups of the population.

4.6.2 Victoria

There have been four notable COVID-19 waves in Victoria during which the surgical data are available for this study. Victoria recorded its first community transmission of COVID-19 in mid-March of 2020 and this marked the beginning of the first wave. While it did not represent a large outbreak by the standards of later waves, it did trigger the state’s first lockdown and the rolling out of heavy restrictions for the first time. On March 16th, a State of Emergency was declared and gatherings of over 500 people were banned, two days later this was reduced to

100 people, on March 25th, ‘Stage 2’ restrictions entered force with closure of non-essential services, finally on March 31st, 2020, ‘Stage 3’ restrictions entered force which meant a full lockdown. This meant only four reasons to leave the home: food and supplies, medical care, exercise, and work or education. Emergency funding was also announced by the state to help businesses and the health system weather the outbreak. It also coincided with outbreaks in other states and with the initial response from the Federal Government.

The restrictions began to be relaxed on May 12th with gatherings at homes allowed and a greater number of people allowed at weddings and funerals. The following day, a timeline to re-open Victoria’s schools was announced. Victoria continued to see a low level of cases after this lockdown and restrictions such as density limits, maximum capacity of venues and home visit limits stayed in place. Cases slowly rose during this period and on 30th of June 2020, a lockdown for specific postcodes in Melbourne’s North and West where transmission was high was announced, along with a strict lockdown of some public housing towers. The ‘postcode lockdown,’ expanded to a full lockdown across Melbourne and nearby areas on July 9th, 2020. Victoria was experiencing a second wave of COVID-19 cases, it would prove to be much larger than the first. The lockdown restrictions were originally in line with the Stage 3 restrictions from earlier in the year. However, on August 2nd, 2020, with the lockdown having failed to stop rising case numbers, Victoria declared a State of Disaster (replacing the existing State of Emergency) and a Stage 4 lockdown was announced. While there was some slight easing of restrictions in September and October, the lockdown finally lifted on October 28th, 2020. However, restrictions were still in place (including restricting the number of home visitors, density limits and a 25km travel distance limit). These continued to relax for the rest of 2020. The COVID Zero policy was successful during this time.

There were several short lockdowns in 2021 in response to specific outbreaks. The approach here was to use lockdowns to give contact tracers time to identify and isolate contacts of positive cases. Victoria introduced lockdowns from February 13th to 17th, May 28th to June 10th and July 16th to July 27th, 2021. This last lockdown was introduced in response to the Delta variant. These short lockdowns were billed as ‘Stage 4’ restrictions and they were much like the second lockdown in 2020, however they lacked a curfew. Delta variant of COVID-19 brought an end to this short lockdown-based, contact-tracing driven approach. While New South Wales was the first to record a Delta case, Victoria experienced a higher peak in Delta cases. Victoria’s July 2021 lockdown did not manage to quash the outbreak and cases started rising again. Just nine days after leaving the fifth lockdown, Victoria entered its sixth on August 5th, 2022. The rules were much the same as in previous waves. However, the response was unlike that for previous waves and three factors changed the approach the government took. The first was that Delta was more infectious than previous strains meaning lockdowns slowed spread but did not reduce case numbers like previous lockdowns. The second was that restrictions seem to have not worked as well as in previous waves with ‘lockdown fatigue’ leading to more limited compliance with public health orders.

Although at the start of the wave, Australia’s vaccination rate was comparatively low compared to the rest of the world, it gave governments another tool to fight COVID-19. These factors saw the abandonment of Australia’s ‘Zero COVID’ policy by federal and state leaders (except for Western Australia). In line with leaders of other governments, Victorian Premier Daniel Andrews stated, “vaccination is our only way out of this pandemic” and eased restrictions not primarily in response to low cases, but in response to meeting vaccination targets. Most restrictions were relaxed on the 29th of October 2021 with the government projecting that Victoria would meet its 80% double-vaccinated target on that day.

4.6.3 Western Australia

Western Australia Western Australia (WA) is Australia's largest state with a population of only 2.7 million (10% of Australia's population). 80% of the state lives in the Greater Perth area. WA is the second least densely populated state, due to its size, only more sparsely populated than the Northern Territory. WA was the fifth Australian jurisdiction to confirm a COVID-19 case on February 21, 2020, almost a month after the nation's first, after a cruise ship evacuee tested positive.

The Western Australia Premier declared a state of emergency on March 15, 2020. The next day indoor gatherings of 500 or more people were banned and on 18 March moved to 100 after agreement with the National Cabinet. Travel in and out of remote indigenous remote aboriginal communities within the state were restricted on March 19, 2020. WA was the third state to initiate border restrictions to other Australian jurisdictions on March 22, 2020, and required a 14-day quarantine when arriving in the state. On March 23, 2020, in line with the National Cabinet advice, non-essential businesses and activities were banned. On April 1, 2020, intra state movement restriction became enforced with WA residents not being permitted to travel outside their regional boundary. Gathering restrictions were relaxed on April 27, 2020, allowing non-essential gatherings of up to 10 people indoors and outdoors. These restrictions were further relaxed on May 18 with up to 20 people allowed to gather, restaurants and cafes opening for meal service and workers encourage to return to work.

Restriction continued to ease in June 2020. By mid-April 2020 WA eliminated community transmission of COVID-19 with only a handful of community transmission occurring in the state until late December 2021. This low case number reflects WA's swift introduction of restrictions, isolation, and strict state border policy to the rest of Australian jurisdictions particularly the COVID-19 prone states of Victoria and NSW. During 2021, WA had minimal restrictions in place with a few targeted snap lockdowns, reflected as closure of businesses and schools, stay-at-home requirements and require wearing masks in public spaces.

Because the pandemic response of WA with tight border closures was unique globally, it offers the opportunity to study the effects of this approach on the conduct of elective surgery. A thorough independent review of the three-year border closure was released in mid-2023.[41] The report details the hard border closure and details how, during this time, "Western Australians were confronted with a variety of challenges, including new variants, local outbreaks, public health measures to minimise the virus and strict border controls for entering the State." The report continues:

> "As more information and evidence emerged about the virus, the WA Government's response scaled up and down based on the risk level in the community. COVID-19 testing and vaccinations became more accessible, strengthening the government's ability to manage the virus, and WA began the transition towards opening its borders. Following the reopening of the borders on 3 March 2022, the WA Government progressively evolved its COVID-19 management and response, leading to the end of the state of emergency on 4 November 2022. This signified the end of the acute phase of WA's longest ever emergency management response."

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[41] Government of Western Australia. *Review of Western Australia's COVID-19 Management and Response,* July 2023. Accessible at: https://parliament.wa.gov.au/WebCMS/webcms.nsf/resources/file-covidmanagementreview/$file/Premier%20-%20Tabled%20Paper%201%20of%202%20-%20Review%20of%20WA%20COVID-19%20Management%20and%20Response.pdf

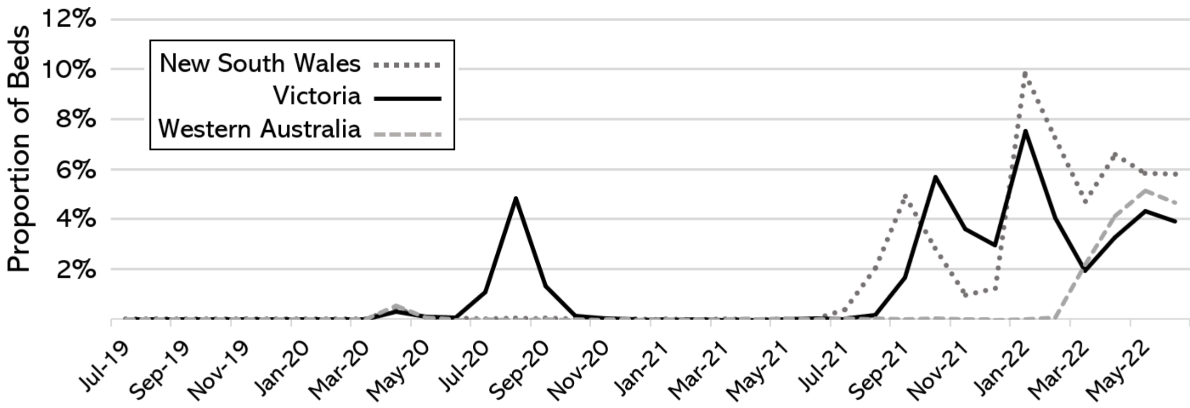
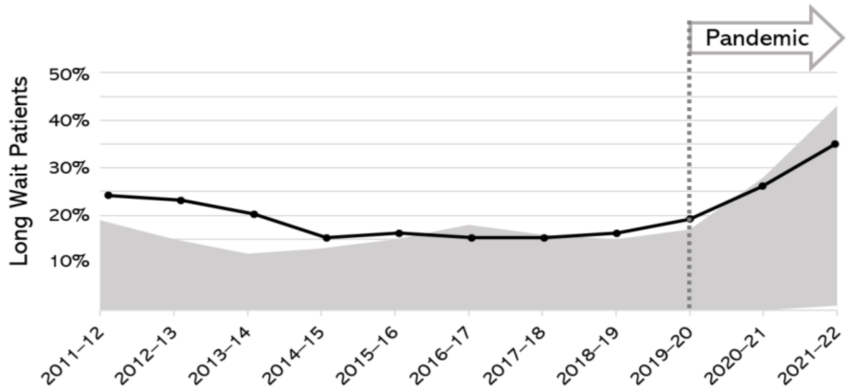
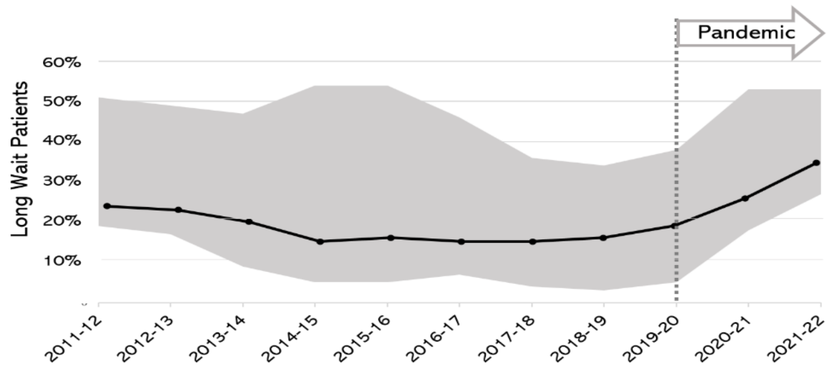


Figure 4.23 The average proportion of public hospital beds occupied by COVID-19 patients each month over the period 2019-2022, for the states New South Wales (NSW), Victoria, and Western Australia (WA).

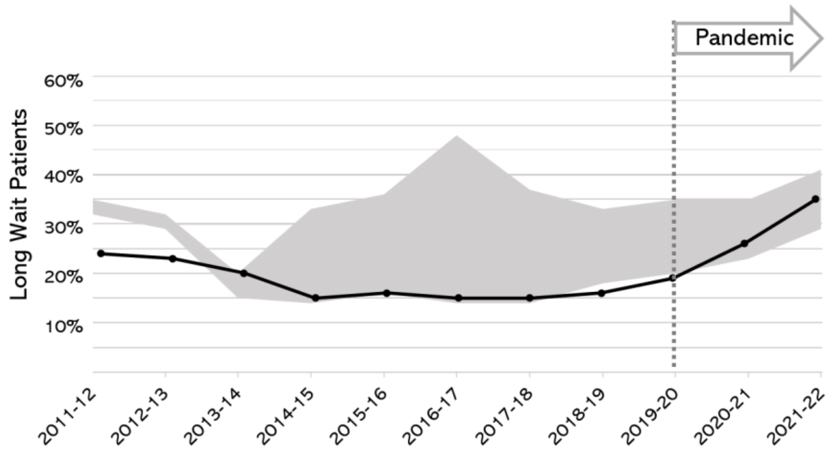
Since there were three distinct jurisdictional approaches in Australia to preserving capacity within health systems – border closure (Western Australia), low threshold to lockdowns (Victoria), and a more *laissez faire* approach (New South Wales) – this allows some analysis of the state-wide effects of these approaches. To achieve this, the available data for every public hospital in each of the three states were used. The hospitals were classified as either regional (medium or large), metropolitan (medium or large) and major and for each hospital group data on the median waiting time for category two and three procedures were examined. Since there was variation in the median waiting times across hospitals with each broad group, the spread from shortest to longest median waiting time was plotted. The results are presented in **Figures 4.24** to **4.31**.



New South Wales

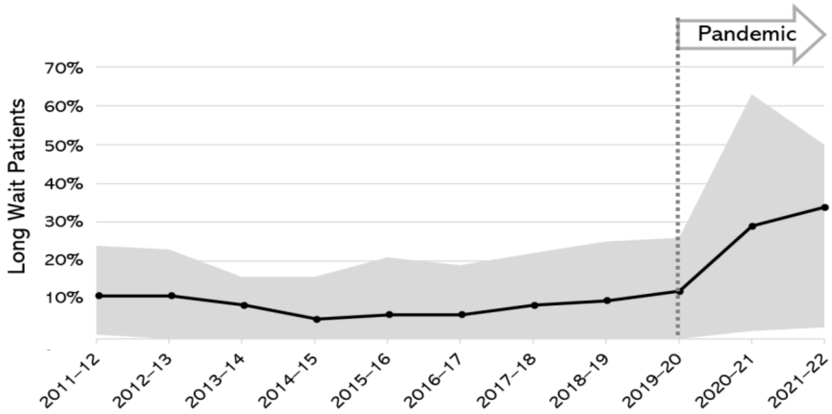


Victoria



Western Australia

Figure 4.24 Proportion (%) of patients booked for surgery at **category 2** waiting longer than the clinically recommended time for surgery in **major hospitals**. The range across hospitals (shaded) compared to the Australian national medians (———). Comparison of NSW, Victoria, and Western Australia over the period 2011 to 2022.



New South Wales

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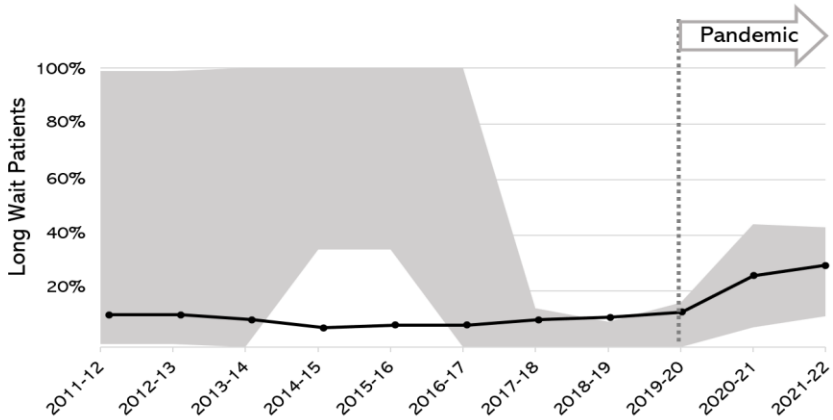
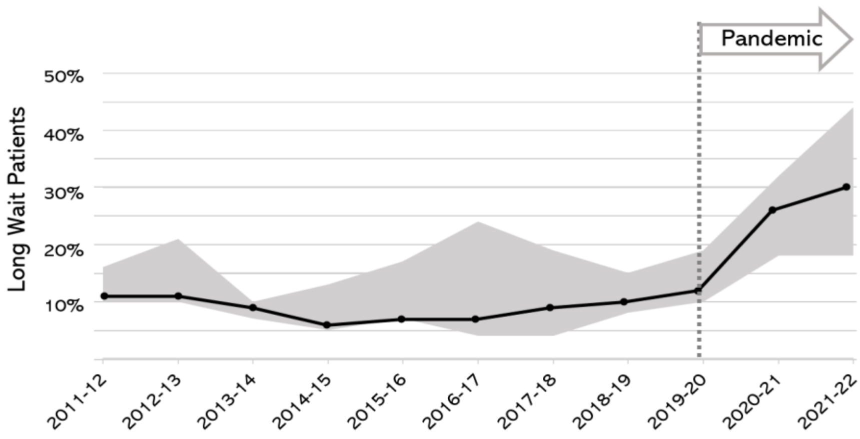
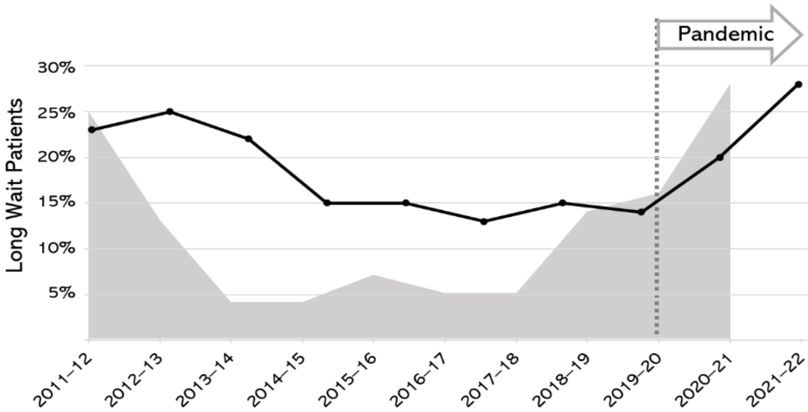


Victoria

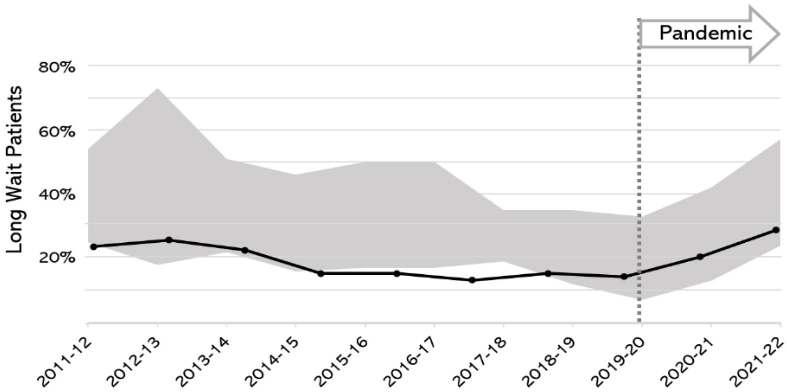


Western Australia

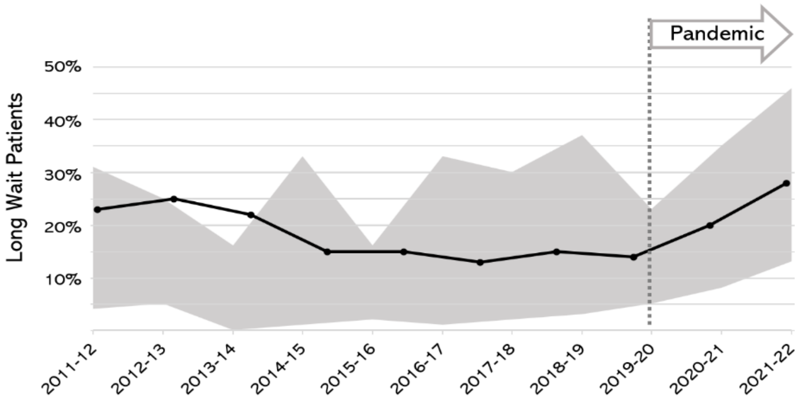
Figure 4.25 Proportion (%) of patients booked for surgery at **category 3** waiting longer than the clinically recommended time for surgery in **major hospitals**. The range across hospitals (shaded ■) compared to the Australian national medians (——). Comparison of NSW, Victoria, and Western Australia over the period 2011 to 2022.



New South Wales

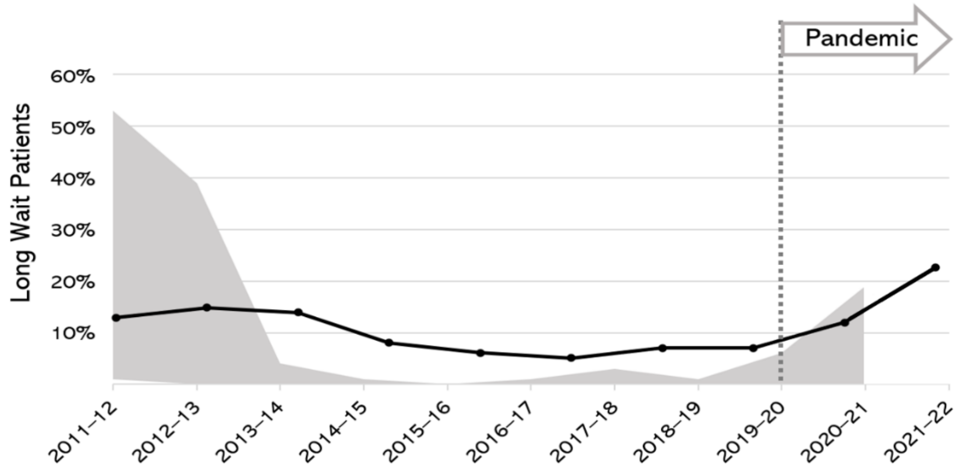


Victoria

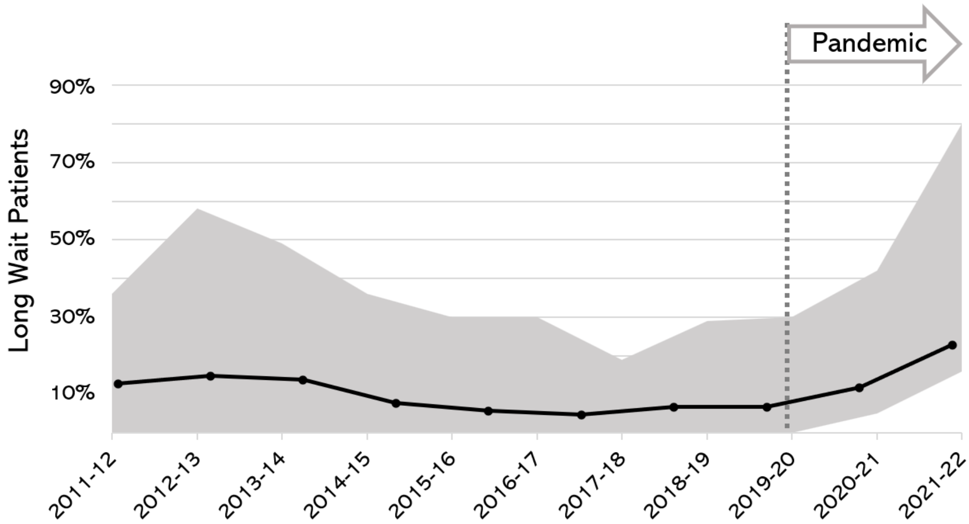


Western Australia

Figure 4.26 Proportion (%) of patients booked for surgery at **category 2** waiting longer than the clinically recommended time for surgery in **large metropolitan hospitals**. The range across hospitals (shaded ■) compared to the Australian national medians (——). Comparison of NSW, Victoria, and Western Australia over the period 2011 to 2022.

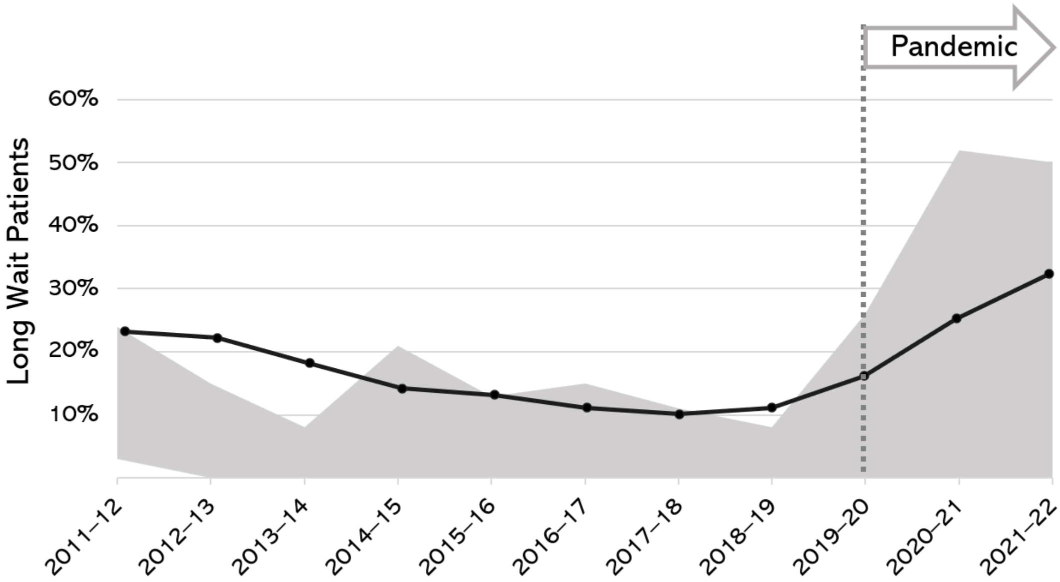


New South Wales

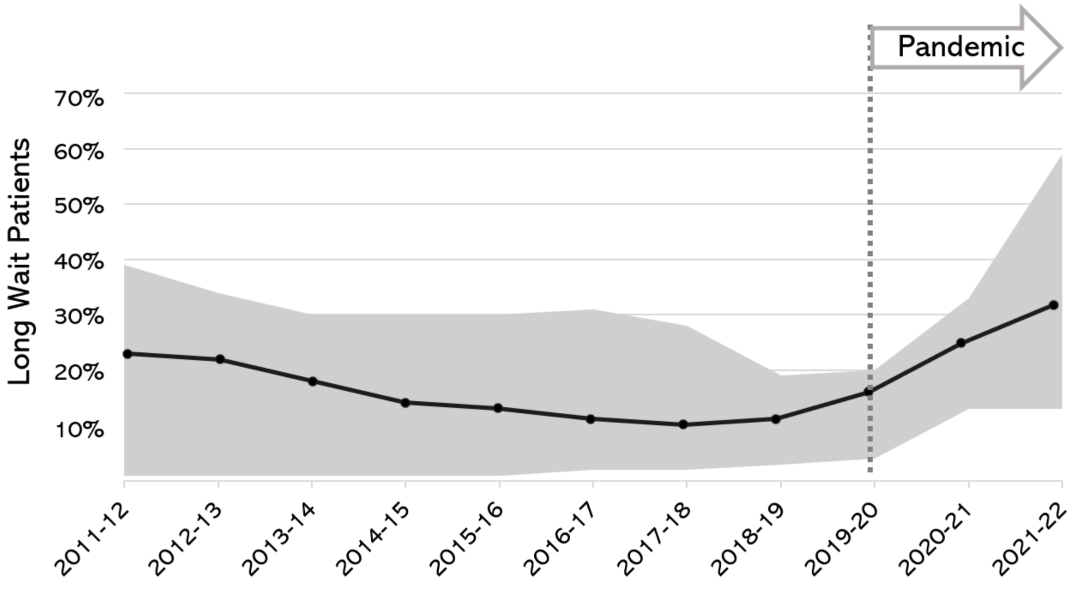


Victoria

Figure 4.27 Proportion (%) of patients booked for surgery at **category 2** waiting longer than the clinically recommended time for surgery in **medium-sized metropolitan hospitals**. The range across hospitals (shaded) compared to the Australian national medians (——). Comparison of NSW and Victoria over the period 2011 to 2022.

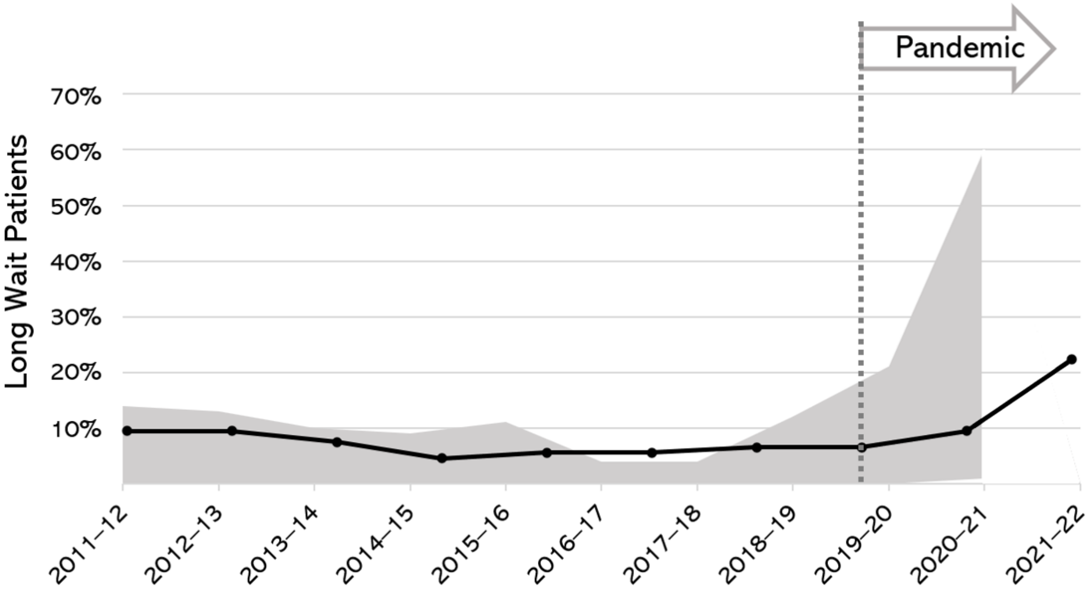


New South Wales

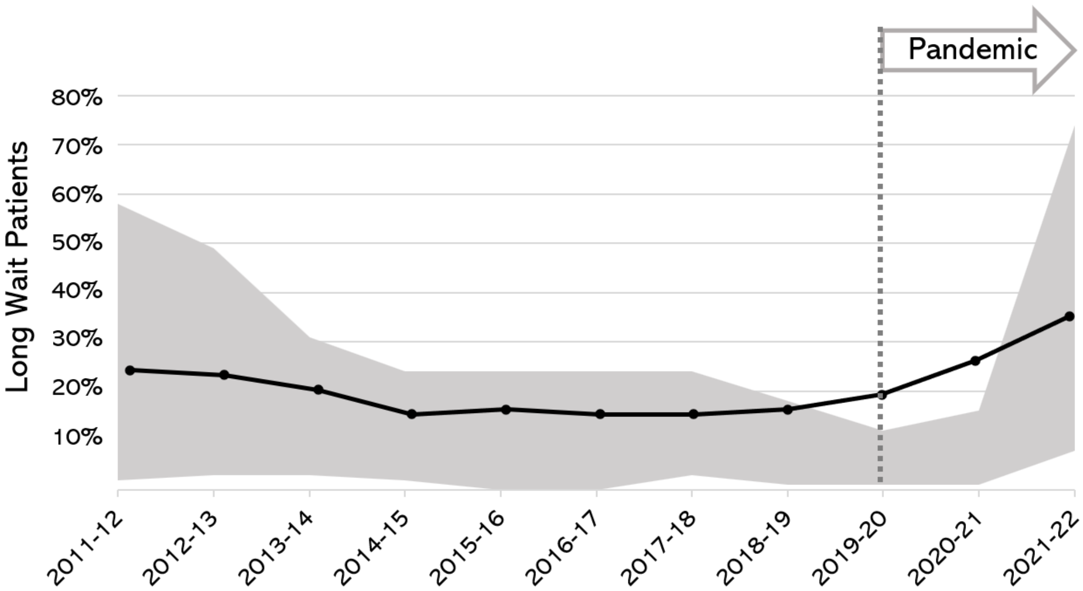


Victoria

Figure 4.28 Proportion (%) of patients booked for surgery at **category 2** waiting longer than the clinically recommended time for surgery in **large regional hospitals**. The range across hospitals (shaded ■) compared to the Australian national medians (——). Comparison of NSW and Victoria over the period 2011 to 2022 (Data for Western Australia unavailable).



New South Wales



Victoria

Figure 4.29 Proportion (%) of patients booked for surgery at **category 3** waiting longer than the clinically recommended time for surgery in **large metropolitan hospitals**. The range across hospitals (shaded) compared to the Australian national medians (——). Comparison of NSW and Victoria over the period 2011 to 2022. Data for Western Australia unavailable.

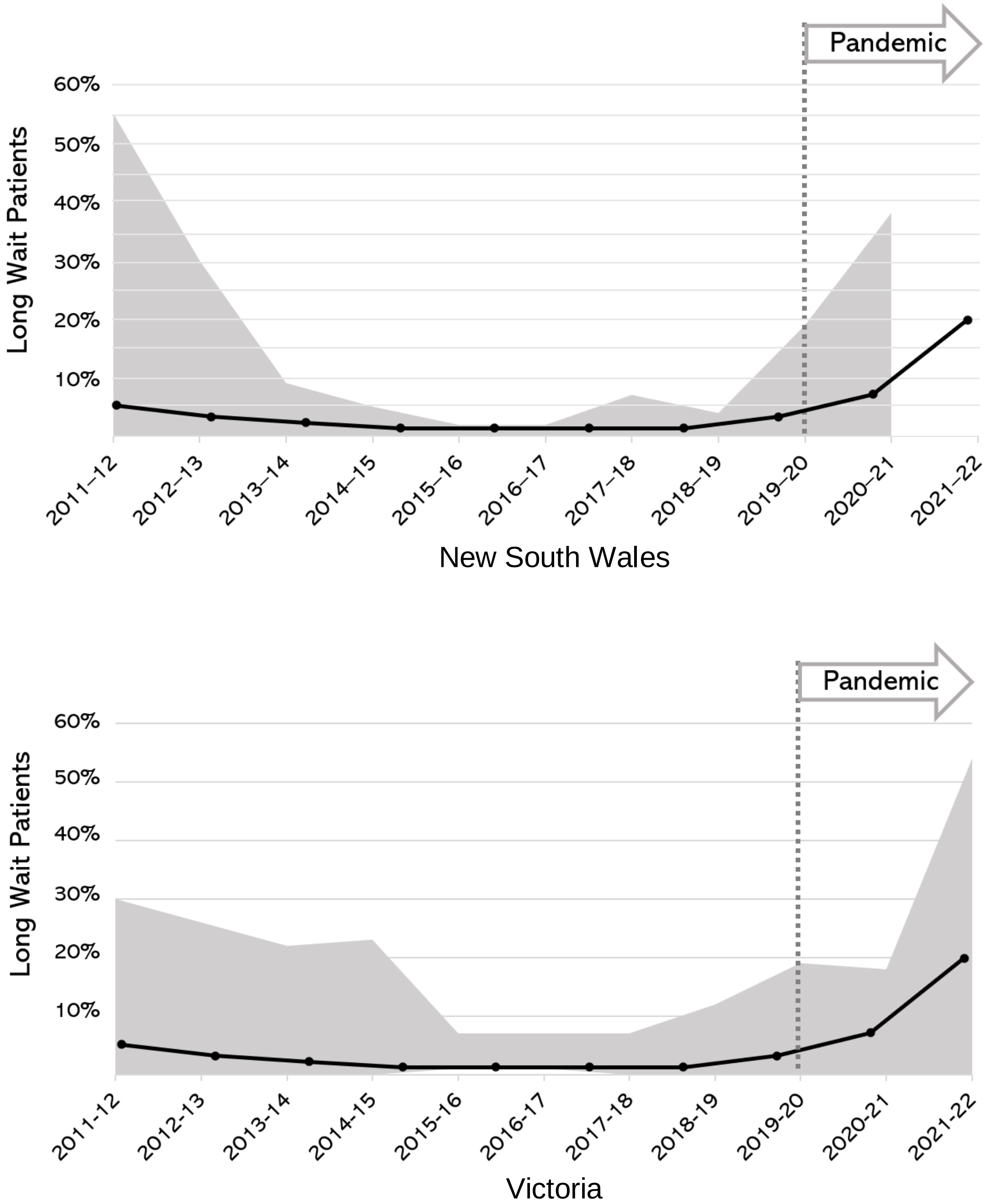
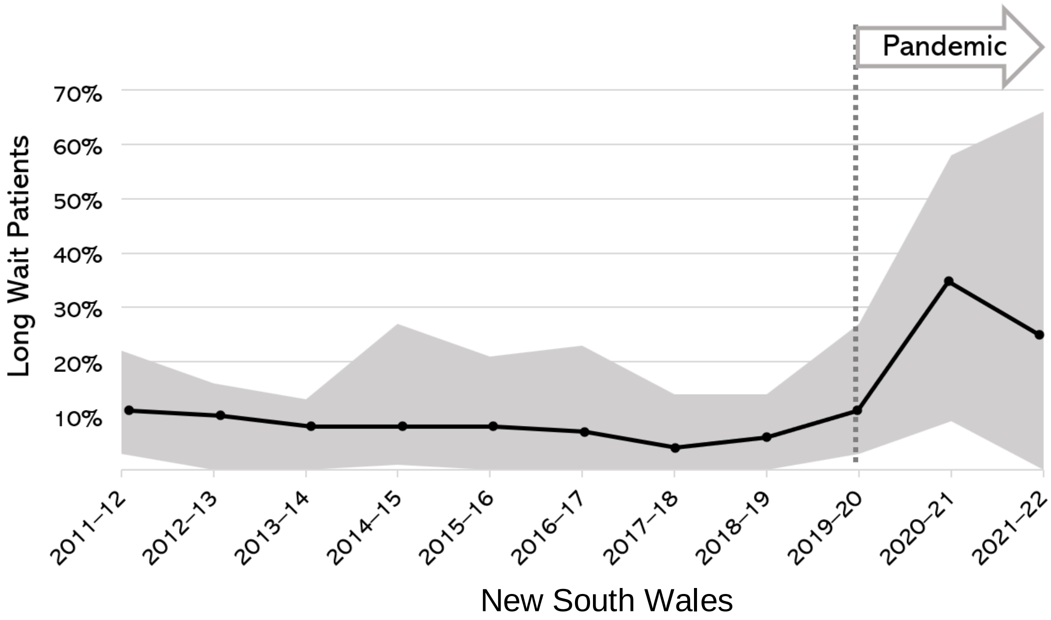


Figure 4.30 Proportion (%) of patients booked for surgery at **category 3** waiting longer than the clinically recommended time for surgery in **medium-sized metropolitan hospitals**. The range across hospitals (shaded ■) compared to the Australian national medians (——). Comparison of NSW and Victoria over the period 2011 to 2022. Data for Western Australia unavailable.



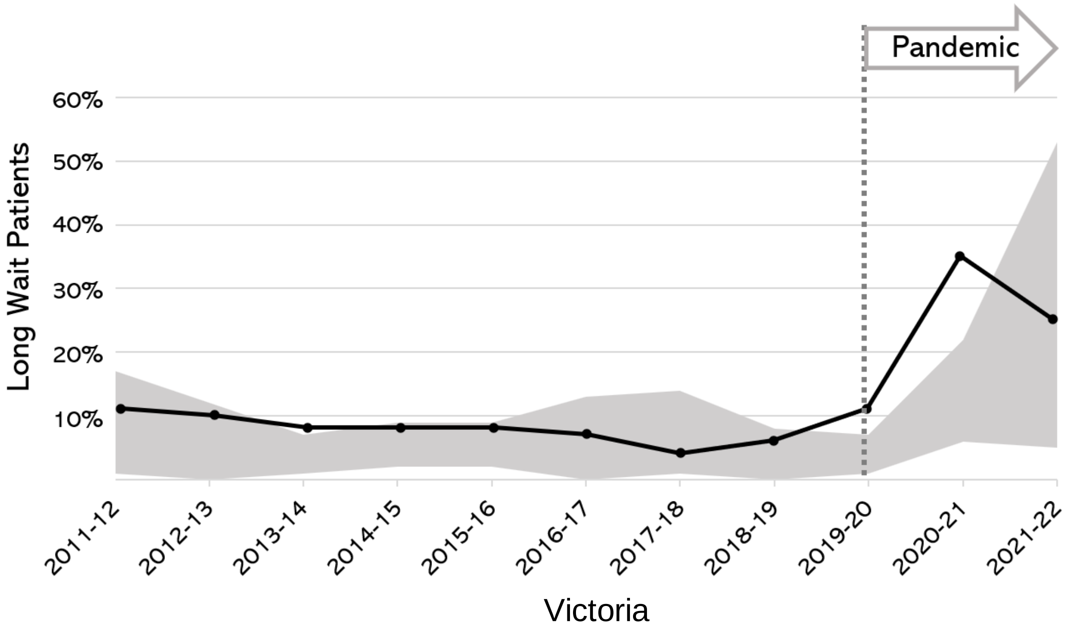


Figure 4.31 Proportion (%) of patients booked for surgery at **category 3** waiting longer than the clinically recommended time for surgery in **large regional hospitals**. The range across hospitals (shaded ■) compared to the Australian national medians (——). Comparison of NSW and Victoria over the period 2011 to 2022. Data for Western Australia unavailable.

4.6.4 Discussion

These comparisons – of three different states with three different public health approaches to the pandemic – showed very similar outcomes for access to category two and three surgical cases. Indeed, even with Western Australia having a hard border and minimal hospitalisation rates for COVID-19 patients there were increases in waiting time for surgery. This suggests that the effects on surgery were independent of the number of hospitalisations for acute COVID-19 infection and that managing these was a complex task. The dataset also allowed a comparison of the effects on the health systems of individual Australian states according to their public health strategies. When *laissez faire*, strict, and total border closures were studied among Australian states, it was difficult to discern any appreciable differences in outcome between the strategies. In the state of Western Australia, for example, where a hard border closure for most of the duration of the early years of the pandemic was enacted, the health system was still affected. It seems likely that restrictions of interstate staff movement, resource and logistic constraints, and precautionary measures to protect the health system had the same effects on the volume of planned surgery performed in major hospitals.

CHAPTER 5

UNDERSTANDING EMBEDDED DISADVANTAGE – GENDERED EFFECTS OF THE COVID-19 PANDEMIC ON ACCESS TO PLANNED SURGERY IN AUSTRALIAN HOSPITALS

> "Being a man or a woman has a significant impact on health, as a result of both biological and gender-related differences. The health of women and girls is of particular concern because, in many societies, they are disadvantaged by discrimination rooted in sociocultural factors."
>
> \- World Health Organization[42]

5.1 Chapter introduction

This chapter presents an analysis of the effects of pandemic disruptions of planned surgery from the perspective of gender. Evidence exists from around the world that women face greater disadvantage in accessing health care: the specifics of access to surgery, in particular, have received much less study. A small number of very recent studies – described in this chapter – provide evidence that women have faced greater challenges in access to healthcare during the pandemic. The aim of the study presented in this chapter was to use national Australian data to estimate the effect of pandemic-related disruptions to planned surgery from a gender perspective. To achieve this data were obtained from the Australian Institute of Health and Welfare (AIHW) regarding every inpatient surgical procedure in Australia. These were used to model anticipated numbers of surgical procedures based on pre-pandemic trends by gender, allowing comparison with the observed numbers of procedures.

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[42] World Health Organization (WHO). Women's Health. Accessible at: https://www.who.int/health-topics/women-s-health

5.2 Gender and access to healthcare

The COVID-19 pandemic has had unprecedented effects on health systems globally, with an important consequence being disruption of elective surgery. Despite measures such as the rollout of COVID-19 vaccination programs, the use of antiviral treatments, as well as other population-wide public health protections, the negative effects on performance of elective surgery continue to disrupt healthcare in Australia and overseas. The Australian Institute of Health and Welfare (AIHW) has reported that the number of patients admitted for planned surgery in Australian public hospitals decreased by 17% in 2021-22 compared both to 2020-21 and the pre-pandemic year of 2017-18.[43] Furthermore the AIHW reports a decrease in the number of patients added to public hospital waiting lists – with reductions of between 10% and 12% - compared to pre-pandemic figures, likely due to reduced access to medical consultations and investigations.

Severe negative effects on patients awaiting planned surgery in other high-income countries were predicted once the scale of the pandemic became clear: it was estimated that 400 000 procedures would be cancelled each month in the British NHS. (Macdonald *et al.*, 2020) Pandemic-related impacts were particularly concerning for time critical procedures such as the diagnosis of, and surgery for, malignant conditions (Parmar *et al.*, 2020) and for children awaiting surgery. (Forner *et al.*, 2022) Beyond these immediate effects on patient care, increases in the number of patients on surgical waiting lists lead to ongoing pressures on health

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[43] Australian Institute of Health and Welfare. Elective surgery. Accessible at: https://www.aihw.gov.au/reports-data/myhospitals/sectors/elective-surgery

systems in dealing with large numbers of patients whose surgery was delayed. A proportion of patients awaiting procedures face potential deterioration in both the conditions for which they await surgery and in other co-morbidities that could make surgery more complex after long delays. Further, doctors training to become specialist surgeons have faced unprecedented disruptions with the potential of years of reduced surgical experience, leading to concerns about the pandemic's effect on the next generation of surgeons and a downstream negative effect for patients. (Lund *et al.*, 2021)

Although it is difficult to estimate precisely the additional burden placed on health systems by disruption to surgery it has been estimated that one in 25 Australians were awaiting an operation or surgical procedure.[44] Similar estimates published by the British Medical Association suggest that over 7 million patients are now awaiting treatment in the NHS.[45] Comparable estimates have been published for other European countries.[46]

A notable aspect of the pandemic's social effects is that, in many respects, women appear to have been disproportionately affected. (Turner *et al.*, 2022) Beyond the adverse effects on access to care during pregnancy there is evidence of a disproportionate effect on women's mental health. (Almeida *et al.*, 2020) Data also suggest that pandemic protections such as lockdowns have increased rates of violence against women (Sánchez *et al.*, 2020), and access to gendered screening procedures such as mammography (Figueroa *et al.*, 2021) and cervical

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[44] Australian Medical Association. Addressing the elective surgery backlog. Accessible at: https://www.ama.com.au/articles/addressing-elective-surgery-backlog

[45] British Medical Association. NHS backlog data analysis. Accessible at: https://www.bma.org.uk/advice-and-support/nhs-delivery-and-workforce/pressures/nhs-backlog-data-analysis

[46] Eurohealth. Addressing backlogs and managing waiting lists. Accessible at: https://apps.who.int/iris/bitstream/handle/10665/351082/Eurohealth-28-1-35-40-eng.pdf?sequence=1&isAllowed=y

screening tests. (Leeson *et al.,* 2022) More broadly, there is emerging evidence that barriers to accessing healthcare during the pandemic have been gendered with women facing greater challenges that men. (White *et al.,* 2022) For example, a study from Chile reported a greater impact on diagnosis of time-sensitive conditions such as cancers and serious heart disease for women than men. (Pacheco *et al.,* 2021) There has been little research into whether the pandemic has had a gendered effect on access to surgery. Only one study – reporting results of a survey that found women were less likely to feel comfortable about having elective surgery – was identified in the literature search. (Moverman *et al.,* 2021) The aim of this study was to determine whether the pandemic had a gendered effect on elective surgery in Australia.

5.3 Methods

To reflect the data release and benchmarking processes currently used in Australia, procedure selection on the AIHW list of key indicator procedures (**Box 5.1**). Also, since the aim of this study was to investigate the effect of pandemic-related health system disruptions on elective surgery for adult Australians, procedures that largely involved patients under the age of 20 years (myringoplasty, tympanoplasty, myringotomy, and tonsillectomy) were not considered. Also excluded were coronary artery bypass graft (CABG) procedures due to the level of urgency with which they are performed in Australian hospitals. Although listed as category 2 (within 60 days), the median (50%) waiting time in public hospitals for CABG in the most recent pre-pandemic yearly period (2018-19) was only 17 days with a 90th centile wait of 75 days: clearly these procedures are prioritised. It addition, it was important to include comparisons both of gender specific procedures (such as hysterectomy and prostatectomy) and highly gendered procedures (inguinal hernia repair, where AIHW data show that 91% of all procedures in adults are in male patients). As the exemplar of emergency surgery appendicectomy was chosen, where 47% of procedures in adults are performed on males which is close to gender neutrality.

	Urgency Category	Median waiting time [Days]
Cataract extraction	3	84
Cholecystectomy	3	45
Coronary artery bypass graft	2	17
Cystoscopy	3	24
Haemorrhoidectomy	3	49
Hysterectomy	3	61
Inguinal hernia repair	2	59
Myringoplasty/Tympanoplasty	3	200
Myringotomy	3	62
Prostatectomy	2	44
Septoplasty	3	241
Tonsillectomy	3	125
Total hip replacement	3	119
Total knee replacement	3	209
Varicose vein treatment	3	108

Box 5.1 List of AIHW key indicator procedures, with urgency category and median waiting time for the procedure in pre-pandemic year.

Data regarding all the selected procedures were extracted from the AIHW national procedural database. The database holds information collected through the National Health Information Agreement as required by and specified in the National Minimum Data Set relating to hospitals: the data are provided to the AIHW by all Australian state and territory health departments.

Procedures use an agreed national standard, the *Australian Classification of Health Interventions* (ACHI), which is based around the Australian National Medical Benefits Schedule (MBS). Validation studies of the AIHW dataset have reported 99.5% agreement with "true" morbidity in a female population (kappa 0.86). (Roberts *et al.*, 2008) Data are pooled by financial years (July to June) and we selected data for the ten-year period from July 2011 to June 2021 using procedures coded according to the ICD-10-AM/ACHI guidelines, as detailed in the additional material provided online. The year 2019-20 was our period of interest as it included the most severe restrictions on elective surgery in Australia. To estimate the effect of the restrictions, we developed polynomial regression models with the highest R^2 (co-efficient of determination for goodness-of-fit) to estimate the predicted number of procedures for 2019-20. For each gender and procedure, two models were developed. The first (model 1) assumed that the number of procedures for 2020-21 represented a catch-up (tempo) figure that took into account lost surgical productivity in 2019-20. The second (model 2) made no assumption about the 2020-21 figure and continued the best-fit projected trend shown across the period 2011-2019. We compared the observed number of procedures for each gender in 2019-20 with the estimates from models 1 and 2 to establish a range of variance.

The data were extracted and entered into Excel™ spreadsheets and statistical analysis was performed in GenStat (https://www.vsni.co.uk/software/genstat/). The study received prospective approval from the Human Research Ethics Committee of the Australian National University.

5.4 Results

Data were extracted from the comprehensive national dataset for every year from 2011 to 2021, inclusive, with no data gaps for any procedure. Results for all procedures are presented in **Table 5.1**. In the first instance, with respect to emergency surgery, the` analysis of appendicectomy in adult Australians revealed no evidence of a gendered effect during 2019-20 (**Figure 5.1, Table 5.1**). However, for each of the non-gender specific procedures studies our estimates of the decrease in procedure numbers was greater for women than men (**Figures 5.2** to **6, Table 5.11**). For the gendered conditions, either highly gendered conditions (inguinal hernia repair in men) or gender-specific procedures for benign disease (hysterectomy and endometrial ablation for women), we found similar effects with a greater proportionate disruption for women than men (**Figure 5.8, Table 5.1**). When two gender-specific time critical procedures were studied – radical prostatectomy and radical hysterectomy – again, we found a greater reduction in numbers for women than men (**Figure 5.9, Table 5.1**).

Procedure		Predicted Model 1	Model 2	Observed	Variance Range	
Appendicectomy	Male	13688	14515	13844	+1.0%	-4.6%
	Female	16066	13492	15551	+15.3%	-3.2%
Cataract extraction	Male	118995	113208	101189	-10.6%	-15.0%
	Female	148963	155753	124974	-16.1%	-19.8%
Cholecystectomy	Male	18497	18781	18216	-1.5%	-3.0%
	Female	38880	38867	36638	-5.7%	-5.8%
Haemorrhoidectomy	Male	5312	5199	5119	-1.5%	-3.6%
	Female	5305	5600	4817	-9.2%	-14.0%
Inguinal hernia repair	Male	39387	39845	38526	-2.2%	-3.3%
Hysterectomy (benign)	Female	27115	29124	25773	-4.9%	-11.5%
Endometrial ablation	Female	13577	14079	12379	-8.8%	-12.1%
Septoplasty	Male	15799	15265	12477	-18.3%	-21.0%
	Female	12157	13906	9469	-22.0%	-31.9%
Total hip replacement	Male	18780	17486	16934	-3.2%	-9.8%
	Female	22868	23454	20863	-8.8%	-11.0%
Total knee replacement	Male	21435	20108	19387	-3.6%	-9.6%
	Female	28976	29106	24314	-16.1%	-16.5%
Radical Prostatectomy	Male	10137	9639	10742	+6.0%	+11.0%
Radical Hysterectomy	Female	1759	1837	1080	-38.6%	-41.2%
Overall Elective	Male	255232	243014	223670	-12.4%	-8.0%
	Female	257528	270968	222590	-13.6%	-17.9%

Table 5.1 Results for indicator procedures across the study period using model 1 (tempo) and model 2 (no tempo assumption) with predicted and observed numbers of procedures and ranges of variance.

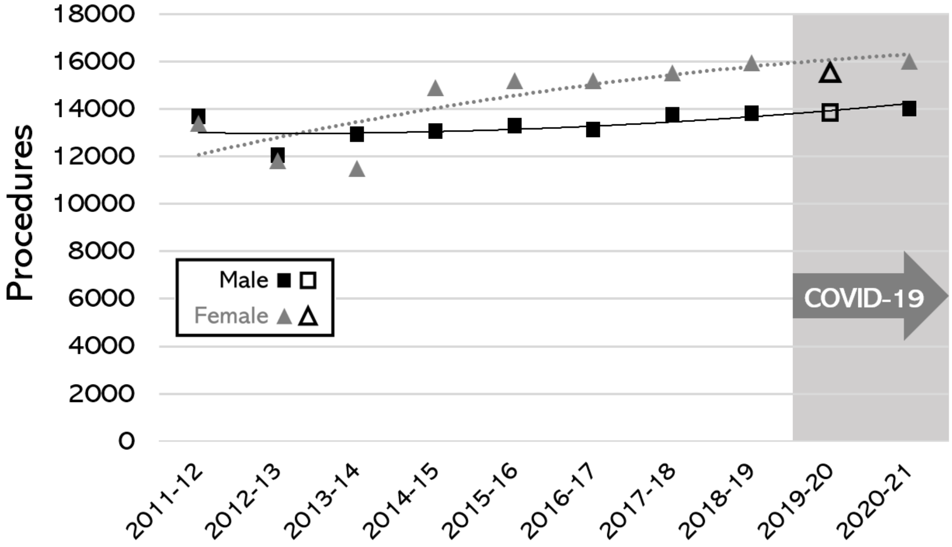

Figure 5.1 Total number of **appendicectomy** procedures performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).

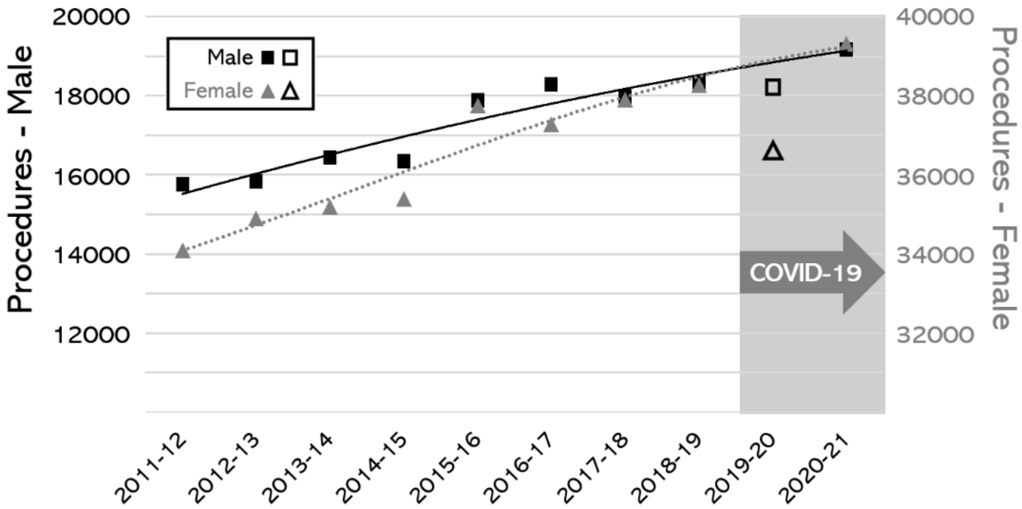

Figure 5.2 Total number of cataract procedures performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).
Note scale difference by gender, with scale for female patients on the right side of the figure, and scale for male patients on left side.

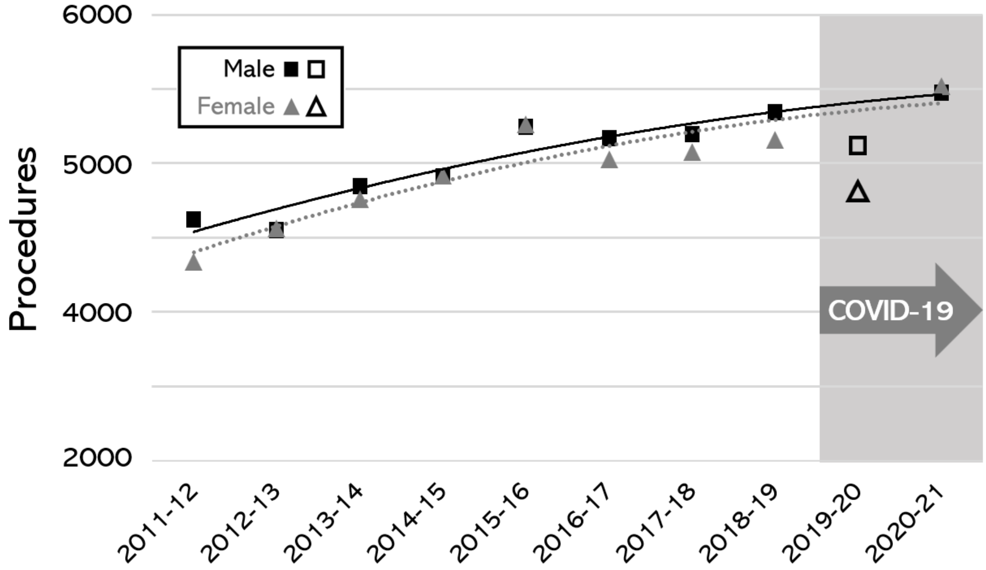

Figure 5.3 Total number of **cholecystectomy** procedures performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Note that the scale for female patients is at the right side of the figure, and for males at the left side. Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).

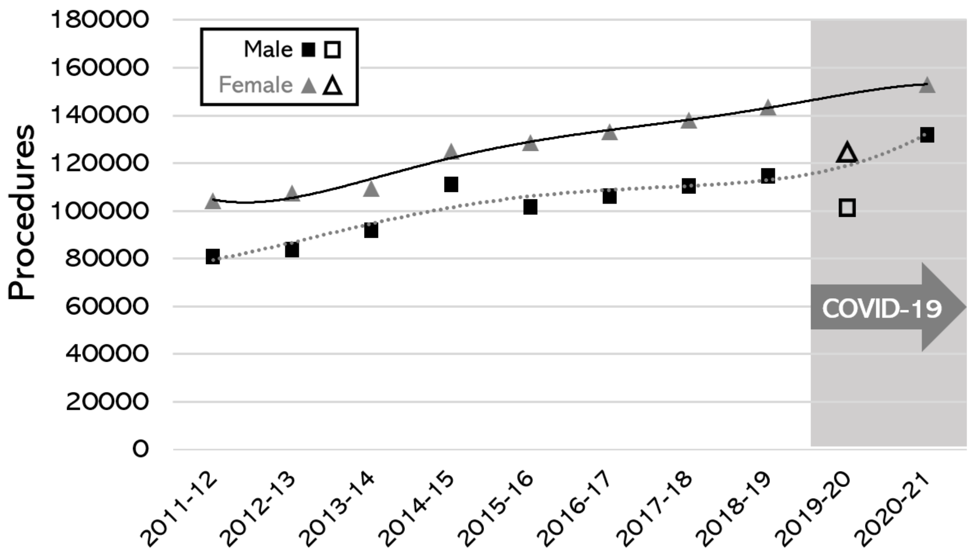

Figure 5.4 Total number of **cataract** procedures performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).

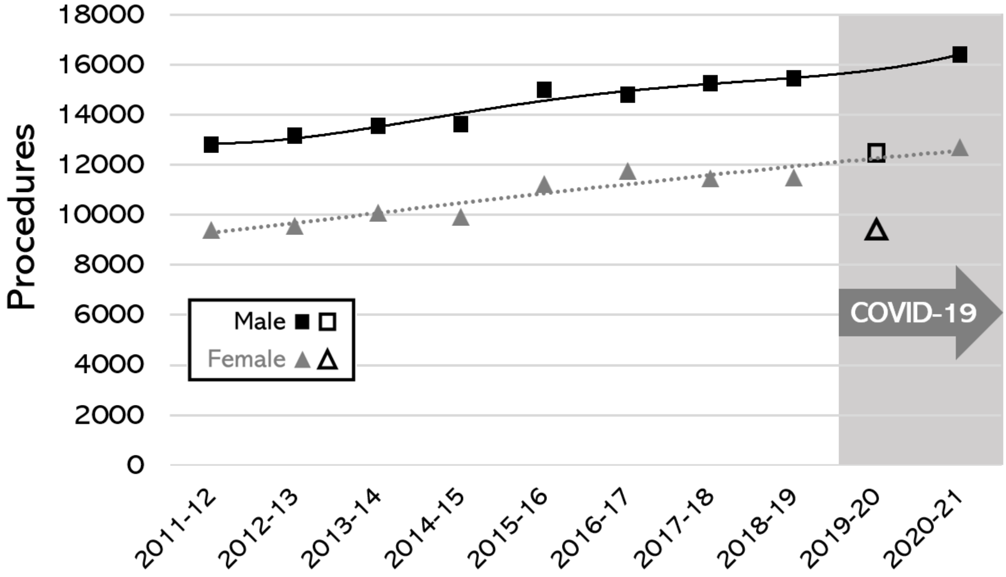

Figure 5.5 Total number of **septoplasty** procedures performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).

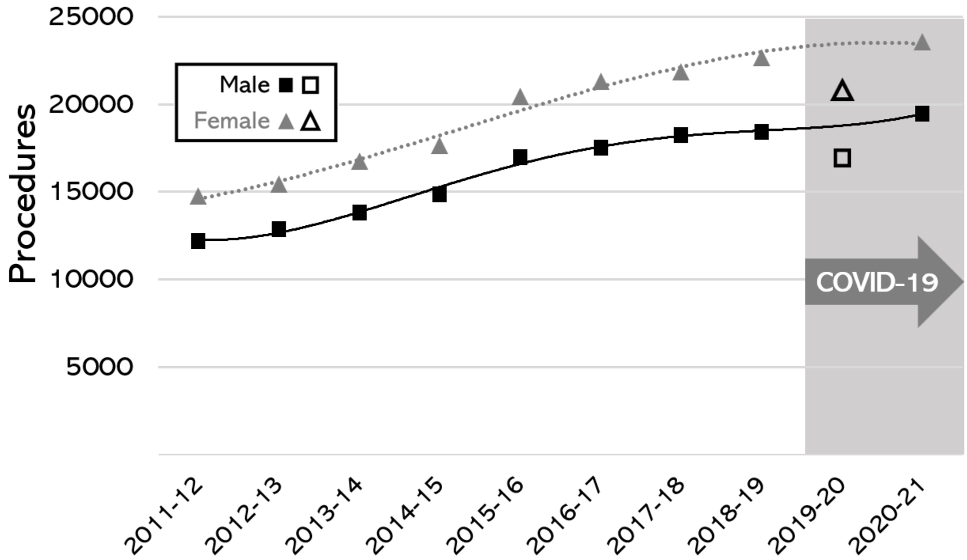

Figure 5.6 Total number of **total hip replacement** procedures performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).

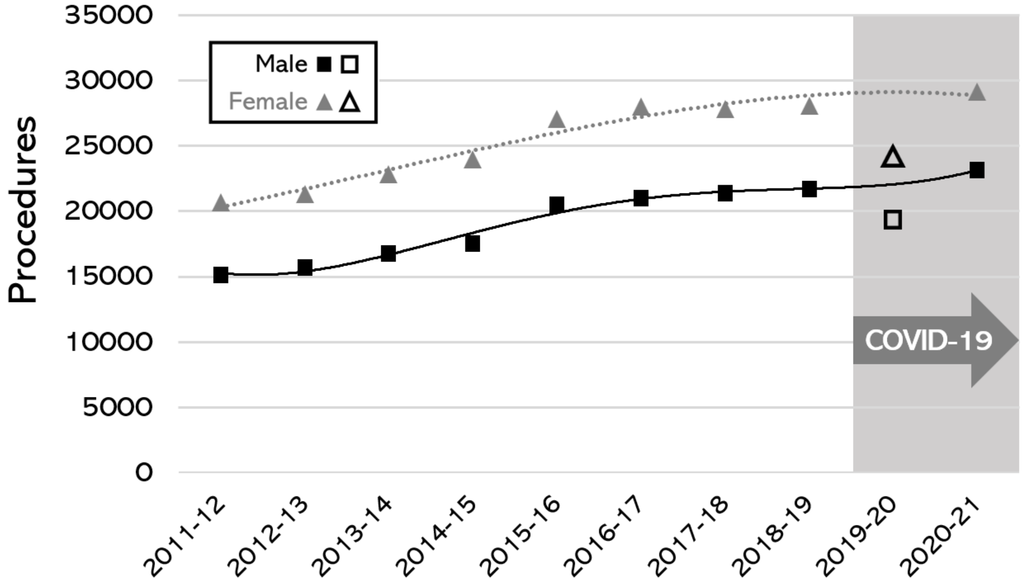

Figure 5.7 Total number of **total knee replacement** procedures performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).

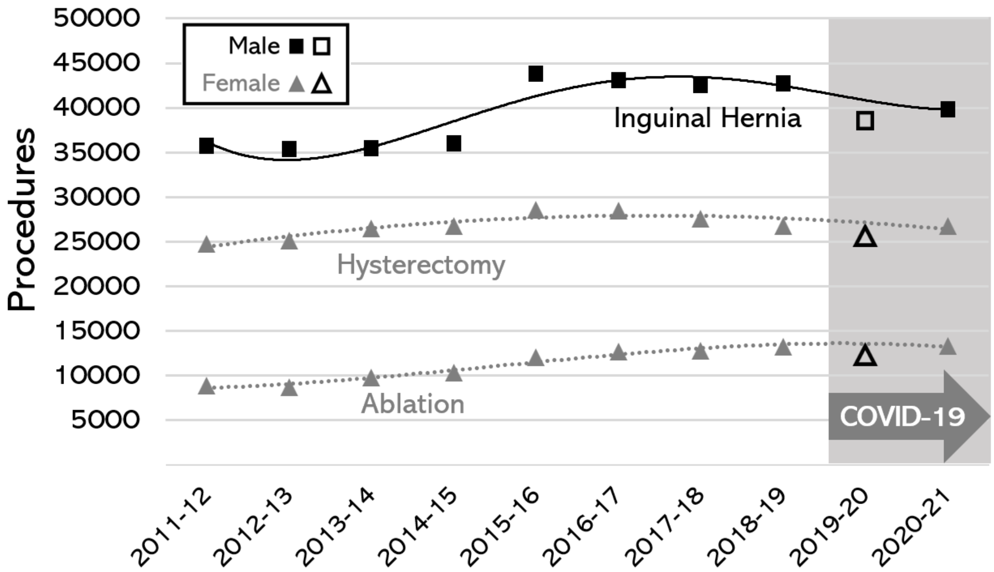

Figure 5.8 Total number of **inguinal hernia repair (male), hysterectomy** and **endometrial ablation** procedures (female) performed in Australian hospitals for patients aged 20 years or more during the period from July 2011 to June 2021, according to gender (male ■, female ▲). Figures for the peak period of surgical restrictions shown as hollowed symbols (male □, female △).

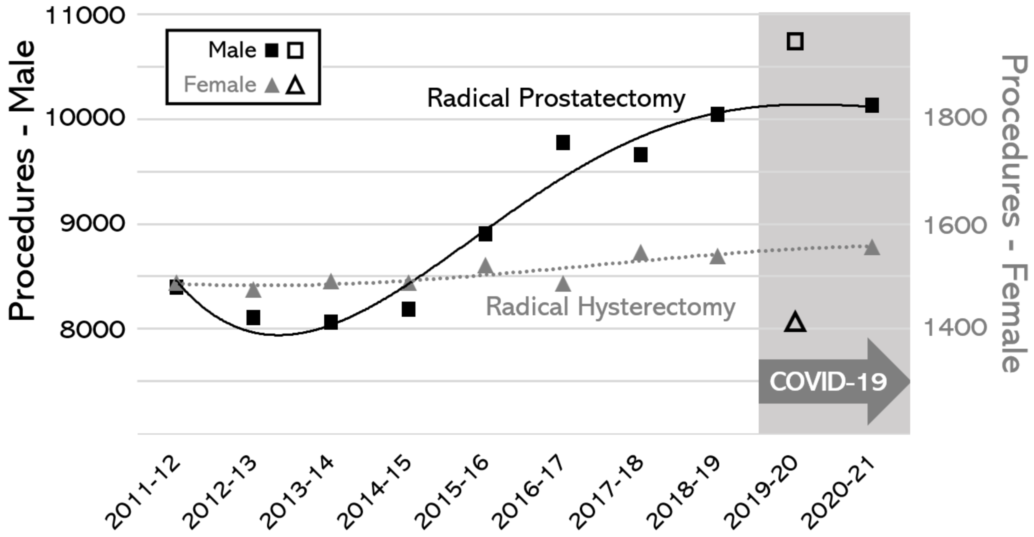

Figure 5.9 Total number of procedures performed for adults (age 20 to 84 years) in Australian Hospitals comparing **radical prostatectomy** with **radical hysterectomy** by gender of patient, 2011 to 2021 inclusive.
Note scale difference by gender, with scale for female patients on the right side of the figure, and scale for male patients on left side.

5.5 Discussion

The COVID-19 pandemic has had profound effects on health systems globally, due both to increased acute demands on health resources and also to delays in provision of planned surgery contributing to increased waiting lists for planned care. This study provides evidence that, in the Australian health system, women were affected more by delays in key planned surgical procedures than men. This gender disparity in access to healthcare is consistent with data regarding the worsening of existing gender inequalities across various social and economic indices at a global level. (Flor *et al.*, 2022)

There are obvious limitations to the study. It is not possible to make any adjustment for severity of disease in dealing with population-level data, so it may be that women had less urgent need for treatment. It also is possible – indeed likely - that women were more reluctant to undergo procedures and so were not subject to external biases: such an assumption was supported by one study. (Moverman *et al.,* 2021) It also seems likely that women will have had increased caring responsibilities, making them less able to undergo care themselves. There is evidence that women are more likely to be providers of care to older relatives or children who were unable to go to school. (Bühler *et al.,* 2021) Each of these potential modifying factors is not intrinsic to the health system. However, ensuring equity in healthcare should be a fundamental goal of all health systems.

One of the important reasons for analyses such as this is the opportunity to identify potential inequities so that these can be corrected. There is a body of evidence detailing known sources of inequity in access to surgery. (de Jager *et al.,* 2019) To deal with inequity in access to surgery, it is important that prioritisation systems for surgery should take into account not only the severity and impact of the condition being treated, but have mechanisms allowing for the identification of systemic biases that might disadvantage demographic or other groups. (Silva-Aravena *et al.,* 2020) Our data suggest that women were more likely to be affected by reductions in planned surgery over and above other potential inequities in surgical prioritisation. With a residuum of large number of patients now waiting for care, it thus is critical that prioritisation systems are constructed and implemented so as to identify and deal with any intrinsic gender bias in selection for, or prioritisation of, planned surgery. (Guo *et al.,* 2022)

CHAPTER 6

DISCUSSION AND CONCLUSIONS

> "The COVID-19 pandemic has exposed the longstanding structural drivers of health inequities, such as precarious and adverse working conditions, growing economic disparities, and anti-democratic political processes and institutions. These important determinants of health have interlinked with class, ethnicity, gender, education level, and other factors during COVID-19 to exacerbate existing social vulnerabilities in society."
>
> \- Paremoer *et al.*, 2021

6.1 The big picture

Australia has an almost-unique universal health system characterised by a blend of public and private practice. The Medicare system provides cash transfers that fund part or all of cost of consultations, investigations and tests, and discrete episodes of care as well and prolonged courses, such as cancer care or fertility treatment. This system is funded by a levy on all individual taxpayers who declare greater than a prescribed income, as well as a series of tax incentives and cash transfers designed to drive uptake of private health insurance. Public hospitals are funded through a formula prescribing the contributions of both the Federal Government and individual Australian state and territory governments but are administered by the individual jurisdictions. Private hospitals are owned and run by private entities – including faith-based organizations such as Catholic Healthcare Australia – but commonly will provide operating theatre time and resources for purchase by public hospitals. While the system is complex in comparison to many other OECD countries, the system ranks well. The Commonwealth Fund's 2021 independent analysis ranked Australia's health system third in the world – based on access to care, care processes, administrative efficiencies, equity, and overall health outcomes – behind Norway and The Netherlands.[47]

Surgery is an essential part of modern health care and in Australia, prior to the pandemic, approximately 2.2 million planned surgical procedures were performed each year.[48] In Australian public hospitals, where approximately 35% of planned surgery is performed, waiting lists have long been used as a non-price rationing mechanism. Unfortunately the disruption to hospital activity resulting from responses to the pandemic has meant that the volume of planned surgery performed has reduced by an unprecedented amount with estimates of as many as 500 000 Australians now on waiting lists.[49] To deal with such an amount of surgery will require not only enormous resources but also a new paradigm in the way that prioritization is undertaken. (Babidge, *et al*., 2020) However the situation also provides an important opportunity to re-evaluate the processes, functions, and outcomes of surgical prioritization and waiting list management. Undertaking this with an equity lens and normative approach has the potential to improve allocative efficiency in one of the most resource-intensive areas of health care activity at a time of increasing resource constraint. To underpin this, however, a clear understanding of the structural inequities and biases inherent in the current system is fundamental to ongoing system improvements.

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[47] The Commonwealth Fund: https://www.commonwealthfund.org/publications/fund-reports/2021/aug/mirror-mirror-2021-reflecting-poorly

[48] Australian Institute of Health and Welfare (AIHW). Surgery in Australian Hospitals. Accessible at: https://www.aihw.gov.au/reports/hospitals/hospitals-at-a-glance-2017-18/contents/surgery-in-australia-s-hospitals

[49] Australian Medical Association (AMA): https://www.ama.com.au/articles/addressing-elective-surgery-backlog#:~:text=Analysis%20performed%20by%20the%20AMA%20reveals%20that%20by%20the%20end,backlog%20of%20almost%20five%20months.

The studies described in this dissertation aimed to provide a deeper understanding of the factors affecting access to, and waiting times for, planned surgery in Australian public hospitals. Following on from those results, studies were undertaken that provided a detailed examination of the effects of the pandemic on planned surgery in the Australian health system. When taken together, these results reveal that – prior to the COVID-19 pandemic – access to surgery in Australian hospitals was affected by a number of important structural inequalities. As health systems recover from the pandemic shock it is appropriate to evaluate the lessons inherent in the response and understand how to manage the historically large number of patients now awaiting planned surgery.

6.2 A summary of the studies

The first study examined the effect of socioeconomic status (SES) on access to specialist surgeons. To do this data were obtained from Medicare Australia – the body that finances medical consultations in the Australian health system – regarding the postcode of residence of patients who claim for a surgical consultation along with age, gender, and the subspecialty of the surgeon. The postcode of residence was used to estimate the patients' SES and rurality (a major factor affecting health care access in Australia) and correlate this with rates of first visit with a surgeon. In young Australians aged less than 20 years, the rate of surgical visits showed a gradient with reduced rates associated with decreasing SES. For this group rurality was influential but manifest an inverse-U curve. For adults there were age and gender gradients confirming an effect of SES but for several specialties the results were inverse compared to children and adolescents.

The second study examined SES and rates of surgery for high- and low-value procedures using data from the Australian Institute of Health and Welfare (AIHW). These studies confirmed an inverse gradient – with higher SES associated with lower rates of surgery – in both the high- and low-value procedures. Since low-value surgery is undesirable identifying and reducing the use of low-value procedures has the potential to improve surgical access in a time of crisis.

The third study used data from the AIHW to quantify the effects of the pandemic on performance of planned surgery in Australian public hospitals. Modelling showed that waiting times for, and the proportion of patients who waited longer than clinically recommended for, planned surgery increased across all key procedures and have not returned to pre-pandemic levels. An estimate of the number of planned procedures not performed during the pandemic yielded a range between 216000 and 412000 procedures. Australia also had state-based pandemic public health responses to the pandemic: tight border controls in Western Australia; intermittent prolonged lock downs in Victoria; and, a *laissez faire* approach in New South Wales. The effects on waiting lists for surgery using these three approaches revealed increases in waiting times for surgery and high levels of inter-hospital variation with no obviously superior approach.

The final study examined the effects of gender on access to planned surgery during the pandemic using AIHW data. The results revealed that for every procedure studied, females were less likely to have undergone surgery than males, suggesting an inherent gender bias in access to surgery.

Taken together these studies suggest that, in the Australian health system, there is considerable inherent inequality of access and update across SES, rurality, and gender, affecting access to planned surgery in public hospitals. Reducing these inequalities would be expected to improve access to and outcomes from healthcare in future.

6.3 Moving forward with planned surgery

Disruption to surgery – both planned and emergency – resulting from the pandemic shock has led to avoidable pain and disability to people who already need treatment to be healthy and productive. Importantly, health systems across the world have been left with large numbers of patients awaiting planned surgery. As Søreide and colleagues (2020), writing in the *British Journal of Surgery*, have warned:

> "The ongoing pandemic is having a collateral health effect on delivery of surgical care to millions of patients [who] are being deprived of surgical access, with uncertain loss of function and risk of adverse prognosis as a collateral effect of the pandemic. Surgical services need a contingency plan for maintaining surgical care in an ongoing or post-pandemic phase."

Since waiting is inevitable in publicly-financed or insurance-based healthcare systems that undertake non-price rationing, with the unprecedented effects of the pandemic playing out it is important to understand the broad principles of access to publicly-funded surgery in health systems such as Australia. The systems that allow planned surgery to be performed extend from general practitioners (GPs), acting as 'gatekeepers,' who recognise health conditions potentially requiring surgery, through referral to and further assessment by specialist surgeons, access to diagnostic tests such as imaging and pathology, administrative systems to facilitate hospital admission, and the complexity of providing not only the surgery but perioperative care including rehabilitation or intensive care facilities at time. For these reasons, there is no single explanation for waiting times other than insufficient capacity. However, investigation of possible reasons for unacceptable delays in the provision of surgery is critical to understanding how best to manage, triage, and prioritise surgical care within existing or planned capacity.

If we accept that long waiting lists for planned surgery and other healthcare services represent a dysutility for individual patients and their families, the use of 'reasonable' waiting lists as a non-price rationing mechanism is likely to improve the overall efficiency in use of scarce health resources (Oudhoff *et al.*, 2004; Johar *et al.*, 2011). Demand in healthcare tends to be stochastic across the timescale of months, adding to the difficulty in responding to increases in demand and maintaining a market equilibrium (Arrow, 1963). As Street and Duckett (1996) explain: "it is not possible to operate at full capacity any system subject to random fluctuations in demand without a queue developing, and by maintaining a pool of patients the potential for under-utilisation of hospital resources is reduced." Supply, on the other hand, is almost always inelastic at least in the short- to medium-term. (Ellis, Martins & Zhu, 2017)

Edwards (1997) addressed the equity-efficiency trade off implicit in maintenance of surgical waiting lists thus:

> "Within a cash limited public health service, patients cannot expect the right to receive all treatments within a maximum guaranteed waiting time; rather, patients can expect to receive treatments which have been proved clinically effective and relatively cost effective, within a clinically appropriate time for their condition. Patients will have to accept that those requiring less urgent treatments may have to wait longer than those requiring more urgent treatment."

Accepting that waiting lists for planned surgery provide a mechanism to strive for maximum allocative efficiency in healthcare markets, it follows that allocation to a surgical waiting list in the first place should be an equitable process. However, while the dynamics of surgical waiting list management are underpinned by a theoretical and quantitative literature, the processes that lead to allocation to surgical waiting lists have remained largely unstudied.

One obvious influence, even in countries with universal health systems such as Australia and the UK, is the SES of the patient. McIntyre and Chow (2020) have conducted a systematic review of waiting times once a patient is placed on a surgical waiting list in OECD countries, including Australia, Canada, Denmark, Finland, Ireland, the Netherlands, New Zealand, Portugal, Spain, Sweden, and the UK. They concluded that there is a "relationship between SES and waiting time. This is particularly concerning in publicly funded health systems where service delivery is intended to be dependent on need rather than the ability to pay." A negative relationship between SES and access to surgery is particularly concerning since the relationship between socioeconomic disadvantage, quality-adjusted life expectancy, and a greater need for healthcare is well recognised. This negative relationship was termed the 'inverse care law' in a seminal paper by Hart (1971)

(Individuals at socioeconomic disadvantage face both greater risks of ill health and barriers in accessing healthcare (Van Lenthe & Mackenbach, 2021). Patients at socioeconomic disadvantage have less access to preventive care and tend to present with later stage disease (Veugelers & Yip, 2003; Cookson *et al.*, 2016; Valenti *et al.*, 2016).

6.4 Summary of the findings

6.4.1 Socioeconomic status, rurality, and surgical referral

The first study described in this dissertation, described in chapter 2, used data from the Australian government single payer Medicare to identify first visits with a specialist surgeon undertaken in the last pre-pandemic year 2019 according to gender, age, and postcode of residence (the latter allowing an estimation of SES and rurality for every patient) as well as the specialty of the surgeon across all of Australia. For young Australian patients – those aged less than 20 years – a clear gradient was found with a reducing rate of first surgical consultation as SES decreased. However, for adult patients the findings were more complex. A clear and anticipated divide was found with older patients having higher rates of surgical consultation. For consultations with general surgeons the gradient was reversed to that of young patients, showing an increased rate of consultation with lower SES, stratified for age. This relationship was not present with ENT or orthopaedic surgeons, but when all other surgical specialties were combined the reverse gradient was present. A strong relationship was present with rurality for adults, although the highest rate of consultation was found in outer urban and large regional areas, in an inverse-U shaped relationship.

Taken together, these results suggest that even in a high-income country with a universal health system such as Australia, SES and rurality are associated with disparities in access to healthcare. Whether these findings reflect an underlying burden of disease, or perverse incentive that work to increase referral from bulk-billing GPs (the lowest-cost part of the Australian health system) – or both – the relationships uncovered have important implications for improvement both of efficiency and of equity for Australians in their health system. These findings should prompt further study in the post-pandemic setting and as waiting lists for planned surgery reach historically high levels.

6.4.2 *Socioeconomic status, 'high' and 'low' value surgical care*

Once patients have consulted specialist surgeons, many will be assigned to public hospital waiting lists for surgery. One of the key issues facing health systems in Australia and globally is the issue of 'value' in healthcare. The provision of high-value care, and elimination or minimisation of low-value care should result in better health outcomes and, theoretically at least, reduction in expenditure and use of resources if care that offers little or no value to patients is reduced (Porter, 2010; Teisberg *et al.*, 2020). Value-based healthcare should serve as a path to achieving the 'triple aim' of improved patient experience of care, improved health of populations, and reduced cost of healthcare. Reducing the use of low-value care would be expected to contribute to cost containment and increases in efficiency in healthcare, with resulting reductions in expenditure that should not harm health outcomes.

It is likely that a large number of factors contribute to healthcare value including financial incentives, health system structures, geographical factors, population demographics, medical education of doctors and other healthcare workers, and patient involvement (Landon, Padikkala & Horwitz, 2022). Discouraging the use of low-value care and promoting, instead, the high-value care requires a thorough understanding of the factors driving care uptake at multiple levels, including system-level factors (such as healthcare policies and remuneration systems), hospital-level factors (such as treatment protocols and guidelines), doctor- or practice-level factors (patterns of practice), and patient-level factors (health literacy). At this time, major gaps remain in our understanding of value-based healthcare promotion, not least of which include the methodologies that underpin and ensure that identification of low-value treatments is robust and rigorous. (Baker *et al.*, 2013)

Despite the large amount of effort put into understanding drivers and enablers of high-value care, only a very small amount has pertained to surgery. For example, an analysis of the Choosing Wisely (CW) recommendations found that only about one in 20 recommendations are related to surgical procedures. (Antunez, Telem & Dossett, 2019) De-implementation of low-value surgical care is not necessarily an easy undertaking. (Rosenberg *et al.*, 2015) The persistence of low-value surgical procedures is likely to be due to factors that are multiple and multilevel including supply-side drivers such as individual surgeons' habits and training, the well-recognised financial drivers of supplier-induced demand, 'overtreatment' related to concerns about litigation, and industry influences. There also are likely to be demand-side drivers related to information asymmetries and patient perceptions. (Berlin *et al.*, 2020)

One of the potential drivers of the use of low-value surgical procedures could be pathways of referral to surgeons. The first study in this dissertation has shown that SES is associated with surgical referral in adults. In the second major study of the project, SES was examined as a potential driver of low-value surgery. The hypothesis tested was that patients of higher SES – presumably with more resources and supports – would be more likely to undergo low-value surgical procedures because they could afford it. In fact, the opposite was noted in the procedures studied both with the high-value (cholecystectomy and inguinal hernia repair) and low-value (knee arthroscopy and abdominal hysterectomy in pre-menopausal women) procedures studied.

6.4.3 A role for information asymmetry?

Similarly to the first study of surgical referral, the results were unexpected and to a certain extent counterintuitive. The theoretical underpinning of the hypothesis was that SES is related to a patient's access to resources and ability to afford a surgical procedure, and access to a surgeon and surgical facilities, whether through private health insurance or through a capacity to afford the time necessary for the procedure and recovery from a procedure (Lueckmann *et al.*, 2021). Despite the theory, at a national population level in Australia the exact opposite was found for these common indicator procedures.

Similar to the findings of the first study, there are important potential implications and actions that should arise from the data. It is possible, for example, that information asymmetry between health consumers (patients) and suppliers (in this case, surgeons and the GPs who provide surgical referrals) are contributing to this market failure (Campbell *et al.*, 2018). This conclusion is supported by some preliminary data from Denmark (another high-income country with a universal health system) showing that a high prevalence of 'inadequate health literacy' that is 'strongly associated with a low socioeconomic status' (Svendsen *et al.*, 2020). Thus, the finding in this study points to a need for a campaign to increase health literacy in disadvantaged patients as an important step in reducing the use of low-value care. Patients with lower levels of health literacy would be vulnerable to information asymmetry and supplier-induced demand in surgery (Schwesinger & Diehl,1996).

The other potential explanation for the findings – and these are not mutually-exclusive by any means – is that the observed gradient in hernia surgery rates might reflect the individual patients' personal circumstances. For example, a patient with few symptoms from an inguinal hernia might not materially reduce the utility for a person with a professional and less physically-demanding occupation, whereas patients at socioeconomic disadvantage could be more likely to have a physically-demanding occupation for which an inguinal hernia would have a more adverse effect (Fujishiro, Xu & Gong, 2010).

6.4.4 Reflections on the COVID-19 pandemic

All of the findings from these studies of the pre-pandemic situation point to important potential strategies to improve the allocative efficiency of the Australian health system. In the pandemic-associated situation we now find ourselves in, with historically high volumes of patients waiting for planned surgery that was delayed by the pandemic, the identification of patients who have been inappropriately referred for surgery, or who wish for common but 'low value' surgery, are key drivers of continuing demand for surgery.

The second set of studies described in chapter 4 of the dissertation – involving surgical care during the pandemic – aim to add some perspective to the effects of the pandemic shock on Australia's health system and its effect on planned surgery. The magnitude of the task in the Australian setting is well-recognised and poses a major priority for the system likely until the end of the current decade (Watters & Aitken, 2022). It became obvious early that the pandemic had the potential to overwhelm the capacity of the Australian healthcare system and, in response, the Australian Government Department of Health enacted health management plans to ensure the appropriate allocation of resources. One element of this response was the issuing of directives regarding elective surgery: either to postpone non-urgent surgery or, where patients could not wait, redirect from public to private providers, if necessary, due to a potential lack of capacity in the public healthcare system. The intention of these directives was to protect surgical teams and patients from infection, and to preserve medical supplies and vital equipment needed for the anticipated surge in COVID-19 patients requiring high-acuity care. RACS and the specialty surgical societies produced guidelines to dispel uncertainty around patient and procedure classifications and support decision-making for the postponement of surgery (Babidge *et al.,* 2020). From the outset, however, concerns were expressed that rigid adherence to restrictions in elective cases had the potential to create an unintended consequence of a surge in surgery following the first wave of COVID-19, potentially overwhelming and compromising healthcare across the country (Fisher *et al.,* 2020).

To provide estimates of the volume of surgical cases not performed in Australia over the early part of the pandemic, the third study described in Chapter 4 used AIHW waiting list data to examine the quantitative effects on planned surgery in Australia. The first study estimated that between 260,000 and 413,000 operations were not performed in Australian public hospitals over the pandemic period until the end of June 2022. Across all of the surgical specialty groups increases in the median waiting time for planned surgery was observed, and these waiting times had not returned to pre-pandemic levels for ophthalmology, otorhinolaryngology (ENT), and orthopaedic surgery. Similarly the number of patients who waited longer than clinically-indicated for surgery was observed to have increased across all surgical specialties with, again, the greatest deteriorations in ophthalmology, ENT, and orthopaedic surgery. None of the surgical specialties showed a return to pre-pandemic levels by the end of 2021-22.

When all of the key indicator procedures in adult and young patients were studied, the data show the pandemic had been associated with a reduction in surgical volume and increases in median waiting time for surgery. The proportion of patients who waited longer than clinically recommended for the surgery with none of these values returning to pre-pandemic levels by the end of the study period. These changes in surgical care are likely to have had major and significant effects when the forgone QALYs that could have been gained by earlier surgery are considered. This changes, in turn, would be predicted to increase the need for non-surgical care and reduce the overall productivity of the Australian economy (Lee *et al.*, 2021).

6.4.5 A state-level analysis

The dataset used in this thesis also allowed a comparison of the effects on the health systems of individual Australian states according to their public health strategies. When *laissez faire*, strict, and total border closures were studied among Australian states, it was difficult to discern any appreciable differences in outcome between the strategies. In the state of Western Australia, for example, where a hard border closure for most of the duration of the early years of the pandemic was enacted, the health system was still affected. It seems likely that restrictions of interstate staff movement, resource and logistic constraints, and precautionary measures to protect the health system had the same effects on the volume of planned surgery performed in major hospitals.

6.4.6 Gendered effects of the pandemic on planned surgery

Lastly, the specific case of gender and its effects on access to planned surgery during the pandemic was studied using AIHW data and is described in Chapter 5. It was noted early in the pandemic that women appeared to be disproportionately affected by the effect of the pandemic on the health system. (Turner *et al.*, 2022) Pandemic protections such as lockdowns had been shown to have increased rates of violence against women (Sánchez *et al.*, 2020), and access to gendered screening procedures such as mammography (Figueroa *et al.*, 2021) and cervical screening tests were negatively affected (Leeson *et al.*, 2022).

The final study of this dissertation provided strong evidence that, in the Australian health system, women were affected more by delays in key planned surgical procedures than men. This gender disparity in access to healthcare is consistent with data regarding the worsening of existing gender inequalities across various social and economic indices at a global level (Flor *et al.*, 2022).

6.5 Strengths and limitations of these studies

The studies presented in this dissertation have a number of key strengths. In the first instance they use national population-level data that have been through a rigorous mandated collection process and use robust metrics such as the Australian Bureau of Statistics' IRSAD (Index of Relative Social Advantage and Disadvantage). Similarly, the waiting list data are at national level, cover a prolonged timescale, and include granular data to the level of individual hospitals. These rich data have allowed a comprehensive and thorough analysis and support robust conclusions.

There are, however, a number of important limitations to these studies. In the first instance, there are insufficient data regarding the individual reasons for surgical referral. These will never be available for a national-level database and would require review of individual referral correspondence. To test hypotheses regarding differing referral patterns would likely involve direct interviews with patients and their referring doctors. For this reason, the data can provide potential hypotheses for testing but can never provide comprehensive information about underlying patterns of surgical disease.

Another important limitation regards the uptake of 'high' and 'low' value surgical care and procedures. The results of the study described in chapter 3 again provide intriguing insights into choices of surgical care and into possible health literacy issues or of information asymmetries between patient and surgeon. However, without targeted interviews it is unlikely that the reasons for such choices of care, or recommendations by surgeons, were made.

The large scale national datasets required for analyses of the planned surgery disruptions provide important evidence, but can never provide granular data regarding decision-making. Was it patient choice to forego surgical procedures, or were the cancellations imposed by systemic responses to hospital resource constraints? This is an important limitation in terms of planning a response to deal with the backlog of procedures cancelled during the height and in the aftermath of the pandemic. Importantly, though, it also should play a role in shaping ongoing improvements to surgical workflows. Understanding what factors might prompt patients awaiting care to forego that care is one of the fundamental tenets underpinning equitable systems for waiting list management.

Related to this, the studies of gendered disruptions to care described in chapter 5 are important for highlighting the inequity but can shed no light on the underlying reasons. This is a limitation that is important, and that should prompt further analysis of the reasons why women were more disadvantaged.

6.6 Novel contributions of the dissertation

The studies described and presented in chapters 2, 3, 4, and 5 provide a number of novel contributions. In the first instance the effects of socioeconomic status and rurality on access to surgery had never been studied in Australia before. The magnitude of effect in young Australians – with a large socioeconomic gradient – has not previously been described and should demand an urgent policy response from the Australian government. Similarly, the magnitude of the effect in adult Australians is a unique finding, not described previously, and should prompt further detailed analysis and a potential policy response.

The insights gained into rates of 'high' and 'low' value surgery again have not previously been described. That such a socioeconomic gradient persists, and is counterintuitive in that patients of higher socioeconomic status have lower rates of these procedures, is potentially of great importance in a policy sense. Because of the importance of reducing rates of low value surgical care the findings should, again, prompt further investigation.

The data regarding the gendered differences in planned surgery in Australian hospitals, detailed in chapter 5, have not previously been described and should be of great concern. It is hoped that these findings will prompt further review and a possible policy response.

6.7 Further research

The work and findings described in this dissertation should lead to a great deal of further research. Projects would include detailed patient- and doctor-level analysis of referral pattern according to rurality and socioeconomic status, and patient willingness to travel. With respect to 'high' and 'low' value surgical care, research into the reasons for the gradient observed – in particular, aspects of health literacy and possible information asymmetry – should be undertaken. Lastly, a more detailed patient-level analysis of the gendered effect of the pandemic on surgery should be undertaken.

6.8 Conclusion

The studies presented in this dissertation have provided insights into the dynamics of access to planned surgery that open new potential lines of inquiry. It is likely that SES, rurality, and gender are strong influences on access to planned surgery in Australia. As the health system deals with the profound effects of the pandemic, including the unprecedented backlog in elective surgery, an opportunity exists to build improvements. Such improvements could include mechanisms to address now-proven inequities associated with SES, rurality, and gender. There is a need for the Australian healthcare system to devote resources to improving health literacy for those at greatest disadvantage, and examine afresh the potential perverse incentives for primary care physicians responding to incentives designed to benefit patients of lower SES (bulk billing incentives) by shifting care to more expensive and resource-consuming sectors of the healthcare system. The opportunity for reform now stands before us to create a better system for the future. As was articulated by President Barack Obama's former Chief of Staff, Rahm Emanuel: "You never let a serious crisis go to waste. And what I mean by that it's an opportunity to do things you think you could not do before."[50]

[50] Emanuel, R. Let's make sure this crisis doesn't go to waste. *Washington Post*, published March 25th, 2020. Accessible at: https://www.washingtonpost.com/opinions/2020/03/25/lets-make-sure-this-crisis-doesnt-go-waste/

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ATTACHMENT

Systematic Review

CASE PRIORITISATION METHODS FOR ELECTIVE SURGERY: A PANDEMIC UPDATED SYSTEMATIC REVIEW.

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BACKGROUND

Surgery is a fundamental part of human health care and it has been estimated that, globally, almost 250 million operations are performed every year.(Rose et al, 2014) Despite this activity, billions of people in low- and middle-income countries still lack access to essential surgical care.(Kushner et al, 2010) Although it is challenging to make precise estimates, there is a substantial burden of unmet need for surgical care with recent estimates suggesting a global shortfall of as many as 143 million surgical procedures each year.(Grant et al, 2020; Bickler et al, 2010) It should be no surprise that the COVID-19 pandemic has had a major impact on surgery, both elective and emergency, around the world. The pandemic has stressed health systems in virtually every country globally and one of the negative effects has been to place constraints on the performance of elective surgical procedures.

The effects on patients awaiting planned surgical procedures were recognized early in the pandemic, with estimates for the British NHS that 400 000 procedures would be cancelled each month and warnings that dealing with the backlog would take years.(Macdonald et al, 2020) Particular concerns were expressed for the impact of pandemic-related delays in cancer surgery (Parmar et al, 2022) and for the families of children awaiting surgery.(Forner et al, 2022) In addition, doctors in training to become specialist surgeons faced major disruptions with the potential of years of reduced surgical experience, leading to concerns about the pandemic’s effect on the next generation of surgeons and a downstream negative effect for patients.(Lund, Sadler & McLarty, 2021)

In Australia, the number of elective procedures performed in public hospitals was still 16.9% lower in financial year 2021-22 than in the pre-pandemic year 2017-18.(AIHW) Importantly, the number of patients added to surgical waiting list was also 10% less than the pre-pandemic period, almost certainly due to reduced patient access to surgical specialists resulting from the pandemic restrictions. The principal that patients face delays not only while waiting for surgery, but also while waiting to see a specialist about a surgical condition, prompted the Australian Medical Association to release modelling that estimated one in 25 Australians were awaiting an operation or surgical procedure.[1] Similar data have been published by the British Medical Association estimating that over 7 million patients are now awaiting treatment in the NHS.[2] Similar estimates have been published for other European countries.[3]

Large waiting lists for elective surgery have a number of important consequences for patients and health systems.(Reason, Pichora & Johnson, 2022) In the first instance there is good evidence that long waiting times have adverse consequence for both the physical and mental health of patients.(Forner et al, 2021B; Kulkarni et al, 2021; Sibanda et al, 2022) Secondly, pandemic-associated effects on both the physical and human resourcing of health systems place great pressures in dealing both with long-wait patients and those newly-added to priority lists.(Macdonald et al, 2020B)

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The complexity of health system resource allocation and ongoing prioritization/re-prioritization in the pandemic environment is well recognized.(Uimonen et al, 2021) For example, there is debate about the balance between emergent and non-urgent surgical cases and how to prioritize these in real time.(Aitken & Watters, 2022) To inform 'recovery' plans developed to deal with pandemic-associated backlogs in surgery there have been calls for new prioritization algorithms.(Coleman, Argenziano & Fischkoff, 2020) Such prioritization systems will need to take into account both health system resources, clinical urgency, and patient expectations.(Wiseman et al, 2020; Hodgson et al, 2022) A systematic review addressing waiting list prioritization was published in 2021 .(Rathnayake, Clarke & Jayasinghe, 2021) but all of the studies identified were from the pre-pandemic epoch. We have undertaken an updated systematic review with the aim of identifying and updating the contemporaneous evidence will update and build upon the original publication by Rathnayake and colleagues.

METHODS

Using the systematic review of Rathnayake and colleagues (2021) a starting point, we searched the databases EMBASE, Medline, SCOPUS, Cochrane Library, CINAHL, Web of Science and ASSIA. The respective database records were searched for articles published after January 2020 up to the time of the review searches, November 2022. In line with the Rathnayake review, articles were included if they represented prioritisation methods for all major elective surgery waiting lists of adult patients with the exception of cancer and cancer-related surgeries. Paediatric surgery was also excluded. There were no inclusion criteria placed on study designs and the study details are presented as part of the data extraction tables. The detailed eligibility criteria for the review are presented in Table 1, and is based on the Population, Intervention, Comparison and Outcome (PICO) framework (Schardt et al., 2007).

Using the same search strategy implemented by in (Rathnayake & Clarke, 2021) the Medline searches were conducted first and the strategy was then tailored to compliment the different search interfaces of the other databases. The PRISMA (M. J. Page et al., 2021) guidelines for the reporting of systematic reviews were adhered to throughout this review. The PRISMA study selection flow chart for this review can be found in Figure 1.

A narrative synthesis was undertaken once the data extraction was completed. Each of the identified studies were Quality Appraised by the lead author (JD) using the relevant Joanna Briggs Institute (JBI) critical appraisal tools (Munn et al., 2019). A double screening was conducted with my collaborator and fellow MRes Health Economics student Professor Stephen Robson. This double screening allowed for any discrepancies and disagreements to be discussed until a consensus was achieved.

RESULTS

A variety of evidence was identified from this search. Several studies reported on the implementation and construction of patient prioritisation tools (PPTs) or new prioritisation pathways. However, many did not present a clear comparison of the impact the PPTs had on waiting lists, waiting times and access to treatment for patients when compared to usual care pathways. The lack of Randomised Control Trials (RCTs) in the literature limits the ability for PPT intervention comparisons to be made in relation to waiting time outcomes, a finding consistent with the findings of (Rathnayake & Clarke, 2021).

EVIDENCE OF PRIORITIZATION METHODS

There was mixed evidence of the effectiveness of prioritisation methods in reducing waiting times in elective care settings. A key theme of the evidence suggested that PPTs can lead to increased access to treatment for the most ‘at need’ cases, resulting in reduced waiting times for the most severe amongst the elective waiting list cohort. However, this at times led to a trade-off of longer waiting times for less ‘at need’ patients. (Déry et al., 2020) conducted a systematic review of prioritisation tools in non-emergency healthcare services and reported results from across disciplines. Some notable findings of the review concerned PPTs used in both Cataract and Knee surgeries wherein there were positive reductions in waiting times for patients categorised as highest priority (most at-risk), but at the expense of greater waiting times for those patients categorised as the lowest priority (Comas et al., 2008, 2010; Fantini et al., 2004).

(Oliveira et al., 2020) produced a mathematical model of patient prioritisation using patient utility values as means of categorisation. As in (Déry et al., 2020), the prioritisation process reduced time for access to treatment for the most urgent cases at the cost of longer waits for the lower utility cases. The authors offered mitigations for this undesirable effect by proposing the inclusion of utility values deteriorating as a function of time spent on the waiting list. (Silva-Aravena et al., 2021) developed a patient prioritisation system that did incorporate consideration of changes in patient condition as a function of time already spent on a waiting list. The system was implemented and a considerable decrease in average time spent on a waiting list compared to usual care was observed (462 days for usual care fell to 282 days after the patient prioritisation system). It should be noted that in Chile there was no existing standard patient prioritisation method before the (Silva-Aravena et al., 2021) system was implemented, which may have influenced the effect the method had on waiting time reduction.

(Cheng et al., 2021) developed a cataract risk stratification tool from existing literature on systemic risk factors for poor outcome from COVID-19 infection as well as a surgical ‘need’ score. The tool enabled authors to categorise patients into risk categories. The categorisation was effective in identifying the most at-risk patients however the study offered no outcome data on wait time effects as a result of the intervention.

(Glick et al., 2021) developed and implemented a patient prioritisation model as they resumed elective dental surgery post COVID-19 restrictions with the aim of addressing the low-risk started/planned surgeries disrupted by the pandemic. The authors suggested the prioritisation tool was effective in identifying risk categories of patients on their waiting list, which enabled the efficient restart of elective surgery. (Clarke et al., 2020) suggested that prioritisation of patient risk in conjunction with greater inter-hospital collaboration via pooled waiting lists could enable greater access to elective surgery and lead to reduced waiting times in England. This study showed that there are existing hospital networks in England that are performing high volumes of low-risk procedures for low-risk, local patients. With some 80% of procedures performed falling under the low-risk prioritisation category. Many of the most common procedures identified including GI endoscopy, excisions of skin lesions and joint injection or aspiration, may be performed as ‘day case’ procedures and the ability to increase procedural throughput is less encumbered by the need for close anaesthetic support or high-dependency recovery space in these procedures. The study further assessed the average patient travel distance to access their care. The analysis suggested that some low-risk, fit patients could be asked to travel a slightly greater distance to access their care with the benefit of a reduced waiting time as opposed to being assigned their closest hospital for surgery. The findings suggest that procedure priority variation is reduced significantly when provider networks expand and smaller surgical communities coalesce into larger geographic regions.

(Valente et al., 2021) developed a model to prioritize access to elective surgery and found no evident effects in terms of reduction or increase of the overall waiting list length.

EVIDENCE OF SUPPLY SIDE INTERVENTIONS

Considerable evidence was identified of strategies focusing on supply-oriented initiatives to combat elective waiting lists. A key theme identified was healthcare policy makers running initial trials to identify any problem areas in their existing elective pathways before creating a tailored PPT or pathway intervention based on identified problems. (Quercioli et al., 2022) observed organisational issues in their hospital and introduced a multidimensional intervention to address these issues and attempt to reduce their elective waiting list. Although no patient prioritisation was conducted, the interventions consisting of a dedicated elective surgery room, extra resources made available to increase medical staff available dedicated to elective surgeries and greater flexibility in allocation of operating sessions led to sustained lower waiting times over the one-year period assessed.

(Ong et al., 2022) introduced a ‘twilight’ operating room for elective surgeries outside of their organisations’ standard operating times. The introduction of the twilight operating room completely cleared the authors’ institution elective surgery waiting list during the period July 2020 to April 2021. The authors suggest this is a feasible model to addressing elective backlogs, however the single institution study design and small sample must be considered. Another identified study suggested performing surgeries outside of standard operating hours was effective in reducing elective surgery backlogs. (Wiebe et al., 2022) suggested weekend surgeries for surgeries categorised as ‘low-acuity, high-volume’ can reduce overall elective surgery waiting times. These are surgeries that can be performed relatively easily and also contribute a significant proportion of a given waiting list. This interestingly goes against the prioritisation scores presented elsewhere in the literature as PPTs tend to place greater emphasis on patients most at risk, even if these may not be ‘low-acuity, high-volume’ surgeries. The authors also suggest pre-scheduling future treatment at the time of consultation as opposed to scheduling from a wait list can be advantageous and lead to fewer cancellations and increased access.

(Cifarelli et al., 2021) present data on how the start time of elective surgery can have a large impact on patient Length of Stay (LOS). The authors used adult elective surgical patient records from 9,258 patients across five surgical service lines to assess the post-operative LOS differences of elective surgeries that started before 3pm against those starting after 3pm. The authors identified that surgeries starting after 3pm resulted in an average extra one post-operative day LOS. This was more pronounced in the orthopaedic and neurological areas. This increased LOS by one day represents a total of 487 inpatient hospitalization days for which there is no decrease in occupancy capacity. The findings of the study suggest the importance of strategies that give consideration to timings of surgery scheduling.

Only one economic evaluation was identified in the search. (Boyd et al., 2020) focused on elective cataract surgery and conducted a cost-effectiveness analysis alongside a clinical RCT. The authors suggest prioritisation be given to cataract surgery as it was found to be substantially cost-effective against other elective surgeries making up the backlog in New Zealand. The modelling results suggest that expediting first-eye cataract surgery by 1 year provided good cost value, generating 240 QALYs in the modelled New Zealand population with an ICER of NZ$10 600 (US$7540) per QALY gained. The authors further suggest expediting surgery in younger cataract cases (approx.65-69 years) may have greater spillover effects when accounting for re-introduction into the workforce and productivity gains following surgery than older age cases. The methodology of (Boyd et al., 2020) may be extremely useful if conducted and applied in other countries across the world. As costs are such a significant issue in healthcare resource allocation, identifying surgeries that are cost-effective could go some way in aiding the decision making and planning process as countries attempt to reduce their elective surgery backlog. A blog by Prof Rhiannon Tudor Edwards and Jacob Davies collected cost per Quality Adjusted Life Year (QALY) estimates of typical surgeries in different specialties contributing significant demand for elective surgery in the UK. These cost per QALY estimates can be useful for policy makers if the goal is to get the most health benefits for the population from available funds through the NHS and other care organisations.

CONCLUSION

This updated systematic review has identified potential for patient prioritisation tools (PPTs) to reduce the global elective surgery backlog. A framework evaluating utility or need of a waiting list cohort has been found to reduce waiting times in the most in-need patients. Supply-oriented interventions improving the number of surgeries that are available to be performed also has evidence of reducing elective surgery waiting times. Reducing the number of cancellations and better pre-operative screening and patient-practitioner discussions can also lead to more positive outcomes. The feasibility of supply side interventions being made available in the current economic landscape has to be acknowledged. In light of the financial pressures already facing the NHS and healthcare systems across the world as they emerge from a global pandemic, it will be down to the views of policy makers as to whether the funds for supply-side initiatives are made available or whether greater emphasis on patient prioritisation and interventions aimed at improving surgery efficiency will be favoured as an approach to reducing the elective surgery backlog.

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Table 1: Eligibility Criteria in Patient/Population, Intervention, Comparison and Outcomes (PICO) framework

	Inclusion criteria	Exclusion criteria
Population	Adult patients on major elective surgery lists	Adults on cancer and cancer-related surgery waiting lists
Intervention/exposure	Studies evaluating prioritisation method(s) for patients on elective surgery lists	Studies not evaluating a prioritisation method(s) for patients on elective surgery lists
Counter intervention	Usual care pathway	Studies not evaluating usual care pathways against an intervention
Outcome measures	Reduced time spent on elective surgery waiting list Reduction in number of patients waiting on an elective surgery waiting list	N/A
(Immediate) Setting	Any health care setting(s) or community care setting where patients are on an elective surgery waiting list	Any setting(s) without an elective surgery waiting list
(Wider) Context	Prioritisation methods for reducing waiting time on elective surgery waiting lists	Any context not discussing prioritisation methods for reducing waiting time on elective surgery waiting lists
Study design	Qualitative studies Quantitative studies Mixed methods studies Systematic Reviews Rapid Reviews Scoping Reviews	N/A
Countries	OECD countries	Non-OECD countries
Publication language	English or Welsh	Publications not In English or Welsh
Publication date	January 2020 to November 2022	Papers published pre-January 2020.
Publication type	Published, pre-print, grey literature.	N/A
Other factors	N/A	N/A

Figure 1 PRISMA study selection flowchart (M. Page et al., 2021)

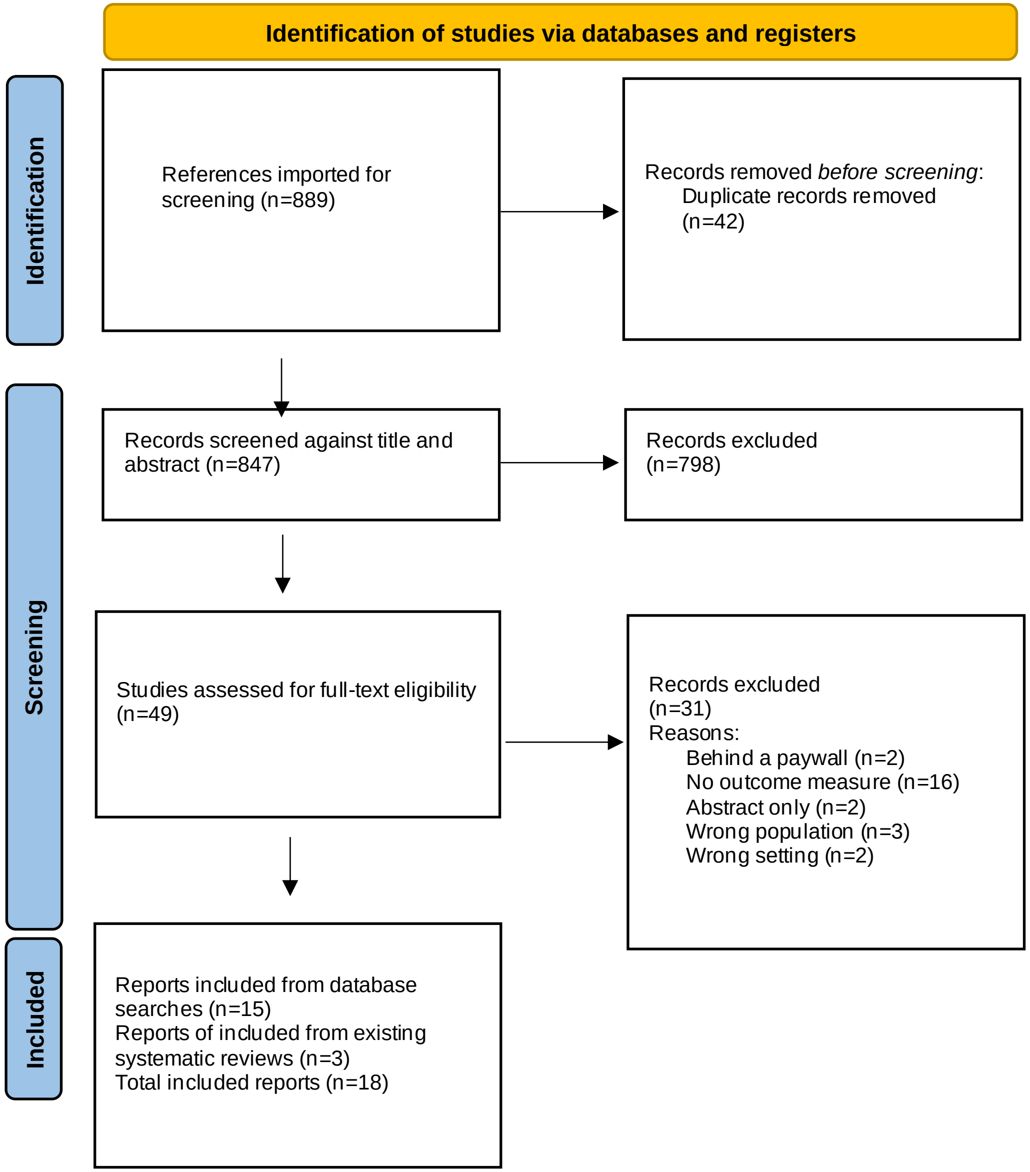

Table 3: Abbreviations:

Acronym	Full description
COVID-19	Coronavirus disease 2019
ICER	Incremental cost Effectiveness Ratio
LOS	Length of Stay
NICE	National Institute of Health and Care Excellence
NHS	National Health Service
MRes	Masters by Research
OECD	Organisation for Economic Co-operation and Development
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PPT	Patient Prioritisation Tool
QALY	Quality Adjusted Life Year
RCT	Randomised Control Trial
SR	Systematic Review

Table 4: Summary of secondary evidence

Citation (Country)	Review details	Included studies	Quality	Findings and observations/notes
(Wennberg et al., 2020) **Canada** SAGE Journals	**Review period:** 2000-2018 **Review purpose**: To provide an overview of elective surgery wait time reduction initiatives across the Canadian provinces **Included study designs:** Press releases, government publications, web pages and academic papers **Included outcome measures:** Elective surgery wait time reduction initiatives and frameworks	**Number of included studies: 12** included initiatives **Key characteristics:** The 12 initiatives reflected pan-Canadian approaches to reducing elective surgery waiting lists	To be checked via JBI	• The initiatives were broadly organized into a **supply-demand-performance** management model, where **supply-oriented** initiatives aim to **reduce wait times by increasing the number of surgeries performed**, **demand-oriented** initiatives aim to **reduce wait times by decreasing the number of surgeries needed**, and **performance management-oriented** initiatives which **monitor performance and set targets** to support improvements in performance. • **Unconditional Funding** (allocation of incremental money for healthcare without restrictions), **wait time monitoring (**track patients waiting for surgery and standardize wait time measurements across the province) and **patient pathway efficiencies** (focused on standardizing patient assessment and referrals) were the most abundant initiatives in Canada during this period. • **7/12 initiatives were supply-oriented** (aiming to reduce wait times by increasing the number of surgeries performed). • Three strategies with evidence for effectiveness were identified in

				Kreindler's study**: investing in capacity, directly paying for activity, and creating targets and strong incentives for wait time reduction**. • Kreindler makes the broad conclusion that such strategies, which are more "**direct" in their approach, are more effective at reducing wait times than "indirect" strategies**, such as public reporting of wait time information or unenforced guarantees. However, indirect strategies may be more attractive to governments as their implementation requires less effort and financial investment. In a recent Cochrane review, the provision of more accessible services (open access or direct booking/referral) showed some promise in randomized trials. • However, there is overall **no sound evidence to date** that supports any particular intervention over another.
(Déry et al., 2020) Canada Biomedical Central	**Review period:** Up to January 2019 **Review purpose:** This paper systematically synthesizes and analyzes the published evidence concerning the development and challenges related to the validation and implementation of PPTs in non-emergency settings.	**Number of included studies: 48** included studies **Key characteristics:** The **48** studies reflected 34 different patient prioritisation tools (PPTs)	TBA via JBI	• Despite the large number of PPTs studied, **implementation into clinical practice seems to be an open challenge.** • Comas et al., showed that **prioritization systems produced better results** than a **First In First Out (FIFO) strategy** in the contexts **of cataract and knee surgeries**. They concluded that the **waiting times weighted by**

	Included study designs: Peer reviewed articles **Included outcome measures:** Wait time on elective waiting list			**patient priority produced by prioritization systems were 1.54 and 4.5 months** shorter than the ones produced by FIFO in the case of cataract and knee surgeries, respectively. • In cataract surgery, one study found the prioritization system concerned made it possible for patients with the highest priority score (91-100) to wait 52.9 days less than if the FIFO strategy were used. In contrast, patients with the lowest priority score (1-10) saw their mean waiting time increase from 193.3 days (FIFO) to 303.6 days. • In Cataract again, a PPT using a total score of priority then sorting patients in groups (group 1 having the greatest need for surgery and group 4 the least need), the **mean waiting time for surgery was 3 years shorter** across all indication groups. • Tebé et al., noted that the application of a system of prioritization seeks to reorder the list so that patients with a higher priority are operated on earlier. However, this does not necessarily mean an overall reduction in waiting times. • Valente et al., studied a model to prioritize access to elective surgery and found no evident effects in terms of reduction or increase of the overall waiting list length.

				• There was evidence that clinicians felt PPTs helped to create a more homogenous vision of patient need and it is helpful to collect relevant information on those needs. There was also evidence that services were able to be delivered more equitably in a physiotherapy setting. • A survey found only 19.5% of surgeons agreed existing PPTs were effective methods of prioritisation and 44.8% believed further development of surgical scoring tools had the potential to be effective ways of prioritising patients.

Table 5: Summary of Primary evidence

Citation (Country)	Study details	Participants and setting	Observations/notes	Key Findings
(Valente et al., 2021) **Italy** British Journal of Surgery	**Study Design:** Feasibility pilot cohort study **Type of intervention [*exposure*]:** Bespoke software-aided, interhospital, centralized, multidisciplinary pathway serving	**Sample size:** 240 referrals **Participants:** Patients awaiting all major elective urgent surgery. Mean age of 68.7 years. **Setting:** Hospital setting in Genoa, Italy	Although 'all major elective urgent surgery' may include Cancer patients, this review was included on the basis that it did not focus on cancer specifically but the entire elective backlog.	• Study proposed a bespoke software-aided, interhospital, centralized, multidisciplinary pathway serving all major elective urgent surgeries in Genoa. • The pathway was aided by the existing Surgical Waiting List InfoSystem (SWALIS) -2020 prioritisation model that is based on patient clinical urgency and waiting times. • Waiting lists were monitored, and theatres fully allocated based on prioritized demand for the services. The mean(s.d.) SWALIS-2020 score at admission was 88.7(45.2) in week 1, then persistently over 100 per cent (efficiency), over a controlled variation (equity), with a difference between A3 compared with A1 153.29 (103.52) *versus* 97.24 (107.93) respectively; $P < 0.001$), and A3 *versus* A2 (153.29(103.52) *versus* 88.05(77.51); $P < 0.001$).

	all major elective urgent surgery **Data collection methods:** Data collected from hospital records on waiting times and patient pathways. **Quality rating: TBC**	**Dates of data collection:** March-May 2020		• A total of 222 patients eventually had surgery, with no pathway-related complications or delayed/failed discharges. • It was found that the SWALIS-2020 model smoothly **selected and prioritized the very few patients with the greatest need**.
(Oliveira et al., 2020) **Canada** Operations Research for Health Care	**Study Design:** Feasibility study **Type of intervention [*exposure*]:** Mathematical model for patient scheduling **Data collection methods:** Hospital records in Urology department **Quality rating: TBC**	**Sample size:** N/A **Participants:** Patient data from Urology waiting list **Setting:** Urology department of Canadian hospital **Dates of data collection:** 2016-2017		• This paper proposes an integrated approach to merge patient prioritisation and patient scheduling to improve access to services in an elective setting. This approach assigns **utility values** to individuals on an elective surgery waiting **list reflecting urgency among everyone** else on the list. • A mathematical model then **assigns patients to surgeons** via a method of **utility maximization** given practical requirements and restraints. • The numerical results confirm that the use of an objective function designed to maximize utility **does not deteriorate the efficiency of the resulting schedules** in terms of the number of surgeries performed. When compared to the existing hospital prioritisation method. • They also show that, patients with **higher utility scores are scheduled first**, and their **waiting time before surgery are shorter** than those of lower utility. In doing so however, **this naturally leads to longer, and in some cases unacceptable waiting times for lower utility patients**. • To mitigate this undesirable effect, the authors propose a dynamic utility updating approach to increase the utility of patients according to their time spent on the waiting list.

(Quercioli et al., 2022) **Italy** Annals of hygiene Preventive and Community Medicine	**Study Design:** Pre-post evaluation study **Type of intervention [*exposure*]:** Multidimensional intervention **Data collection methods:** Hospital electronic register data **Quality rating: TBC**	**Sample size:** N/A **Participants:** Patient data from Urology waiting list **Setting:** Italian district hospital **Dates of data collection:** 2018-2019		• This study aimed to evaluate the effectiveness of a multidimensional intervention in reducing waiting times for elective surgery. • The main organisational issues of the elective surgical pathway were: - assignment of operating sessions to the various specialties on a historical basis without taking into account changes in the number of patients on the waiting list; - the same path for ordinary operations and day surgery; - the composition of the surgical nursing team was not flexible and was unrelated to the complexity of the operations, which limited the time available for surgery. • The authors used the organisational issues to identify useful interventions to combat the elective backlog. These were: (1) **Separating the flow of ordinary activity from that of day surgery** by creation of a specific operating room for elective day surgery, (2) **Increasing the time available for surgery** via extra funding being made available to increase medical staff hours and the onboarding of upskilled scrub nursing staff to circulating nurses helping in the operating rooms, (3) **Flexible allocation of operating sessions on the basis of the waiting list** by assigning additional operating time gained from staff changes to different specialties proportionally based on needs (length of specialty waiting time and average wait time). • The intervention showed sustained reductions in waiting times for elective surgery over a one-year period of implementation. Waiting times for non-high-priority cases shortened significantly for all specialties ($p<0.01$) except for urology. For general surgery, orthopedics and gynecology, mean waiting times for day surgery decreased from 198 to 100 days (-50%) and for ordinary operations from 213 to 134 days (-37%). Waiting times for high-priority cases also shortened.
(Wiebe et al., 2022) **Canada**	**Study Design:** Feasibility study **Type of intervention**	**Sample size:** N/A **Participants:** Patient data from Urology waiting list		• The authors proposed a multistep plan to improve access for scheduled surgeries without neglecting urgent cases in the process. • The authors identified that increasing available funds is necessary in any plan to reduce waiting lists.

Canadian Medical Association Journal	**[*exposure*]:** multistep plan **Data collection methods:** **Quality rating: TBC**	**Setting:** Urology department of Canadian hospital **Dates of data collection:** 2016-2017		• Although increasing funds for perioperative care to hire additional personnel is necessary, improvements can be made even within the long-standing constraints of Canada's surgical systems. Scheduled surgeries that require inpatient or intensive care can be prioritized when demands on hospital beds are predictably lower, such as outside of the flu season, during the spring and summer months. Weekend surgical programs to complete low-acuity, high-volume scheduled procedures have been shown to reduce wait lists without adding to the inpatient hospital burden, although hiring practices need to support the extra perioperative staff needed to avoid overextension of work hours for existing staff. • Surgical smoothing refers to a range of efforts to optimize efficiency in surgical booking and increase throughput. Examples include the use of novel surgery booking systems, such as prebooked scheduling at time of consultation (instead of scheduling from wait lists), which have been shown to improve access for scheduled procedures with fewer cancellations. Machine learning algorithms can be used to optimize efficiency in case booking, accounting for variables such as specialty, individual surgeon, case length and case type. • Using more efficient and reliable methods of booking can help offset the continuing problem of personnel shortages in anesthesiology and nursing. • Ambulatory surgical centres that function within regional health care partnerships, rather than as siloed entities, can effectively distribute surgeries by geography, expertise and acuity. • Centralized booking and single-entry referral systems for scheduled procedures have also been shown to maximize use of operating resources and clear wait lists of standard, but necessary, procedures.
(Cheng et al., 2021) **Scotland** BMC Health	**Study Design:** Prospective review of patient records **Type of intervention [*exposure*]:**	**Sample size:** 744 patients awaiting cataract surgery **Participants:** Patient data from Cataract waiting list		• The authors developed a risk stratification tool from existing literature on systemic risk factors for poor outcome from COVID-19 infection as well as a surgical 'need' score. Scores derived from the tool were used to generate 6 risk profile groups to allow prioritised allocation of surgery. • We **stratified patients on the waiting list** based on a balance between their **'risk'** and '**need',** prioritising those with the **greatest 'need'** and **lowest 'risk'**. This led to the creation **of 6 different**

Services Research	Risk stratification tool **Data collection methods:** Prospective review of electronic patient records **Quality rating: TBC**	**Setting:** NHS hospital setting **Dates of data collection:** 2019		**phased stages**. In each stage, **patients with the greatest need score and lowest risk score are prioritised**. • Using the risk stratification tool, **171 (23 %) patients** were allocated in the highest 3 priority stages. • In this study, 573 patients were stratified into stages 4 to 6. The resulting small number of patients in Stages 1 to 3 led to those patients being invited for cataract surgery promptly.
(Cifarelli et al., 2021)	**Study Design:** Retrospective review of patient records **Type of intervention [*exposure*]:** N/A **Data collection methods:** Retrospective review of electronic patient records **Quality rating: TBC**	**Sample size:** 9,258 patients across five surgical service lines **Participants:** Patient data from adult elective surgical cases **Setting:** US hospital setting **Dates of data collection:** 2017-2019	Although lacking in specific information regarding outcome and/or satisfaction, hospital length of stay has been the predominant measure in outcomes research, largely based on the universal understanding that the reduction in hospitalization time is a positive attribute The limitations of this work include its single institutional, retrospective nature and the lack of outcome data with regard to readmission, and surgeon-specific post-operative management guidelines.	• The authors identify hospital length of stay (LOS) as an important metric when assessing and scheduling elective surgery workflows. • The authors used adult elective surgical patient records from 9,258 patients across five surgical service lines to assess the LOS differences of elective surgeries that started before 3pm against those starting after 3pm. • The median post-surgical length of stay for all cases was 2.1 days for the before 3 PM group and three days for the after 3 PM group ($p < 0.001$). • Of the service lines examined, Orthopedic Surgery and Neurological Surgery were both found to have a significantly shorter median LOS in the before 3 PM start time group based on the Mann-Whitney Test ($U = 413072$, $p < 0.001$; $U = 139251$, $p < 0.05$, respectively). • Overall, these data support the concept that late start (after 3 PM) elective surgical cases result in an increase in median LOS for patients, specifically those undergoing Orthopedic and Neurosurgical cases. From a cost perspective, this increase LOS by one day represents a total of 487 inpatient hospitalization days for which there is no increased revenue generation, and a decrease in occupancy capacity. • Surgical scheduling of elective procedures with planned inpatient hospitalizations to start after 3 PM has the potential to lengthen stay. Such increased length of stay may result in opportunity loss for elective procedure margin, indicating a role for consideration of developing institutional strategies for scheduling optimization.

(Ong et al., 2022) Australia	**Study Design:** Retrospective audit of surgeries **Type of intervention [*exposure*]:** Twilight surgeries outside standard operating hours **Data collection methods:** Retrospective review of hospital operating room database **Quality rating: TBC**	**Sample size:** 223 surgical procedures **Participants:** Adult elective surgical cases **Setting:** Australian hospital setting **Dates of data collection:** July 2020- April 2021		• In general, elective surgeries are usually performed during standard office hours between 9am and 5 pm. In our institution, we have a morning session between 9am and 12.30 pm and an afternoon/PM session between 1 pm and 4.30 pm. • The 'Twilight' operating room was introduced where elective cases were performed after hours between 5 pm and 8.30 pm. The authors hypothesise that this concept can be extrapolated to provide a feasible alternative to address global burden of cancelled surgeries due to COVID-19 pandemic. • The **waiting list in the authors' institution was completely cleared for July 2020 to April 2021 with no overdue elective surgeries**. Importantly, no post-operative complications were reported. This model is a feasible and safe strategy to restore surgical activity impacted by COVID-19 pandemic.
(Silva-Aravena et al., 2021)	**Study Design:** Mixed methods study **Type of intervention [*exposure*]:** Patient prioritisation system **Data collection methods:** Questionnaire	**Sample size:** 205 patients admitted to waiting list during study period **Participants:** Patients on adult elective surgery waiting list **Setting:** Chilean hospital setting **Dates of data collection:** July-September 2018		• The proposed prioritisation system featured three methodological contributions; (1) **an ad-hoc medical record form** that captures the biopsychosocial condition of the patients; (2) **dynamic scoring** scheme that recognizes that **patients' conditions evolve differently while waiting for the required elective surgery**; (3) a methodology for prioritising and selecting patients based on the corresponding dynamic scores and additional clinical criteria. • The 3 areas underpinning the system were created and revised through evidence from the literature, healthcare professionals and patient feedback. • The designed system allowed a decrease in the average number of days on a waiting list from 462 to 282 days against usual care (in Chile, there was no existing standard patient prioritisation method) for the period December 2017 to December 2019.

	Quality rating: TBC			• The system allowed a decrease in average waiting time during a period when the total number of patients on waiting lists at the hospital increased.
(Boyd et al., 2020) **New Zealand**	**Study Design:** Economic Evaluation **Type of intervention [*exposure*]:** Injurious falls model **Data collection methods:** Literature review and NZ Ministry of Health data **Quality rating: TBC**	**Sample size:** Modelled NZ population **Participants:** Patients on elective cataract surgery waiting list **Setting:** New Zealand healthcare system **Dates of data collection:** April 2018	• A follow-up RCT to the one used for our modelling found a further improvement in visual function and health gain, but this was a smaller effect than those gained in first-eye cataract surgery • The modelling utilised inputs from the literature including high-quality datasets provided by the Ministry of Health, which were used to determine public sector costs, patient demographics and procedure numbers	• The results suggest that in NZ, prioritisation should be given to reducing waiting times for cataract surgery given it might be one of the most cost-effective elective surgical interventions. • In order to maximise cost-effectiveness priority could be given to expediting cataract surgery in **younger people** for whom our results show that the procedure is most cost-effective. Some of these younger people in the age group 65–69 years **will still be working in the formal economy** and therefore benefits of surgery are likely to be even greater from a societal perspective. • The modelling results suggest that expediting first-eye cataract surgery by 1 year provides good cost value, generating 240 QALYs in the modelled New Zealand population with an ICER of NZ$10 600 (US$7540) per QALY gained. Furthermore, this modelling suggests that performing cataract surgery as a routine procedure (vs not performing surgery) is excellent value at NZ$4380 (US$3116) per QALY gained.

(Clarke et al., 2020) **England** **BMJ Open**	**Study Design:** Retrospective Observational Study **Type of intervention [*exposure*]:** N/A **Data collection methods:** Retrospective observational study using Hospital Episode Statistics. **Quality rating: TBC**	**Sample size:** 7,811 891 planned operations were identified in 4,284 925 adults **Participants:** All adult patients' resident in England undergoing NHS-funded planned surgical procedures between 1 April 2017 and 31 March 2018. **Setting:** Public and private hospitals providing surgical care to National Health Service (NHS) patients in England. **Dates of data collection:** 1 April 2017 to 31 March 2018		• Pooled waiting-lists for low-risk elective procedures and patients across integrated, expanded natural surgical community networks have the potential to increase efficiency by innovatively flexing existing supply to better match demand. • Risk for each patient was assigned according to low, medium or high risk (for potential morbidity and mortality) by virtue of their age and Charlson comorbidity score. • For each patient, their approximate home location was determined using the coordinates of the population-weighted centroid of their lower layer super output area (LSOA) of residence. • The study presented the elective surgeries making up the majority of the backlog. The top 3 were: Lower GI endoscopy, Upper GI endoscopy and Lens extraction + replacement. • The mean distance travelled from a patient's residence to hospital for surgery was on average 11.3 km. Mean distances for the 28 HVPs ranged from 9.4 km for upper GI endoscopy to 16.2 km for spinal nerve root injection. A total of 2 412 613 (61.7%) HVPs were performed in 'low risk' patients, 988 067 (25.3%) in 'medium risk' patients and 506 794 (13.0%) in 'high risk' patients. The proportion of procedures being performed on 'high risk' patients ranged from 1% for meniscal procedures to 52% for cystoscopy and resection of bladder lesions. In 22 out of 28 HVPs, more than 80% of patients were classified as 'low' or 'medium' risk. • This study showed that there are existing hospital networks performing high volumes of low-risk procedures for low-risk, local patients. • This study included procedures of varying complexity and ability to increase surge capacity to overcome increased elective waiting-lists. Many of the most common procedures featured, including GI endoscopy, excisions of skin lesions and joint injection or aspiration, may be performed as 'day case' procedures and the ability to increase procedural throughput is less encumbered by the need for close anesthetic support or high-dependency recovery space. • Importantly, these data demonstrate that variation is reduced significantly when provider networks expand and smaller surgical communities coalesce into 16 larger geographic regions. We have identified a large group of potentially eligible, fit, lower risk patients

				who could be asked to travel greater distances than the existing median of 13 km for their more minor surgery in order to shorten waiting times.
(Glick et al., 2021) **USA** **Journal of Dental Education**	**Study Design:** Feasibility study **Type of intervention [*exposure*]:** Patient Prioritisation model **Data collection methods:** Dental school records **Quality rating: TBC**	**Sample size:** 3,392 patients on waiting list **Participants:** Patients awaiting elective dental surgery **Setting:** US dental school performing surgery **Dates of data collection:** January – February 2019		• The authors implemented a prioritisation model to allocate the limited number of clinical spaces that were deemed safe to patients on the surgery backlog. • Next, various stakeholders helped identify key factors to consider for prioritizing which patients to schedule. The main categories included (1) medical risk, (2) urgency of need, (3) likelihood to present for an appointment. • Data from these categories were extracted from the EHR and the 3 categories were rated based on priority. The goal was to complete as much "in process" and "planned" treatment as possible for patients with low medical risk. • At the time of the prioritisation model being implemented, there were 11,293 patients with 'planned' or 'in process' treatments. The final number of patients on the lists sent to the department chairs after prioritisation applied was 3392. • After 5 weeks, significant headway was made in achieving the goal of completing "in process" treatment. Of the 3392 patients, 797 (24%) have already been seen in the "consolidated clinic. • The authors finally added that combining the numerical prioritisation with the human aspect of patients is essential for prioritisation decision making.
(Guo et al., 2022) **Canada** **Elsevier Science Direct**	**Study Design:** Cross sectional survey **Type of intervention [*exposure*]:** Patient prioritisation tool based on HRQoL	**Sample size:** 1,792 respondents from sample of 4,072 eligible **Participants:** Patients from four acute care hospitals placed onto elective care waiting list		• Patients recently placed on the elective waiting list were asked to fill out HRQoL questionnaires (PHQ-9). • The HRQoL PROMs were then used to place patients into one of five Priority Levels (PL) based on severity and surgical need. • The prioritisation setting led to a lower than the mean waiting time for patients assigned to the two most severe PLs. Mean wait time was 13 weeks, with PL1 mean wait time being 11 weeks and PL2 mean wait time being 6 weeks. The authors note the difference between PL1 and PL2 wait times can be explained by a significantly lower number of patients assigned PL1 status. • The waiting times for the other 3 PLs was found to be similar (approx. 14 weeks each).

	questionnaire responses **Data collection methods:** Questionnaire **Quality rating: TBC**	**Setting:** Canadian hospitals **Dates of data collection:** September 2014 to December 2019		• The authors identified that patients expecting to wait the longest on the waiting list reported successively lower levels of self-rated health (p < 0.01) and successively higher levels of pain (p < 0.01.) Highlighting the negative consequences of prolonged wait for surgery. • The authors also identified no difference in anxiety symptoms of anxiety among participants expected to wait the longest.