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ADVISORY

The case for investment in:

A quality improvement programme to reduce pressure injuries in New Zealand

19 November 2015
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Acknowledgements

In developing this report we would like to acknowledge and thank Dr Jan Weststrate from Care-Metric and Ms Jenny Phillips from Health Care New Zealand for their valuable contribution and insight throughout each stage of this project.

We would like to acknowledge the contribution to this project by the Ministry of Health (MoH), and joint funding by the Accident Compensation Corporation (ACC) and Health Quality & Safety Commission (HQSC).

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EXECUTIVE SUMMARY

THE CASE FOR INVESTMENT IN: A NATIONAL QUALITY IMPROVEMENT PROGRAMME TO REDUCE PRESSURE INJURIES IN NEW ZEALAND."

Background/context:

The purpose of this project was to determine a value proposition for investment in a national quality improvement programme to reduce the incidence of Pressure Injuries (PI) in the New Zealand Health Sector.

Pressure injuries are a major cause of preventable harm for healthcare services including hospital, residential aged care and home care in New Zealand. Approximately 4-8% of those that receive healthcare in New Zealand experience a PI, regardless of their age or mobility[1]. PI reduces quality of life for sufferers and have a profound human cost including; constant pain, loss of function and mobility, depression, distress and anxiety, embarrassment and social isolation, increased financial burdens, prolonged hospital stays, septicaemia, and even death[2]

[1] The Northern Alliance "Do No Harm" point prevalence survey 2014, with an overall prevalence rate of 4.7% in DHB Hospitals, and the Central DHBs prevalence study 2014, which showed a prevalence range of 8.3% in DHB Hospitals and 7.4% in residential Aged Care.

FIGURE 1.
ESTIMATED TOTAL COST OF PI BY GRADE (2013/2014)

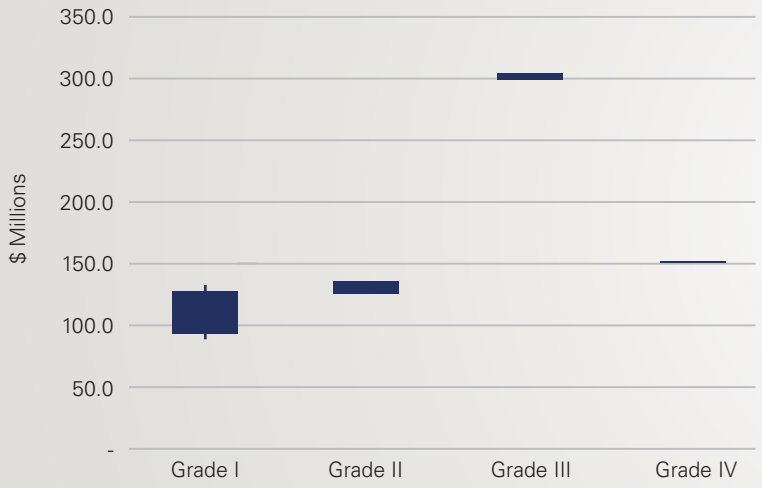
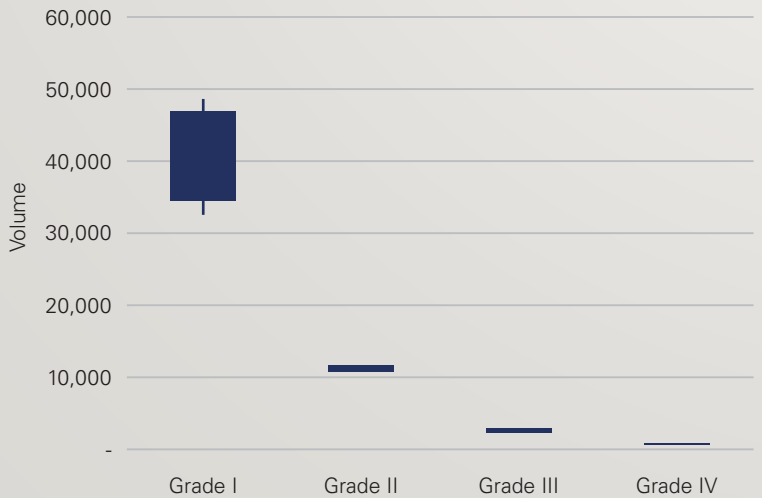


FIGURE 2.
ESTIMATED NUMBER OF PI PER YEAR BY GRADE (2013/2014)



The Approach:

To quantify the incidence and impact of PI to the health sector of New Zealand, a four-step approach was applied:

1 A review of key literature, and of both international and local experience in PI reduction.

2 A series of stakeholder workshops to identify the current New Zealand PI initiatives and their relative success. This included identification of perceived barriers to reducing PI and improving the quality of care, gaining a better understanding of what works, what does not, and the reasons why in various clinical settings.

3 Develop a simulation model to estimate the incidence of PI in New Zealand by healthcare setting by:

- Using data from the National Minimum Data Set (NMDS) for hospital patients, interRAI data for home care and residential aged care
- Applying prevalence data from The Northern DHB Alliance[1] to estimate incidence and severity. This was risk adjusted using patient age, procedure, complexity and setting (e.g. intensive care or rehabilitation wards).

4 Build an investment model to determine the cost benefit of the proposed programme:

- Developing a cost profile per patient for both treatment and loss of quality of life (QoL). Direct cost included clinical time and consumables, extended length of stay (LOS), post discharge primary care and allied health, and readmission for rehabilitation. Grade I and II PI were assumed to fully resolve by the end of the first year and therefore loss of QoL was attributed only to year one. However, for Grade III and IV PI the loss of QoL was calculated over remaining life years using statistical life tables.
- Developing an investment profile aligning each investment with potential benefits in terms of direct cost savings. This was based on the four recommended solution sets for the national quality improvement programme and provided a multiagency approach.
- Developing a PI reduction profile based on the expected reduction in the incidence of each grade of PI in each year of the programme, over a ten year timeframe.
- Deriving cost benefit ratios for the investment to the PI programme for each agency. Cost benefit ratios were calculated on two levels; direct cost savings to the provider and total cost savings to the nation (i.e. providers and patients).
- Qualifying the model by conducting a sensitivity analysis on the expected rate of PI reduction and impact of delays to the programme, reflecting a change in cost benefit ratio, and Net Present Value (NPV) of the investment.

Results and Findings:

Cost of PI: The total cost of PI to New Zealand is estimated at $694 million per annum. Grade III injuries have the most significant impact, attributing 40% (approximately $302 million) of the total cost (Figure 1).

Incidence: Approximately 55,000 people suffer from a PI in New Zealand every year. It is noteworthy that over 3,000 of these develop severe (Grade III or IV) PI each year, resulting in significant negative impact on quality of life (Figure 2).

Impact/Aetiology: PI predominantly impacts people who are immobile, old or incontinent[3]. Furthermore PI can develop rapidly, often within two to three hours[4]. This represents a key challenge to provide continuity of care within current complex healthcare environments. Workshop participants highlighted that the point of patient transfer between health professionals (and organisations) is a significant contributing factor for PI. However, it was also identified as an opportunity where greatest gains could be potentially achieved.

Current situation in New Zealand: Sector feedback via the stakeholder engagement workshops identified the following emerging themes:

1 There is insufficient emphasis of PI throughout the New Zealand health system (workshop outcome).

2 Line staff responsible for caring for PI are not authorised to make prevention decisions.

3 The impacts of PI on a patient's quality of life are not often observed by the healthcare worker whose actions or inactions caused them.

4 Family and whanau involvement in patient care is not utilised to assist in providing basic preventative measures.

5 The overall size of problem of PI may be hidden since health providers in New Zealand do not routinely assist patients to submit ACC treatment injury claims for PI.

6 Inconsistent reporting of PI as serious adverse events

7 The lack of a multi-agency approach limits the translation of ideas and innovation.

Existing International Quality Improvement Programmes: Evidence-informed quality improvement programmes to reduce the incidence of PI exist worldwide. A system-wide exemplar in the Netherlands observed a 50% reduction in PI following implementation of a quality improvement programme across 16 centres in both acute care and residential aged care settings[5,6]. The key lessons from this programme were that achieving sustainable gains requires clinical leadership, changes in clinical practice, multi-year programmes, and ongoing monitoring of point prevalence.

Other international literature indicates that significant gains can be achieved through improved care practice and measurement, and use of clinical guidelines[7]. Conversely, risk assessment tools were shown to be imperfect predictors of risk[8]. Advanced static based support surfaces are well supported by the literature to decrease risk for PI when compared with standard hospital mattresses[9].

Benefits: The benefits from a PI reduction programme are two-fold: direct cash benefits to health providers and their funders through reduction in treatment costs; and quality of life benefits to individuals and society, measured by quality adjusted life years (QALY).

The potential cost-benefit of the proposed investment in PI reduction is significant. Over a ten year period it is estimated the total number of people experiencing PI could be reduced from 54,700 to 16,600, representing a 70% reduction. This analysis is based on the optimistic rate of 15% reduction of PI per annum, indicating it will take ten years to achieve a 70% reduction rate in new PI in the New Zealand health sector.

- Direct cost benefit to Health Sector: The results from this analysis demonstrate cost benefit ratio of 1:1.13 in the first year increasing to 1:8.2 by year ten, directly to the health sector (Figure 3).
- Total cost benefit (including QALY): Patient and society benefits are greater. Anticipated total gains of $84 million per annum in year one, increasing to $508 million per annum by year ten, provides a cost benefit ratio of 1:11.8 in year one, increasing to 1:100 by year ten.
- The important caveat to note is that the derivation of these estimates rests on key assumptions, discussed below, and setting an overall target to reduce PI prevalence to between 2%-3% in New Zealand within a decade.

FIGURE 3:
INVESTMENT AND DIRECT BENEFITS FOR ALL INDUSTRY GROUPS (EXCL QALY)

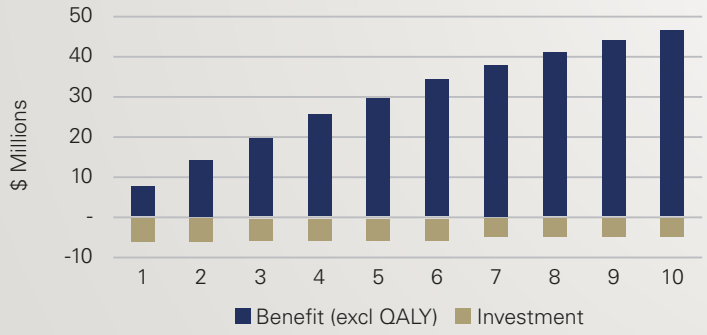


FIGURE 4:
INVESTMENT AND NET BENEFITS FOR ALL INDUSTRY GROUPS (INCL QALY)

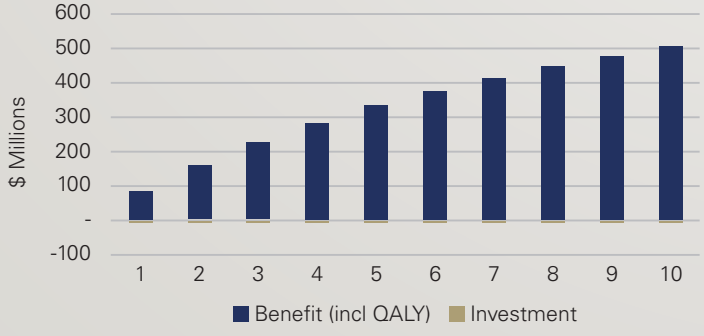
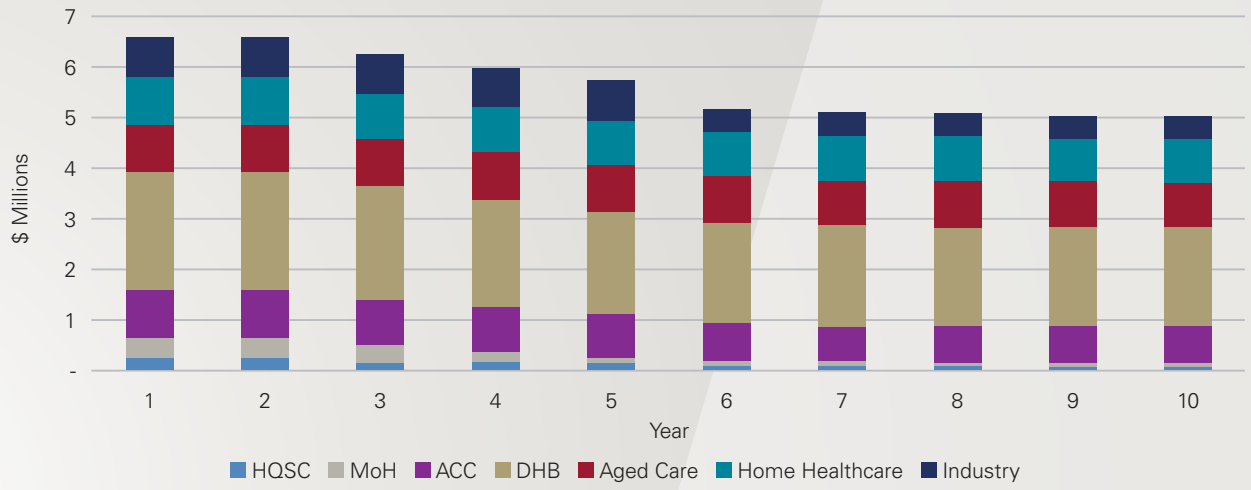


FIGURE 5:
ANNUAL INVESTMENT BY SECTOR GROUP



Required investment: Our analysis suggests that an average investment of $5.7 million per annum by the sector over the next ten years ($6.6 million in year one, reducing to $5.0 million by year ten) has the potential to reduce incidence of PI by up to 70%.

The guiding investment philosophy for a National PI reduction programme is based on aligning the financial responsibility for investment to the parties that will receive greatest benefit and those who are best placed to meet their duty of care. That is, it is recommended that the industry group who will receive the most benefit from PI reduction should proportionally invest the most. Seven potential investment groups were identified for this programme, including both private industry and public health services and operators of Aged Care facilities. These are:

- District Health Boards
- Accident Compensation Corporation
- Health Quality & Safety Commission
- Ministry of Health
- Industry participants, e.g. equipment suppliers
- Residential aged care providers
- Home and community health providers.

Figure 5 demonstrates the stratified financial investment shared over the seven sector groups to generate a public-private partnership for the investment.

Limitations to this Study

A key assumption of this model is that a national PI reduction and quality improvement programme in New Zealand can achieve a similar rate of reduction as that achieved in the Netherlands (LPZ PI monitoring), despite starting with a lower prevalence rate (6-8% in New Zealand versus approximately 18% in the Netherlands). Few countries have reduced PI prevalence to between 2-3%, which is the goal of this programme. In a 2013 published study the Collaborative Alliance for Nursing Outcomes (CalNOC), who monitors the outcomes of PI prevention programs in hospitals in the US, evaluated the outcomes of PI prevalence of 78 hospitals[10]. They were able to demonstrate that over the 8 year period (2003-10) Hospital acquired PI (category I-IV) reduced from 10.4% to 1.8%.

The Agency for Healthcare Research and Quality in the USA published a critical analysis of the evidence for patient safety practices, illustrating that very low levels of PI are possible[11]. USA's largest Catholic not for profit health system demonstrated a 90% reduction in PI prevalence from 5.7% to 0.45%[12]. Separate initiatives reduced PI prevalence from 12.8% to 0.6%[13], and 2.8% to 0.48%[14], respectively. Furthermore, a 710 bed multisite hospital observed a reduction in PI from 9.4% to 1.8% over a three year period[15]. Whilst recognising that these studies are site or service specific and ensue their own set of limitations, they illustrate the views of both clinical leaders and academics that very low levels of PI prevalence can be achieved in regular clinical practice.

To address this potential limitation we modelled high, medium and low annualised reduction rates (i.e. 15%, 10%, 5%).

Value Proposition:

Our analysis indicates that a total investment across the sector of $5.7 million per annum for the next ten years could reduce the incidence of new pressure injuries by up to 70%, assuming a year on year reduction of 15%. This would save initially $84 million per annum in total costs (patient and society) increasing to $504 million per annum by year ten to New Zealand society, with $7.4 to $46 million per annum of savings directly attributable to the New Zealand health sector.

As expected the cost benefit ratio declines with lower levels of annualised PI reduction (notably all scenarios found a net gain to society).

- If a 10% annualised reduction is achieved the number of PI will fall from 55,700 per annum to 25,166 (a 53% reduction in PI incidence).
- If a 5% annualised reduction is achieved the number of PI will fall to 37,437 from 55,700 per annum (a 32% reduction in PI incidence).

Conclusions:

PI result in substantial suffering, and consumes considerable financial resources and health services. PI can be prevented. By identifying both the direct treatment costs and indirect social costs attributable to PI, it is estimated that an average investment of $5.7 million per annum is required across the sector in the next ten years to reduce incidence of new PI by up to 70%, at an annualised rate of 15%. If this aspirational goal cannot be achieved in practice, even attempting a 5% reduction each year will still result in an overall 32% reduction. Current international evidence and local clinical expertise suggest the best way to achieve this is through a nationally coordinated, multi-agency approach coupled with strong clinical leadership.

FIGURE 6:
NATIONAL PI REDUCTION PROGRAMME RECOMMENDED SOLUTION AREAS

REDUCING PI DOES NOT HAVE TO BE COMPLEX. THE RECOMMENDED PROGRAMME INVOLVES STREAMLINING CLINICAL PRACTICE, AUTHORISATION OF STAFF TO TAKE ACTION, AND PROVIDING LEADERSHIP OVER AN EXTENDED PERIOD OF TIME.

If this can be achieved then the expectation is for a significant reduction in PI and improvement in quality of life for the thousands of individuals who are subject to preventable harm every year.

Recommendations:

Establish a cross-agency programme to reduce the incidence of PI in New Zealand to 2-3% (Figure 6).

This programme should run for ten years, and include these key features:

1 Streamlining clinical practice

2 Giving staff the authority to access equipment

3 Building a leadership culture

4 Improving support systems.

Include all key groups: District Health Boards (DHBs); Accident Compensation Corporation (ACC); Health Quality & Safety Commission; Ministry of Health; industry participants, e.g. equipment suppliers; residential aged care providers; and, home and community health providers.

References:

1 The Northern Alliance, through the "First, Do No Harm" point prevalence survey, 2014.

2 European Pressure Ulcer Advisory Panel & National Pressure Ulcer Advisory Panel 2009. *Prevention and treatment of pressure ulcers: quick reference guide.* Washington DC: National Pressure Ulcer Advisory Panel.

3 Reswick, J. B. & Rogers, J. (1976). Experiences at rancho Los Amigos hospital with devices and techniques to prevent pressure sores. In R.M Kenedi, J.M.Cowden and J.T. Scales, editors. *Bed sore mechanics* (pp. 301-310). The Macmillan press Ltd.

4 Stekelenburg, A., Strijkers, G.J., Parusel, H., Bader, D.L., Nicolay, K. & Oomens, C.W. (2007). Role of ischemia and deformation in the onset of compression-induced deep tissue injury: MRI based studies in a rat-model. *Journal of Applied Physiology*. 102(5), 2002-2011.

5 Strating, M.M.H, Nieboer,A.P, Zuiderent-Jerak, T. & Bal, R.A. (2011) Creating effective quality-improvement collaboratives: a multiple case study. *BMJ Quality and Safety*, 20(4),344-350.

6 Strating, M.M, & Nieboer A.P. (2013). Explaining variation in perceived team effectiveness: results from eleven quality improvement collaboratives: Effectiveness quality improvement collaboratives. *Journal of Clinical Nursing*, 22(11-12), 1692-1706.

7 *National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific PI Alliance. Prevention and Treatment of Pressure Ulcers: Quick Reference Guide. Haesler, E. (Ed.) (2014).*

8 *Clinical Guidelines Committee of the American College of Physicians (2015).* Risk assessment and prevention of pressure ulcers: a clinical practice guideline. Annals of Internal Medicine, 162(5), 359-369.

9 *Reddy*, M. & Gill, S.S. (2014). The effectiveness of pressure ulcer risk assessment instruments and associated intervention protocols remains uncertain. *Evidence-based Medicine*. 19(3), 93.

10 Stotts, NA., Brown D, Donaldson NE, Aydin C & Fridman M. (2013). Eliminating hospital-acquired pressure ulcers within our reach. Advances in skin and wound care. Vol 26 No 1 (13-18).

11 Sullivan, N. *Making Health Care Safer II: An updated Critical Analysis of the Evidence for Patient Safety Practices. (2013). Agency for Healthcare Research and Quality (US).*

12 Gibbons W, Shanks HT, Klienhelter P, Jopnes, P. Eliminating facility-acquired pressure ulcers at Ascension Health. Jt Comm J Qual Pat Saf. 2006 Sep:32(9):488-96.

13 Walsh NS, Blanck AW, Barrett KL. Pressure ulcer management in the acute care setting: a response to regulatory mandates. Journal of wound, ostomy and continence nursing. 2009 Jul-Aug;36(4):385-8.

14 Lynch S, Vickery, P. Steps to reducing hospital-acquired pressure ulcers. Nursing. 2010 Nov;40(11):61-62.

15 Courtney BA, Ruppman JB, Cooper, HM. *Save our skin: initiative cuts pressure ulcers in half.* Nurs Manage. 2006 Apr;37(4):36-38.

INTRODUCTION

PRESSURE INJURIES (PI) AFFECT APPROXIMATELY 4-8% OF PEOPLE RECEIVING HEALTHCARE IN NEW ZEALAND.

Serious PI can have profound human costs, which are often not fully appreciated by those of us working within the healthcare system.

The effects of PI include: constant pain; loss of function and mobility; depression, distress and anxiety; embarrassment and social isolation; increased financial burdens; prolonged hospital stays; septicaemia, or even death (Braden B. et.al, National Pressure Ulcer Advisory Panel, UK). Recovery from PI is often long and slow, resulting in significant cost to funders and providers of healthcare, as well as to the quality of life of individuals and their families.

The cause of pressure injuries is well known, and PI is now widely considered a treatment or iatrogenic injury. Our report takes the stance that most PI can be prevented and by taking this stance, the New Zealand health sector can maximise the benefits to both health providers and individuals. However, as highlighted by the literature and existing initiatives, achieving this requires a far more in-depth understanding of PI. It also requires involvement from all players in the healthcare system; including patients themselves, family and Whānau.

We estimate that the total cost of PI to New Zealand is approximately $694 million per year, including quality of life impacts. This paper provides the New Zealand health sector, including HQSC and ACC, with a strategy to reduce pressure injuries. This strategy can only be achieved with strong clinical leadership, and inter-agency support from the MoH, ACC, and the broader health sector, over an extended period of time.

It will also take a shift in culture and practice; including empowerment of front line clinicians and carers, local decision-making and team work.

To achieve this, we must answer four key questions:

- How do we make PI prevention easier to achieve at the point of care delivery?
- Who should invest?
- How much should they invest?
- What is the evidence that this works?

To answer these questions, we have drawn on a broad base of knowledge. This includes PI initiatives in countries such as the Netherlands and the United Kingdom, and the lessons learned from patient safety initiatives in New Zealand, such as "First Do No Harm".

We have also adopted a broader systems-wide perspective, by looking at other patient safety initiatives (such as reduction of medication errors and falls), and what they teach us.

The results of our analysis are captured in a PI "simulation model" designed to estimate: the prevalence of PI in each healthcare setting; the costs associated with treatment and quality of life; and the nature and return on investment over time.

As this project progressed, it became clear that if we are to significantly reduce PI in the healthcare sector, we need solutions and recommendations that are both simple and practical.

THE DEFINITION OF A PRESSURE INJURY IS: "A LOCALISED INJURY TO THE SKIN AND/OR UNDERLYING TISSUE USUALLY OVER A BONY PROMINENCE, AS A RESULT OF PRESSURE, OR PRESSURE IN COMBINATION WITH SHEAR".

(National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers: Quick Reference Guide. Emily Haesler (Ed.). Cambridge Media: Perth, Australia; 2014).

This report provides the HQSC, ACC, and other healthcare agencies with a cornerstone document and value proposition. We have provided the sector with specific recommendations on who should invest, where to focus investment, and what is the cost-benefit ratio of doing so. This report is designed to be equally meaningful to policy makers, healthcare executives, clinicians, caregivers, and indeed patients and their families.

During our research and stakeholder workshops, there was a general consensus that PI are mostly preventable. There was also recognition that once a PI develops, it will create unnecessary pain, suffering, loss of quality of life, and cost to the individual as well as the cost to healthcare organisations and society.

In developing this report we use the terms PI reduction, PI prevention, and PI quality improvement interchangeably. While they have different emphasis, they are all key aspects of any programme to minimise the occurrence and impact of PI.

REPORT HIGHLIGHTS

01/ **A compelling case** for a national PI prevention and quality improvement programme

02/ **Commit to a ten-year programme** to achieve sustainable reductions in PI

03/ **Provide strong clinical leadership:** PI reduction is an opportunity, for strong clinical leadership at all levels

04/ **Streamline practice:** To be successful there is a need to streamline the care process and clinical practice

05/ **Authorise staff:** There is a need to authorise staff at the coal face to take preventative action

06/ **Adopt a multi-agency approach:** The best way to achieve success is through a multi-agency co-funded approach lead by the HQSC

WHAT ARE OUR OBJECTIVES?

THE PRIMARY OBJECTIVE OF THIS PROJECT WAS TO:

Develop a "value proposition" for an investment in a national quality improvement programme to reduce the prevalence of Pressure Injuries (PI) in the New Zealand Health Sector.

To achieve this, we aimed to answer the following questions:

What is the problem?
Here we provide an overview of why PI is still prevalent, despite meaningful efforts to minimise harm.

Do we understand PI?
In this section we provide an insight into international research and local and international PI reduction programmes.

How much do PI cost New Zealand?
Here we identify the impact on both the individual's quality of life, and cost to healthcare organisations.

How do we reduce PI in New Zealand?
Our objective is to provide a clear set of recommendations designed to promote PI consensus for a national approach to PI reduction.

What is the value proposition?
This is designed to engage agencies to work together to reduce PI, match investment to potential gains, and demonstrate the cost-benefit of the investment case.

WHAT IS THE PROBLEM?

THE KEY PROBLEM IS THAT MOST PI ARE AVOIDABLE. WORKSHOP PARTICIPANTS WERE QUICK TO POINT OUT THAT PI IS CONTRARY TO THE FUNDAMENTAL ETHOS OF THE HEALTHCARE SYSTEM WHICH IS "FIRST DO NO HARM".

This is a well-recognised phrase, yet the prevalence of PI remains persistently high.

This thinking created the agenda for a more in-depth analysis of the PI problem and this section sets out to identify some of the key factors inhibiting efforts to further reduce PI to an acceptable level.

These include:

1 The health system places too little emphasis on PI prevention in all settings.

2 Organisations do not authorise clinicians to make prevention decisions.

3 Many people working in healthcare do not see the devastating end consequences of their actions or inactions on PI and quality of life.

4 Healthcare organisations do not assist patients to use the skills and knowledge of patients and their family or Whānau to provide basic preventive measures.

5 Health providers do not routinely submit treatment injury claims for PI so the problem remains unrecognised at a higher level.

This list is not exhaustive, but highlights the drivers of system failure, and the need to overcome cultural and organisational barriers to quality improvement.

Problem 1: The health system places too little emphasis on prevention in all settings.

Vocational education in health care is primarily based on care and treatment, with minimal emphasis on prevention or 'first do no harm'. As a consequence, PI are often still seen as a natural or expected consequence of the treatment process. This is reflected in the low number of ACC claims for PI.

Problem 2: Organisations do not authorise line staff to make prevention decisions.

Time-consuming processes and professional demarcations make it difficult for healthcare professionals and carers to implement preventative measures in a timely manner. This is common in all settings, and given the rapid nature of PI onset, long assessments and delayed decisions due to limited resource availability simply exacerbate the problem.

In addition, the assessment, prevention, and treatment of PI is often made too complex and no more effective than simpler methods (Schoonhoven et al, 2002). Many providers have created complex evaluation and decision-making tools, and implemented restrictions on who can make PI prevention decisions or order equipment.

Problem 3: Many people working in healthcare do not see the devastating end consequences of their actions or inactions on PI and quality of life.

Most often healthcare professionals are only involved in the part of the care process that relates to their area of expertise. This means they seldom see the downstream effect of PI that occurred in their facility or setting.

The practicalities of a clinical setting are characterised by competing priorities particularly at patient admission, transfer and hand over. In addition, the health care process has become significantly faster, with Day of Admission Surgery, the introduction of Assessment Wards, and reduced length of stay. This has truncated the time for care decision-making, and reinforced a 'tick box' approach to decision-making. Finally, the shift system (or visit system) mitigates against immediate PI prevention, as assessment protocols and treatment options can always be deferred to the next shift or setting.

Even in palliative, community, and Aged Care settings, residents are often transferred for treatment or referred to a specialist (such as a wound care nurse), with associated transfer of responsibility. In these circumstances, the full psychological and family effects are seldom visible and remain unrecognised.

Problem 4: Healthcare organisations do not assist patients to use the skills of patients and their family or Whānau to provide basic preventive measures.

PI prevention is not complex, yet we continue to ignore the important role that patients, families, and Whānau can play in prevention and surveillance (AHRQ, 2011). Most often this is because, as a system, we have failed to take the opportunity to educate families on what a PI is and how to recognise PI risk.

Further, we are also yet to provide patients and families with simple steps they can take in PI prevention, e.g. equipment, positioning, support, skin care and nutrition (Kwiczala-Szydłowska, Skalska, & Grodzicki, 2005). For example, of the 25 healthcare facilities in the central North Island surveyed, only four had a PI prevention brochure to educate patients, families and Whānau on how they could assist in PI prevention. While brochures are only one aspect of education, this is a simple example of where education can extend beyond the hospital.

PI are predominantly seen as a nursing problem due to nurses often being involved in both the prevention and treatment phase. This has two effects: it removes the responsibility of PI from management and other professionals involved in the care process such as families, doctors, and care givers; and secondly, within nursing, it has encouraged prevention of PI to become the domain of the wound care specialist or tissue viability specialist. Consequently, this provides the opportunity to shift responsibility for both prevention and care away from the front line of care. Until PI prevention and treatment is seen as more than a nursing problem, PI will not attract the high level attention of healthcare executives, clinical leaders, carers, and supporting agencies.

Problem 5: Health providers do not submit ACC claims for PI, so the problem remains unrecognised at a higher level.

As a universal insurer for treatment injury, ACC plays an important part in the recording, analysis, and treatment of PI in New Zealand. However in 2012/13 there were 349 ACC claims for PI submitted, yet approximately 55,000 people experienced a PI during the same period (with 3,000 PI being serious adverse events at Grade III or IV). If all patients who suffer a PI made a claim and this was accepted, we estimate the direct cost to ACC (excluding earnings compensation) would be approximately $68 million per annum. The nature of complex systems is that unless adverse events such as PI are recorded, claims made, and financial liability calculated, they will not receive the attention they deserve.

Pressure injuries remain under-reported in all settings. This includes nursing and medical notes, discharge letters, National Minimum Data Set (NMDS) coding, interRAI, and ACC 45 form for lodging an injury claim and ACC2152 (Treatment Injury Claim). For example, analysis of NMDS data for the 2013/14 year highlighted just 5,000 cases out of 1.2 million episodes, or 0.42%, were recorded in the NMDS). By comparison, point prevalence studies in the central DHB region show prevalence rates between 4-8%. If the prevalence data from the project was applied to the NMDS in our simulation model, this would indicate that ACC should have received over 3,000 claims per annum from people suffering a Grade III or IV PI . Our expectation is that at a minimum all 3,000 Grade III and Grade IV PI should have triggered an ACC claim (ACC 45 plus ACC 2132), and should be reported as a sentinel or Serious Adverse Events (SAE) to the HQSC.

If PI remains under-reported, then prevention efforts will remain unfocused or ineffective. Additionally, liability for treatment and rehabilitation will remain with the individual (or provider), potentially denying the patient a statutory entitlement to rehabilitation and compensation.

Throughout this project, it was pointed out to us by stakeholders that PI reduction initiatives are often limited to increased awareness, with the support of a few dedicated professionals (often wound-care nurses), and only funded for one or two years. While this approach may provide early gains, they are arguably only the result of the "Hawthorne effect" and may not be able to be sustained.

Participants also pointed out that PI reduction programmes are vulnerable to changes in leadership at an organisational or programme level. They frequently suffer common problems such as change fatigue, and incur additional compliance requirements.

Point prevalence surveys and monitoring tools are mostly reported at organisational or hospital level. Departments within a DHB do not see their own profile, or how they compare to like services in other DHB. In addition, this data is not often supported by in-depth analysis such as Root Cause Analysis or Serious Adverse Event (SAE) reporting and investigation, or discussion of cultural drivers.

There is significant international research on PI. International prevalence surveys indicate that PI incidence in acute hospital settings varies between 0.4-38%, and between 2.2-23.9% for residential aged care (Hughes, 2008).

Our research found that leading DHBs in New Zealand that have a PI reduction program indicated PI prevalence is as low as 4.78%. In aged care, prevalence is estimated 8.4% (based on PI Clinical Assessment Protocols (CAPs) in an interRAI sample of 31,000 patients' estimates). An additional study involving 690 patients in DHB hospitals in the central North Island and 641 patients in residential age care showed prevalence rates of 8.4% in hospitals and 7.5% in residential aged care respectively (Care-Metric, 2014).

In the following sections of this report, we set out to address many of the problems we identified. To achieve this we have adopted a simple question-and-answer format, which we believe will enhance the understanding of PI and the avenues to PI reduction. The aim is to assist policy makers, funders, healthcare executives, families, and those directly involved in patient care with assessing and improving their understanding of the aetiology of PI.

WHAT DO WE UNDERSTAND OF PRESSURE INJURIES?

WHAT ARE PRESSURE INJURIES?

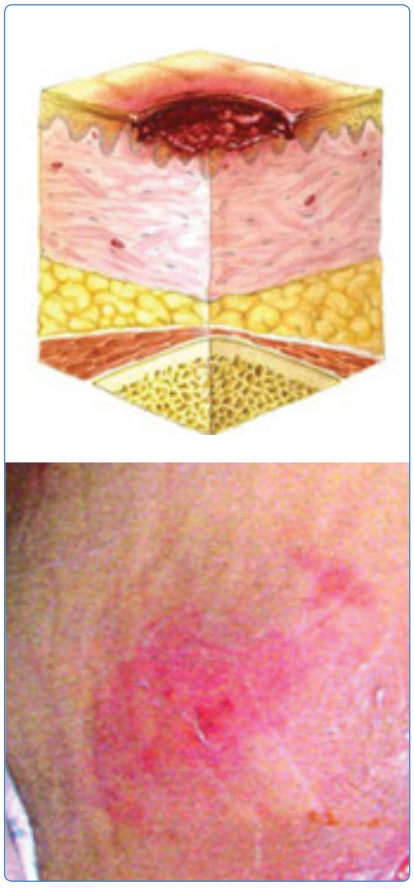
Pressure injuries are areas of damage to the skin and underlying tissue caused by constant pressure or friction. PI are also variously described as bedsores, or pressure ulcers, and sometimes even pressure sores.

How do we describe PI?

PI are commonly stated in six categories. The grades of PI are described using the 2014 international guidelines (Hasler, 2014). These guidelines are an internationally agreed reference tool. The six grades are:

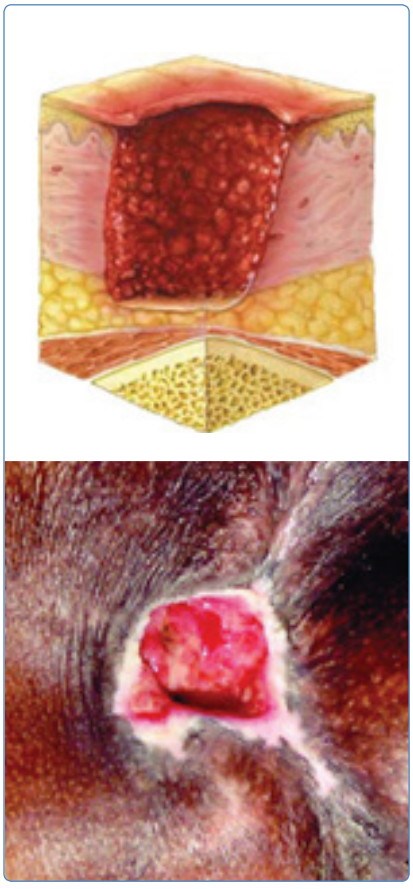
Grade I: Non-blanchable erythema.

A Grade I PI displays intact skin with non-blanchable redness of a localised area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its colour may differ from the surrounding area.



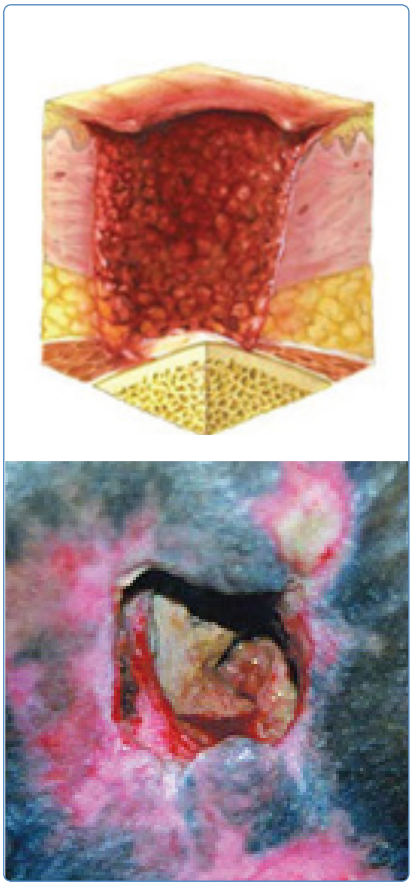
Grade II: Partial Thickness skin loss.

Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister.



Grade III: Full thickness skin loss

Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunnelling.



Grade IV: Full thickness tissue loss

Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunnelling.

In addition to these four categories, a recent update of the international guidelines added two more categories:

Unstageable: An unstageable injury is where the depth of the PI is unknown as the base of the injury is covered with slough and/or eschar. A slough or eschar is a piece of dead tissue that is cast off from the surface of the skin, particularly after PI, and can be a gangrenous ulcer or fungal infection.

Suspected deep tissue injury: A suspected deep tissue injury is where the skin is not broken but the underlying tissues are clearly discoloured (purple/maroon) and raises the possibility of serious damage to the underlying tissues.

A Grade I PI is when the skin is red but not broken. When at this stage, if the pressure is relieved in an adequate manner the skin is often able to return back to its original state. From a Grade II and upward, the pressure has caused non-returnable damage to the skin; and these are considered wounds that need active treatment

"I MISS OUT ON WHĀNAU MEETINGS AS I HAVE TO LIE PRONE FOR LONG PERIODS OF TIME. THIS ISOLATES ME FROM WHAT IS GOING ON IN MY FAMILY."

41-year-old with PI

RANGI'S STORY

Rangi is a 41-year-old Māori man who has been tetraplegic for 20 years. He is very aware of the dangers of pressure injuries and is proactive in every way to prevent them from occurring. Nevertheless, they sometimes develop and require treatment. When they do, this is what he experiences:

INCREASED SOCIAL ISOLATION

"I miss out on Whānau meetings as I have to lay prone for long periods of time. This isolates me from what is going on in my family."

LOSS OF UPPER BODY STRENGTH

"Lying prone in bed reduces the strength in my upper arms as I am not using them as much as I would do when I am in my wheelchair. So every time I have to make sure I get back in to shape."

DEPRESSION

"I missed out on a couple of important school meetings of my children. I missed those important moments where, with all the other parents, you are proud of what they have achieved."

Pressure injuries also affect Rangi's wife and the rest of the family. Not having her husband at the school ceremony made her feel as though she was being seen as a single parent.

LACK OF UNDERSTANDING

"The public is not aware of how dangerous and debilitating pressure injuries are. Information is crucial so that when I ask for a comfy seat, people do not question that request."

"Also, the DHB needs to understand that my own equipment is crucial to me. During one of my visits they took it away and my own family had to make sure that I was turned regularly."

(NB: Names have been changed to protect confidentiality)

Who is susceptible to PI?

Anyone who is immobile is susceptible to a PI.

PI are more common in people with reduced mobility, such as older people, or those confined to a bed or chair. While PI are often associated with older people, they are also common in neonates, people who have undergone surgery, or the disabled.

We estimate that approximately 55,000 people in New Zealand suffer a PI every year. This estimate was derived from a simulation model using NMDS, and interRAI data covering both home care, and Aged Care facilities. Prevalence data from the Northern Regional DHBs Alliance was included, enabling an estimate to be calculated.

As indicated in Figure 7 to the right, the majority of PI are classified as Grade I, with an average of 40,600 cases derived from our simulation model. We estimate that Grade II PI accounts for another 11,000 (range 10,500-11,500), and the more serious Grade III and Grade IV a further 3,000 incidences.

Table 1 below provides a summary of our simulated incidence rates by setting. The results reflect the relative number of patients treated in each setting. DHB hospitals provide over 1.2 million patient episodes in New Zealand hospitals and treat 920,000 people annually. By comparison, the number of home care approximately 110,000, with a further 27,000 in long term care facilitates for older people.

In this analysis, it is important not to associate prevalence in any one setting with causation, as patients are often transferred between facilities and may have acquired their PI in a different environment.

Discussion around a specific setting

While patients most at risk are the old and immobile, we have deliberately excluded analysis of PI by service; as this blame, when in practice a patient may have been admitted with a PI.

HOW WE ESTIMATED THE NUMBER OF PEOPLE WITH PI

To forecast the benefits of a PI reduction and quality improvement programme we estimated the absolute number of people affected by PI in New Zealand in any one year. This was achieved by:

- Establishing a population set using NMDS, and InterRAI data
- Overlaying prevalence data from the Northern Region Alliance point prevalence survey.
- Development of probability distributions weighted for risk factors such as age, complexity, ICU use, operative intervention, co-morbidities, and extended length of stay.
- Developing a Monte-Carlo simulation model, and running it 10,000 times.

This provided us with range estimates of PI by Grade by setting.

FIGURE 7:
ESTIMATED NUMBER OF PI PER YEAR BY GRADE (2013/2014)

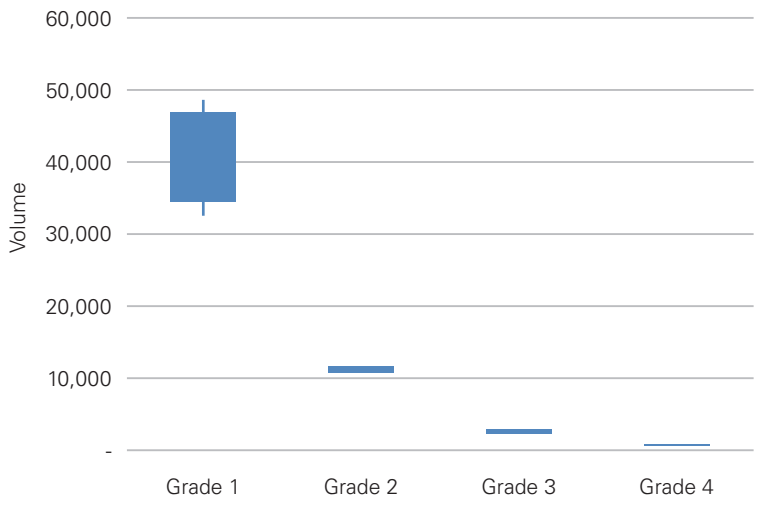


Table 1: Estimated Incidence of PI by Grade & Setting

Type	DHB Hospitals	Home Care (HC)	Residential Aged Care	Total
Grade 1	36,217	3,009	1,372	40,597
Grade 2	8,843	1,241	994	11,078
Grade 3	1,987	265	195	2,448
Grade 4	346	140	101	587
Total	**47,393**	**4,655**	**2,662**	**54,710**

JOHN'S STORY

John, a widower of 71 and recently retired, was admitted to hospital with an ischaemic leg. Prior to admission his mobility had decreased quickly over the last two days and he was unable to walk. He has a medical history of heart disease, peripheral vascular disease, diabetes and COPD, making him extremely susceptible for developing a pressure injury if timely prevention is not put in place. His words create the following story.

"WHEN I TRANSFERRED TO THE HOSPITAL, I HAD TO WAIT 36 HOURS IN THE EMERGENCY DEPARTMENT BEFORE A BED WAS AVAILABLE. DURING THAT TIME, I WAS UNABLE TO MOVE AND BECAME INCONTINENT."

"I TOLD THE DOCTORS AND NURSES THAT I HAD A SORE BOTTOM BUT NO ONE PAID ATTENTION TO IT."

John was admitted to the ward without a pressure injury risk assessment, and this was not completed until day four. The nursing notes stated that John had a reddened area on his sacrum. However, there is no record of a preventive intervention being put in place. On day ten, two days after his operation for a below-knee amputation, the sacral pressure injury was re-observed and documented as Grade III. Only at this stage was a pressure-relieving mattress ordered and a wound care specialist consulted.

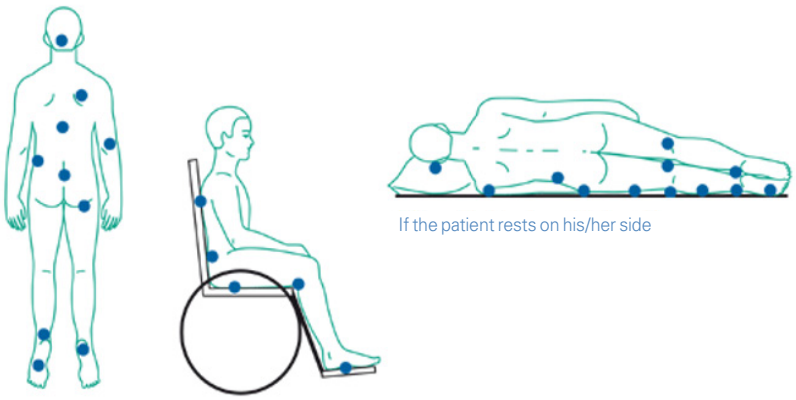
The prolonged rehabilitation time caused him considerable pain and isolation. Reflecting on the ordeal, he said:

"THE WOUND ITSELF WAS MOSTLY NUMB DUE TO IT BEING SO DEEP. I REMEMBER THE SMELL FROM THE WOUND, WHICH WAS TERRIBLE. I FOUND IT EMBARRASSING AND DID NOT WANT ANY VISITORS. THE MOST DISAPPOINTING PART WAS NOT BEING ABLE TO GET ON WITH MY REHABILITATION FOLLOWING THE AMPUTATION. IT FELT LIKE MY LIFE WAS PUT ON HOLD. AT TIMES I WAS FRUSTRATED AND ANNOYED BUT PUT ON A BRAVE FACE FOR THE STAFF."

John's case highlights how simple preventable action in the ED could have saved considerable suffering, and the importance of frequent assessment when immobile.

(NB. Names have been changed to protect confidentiality)

FIGURE 8:
TYPICAL BODY LOCATIONS FOR PI



Adapted from *Clinical Practice Guidelines #3*, Agency for Health Care Policy and Research, US Department of Health and Human Services.

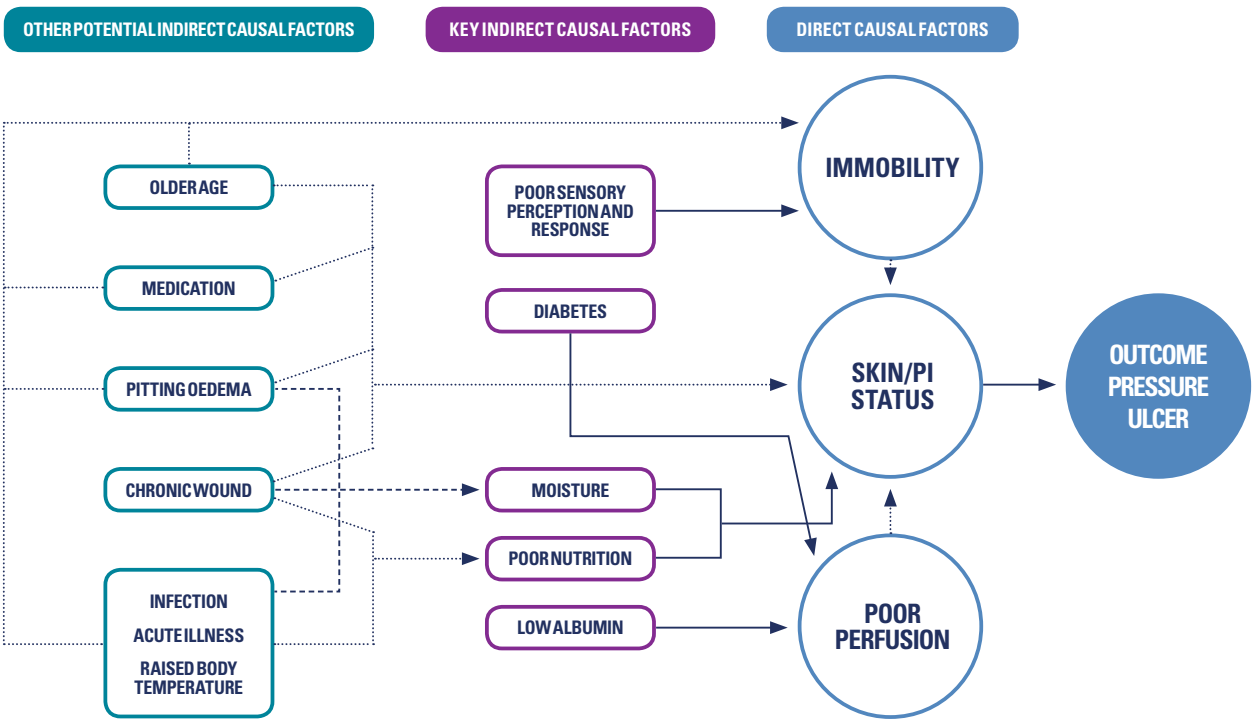
How do PI develop?

PI develop mostly on locations where there is a limited amount of tissue between the surface the person lays or sits on, and the bones in the body. They also develop in other areas, especially in combination with tubes and catheters when these are not regularly assessed and repositioned, e.g. babies in Neonatal Intensive Care Unit (Visscher and Taylor, 2014).

The explanation on how people get PI is reflected in the medical description. The Latin name of PI is Decubitus. This derives from the word decumbere, meaning "to lie down". The word in itself reveals where and how PI are most likely to develop.

Figure 8 shows a body map of where patients are most likely to develop a PI given their position if stationary. If a person is laying or sitting in a fixed position for more than one or two hours, they are at risk of a PI.

FIGURE 9:
CAUSAL DIAGRAM FOR PI



What are the factors causing a PI?

Figure nine provides a conceptual framework for PI showing direct causal factors, indirect causal factors, and potential factors. The concept diagram explains the relationship between these factors in how pressure injuries occur (Coleman et al, 2014).

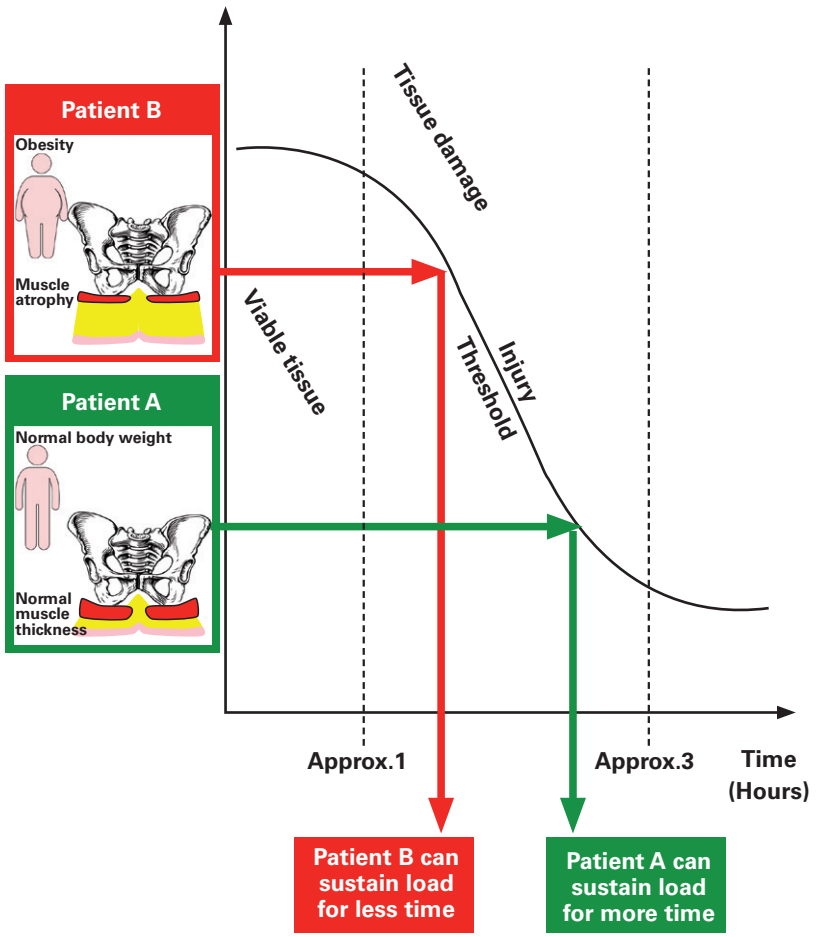
How long does it take for PI to occur?

PI can occur very rapidly, often within two to four hours (Kosiak, 1961; Reswick and Rogers, 1976; Stekelenburg, 2007). The speed of how fast a PI develops depends on the amount of pressure or shear forces that are applied, and the susceptibility and tolerance of the individual to cope with the applied pressure. Low applied pressure combined with high susceptibility and low tolerance can just be as detrimental as high applied pressure combined with low susceptibility and high tolerance ("Prevention and treatment of pressure ulcers: Clinical Practice Guidelines," 2009).

This explains why even normally healthy people can develop a PI. It also explains why a change in health status or treatment can trigger a PI. For example a well patient admitted for an elective procedure who receives sedation or pain medication is then at risk.

The adjacent graph explains that a short high pressure applied to the skin can be just as detrimental as a low pressure for a long time (Gefen, 2008).

FIGURE 10:
RELATIONSHIP BETWEEN PRESSURE, TIME, AND SKIN CONDITION



THE LATIN NAME OF PRESSURE INJURIES IS DECUBITUS. THIS DERIVES FROM THE WORD DECUMBERE, MEANING, "TO LIE DOWN".

The word in itself reveals where and how pressure injuries are most likely to develop.

DANNY'S STORY

IN 1999, DANNY WAS A FORESTRY WORKER, WHEN A ROTTEN TREE BEHIND WHERE HE WAS WORKING FELL ON HIM. DANNY'S STORY TOLD IN AN INTERVIEW AS PART OF THIS PROJECT IS AS FOLLOWS:

"I knew straight away I had a spinal injury, and I would probably never walk again, but didn't know what this meant for my future.

"After months of treatment and rehabilitation, I vowed that I would not let this get me down. I took up wheelchair basketball soon after my rehabilitation finished. In 2002, I was selected to represent New Zealand in wheelchair basketball at the FESPIC games held in Korea.

"I continued to play basketball for New Zealand with a dream of going to the Paralympics, in 2009. I took part in the "Accelerate to Excellence" programme run by Paralympics New Zealand and was introduced to rowing, training every day for six months and finally trialling for the world championships in 2010 at Karapiro. I made the cut for the team! I had a great regatta and against all expectations won a bronze medal at the champs. I then went on to the world champs in Slovenia in 2011 and qualified the boat for the Paralympics in London in 2012, where I came first in the 1000 meter B-final.

"I am very much a family man. My partner and I have five kids. I live on a 2.5-acre lifestyle block, on which I run a couple of cattle. I have my own health and safety business and it is rare to find me 'sitting still'.

"My battle with pressure injuries started when I had to sit on a plane for a long time without a pressure reducing cushion. This caused my skin to break down and it took a considerable time to heal, this was on the plane to the world champs in Slovenia in 2011.

"The second occasion occurred after the Paralympics in 2012. I made sure I had prevention material in place; but again the journey in combination with the physical stress of the rowing caused the skin on my buttocks to break down. This time it did not heal by itself and I needed surgery.

Last September the skin broke down again due to unknown cause. The wound did not heal, and ultimately became infected, and I ended up in hospital. Currently I am on the waiting list to receive surgery.

"Having a pressure injury seriously affected my life. As the pressure injury is on my buttocks, I cannot sit properly in my wheelchair and have to lay most of the time on a bed or in my Lazyboy. I only can work for a couple of hours each day, and having my own business I had to hire additional staff to make sure the business survived.

"Prior to the pressure injury I did the site visits for work but now that is not possible. I now spend most of the time immobile, which affects my physical strength especially my arms. This is important as I now find it difficult to move from my wheelchair into the car. It is also difficult to lift my buttocks from the wheelchair or chair so that the skin and muscle get sufficient oxygen and build-up of fluids caused by pressure are removed.

"You can imagine that having a pressure ulcer also affects my family life. It has been more than 4 months ago since we were able to go out and socialise together. I now cannot attend important occasions for my partner and children. Going out for a coffee has become a real treat.

"It's also the social aspect of being laid up that I find hard. Although I have a regular flow of visitors and friends; and the family has been awesome, it is the fact that I am stuck at home 95% of the time that gets me.

"Even in a wheelchair I am a keen pig hunter and I feel sorry for my dogs who are not getting the work and exercise that they are used to getting. Now they have started playing up around the home, digging holes, escaping from their paddock and tricks like that.

"Perhaps the biggest problem I find is explaining to others why I cannot do what I used to do. Pressure ulcers are literally a hidden ugly issue. The wounds are on locations you do not want to show off, they are nasty, and they smell, especially when they are infected. Once you have them, it is very hard to get rid of. It is also very hard to explain to others, as they either have no idea what you are talking about, or have no idea how seriously they affect my health. In my opinion, the topic of preventing pressure injuries need to be addressed more prominently in New Zealand."

What are the risk factors for PI?

The key risk factors for PI are immobility; conditions that affect the resilience of the skin (continence, moisture, oedema, age, medication); and conditions that affect the perfusion (nutrition, diabetes, infection).

Recently released international guidelines identified several groups of individuals that are particularly vulnerable to developing a PI (Haesler (Ed.), 2014). These groups are people who are:

- Obese
- Critically ill
- Elderly
- Peri-operative
- Palliative
- Neonates
- Spinal cord injured.

Patients with spinal injuries and those confined to a wheel chair are considered a high-risk group for developing a PI. This is because the normal muscle tone is decreased due to incapacity and the ability of the muscle and skin is also reduced. Combined with the absent or reduced pain sensation, PI often develop easily and unnoticed in this group. To illustrate this we have included Danny's story as part of this document. A recent PI point prevalence study in New Zealand spinal units showed considerable year to year variation with Grade I-IV as high as 25%.

Are PIs preventable?

Yes. Most PI are preventable. Fundamentally, the significant number of PI are a result of a failing healthcare process rather than the underlying condition or an anticipated result of the treatment such as surgery.

Evidence suggests that up to 95% of PI are preventable when appropriate interventions are in place (Black et al, 2011) Although there is some understanding that there are situations in which the development of a PI is unavoidable (e.g. where a patient had a fall and was on the floor for some time unattended), the damage should be restricted to category I or II.

Nevertheless, there is now wide international support for PI appropriate preventive measures to be adopted in a timely fashion.

All PI start as Grade I and development travels through each category of severity (category I, II, III & IV). Therefore preventing PI progression is, in the vast majority of cases, feasible. Early intervention for Category I or II can certainly prevent advancement. PI category III and IV are increasingly considered "never events". Many leading healthcare providers internationally, and in New Zealand, include them as Serious Adverse Events (SAE) as a routine part of their quality improvement processes.

This view is now supported by regulatory and funding reforms in the USA, where patients that develop a PI two days after admission are now regarded by Medicare in the USA as nosocomial (facility acquired) and do not receive reimbursement of their cost. The Department of Health in Queensland, Australia has now introduced financial penalties on providers of A$30,000 for PI Grade III, and $50,000 for PI Grade IV. In New Zealand, facility-acquired PI is covered as a "no-blame Treatment Injury" through ACC. This environment provides significant opportunity for leadership and a collaborative approach between patients, providers, and ACC to change the culture necessary to prevent PI.

Why have we not been able to minimise PI?

Despite high recognition that PI are largely avoidable, the question remains: why haven't we been able to eliminate PI?

There is a strong belief that PI occur due to weaknesses or failings in the healthcare system, rather than the people within the system. This view is supported by the safety literature in a wide range of industries, not just healthcare.

Breaks in the continuity of care:

PI is most likely to occur when there is a break in the continuity of care. Participants in our workshop series highlighted the importance of continuity of care and routine to prevent PI occurring or progressing. This included tasks such as assessment (e.g. SKIN protocol), hourly rounding and repositioning of patients.

Stakeholders workshops reported that a leading reason for continued incidence of PI could be attributed to when the patient is transferred or carers are busy. This led to an emerging consensus that breaks in the continuity of care often occur at point of transfer. There is a change in condition; or a patient comes under the care of a new health professional or organisation. This happens more frequently than we often imagine. For example, a patient may be cared for at home and, following a fall, lay on the floor for two hours; thus creating the preconditions for PI. Once transferred by ambulance, they are stabilised in ED and wait for a transfer to an assessment ward. After some hours in an assessment ward, they are transferred once more to a surgical ward, where they may be transferred again for diagnostics, procedure or imaging before being returned to the ward. If surgery is to take place, they are then transferred a further four times; once to the perioperative holding bay (or pre anaesthetic), once to the operating room, then recovery, and back to the ward. If carers are not aware, this creates several opportunities for PI to arise. From these stakeholder discussions, the concept of "Transfer" emerged as a key area where PI risk is the highest; and if addressed, where the most gains can be made.

Even when a patient or resident is in situ, the shift nature of healthcare staff creates a series of hand overs in any one day. Stakeholder feedback identified that if we address the key issues and risks around transfer, the incidence (and consequent prevalence) of PI could be significantly reduced.

Behind the central theme of transfer, participants identified a range of organisational barriers to reducing pressure injuries that will need to be overcome in any national PI reduction programme. These are summarised by Figure 11.

FIGURE 11:
BARRIERS TO PI MINIMISATION

Assessment tools are too complex

Comprehensive assessment tools and care pathways are not a substitute for clinical judgement. Yet most prevention programmes place a disproportional effort on the development of better tools, rather developing the judgement skills of the user.

Assessment tools that were refined in the 1970s and 1980s with Waterlow and Braden scores, and have now become mainstream. However, they have now become part of a complex suite of assessment, recording, liaison, prevention and treatment. For example, one DHB which has a PI prevention programme developed a double sided A4 assessment form based on Waterlow risk assessment. This well laid out sheet was very comprehensive. However, it also required users to score the patient against 46 criteria on a scale of 1-8, add them and relate the score to a further 15 questions before selecting a bundle of care. The sentiment and dedication of the PI prevention team who developed this was admirable. Unfortunately, the practicality of using the form in a clinical environment where there are numerous similar assessments going on resulted in low completion rates and delayed decision making.

This raises the question of how many, and what type, of assessment tools should we use in an ever more complex and fast-moving healthcare environment.

Low reliance on clinical judgement

Workshop participants highlighted their belief that high reliance on assessment tools is often used as a substitute for clinical judgment in PI assessment and prevention. The importance of using generic clinical skills is emphasised in the 2005 National Institute for Health and Care Excellence (NICE) PI prevention guidelines. The NICE guidelines state that a PI risk assessment should always be accompanied by a clinical assessment. However, this does not need to be complex. Recent research emphasised that a visual assessment coupled with clinical judgement was equally as effective in identifying PI risk (Qaseem, 2015).

Competing priorities

In the past three decades, the delivery of healthcare has become faster and more specialised. In the 1970's hospital, patients were cared for on average by two health care professionals, mainly a doctor and a nurse, principally in one or two settings such as a ward or theatre. By the year 2000, this number has increased to an average of 15 different people providing care over a single episode (Gawande, 2012). This creates multiple opportunities for the risk of PI to go unassessed or unnoticed, as carers focus on treatments or interventions. Compounding this, the average. This trend is likely to continue as we face an aging population with higher levels of chronic disease co-morbidity, and complexity.

Lack of access and authority in equipment

Almost all preventative and treatment plans for PI involve some form of pressure relieving equipment such as a mattress, cushion or protector. However, the difficulty of accessing equipment in a timely manner was raised as a common reason for systems failure. When asked why, participants in the workshops with front line experience suggested that sometimes this was due to the need to seek specialised advice e.g. occupational therapists (OT) before ordering equipment, or the complex order and delivery processes when an equipment decision was made. Overcoming these barriers appears to be one of the keys to maintaining continuity of care and reducing the incidence of PI.

Insufficient leadership

Many participants highlighted a perceived leadership vacuum when it comes to PI prevention. It was very evident that in all healthcare settings, there are groups of health professionals who are passionate about PI treatment and prevention. Many of these people are working in specialised roles as wound care nurses, occupational therapists, or in palliative care; and see the result of Grade III and Grade IV PI. They are all looking for leadership and support in their work environments. At one end of the scale, they are looking for boards, CEOs and clinical leaders to recognise the problem and support a culture of prevention. At the other end of the scale, they are looking for senior nurses or care givers on the floor to join in rounds where PI prevention can be discussed as part of normal care and treatment. In all cases, they are looking for the authority to use their skills and judgement to make decisions and implement simple effective PI prevention.

Underdeveloped support systems

With the ever-increasing pace of healthcare, there is a growing emphasis on patient pathways, checklists, and consistency. Simply adding PI to these lists was seen by workshop participants as counterproductive, simply because it becomes one more thing to do, or plan. Simple and automated recording and ordering systems would help ensure PI assessment is completed as well as meeting the immediate demands of treatment and care.

There was a call for use of more intelligent systems that provided reminders and "stop-go" fields given certain patient characteristics such as age, continence and mobility. These could, and perhaps should, be linked to the core Patient Management Systems (PMS) and clinical record, and would therefore enable the ordering of equipment bundles to be automated.

Following the publications of the two references: "To Err is Human" and the "Crossing the Quality Chasm: A New Health System for the 21st Century", it became clear that PI develop because of system failure rather than failing health professionals. Removing systems barriers is in line with patient pathways and quality programmes – the challenge is to integrate PI prevention into other task groups such as purposeful rounding.

WHEN PROBED FURTHER AS TO WHY PI STILL HAPPEN, THE EMERGING CONSENSUS WAS THAT "THINGS USUALLY GO WRONG WHEN A PATIENT GETS TRANSFERRED OR CARERS GET BUSY."

THIS LED TO AN EMERGING CONSENSUS THAT BREAKS IN THE CONTINUITY OF CARE OFTEN OCCUR AT POINT OF TRANSFER WHEN A PATIENT COMES UNDER THE CARE OF A NEW HEALTH PROFESSIONAL.

PI Workshops 2014

What does the literature say?

To address some of the barriers raised, we looked to the literature on issues faced by other healthcare providers, and how they have addressed them overseas.

The literature highlighted the fact that healthcare delivery is strongly influenced by competing priorities. In this competing environment, issues that are acute and visible have preference above the other issues that are not visible and less acute. Preventative initiatives are less likely to be implemented when there are competing priorities. Therefore, what barriers the industry chooses to address and how they are addressed is critical to the extent that PI development can be minimised.

Figure 12 highlights the important factors that come out of this research (Harris, Kwon, Berrian, & Calvo, 2012). Harris et al evaluated the Institute for Health Improvement (IHI) collaborative breakthrough model to identify key components that determined success in quality improvement programmes. There are strong similarities between the barriers highlighted in the workshops and the framework suggested by Harris et al. Certainly leadership was a big factor. The need for empowerment and team work matched the emphasis on clinical judgement and authority to order equipment. Furthermore, the need for supporting systems matched many of the characteristics of the measurement box below. One thing that Harris did raise, and which was overlooked by participants in New Zealand, was the issue of external partnerships and sustainability. The importance of national partnerships and sharing best practice should not be overlooked.

For example, a six-year collaborative project in the Netherlands in preventing a large number of PI came to the similar conclusion (M. M. H. Strating, et al, 2011 M. M. Strating & Nieboer, 2013).

FIGURE 12:
FACTORS SUPPORTING SUCCESSFUL PI REDUCTION

LEADERSHIP

- Champion
- Outline a vision
- Establish a "Bold" aim
- Ongoing support

EXTERNAL PARTNERSHIPS

- National
- Local
- Non-traditional

TEAMWORK

- Information sharing
- Staff empowerment
- Teams reflect all levels of organisation
- Recognise and reward efforts

MEASUREMENT

- Measurement strategy
- Infrastructure for data collection
- Routine monitoring and feedback
- Inventory of best practices

SUSTAINABILITY

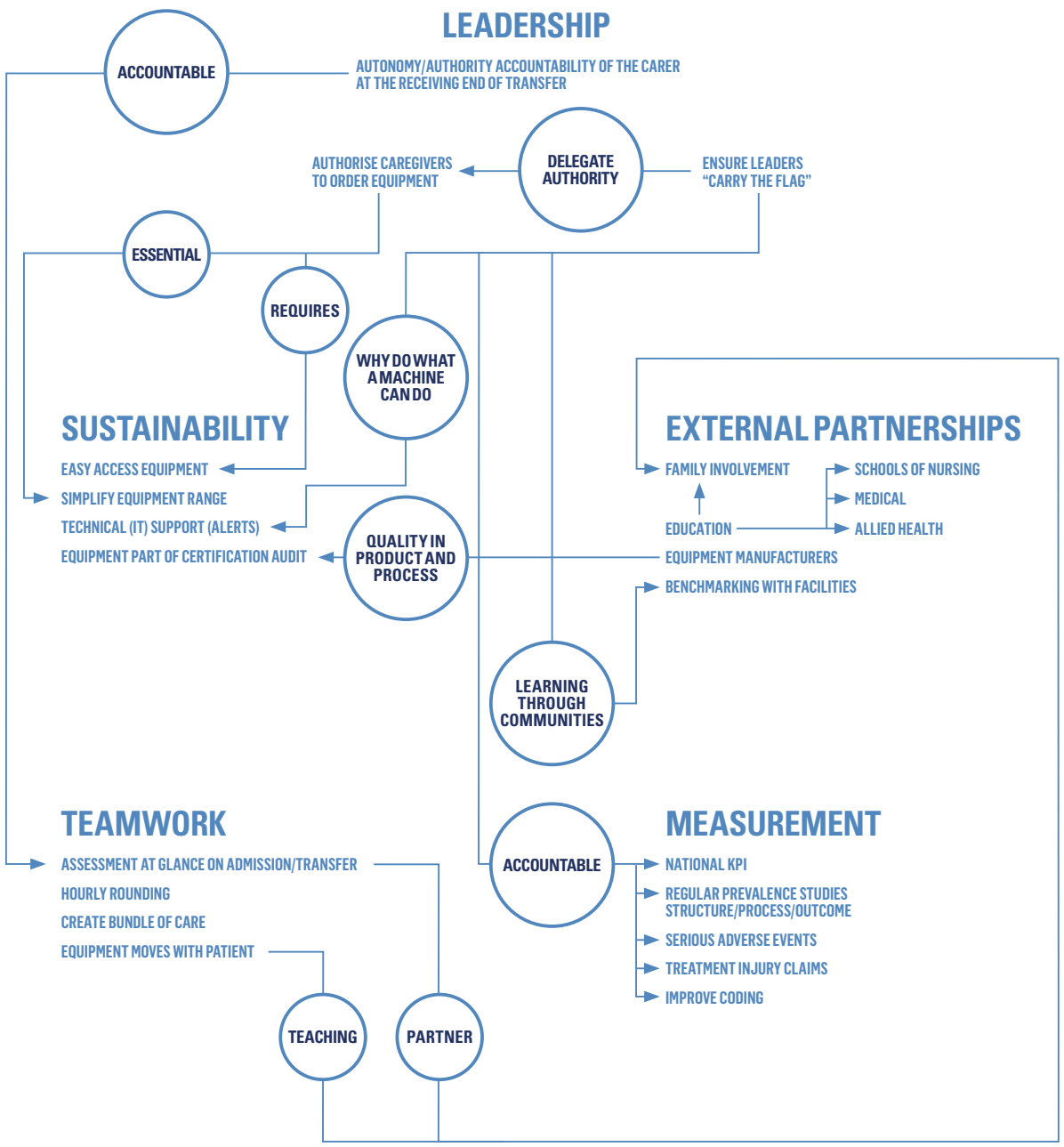
- Sharing of best practices
- Technology-enabled coordination
- Communities of practice

A key source of literature on PI prevention and quality improvement has been published by the Institute of Health Policy at the University of Rotterdam in the Netherlands. A particularly useful article titled "Creating Effective Quality-improvement Collaboratives: a Multi Case Study" was published in the British Medical Journal (BMJ) Quality and Safety in 2011 (Strating, 2011).

Their conclusion was "although the level of evidence on preventing pressure ulcers is high, and the team leaders perceive a high measurability, the collaborative target is not perceived to be achievable and challenging average, prevalence rates decreased from 18% to 10%. Only six of the 16 teams improved prevalence by more than 50% and achieved the collaborative target".

This is useful in helping New Zealand set its future PI reduction targets and identify what is possible, and lessons for similar programmes in New Zealand.

FIGURE 13:
REDUCING PI:
RELATIONSHIPS BETWEEN FACTORS CRITICAL IN SUCCESSFUL PI QUALITY IMPROVEMENT PROGRAMMES



Source: HQSC Regional PI Workshops 2014

HOW MUCH DO PRESSURE INJURIES COST NEW ZEALAND

WE ESTIMATE THAT THE TOTAL COST OF PI TO NEW ZEALAND IS $690 MILLION PER ANNUM. THIS SECTION OUTLINES HOW THIS IS CALCULATED, WHO BEARS THIS COST, AND WHAT ARE THE KEY DRIVERS OF COST.

The cost estimate for PI is based on the estimated 55,000 people who receive a PI annually derived from the simulation model. The cost per case is based on a bottom up costing technique from provider data in New Zealand. The cost of PI was made up of:

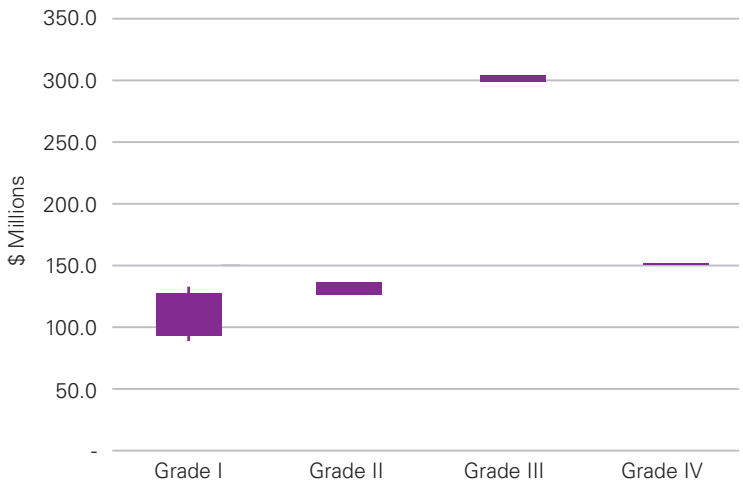
- Treatment costs
- Increased Average Length of Stay (ALOS)
- Rehabilitation costs
- Loss of Quality Adjusted Life Years (QALY).

As illustrated by Figure 14, Grade III PI account for almost half of the burden of disease, with a total annual cost of approximately $300 million. While there are only 2,500 cases per year, they have a high per-case cost due to the QALY loss through permanent disability (as highlighted by Figure 15).

The cost per case:

Figure 15 shows the key cost components for each grade of PI. These include direct treatment costs, additional length of stay (LOS), rehabilitation costs, and loss of quality of life.

FIGURE 14:
ESTIMATED TOTAL COST OF PI BY GRADE (2013/2014)



As illustrated by table 2 their total cost per case varies between settings. This difference is because of high cost rehabilitation (including surgery) and additional LOS only impact on the hospital environment. This is not the case in home care and residential aged care. In these settings we have only included the allied health cost component for rehabilitation.

The difference in QALY cost between settings simply reflects the age profile of the patients, and that Grade III and Grade IV PI have a long-term impact on quality of life.

FIGURE 15: TOTAL COST OF PI (INCLUDING QALYS)

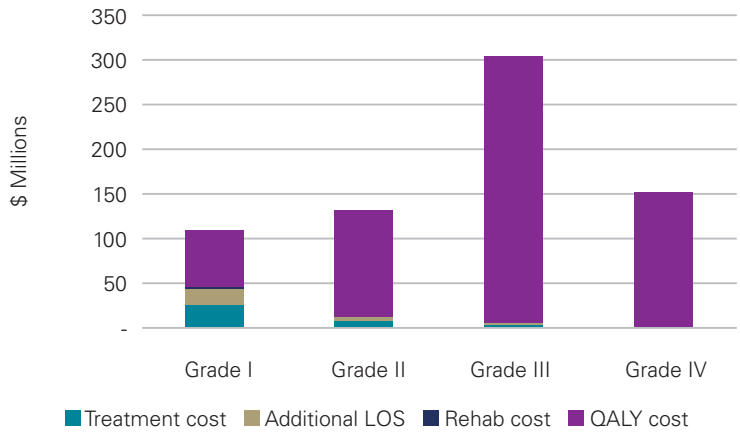


Table 2: Total cost per PI case by setting

Type	Hospital	HC	Residential Aged Care
Grade 1	2,768	2,341	2,216
Grade 2	11,965	11,566	11,316
Grade 3	138,114	65,102	51,400
Grade 4	316,945	187,105	151,446

Table 3: Total cost of PI by Cost Group

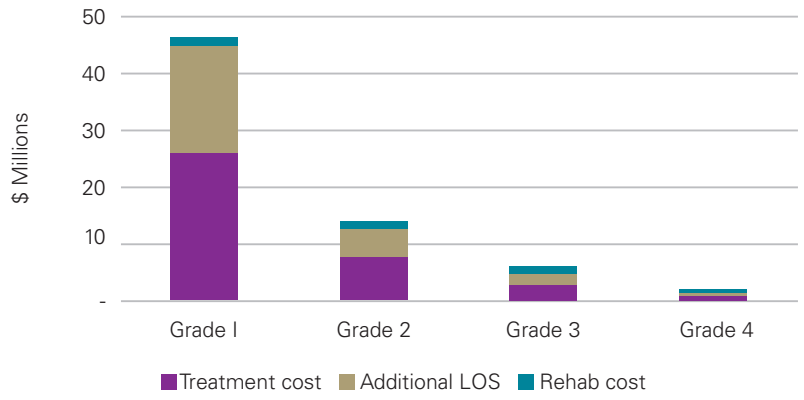
Type	Treatment Cost	Additional LOS	Rehabilitation Cost	QALY Cost	Total
Grade 1	25,895,107	18,979,998	1,381,917	64,025,788	110,282,810
Grade 2	7,736,818	4,867,978	1,177,915	117,616,778	131,399,489
Grade 3	2,778,191	1,864,135	1,331,137	295,806,058	301,779,520
Grade 4	843,032	487,170	594,635	149,147,667	151,072,504
Total	**37,253,148**	**26,199,281**	**4,485,604**	**626,596,291**	**694,534,323**

Direct costs to the healthcare sector

In calculating the direct costs of PI we have included:

- **Time:** Time to treat PI by grade and direct labour costs including insurances and allowances, e.g. ACC levy, KiwiSaver, leave and on-call allowances by vocational category.
- **Clinical Supply Costs:** Clinical supply costs per day, based on the quantity and price of actual products used. This also included additional equipment during the treatment phased base on a rental cost per day.
- **Additional ALOS:** Additional ALOS for PI patients was calculated by comparing ALOS on a diagnostic related group (DRG) basis for PI patients compared to non-PI patients included in NMDS. To overcome the issue of cause and effect (i.e. did people stay longer because they had a PI, or did they get a PI because they stayed longer), we calculated the difference in ALOS for both categories and compared differences at the 95% confidence limits. This showed a 6.8% increase in LOS due to PI.
- **Rehabilitation Cost:** Rehabilitation costs included a return to hospital for elective surgery for PI based on International Classification of Disease ICD-9 Codes, and the associated Weighted Inlier Episode Separation (WIES) case weight. This cost also included post-operative allied heath rehabilitation, e.g. Occupational or Physiotherapy based on ACC reimbursement rates. It did not include capitated payments to General Practice teams or DHB-funded nursing or home care.

FIGURE 16: DIRECT COST OF PI (EXCLUDING QALY)



Note: we did not include an overhead loading in calculating the direct costs. This was in order to reflect these costs as variable in the short term, and therefore responsive to a reduced volume of PI.

Table 3 summarises the total cost of PI by grade and cost category. This illustrates that loss of QALY accounts for 86% of the total cost of PI. However, treatment costs are also significant and provide significant opportunity for providers.

In addition the treatment, additional LOS, and rehabilitation costs represent a significant potential liability for ACC under treatment injury claims (ACC 2152), and is exclusive of Earnings Related Compensation (ERC). It is also exclusive of capitation and out-of-pocket expenses paid to primary care providers e.g. doctor, practice nurse or physiotherapy visits. In this respect, we believe the estimated direct costs of $67 million per annum are conservative, but represent a good benchmark for estimating savings from a national PI reduction process.

EVERY GRADE III PI IN A NEW ZEALAND HOSPITAL COSTS SOCIETY $123,000

Cost to individuals and society

The personal and social cost of avoidable injury are significant. Personal complications include significant pain, depression, local infection, osteomyelitis (infection of the bone), anaemia, sepsis, (infection spread through the blood stream), gas gangrene, necrotizing fasciitis (flesh eating disease), and death (Baden, National Pressure Ulcer Advisory Panel, 2012). Furthermore, 50% of Grade II PI do not heal in eight weeks, and 95% of Grade III or IV do not heal in the eight week period (Bergstrom eta al, JAGS, 2005). Many individuals who recover from Grade III-IV PI suffer permanent disability impacting on the activities of daily living (Makai, 2010).

Our estimates based on international literature assume that Grade I and II PI fully resolve themselves with no long-term effect at a QALY loss of 0.02 and 0.1 years respectively but only in the first year. For Grades III and IV the QALY loss was 0.26 and 0.46 for the remaining life years (Makai et al, Cost Effectiveness of a Pressure ulcer collaborative, 2010). The QALY value used in our simulation model is $150,000. This is based on New Zealand Injury Prevention Strategy which includes the economic cost of injuries in six priority areas (O'Dea, 2012, NZIER 2012).

HOW DO WE REDUCE PI IN NEW ZEALAND?

IN THIS SECTION, WE OUTLINE THE RECOMMENDED SOLUTION FRAMEWORK AT EACH LEVEL OF THE HEALTH SECTOR. THIS INCLUDES THE DEVELOPMENT OF A NATIONAL STRATEGY CENTRED ON IMPROVING CONTINUITY OF CARE AND ENABLING PI PREVENTION AT ALL POINTS OF TRANSFER.

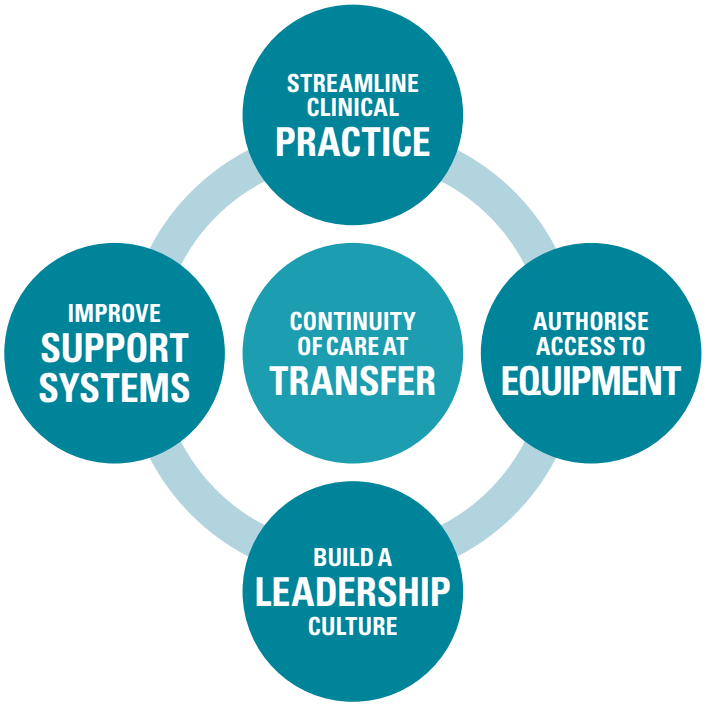
Developing a national PI reduction programme

The need for a nationally-led strategy in PI prevention was very evident at the regional workshops undertaken as part of this project. These reflected the high levels of enthusiasm for PI reduction and a strong appetite for sector leadership and guidance on where to focus their efforts.

KPMG sees the HQSC playing a central role in the development of this strategy, particularly in:

- Engaging the support of other national agencies
- Change in attitudes towards PI
- Streamlining clinical practice for the benefit of better patient outcomes.

FIGURE 17:
KEY ELEMENTS OF A PI PREVENTION AND QUALITY IMPROVEMENT PROGRAMME



Strategy overview

In developing our recommendations, we propose a national strategy across all major healthcare settings such as hospitals, home care, and residential aged care. We also recommend that solutions remain simple. In many instances, solutions will have to be implemented by carers who have little formal training, therefore simplicity is key. To achieve this requires a coordinated message agreed between the HQSC, MoH, ACC, DHBs and peak bodies.

It was clear that access to the right equipment at the right time is central to good clinical decision making, and this should become one of the foundation stones of the strategy. In our calculations, investment in equipment represents the highest cost. However equipment is only part of the solution. Additional equipment is of little value without changes in culture, assessment and clinical practice. For this reason, 45% of the cost of a national programme is invested in improving clinical practice such as assessment and rounding; the engagement of families and educational institutions; and improving information and support systems.

The key elements of the proposed National Strategy are summarised in Figure 17. Central to the proposed strategy is placing the patient at the centre of the process, then focusing on the most vulnerable points in healthcare delivery where PI prevention may be overlooked.

An important theme of the proposed strategy is the empowerment of people involved in the care process. This includes the patients, family or Whānau with the ability to take preventative action. Primary responsibility lies with the DHBs, supported by the HQSC, ACC and MoH.

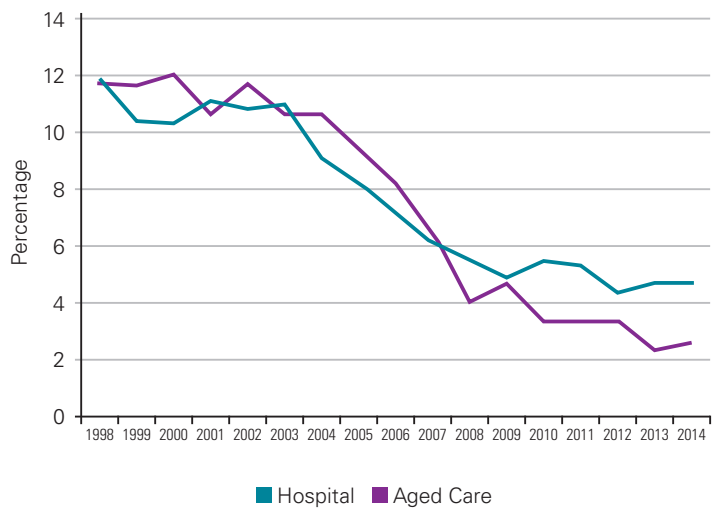
The remainder of the strategy is about sustainability and ensuring that the momentum of the PI programme is maintained. Our key concern is that the life cycle of a national strategy would be too short to embed the behavioural changes that would ensure low PI incidence remains a long-term feature of our healthcare system.

What is the evidence that PI quality improvement and reduction programmes work?

Evidence suggests that large programmes can work. Critical to their success are compliance with the key collaborative lessons from Harris et al (2012).

The strongest evidence for the effectiveness of a nationally sponsored quality improvement programme comes from the experience in the Netherlands. Between 1998 and 2014, PI prevalence was reduced between 65% (for Hospitals) and 75% (for aged care) over the 12 year period. The PI reduction programme in the Netherlands is illustrated in Figure 18.

FIGURE 18:
PI REDUCTION IN THE NETHERLANDS 1998-2014 (HOSPITAL AND AGED CARE)



Source: Halfens, R.J.G.. Meijers, J.M.M., Meesterberends, E., Neyens, J.C.L.. Rondas, A.A.L.M., Rijcken. S., Wolters S., Schols, J.M.G., ALandelijke prevalentiemeting Zorgproblemen Rapportage resultaten. Universiteit Maastricht, CAPHRI, Department of Health Services Research. The Netherlands, 2014.

This result was achieved by the Dutch quality improvement program titled "Better Care". It officially ran between 2005 and 2012, and aimed to improve the quality of seven topics, of which PI was one. The quality improvement program outline for each of the topics was approved and financed by a government agency. Independent quality improvement agencies organised workshops for facilities that wished to take part. Regular measurement was part of the program. In relation to PI, the program supported the overall national reduction of pressure injuries as seen in the yearly pressure injury survey organised and evaluated by the Maastricht University. An evaluation of this program is published by Strating et al (2010). This research highlights the importance of investment over a longer timeframe. This is based on the belief that to be sustainable quality programmes require fundamental changes to culture. This takes time. In addition, as this project shows, even with optimistic reductions, e.g. 15% per annum, it will take ten years to reduce to an acceptable level of 1.8-2.4%.

Based on this evidence, the National Health Service (NHS) has initiated a similar approach through the NHS Safety Thermometer. The NHS designs many of the resources and programmes at a national level to be used by facilities to reduce a number of preventable harm issues. They also provide a measurement tool that provide facilities to visualize the progress they make, and how they perform against other participating health care facilities (www.safetythermometer.nhs.uk).

Evidence from other quality improvement programmes is also relevant to PI. For example, the Agency for Healthcare Quality and Research (AHRQ) in the USA provides a universally available falls prevention manual, and a pressure injury manual. These are key examples where central leadership and programmes support facilities in their PI and fall prevention and quality improvement programmes. Waters et al, 2015 demonstrates that the reduction in PI and falls is not due to the penalties enforced by Medicare, but was actually influenced by quality improvement programs carried out by the sector itself.

Harris et al (2012) provide further evidence that change requires a shift in core values and behaviours currently embedded in our health system, and list five factors that should be included in a PI quality improvement programme (Figure 12). Harris also emphasises the importance of the interrelationship between factors as a core part of successful programmes.

In reviewing this evidence, we concluded that sustainable change can be achieved through a national programme with central leadership, collaboration and support at the coal face, and regular large prevalence studies. However the cultural aspects of healthcare cannot be overlooked. This includes engaging with the next generation of healthcare providers until PI prevention becomes an innate goal and behaviour of the next generation of health professionals.

Specific recommendations

In this section we provide a list of 20 specific recommendations grouped into four themes that sit behind the make-up of a National Strategy, which are:

a. streamline clinical practice

b. empower care givers to access equipment

c. build the leadership culture

d. improve support systems.

To achieve this, we have aimed to take the best components of what we have seen across the DHB sector and place them into a PI prevention framework that is both practical and effective. Recommendations on which agency should take the lead in each area is provided.

Solution Set A: Streamline clinical practice.

Making PI prevention easy is essential if a national initiative is to succeed. Our recommendations in this area are:

- **Recommendation 1(A): Assessment at a glance.** Assessment at a glance has become popular in efforts to meet the demands of a busy healthcare environment, and as a prevention tool of many forms of iatrogenic injury. Assessment at a glance (in particular the skin status check) is where the carer assesses risk using three visually causal factors, e.g. Mobility, Age, and Continence. This is similar to conclusions from recent research which identified three direct PI causal factors (immobility, skin status and perfusion) (Coleman et al, 2014). If a patient meets two of the three criteria, PI prevention should be undertaken, and this recorded in the clinical notes. Further and more detailed assessments, using internationally recognised tools, can be undertaken at a later time in line with the individualised care planning process.

- **Recommendation 2(A): Place responsibility on the carer receiving the patient.**
  An important part of this strategy is defining who takes responsibility and then authorise them to act, particularly at the point of transfer. Our recommendation is that the receiving person is best placed to take responsibility, to make an assessment and take preventative action. This should be emphasised in any PI prevention guideline.

- **Recommendation 3(A): Engage families in the prevention process.**
  Often healthcare professionals assume that they are the only ones who can provide the care required, rather than act as the coach or facilitator. It is important not to overlook the capacity and potential for the patient themselves and family and Whānau to manage prevention. Families are often engaged with the patient over a long period of time, and frequently available when healthcare professionals are not. By building on their knowledge of the patients' needs and vulnerabilities, and if armed with basic knowledge of prevention such as positioning, turning, sitting, toileting, and nutrition, they become powerful allies in the prevention and elimination of PI.

- **Recommendation 4(A): Promote regular team rounding.**
  Because PI can occur quickly, its prevention requires constant vigilance. This involves frequent repositioning, and observation or support to manage other contributing factors. As in many areas of patient safety, traditional routinised rounding i.e. every one, two, or three hours depending on acuity, has proved effective in achieving this. We recognise that many hospitals have replaced rounding with task-based care pathways. However, this is no substitute for traditional rounding and this is particularly important given the aetiology of PI. Rounding is at the core of the culture change required to reduce PI. It reflects practical clinical leadership and team work, and meets existing requirements for formal handover between shifts and settings (Qaseem et al, 2015).

Solution Set B: Authorise caregivers to access equipment.

Having the right equipment at the right time is essential if PI is to be reduced or eliminated. This can be achieved by authorising staff and involving equipment suppliers in the design and implementation of solutions.

- **Recommendation 5(B): Authorise carers to order equipment.**
  If responsibility sits with the receiving carer, then they need to have the authority to make decisions and order the appropriate equipment. Once documented, the "assessment at a glance" should be the only authority needed to order equipment. This removes the need for caregivers to ask for a third-party consultation or approval, e.g. from an occupational therapist.

- **Recommendation 6(B): Make access to equipment easy.**
  Even when authority is given, physical access is often difficult. Equipment is housed in locked store rooms, stock levels are not always certain, and cleaning and maintenance checks are not always complete. In addition, long paper-based order forms and access to orderlies slows the process, particularly when outside regular hours or during nights and weekends. Participation of leading private sector equipment companies attending our workshops quickly identified simple and practical solutions to this problem. These centred on a "loan-lease system". In brief, equipment companies store and maintain an equipment pool and make this available on a one-hour turnaround system through a patient-specific on-line ordering and retrieval portal.

- **Recommendation 7(B): Use treatment bundles of care.**
  Another step in simplifying decision-making and care provision is to use bundles of care, particularly around equipment. This is similar to the approach that has already been adopted by the Northern Region DHBs. This includes:

  - Initial assessment
  - Skin inspection
  - Manage moisture
  - Adequate hydration and nutrition
  - Minimising pressure.

  A recent article in the Annals of Internal Medicine (ACP, 2015) stated that "Multi component interventions are increasingly becoming the standard of care for preventing PI. Bundling care practices and organizing a team approach to care have been shown to be effective at improving patient outcomes (Qaseem et al, 2015).

However, we believe the current bundle description could be simplified further, particularly around equipment, and should include "assessment at a glance."
The distinction between Bundles for PI Prevention and Bundles for PI Treatment should also be distinct and should include:

- PI relieving mattress, hip and heel protectors
- Continence practices
- Provision of fluids and protein.

- **Recommendation 8(B): streamline range of equipment.**
  The wide range of equipment available (and technical characteristics of equipment) is often confusing for nursing and care staff. By introducing a two-tier equipment system (e.g. prevention and treatment) and one or two choices within each tier, ordering the right equipment can be made easy.
- **Recommendation 9(B): ensure equipment moves with the patient.**
  Having simplified the decision-making and authorised carers to take preventative action, it is important that the equipment is not taken away from patients when they are transferred. This problem is often experienced at six weeks post-discharge, when reassessment is required. This is seen as essentially an administrative hurdle which can be solved though the relationship with equipment assessment agencies, e.g. enable DHB and ACC, and providers.

Solution Set C: Build the Leadership Culture.
The leadership around prevention and patient safety is still in its infancy in New Zealand, despite notable initiatives such as the establishment of the HQSC, the Northern DHB Alliance "First Do No Harm", and other regional alliances. Without strong practical clinical leadership at all levels, there is a risk of PI initiatives being lost among other patient safety or injury prevention initiatives. To avoid this becoming a lost opportunity, we recommend that central agencies take the lead and that the PI strategy is linked to other quality indicators and existing programmes (e.g. releasing time to care).

- **Recommendation 10(C): create grade iii and iv PI as "never events".**
  We recommend that PI becomes a "never event" and is included in Serious Adverse Events (SAE) reporting. To achieve this, sector leaders (e.g. Chief Executives, Chief Operating Officers, Chief Medical Officer, and Director of Nursing) need to highlight PI as a significant quality issue. It also requires improving staff understanding of how PI occur, and how to prevent them. The challenge is to overcome the often-held view that PI is a consequence of the healthcare or dying process, and that current prevalence is acceptable. One way of achieving this is including PI (Grade III and IV) in SAE reporting, and undertaking root cause analysis of these events, as is the practice at Auckland DHB. In practice, healthcare organisations should assign responsibility and authority for leading this work to a senior clinical manager.
- **Recommendation 11(C): PI is included as a national quality indicator.**
  Including PI as part of the national quality indicator set for all health providers would create a significant focus on reducing prevalence in DHBs, NGOs (e.g. Disability and Hospice), Residential Aged Care, and Home and Community Health providers.
  This system would be similar to current high-profile KPIs such as Emergency Department waiting times, and Elective Services Performance Indicators (ESPI). This development would be led by the HQSC and supported by the MoH and ACC. The exact form of the PI quality indicator is yet to be determined, but could include prevalence and PI Injury Free Days for Grade III and Grade IV. Further discussion is required on whether the indicators sit in the accountability suite, or the quality improvement suite as Quality & Safety Markers (QSMs).
- **Recommendation 12(C): Use stories to make relevant.**
  The episodic nature of healthcare (with the exception of residential aged care) means health professionals or carers often do not see or feel the end result of a PI. This is because the patient moves to a different setting or is transferred to a different level of care. If health professionals, carers and families could view the PI journey, then they are more likely to include prevention as part of the treatment process. This responsibility best fits with ACC Prevention and Treatment injury units, with the HQSC as a facilitator.
- **Recommendation 13(C): commit to a ten year programme (don't give up).**
  The reduction of PI incidence to acceptable levels will take time, as it requires health professionals, carers, families and institutions to be involved. Initiatives and projects that are planned for just one or two years will only result in short term gain and a drift back to prior state. We recommend that initiatives adopt a ten year timeframe, and are measured over time. This approach has been successful in countries such as the Netherlands, and our modelling highlights this. For example, a 15% reduction annually over ten years will result in a 70% overall reduction in ten years, and a 10% annual reduction will result in a 54% reduction over ten years.

- **Solution 14(C): Teach PI prevention in vocational courses.**
  Behavioural change takes time, and in many cases is "generational" in vocational terms. We recommend that a key leadership initiative should be the inclusion of prevention programmes (including PI) in vocational training programmes. This would include medical training, nursing, and Level 2 and Level 3 New Zealand certificate courses.

Solution Set D: Improve Support Systems

- **Recommendation 15(D): Improve clinical recording.**
  A key barrier to reducing PI is the absence of PI observations in clinical notes. This means that critical supporting information surrounding the onset of PI is not evident, e.g. time, place, condition, and that prevention and treatments are not recorded. We recommend that recording disciplines are included:
  - At the very start of a care worker's career i.e. nursing school, or care qualification.
  - As part of Continuing Medical Education (CME).
  - In rounding notes on Multi-Disciplinary Team (MDT) decision making.
- **Recommendation 16(D): Use technology to trigger prevention.**
  Many of the electronic patient management systems (PMS) and care planning tools have the capacity to make fields mandatory where decision-makers have to take action or record a decision before care can progress. For manual systems, this can often be in the form of an "alert sticker". Those systems should be included in the admission or transfer process and are seen as separate but complementary (although could sometimes be linked) to more comprehensive assessment tools such as interRAI.
- **Recommendation 17(D): Improve the standard of discharge letters and coding.**
  By improving the recording of PI in the clinical notes, coders have the opportunity to include PI in the NMDS data. A key feature of coding is the discharge letter (which is often completed by House Surgeons or Registrars), which needs to record if the patient is PI free or if the PI exists. The introduction of ICD 10-CM has specific diagnosis codes for PI which, with coder training, will improve recording.
- **Recommendation 18(D): Make treatment injury claims.**
  Where PI is present, a treatment injury claim with ACC should be submitted (ACC 45, ACC 2152) and providers should assist patients to submit claims. This is at no cost to the provider. This simple step is critical, as it is the only way that the patient will receive their full entitlement to treatment, rehabilitation, and case management support. By promoting this, the full cost of PI to New Zealand will be known and will support ACC to become fully aware of the cost and prevention aspects of PI.
- **Recommendation 19(D): Promote the use of point prevalence studies.**
  Promoting point prevalence studies is a form of scientific leadership, and supports leaders to identify where and how they may make a difference. A number of DHBs currently run point prevalence surveys (e.g. Northern DHBs, Canterbury DHB). In addition, a number of Residential Aged Care providers also participate in an annual point prevalence survey which includes a range of quality metrics. We recommend this as a national initiative on a public-private basis co-funded by DHBs, ACC, and providers themselves; as they will all benefit from the results.

  In reviewing the current surveys, there are a number of improvements that can be made. In principle they need to include:
  - Specific setting, e.g. ICU, ATR, Long Term Hospital Care, in order to be useful
  - PI prevalence (over all four grades), and PI free days
  - The time for resolution
  - Root Cause Analysis (RCA) of Grade III and Grade IV PI.
- **Recommendation 20(D): Make equipment part of certification audits.**
  Certification is a well-accepted system to evaluate the type and standard of care provided, including preventative actions. However, the availability and suitability of equipment is not currently part of the standards. We recommend that the certification standards relating to PI and facilities be reviewed to ensure that appropriate equipment and prevention is in place.

Overall

The inter-relationship between these recommendations is significant, as to be successful they need to be mutually supporting. Based on Harris et al's work we have mapped these relationships as guidance to the implementation requirements of a PI reduction programme.

WHAT IS THE VALUE PROPOSITION?

IN THIS SECTION WE PRESENT THE VALUE PROPOSITION FOR A NATIONAL PROGRAMME TO REDUCE PI.

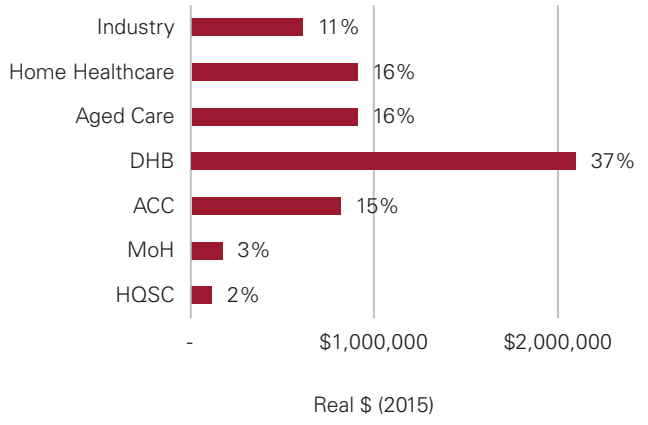
This includes answering questions such as:

- Who should invest?
- What should New Zealand invest in?
- Should the patient pay?
- How much should New Zealand invest?
- How long should this investment be?
- What is the cost-benefit ratio of this investment?
- What are the direct benefits to provider groups?

Who should invest?

The guiding investment philosophy for a national PI reduction programme is based on aligning the financial responsibility for investment to the parties that will receive the most benefit, and who is best placed to meet their duty of care. We have identified seven potential investment groups for this programme, including private industry participants such as equipment companies and operators of Aged Care facilities.

FIGURE 19:
AVERAGE ANNUAL INVESTMENT BY SECTOR GROUP



These are:

- District Health Boards
- Accident Compensation Corporation
- Health Quality & Safety Commission
- Ministry of Health
- Industry participants, e.g. equipment suppliers
- Aged residential care providers
- Home and community health providers.

As illustrated in Figure 19, the financial investment is shared over the seven sector groups in what we believe is a true public-private partnership.

While DHBs are the largest investor at 37%, private sector participants (i.e. home care aged care, Private Industry) account for over 43% of investment, and ACC 15% over the period of the project. Both the HQSC and the MoH play important leadership roles, however their direct investment is just 2% and 3% respectively.

In addition to identifying who should invest, we have also highlighted the expected role, benefits and rationale for participating in the proposed national PI reduction programme.

What should New Zealand invest in?

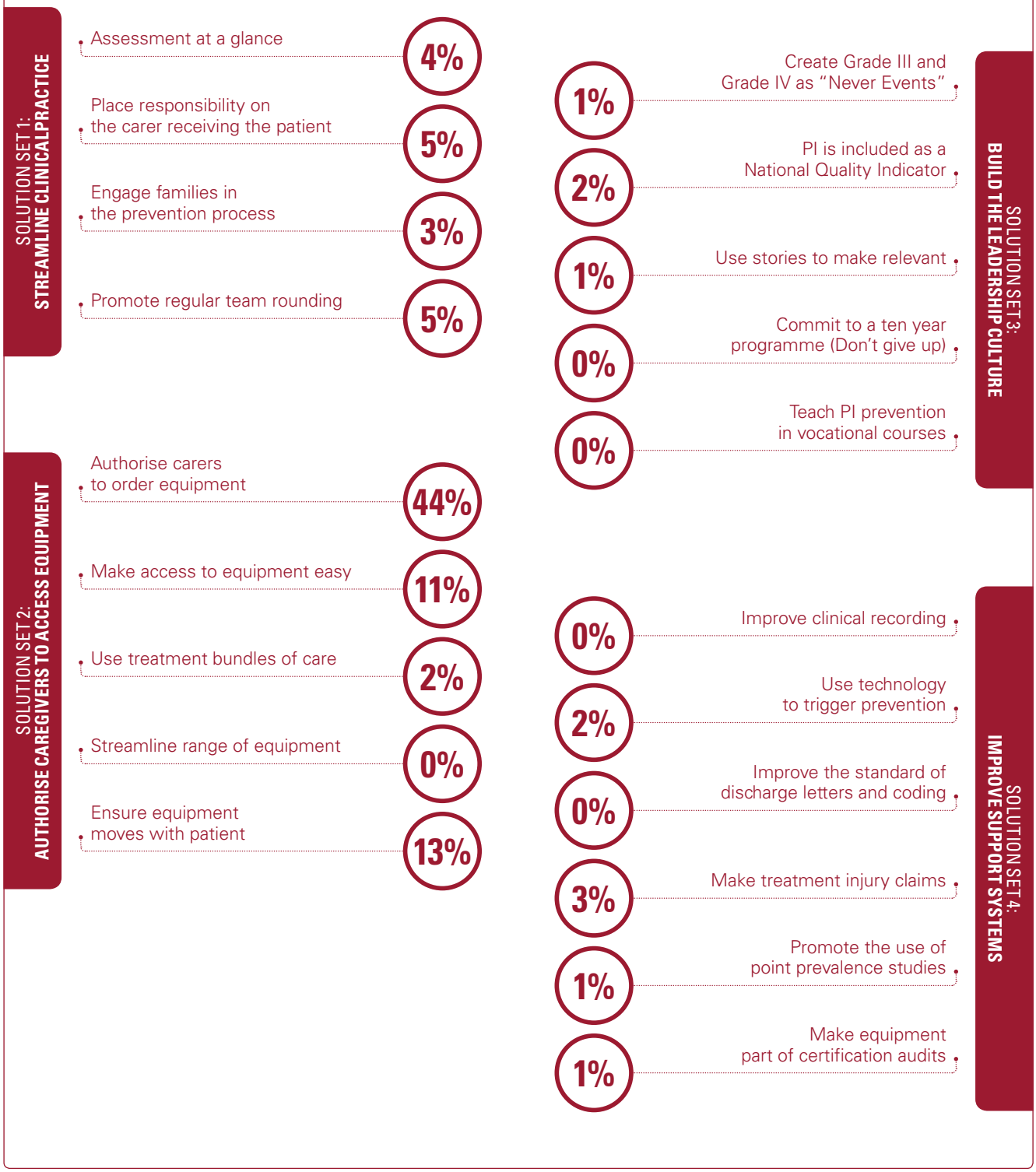
To achieve the expected level of PI reduction will require investment in each of the 20 recommendations over an extended period of time. To evaluate the size and expected returns from this investment, we developed an investment model in conjunction with the simulation model for prevalence and cost. This highlights the indicative investment profile by industry group for each of the 20 recommendations over the total time horizon of the PI reduction programme. Total sector wide investment is anticipated at an average of $5.7 million per annum, with Figure 20 below summarising the expected average investment for each of the 20 recommendations on a per annum basis.

As illustrated on the previous page, the largest investment is in empowering staff to access equipment as a PI preventive measure. It is expected that on average this will cost approximately $3.6m per annum over the period, based on the assumption that an additional 30,000 items of equipment may be ordered per annum as a preventative measure. However, of this the 20 DHBs account for $1.2m, Home Care and residential Aged Care $0.85 million respectively, and industry participants $0.7 million in loan equipment in year one.

Equally important is the investment in other programmes to promote improvements in clinical practice and assessment. These total $1.2 million annually, with higher levels of investment required in the early years and tapering off towards the end of the project.

The other components of the programme focus on systems improvements such as improved measurement, the use of technology and ACC claims. Without systems improvements it will be difficult to more accurately identify PI prevalence and incidence. In turn, this inhibits measuring reductions in PI and the effectiveness of the proposed investment.

FIGURE 20:
SUMMARY OF INVESTMENT BY RECOMMENDATION



Should the patient pay?

It is important to note that we have not assumed any direct financial investment from the patient. The costs associated with Recommendation 3 (A) Engage Families in the Prevention Process involves the development of educational and support material. Investment by patients and family is simply the time in learning about PI prevention and participation in the care and surveillance process. In a similar way, Recommendation 13 (C): Commit to a ten year Programme (Don't Give Up) involves no direct investment apart from organisational decision making, leadership, and perseverance.

How much should New Zealand invest, and for how long?

The investment model assumes commitment to a ten year National Programme, but does not assume expenditure on PI prevention in perpetuity. It is expected that after ten years, costs would revert to "business as usual" (BAU) and be incorporated in operational expenditure.

The proposed investment programme shows total investment of $6.6 million in year one, reducing to $5.0 in year ten with an average investment of $5.7 million annually. The key driver of this investment is the anticipated increased use in equipment for prevention. We have estimated that this will total approximately 22,000 additional loan items across the hospital, home care, and aged care sectors. The remaining costs relate to the support programmes based on proportional and nominal amounts.

Under this scenario, the 20 DHBs have the largest collective investment to make, at an average of $2.1 million annually.

Table 4 details the expected investment by provider group over the proposed ten year duration of the programme.

The principle behind the investment model is that the industry group who will receive the most benefit from PI reduction should proportionally invest the most, as illustrated in Table 4. Significantly, the average cash investment required by the HQSC and MoH at $127,000 and $178,000 respectively per annum is relatively modest. However, this needs to be sustained over ten years. The investment profile for the HQSC therefore starts at $230,000 per annum and reduces to $65,000 per annum in year ten, and for the MoH investment in year one is $385,000 reducing to $72,000 in year ten.

These figures will vary depending on changes in assumptions in respective agency roles and responsibilities, as well as the scope of implementation.

FIGURE 21:
ANNUAL INVESTMENT BY SECTOR GROUP

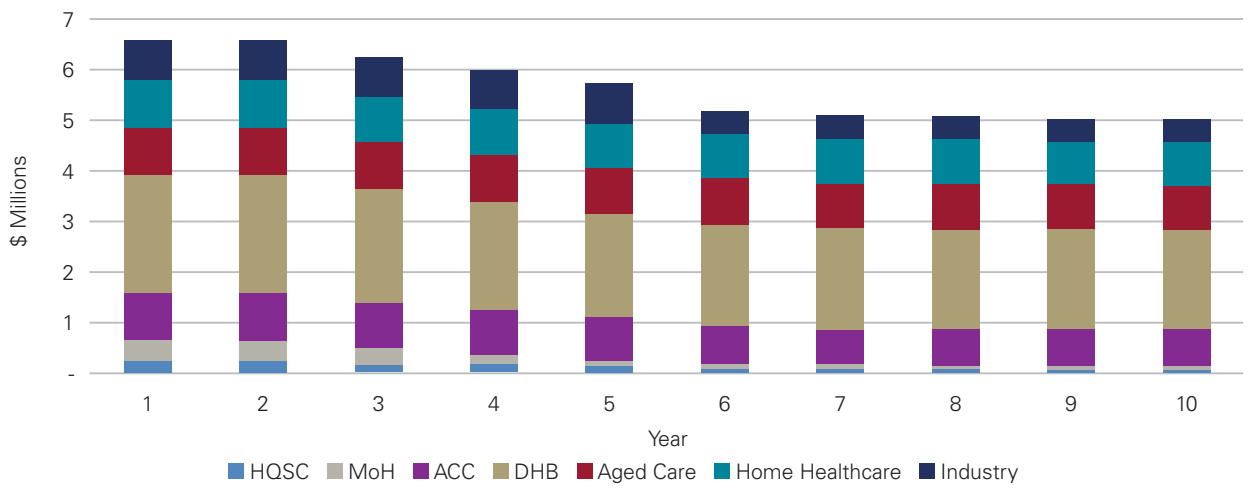


Table 4: Investment in PI Reduction Programme by Industry Group ($)

Year	1	2	3	4	5	6	7	8	9	10
HQSC	230,000	230,000	167,500	145,000	125,000	84,375	75,625	75,000	65,313	65,156
MoH	385,000	385,000	302,500	205,000	130,000	93,125	70,000	66,250	72,188	72,031
ACC	980,000	980,000	920,000	902,500	831,250	751,875	729,375	722,813	713,281	711,641
DHB	2,300,000	2,300,000	2,236,000	2,143,500	2,059,945	2,011,820	1,988,163	1,987,851	1,979,607	1,979,529
Aged Care	955,000	955,000	931,700	924,200	905,739	891,364	886,914	886,836	879,554	879,535
Home Healthcare	935,000	935,000	911,700	904,200	895,739	881,364	876,914	876,836	874,554	874,535
Industry	815,000	815,000	776,700	776,700	769,489	461,989	458,008	458,008	454,515	454,515
Total	**6,600,000**	**6,600,000**	**6,246,100**	**6,001,100**	**5,717,162**	**5,175,912**	**5,084,999**	**5,073,592**	**5,039,012**	**5,036,941**

Table 5: Expected PI Reductions over ten years by Grade

Type	Total 2016	Total 2025	Total Reduction
Grade I	40,597	12,593	28,004
Grade II	11,078	3,193	7,885
Grade III	2,448	686	1,762
Grade IV	587	116	471
Total	**54,710**	**16,588**	**38,123**

What is the cost-benefits of this investment?

The cost-benefit of the proposed investment in PI reduction is significant. Over the ten years, the total number of people receiving PI will fall from over 54,700 to just 16,600 for a total reduction of 70%, as illustrated in Table 5.

The value proposition compares cost with benefits based on the anticipated investment profile over ten years, and an annualised 15% reduction in PI prevalence per annum over that period. This reflects the expected "step down" incidence profile of PI reduction over time. To model this, we have reallocated PI prevented at each grade to the grade below. For example, Grade II reductions become Grade I PI, Grade III reduction become Grade II PI, and Grade IV reductions become Grade III. This is a similar profile to that achieved in the Netherlands from 2006-2014 (refer Figure 18).

The total savings as illustrated in Figure 22 under this investment model, are expected to commence at $84 million in Year one and grow to $508 million by year ten. This is a compelling value proposition from a societal view.

However, because of the impact of QALY gains, we also undertook a cost benefit analysis based on direct costs only (i.e. excluding QALYs, refer Figure 23). This was in order to support sector-based decision makers to assess the value proposition from their own organisations' perspective.

The results from this analysis show that the direct benefits to the sector are still significant. Based on the same sector-wide investment profile over ten years and the same rate of PI reduction, the net benefit in year one is $7.4 million increasing to $46 million per annum by year ten. This represents a cost benefit ratio of 1: 1.13, increasing to 1: 8.2 by year ten.

FIGURE 22:
INVESTMENT AND NET BENEFITS (INCL QALY)

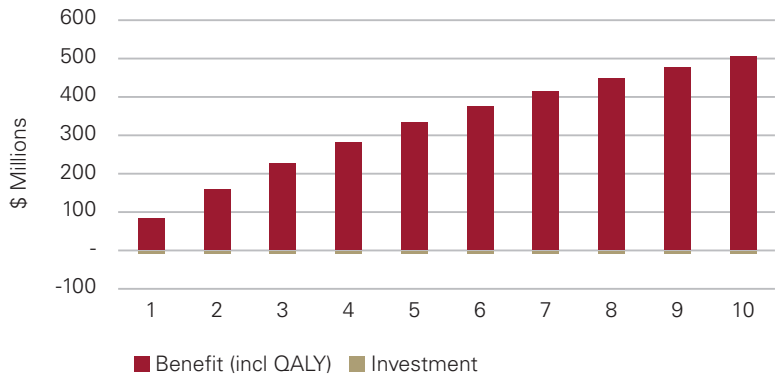
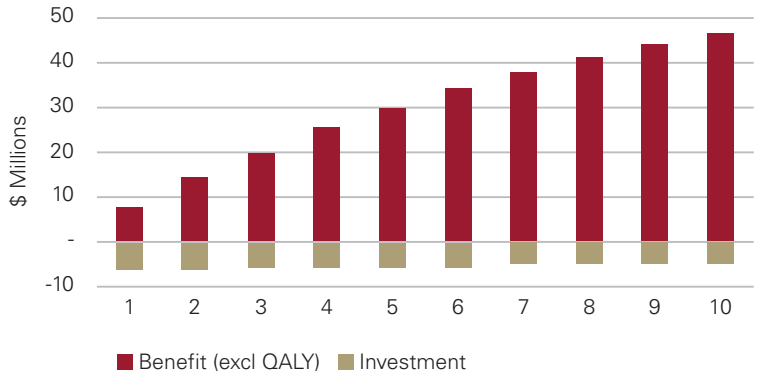


FIGURE 23:
INVESTMENT AND DIRECT BENEFITS (EXCL QALY)



The key limitation to our cost benefit analysis is the absence of a universally agreed start point of PI prevalence and incidence in New Zealand. To overcome we derived a start point using a stochastic simulation mode (based on principles of the Monte Carlo approach) in a similar manner to other international studies (Maki, 2010). One key aspect a national PI prevention and quality improvement programme in New Zealand would be the establishment of a base measure using multi center and multi setting point prevalence studies.

What are the direct benefits to provider groups?

We have also taken the opportunity to drill down in the cost benefit analysis to identify the value proposition by provider group. A brief analysis is as follows with the results presented in Figure 24.

- **DHBs.** DHBs will gain the most from the proposed PI reduction programme. The investment profile for DHBs (refer Table 4] shows that a DHB investment starts at $2.3 million in year one and reduces slightly to $1.9 in year ten. Net benefits excluding QALY start at $7.0 million in Year one and grow to $43.5 million per annum of the available savings.
- **Homebased Care.** The investment profile for home care (refer Table 4) shows that investment starts at $0.94 million in year one, and remains flat over ten years. Net benefits excluding QALY start at $0.46 million over and above the annual investment, and grow to $3.1 million per annum over the ten year cycle. Where DHBs fund clinical supplies and equipment (post six weeks) the investment and benefits will accrue for DHBs.
- **Aged Care:** The investment profile for residential aged care shows an investment of $0.96 million in Year one reducing to $0.88 million by year ten. The net benefit of this investment starts at $0.16 over and above the annual investment in year one and grows only slightly to $1.2 in year ten.

FIGURE 24:
NET BENEFIT BY SECTOR GROUP (EXCL QALY)

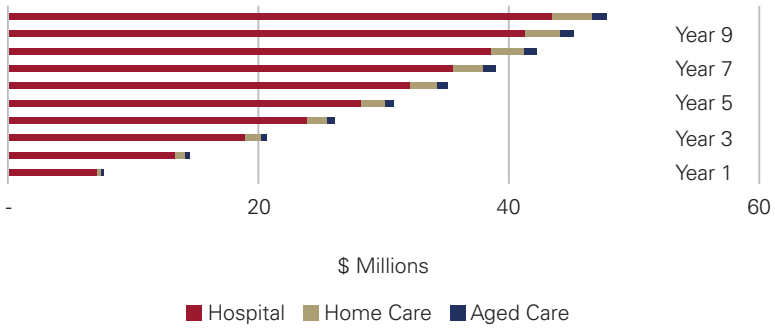


FIGURE 25:
KEY SENSITIVITIES ON NET PRESENT VALUE (NPV)

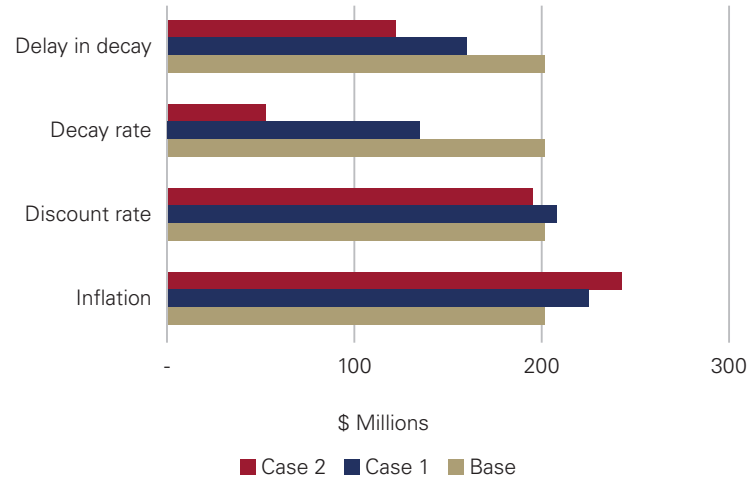


Table 6: Sensitivity Analysis

Factor	Sensitivity	Test	Result
No reduction in year one	The reduction programme assumes both investment and savings in year one. If there are few or no savings in year one the cost benefit ratios will fall.	We tested zero savings in year one, but maintain a ten year forecast.	A one year delay in achieving the savings target would decrease the The Net Present Value (NPV) (excluding QALY) by 26%.
Lower PI reduction per annum	The forecast reduction are 15% per annum for ten years at each grade of PI. If the annual reduction is less then the cost benefit ratios will fall.	We tested a both 5% and 10% per annum rates of reduction.	The reduction in PI would be 53% and 32% from annualised reduction rates of 10% and 5%. All other factors being constant this would decrease the NPV (excluding QALY) by 33% and 74% respectively.
Inflation	The investment model assumes both investment and returns are real dollars as at 2015. If medical inflation is higher than CPI then the cost and benefits would increase.	We tested an inflation scenario at 1.5% and 2.5%.	At 1.5% increase in real costs the NPV of savings (excluding QALY) would increase by 12%.
Discount rate	A discount rate of 3.5% is assumed in the model. A higher discount rate will decrease the NPV of the programme.	This was tested at 2.5% and 3.5%.	At a discount rate of 3.5% the NPV (excluding QALY) is decreased by just 3.1%.
Terminal value	No terminal value was included in the model. It is expected that PI rates will stabilise or only reduced gradually after ten years.	We tested terminal value of benefits past year ten with ongoing investment.	We discounted this scenario as the level of ongoing investment and return was uncertain.

What are the key sensitivities?

In compiling this report there was significant debate as to what would be a realistic rate of reduction from a nation wide PI prevention and quality improvement programme. In particular comparison with the relative success of the Netherlands programme, which started from a significantly higher base. To test this we modeled lower rates of PI reduction per annum (e.g. 10%). Under this scenario patients with PI would fall from 54,700 to 25,166 over ten years or a reduction of 54%, which would reflect a prevalence rate of 2-4% nationally.

In addition, we conducted a range of sensitivity analyses on the cost-benefit model to test the impact of changes in key assumptions. These included:

- No reduction in year one
- Adding a terminal value
- Including medical inflation
- Changing the discount rate.

The sensitivity tests demonstrated that the investment case remains robust, even when there are changed assumptions as summarised in Table 6.

WHAT ARE THE NEXT STEPS?

THIS PAPER SETS OUT TO PROVIDE A VALUE PROPOSITION FOR NEW ZEALAND TO INVEST IN A PROGRAMME TO REDUCE PRESSURE INJURIES.

How to implement this programme is the next step. In summary, we recommend the next steps to include following:

- The HQSC to gain agreement in principle from central agencies on the need for a PI reduction programme
- Central agencies and DHBs to agree on the key messages behind this programme
- Agencies and provider groups to identify their respective roles and responsibilities in relation to each recommendation
- The HQSC to develop a proposed implementation plan
- The HQSC to seek co-funding for the programme.

To assist this process, we have developed an indicative responsibility matrix summarised in Table 7. This highlights the role of each agency, its expected responsibility in relation to each recommendation, and how this may be achieved.

Table 7: Agency Roles and Responsibilities in a Pressure Injury (PI) Quality Improvement and Prevention Programme

Agency	Roles & responsibility	How can this be achieved	Recommendations
HQSC	Engage agencies in quality improvement	• Provide industry/sector leadership • Facilitate a national Quality Improvement and Prevention Programme • Make the case for change – articulate the problem and generate support across the sector • Provide the evidence-based tools and resources for service providers and health professionals to implement a PI programme in their organisation	All 1, 2, 7, 8
	Promote adoption of evidence-based best practice (promote system change, strengthen cross-agency clinical leadership, measurement for improvement)	• Work with the sector/other agencies to develop quality indicators to set base-lines and monitor improvement in practice • Work with sector experts to develop/adapt streamlined 'bundles of care' that support prevention, assessment and treatment • Develop tools and resources to support adoption of evidence-based best clinical practice	3, 10, 12
	Advocate for patients	• Provide educational material for patients and providers on PI prevention using co-design approaches • Grade III and Grade IV PI reporting as Serious Adverse Events (SAEs)	15, 19
	Source funding	• Agree co-funding for PI quality improvement/ prevention programme • Secure commitments for a ten year programme to achieve sustained system-wide improvement	All 10

Table 7: Agency Roles and Responsibilities in a Pressure Injury (PI) Quality Improvement and Prevention Programme (cont)			
ACC	Injury prevention	• Fund the development and implementation of a PI quality improvement and prevention programme (encompassing elements above, but also rehabilitation) • Fund, in partnership with MoH, the development of a community PI awareness programme that will complement the quality improvement effort • Partner in the development of tools and resources to support consumer education in PI prevention	1, 2, 4, 7, 8, 9,16
	Knowledge improvement	• Support clinical leaderships in PI prevention • Co-fund point prevalence studies, Route Cause Analysis	3, 19
	Client entitlements	• Ensure patients receive their entitlement following treatment injury by funding systems to increase awareness and submission of ACC 45, ACC 2152, and the downstream entitlements for clients	12, 18
MoH	Regulatory/quality improvement/prevention	• Identify and invest in opportunities for PI reduction through the certification process (HealthCert), particularly in relation to access to and use of equipment • Invest in using links between InteRAI and "real-time" care individualised care planning to improve prevention	20
	Monitor quality of care	• Implement Grade III and Grade IV PI as a universal quality indicators for DHBs (similar to ESPI) • Align/refine care indicators with nursing KPI's • Co-fund cross sector participation in point prevalence studies, with ACC	11
	Clinical leadership	• Support clinical leadership in PI prevention • Co-fund engagement with clinical leaders to facilitate the cultural change necessary to streamline clinical practice and reduce PI across all sector groups	10, 13
	Workforce development	• Work with educational institutions to incorporate PI prevention into healthcare training at all levels to support prevention and quality improvement efforts	13, 14

Table 7: Agency Roles and Responsibilities in a Pressure Injury (PI) Quality Improvement and Prevention Programme (cont)			
DHBs	Develop a culture of prevention	• Co-fund and lead a culture and behavioural shift towards prevention in healthcare delivery • Active partners in quality improvement initiatives	1, 2, 3, 4, 10, 13
	Streamline clinical practice	• Co-fund and act as partners with central agencies and sector participants to implement evidence-based best practice for PI prevention and treatment • Support the uptake of evidence-based best practice	1, 2, 3, 4, 7, 16, 17
	Empower staff to act	• Redevelop equipment ordering protocols, and fund additional use of bundles including equipment	5, 6
	Integrate care and prevention	• Integrate PI reduction as a quality improvement initiative across all provider groups, particularly at the point of transfer	3, 12, 18, 19
	Improve support systems	• Co-fund and participate in point prevalence studies • Improve recording and coding of PI • Improve the ordering systems for equipment for availability at the right time	6, 9,15
Home Care	Ensure continuity of care	• Work with DHBs to ensure that the PI care plan follows the patient if hospitalised • Equipment follows the patient	2, 6, 9
	Engage families/whānau and patients in prevention	• Provide education and advice to patients and families • Generate patient stories to demonstrate impact of PIs	3, 4, 12, 18
	Continuous quality improvement	• Co-fund and participate in point prevalence studies, with ACC and HQSC	15, 18, 19
Aged Care	Improve care plans	• Invest in real-time assessment and care planning, using InteRAI as appropriate • Develop system reporting to monitor improvements	1, 2, 3
	Demonstrate good clinical practice	• Educate staff in PI prevention as routine best practice • Authorise staff to make good decisions	4, 6, 7, 9
	Continuous quality improvement	• Co-fund and participate in point prevalence studies, with ACC and HQSC	18,19
Industry	Provide clear choices in equipment	• Fund or establish an industry working group (with cross-agency representation) to simplify the range of equipment to support PI prevention, harm reduction and rehabilitation	8
	Ensure equipment is available and fit for purpose	• Partner in "system" and "protocol" arrangements to optimise equipment access and availability	6, 9

CONCLUSION

THIS PAPER SETS OUT TO PROVIDE A VALUE PROPOSITION FOR NEW ZEALAND TO INVEST IN A PROGRAMME TO REDUCE PRESSURE INJURIES.

To develop a sustainable solution, we set out to ask a range of questions – in particular, why despite two decades of research, and numerous more recent quality initiatives, PI remains at persistently high levels.

Using learnings from literature, local and international experience, and contributions from experts in the field through stakeholder workshops, we aimed to isolate the key drivers of PI across all patient groups and all healthcare settings in New Zealand.

The fundamental conclusion is that PI can occur very quickly, often at the point of transfer where there is the potential for a break in the continuity of care. The solution for this is relatively simple. Given that a PI can occur within a very short time frame, the single biggest gains can be made by empowering the carer at the coal face to use their judgement skills and take proactive action. Most often, this involves quick assessment and the immediate provision of pressure-reducing equipment supported by routine essential care, including team rounding. The second clinical finding in this project was that ongoing vigilance is required to ensure that prevention is maintained, even when initial preventative action is taken. The most effective approach to this is regular "team rounding" and simple ongoing cares such as skin checks, repositioning, continence support, and nutrition.

Our key conclusions and messages from this project are:

1 **Compelling Case:** There is a compelling economic case for a national PI prevention and quality improvement programme.

2 **Commit to a ten year Programme:** The programme needs to run over ten years to achieve a sustainable reduction of 70% in PI prevalence.

3 **Provide strong clinical leadership:** To achieve tangible results, there is a need and opportunity for strong clinical leadership at all levels of relevant organisations.

4 **Streamline practice:** There is a need to streamline the care process and clinical practice to ensure that prevention is a normal part of healthcare.

5 **Empower staff:** There is a need to empower staff at the front line to take the preventative action they believe is necessary.

6 **Adopt a multi-agency approach:** The best way to achieve success is through a multi-agency co-funded approach lead by the HQSC.

To achieve this, our belief is that a national prevention of PI programme is required. This would provide the essential context, commitment, leadership and supporting structures. To facilitate this, we have captured 20 practical recommendations, which we believe can form the basis of a national PI reduction programme. Overarching this programme is the opportunity for strong practical clinical leadership, particularly from central agencies and DHBs. Only with this leadership will we be able to make the necessary cultural shifts required to streamline healthcare in what is an increasingly fragmented and fast-moving environment. Strong and practical clinical leadership is also essential if we are to move the culture of healthcare towards prevention; and harness the resources of carers, patients and their families in the prevention process.

Finally, the key risk of all quality improvement initiatives is they are invariably viewed as time-bound projects where gains can be measured over short periods of time. The elimination of PI and the creation of a "No Harm" environment will take time, persistence and patience. Sustainable success may take time for all health professionals, carers and families to first recognise that PI is preventable, and for prevention to become ingrained in our clinical practice. If this can be achieved, then the New Zealand healthcare sector will not only save money but also avoid considerable pain and suffering.

GIVEN THAT PI CAN OCCUR WITHIN A VERY SHORT TIME-FRAME, THE SINGLE BIGGEST GAINS CAN BE MADE BY AUTHORISING THE CARER TO USE THEIR JUDGEMENT SKILLS AND TAKE PROACTIVE ACTION TO PREVENT PI.

Most often this involves quick assessment and the immediate provision of pressure-reducing equipment, supported by routine.

REFERENCE LIST

AHRQ. (2011, April 1). *What Are the Best Practices in Pressure Ulcer Prevention that We Want to Use? (continued).* Retrieved January 23, 2015, from http://www.ahrq.gov/professionals/systems/long-term-care/resources/pressure-ulcers/pressureulcertoolkit/putool3a.html

Aminoff, M. J. (2011). *Brown-Séquard: an improbable genius who transformed medicine.* Oxford ; New York: Oxford University Press.

Bergstrom, N. Litigation or redesign: Improving pressure ulcer prevention. Journal of the American Geriatrics Society. 2005. Aug; Vol 53(9): 1627-1629.

Black, J. M., Edsberg, L. E., Baharestani, M. M., Langemo, D., Goldberg, M., McNichol, L., & Cuddigan, J. (2011). Pressure ulcers: avoidable or unavoidable? Results of the National Pressure Ulcer Advisory Panel Consensus Conference. *Ostomy/wound Management, 57*(2), 24–37.

Chou, R. (2013). Pressure ulcer risk assessment and prevention. *Annals of Internal Medicine, 159*(10), 718–719. http://doi.org/10.7326/0003-4819-159-10-201311190-00017

Coleman, S., Nixon, J., Keen, J., Wilson, L., McGinnis, E., Dealey, C., Nelson, E. A. (2014). A new pressure ulcer conceptual framework. *Journal of Advanced Nursing, 70*(10), 2222–2234. doi:10.1111/jan.12405

De Raad, J. P. (2012). *Towards a value proposition.* Wellington: NZ institute of Economic Research. Retrieved from http://www.hqsc.govt.nz/assets/Falls/PR/Towards-a-value-proposition...scoping-the-cost-of-falls-30-Aug-2012.pdf

Gawande, A. (2012). *How do we heal medicine?* Retrieved from http://www.ted.com/talks/atul_gawande_how_do_we_heal_medicine?language=en

Gefen, A. (2008). How much time does it take to get a pressure ulcer? Integrated evidence from human, animal, and in vitro studies. *Ostomy/Wound Management, 54*(10), 26–28, 30–35.

Haesler (Ed.), E. (2014). *National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific PI Alliance. Prevention and Treatment of Pressure Ulcers: Quick Reference Guide.* Perth, Australia: Cambridge Media.

Halfens, R.J.G.. Meijers, J.M.M., Meesterberends, E., Neyens, J.C.L.. Rondas, A.A.L.M., Rijcken. S., Wolters S., Schols, J.M.G., ALandelijke prevalentiemeting Zorgproblemen Rapportage resultaten. Universiteit Maastricht, CAPHRI, Department of Health Services Research. The Netherlands, 2014.

Harris, Y., Kwon, L., Berrian, A., & Calvo, A. (2012). Redesigning the system from the bottom up: lessons learned from a decade of federal quality improvement collaboratives. *Journal of Health Care for the Poor and Underserved, 23*(3 Suppl), 11–20. doi:10.1353/hpu.2012.0145

Hughes, R. G. (ed). (2008). *Patient Safety and Quality: An Evidence-Based handbook for Nurses.* Rockvill, MD: Agency for Healthcare Research and Quality. Retrieved from http://www.ahrq.gov/qual/nurseshdbk/

Institute of Medicine. (n.d.). *Crossing the Quality Chasm: A New Health System for the 21st Century. Institute of Medicine.* Retrieved from http://www.nap.edu/openbook.php?isbn=0309072808

Kohn, L., Corrigan, J., & Donaldson, M. (n.d.). *To Err Is Human: Building a Safer Health System.* Washington D.C.: Institute of medicine. Retrieved from http://www.nap.edu/openbook.php?record_id=9728

Kosiak, M. (1961). Etiology of decubitus ulcers. *Archives of Physical Medicine and Rehabilitation, 42*, 19–29.

Kwiczala-Szydłowska, S., Skalska, A., & Grodzicki, T. (2005). [Pressure ulcer prevention--evaluation of awareness in families of patients at risk]. *Przeglad Lekarski, 62*(12), 1393–1397.

Makai, P., Koopmanschap, M., Bal, R., & Nieboer, A. P. (2010). Cost-effectiveness of a pressure ulcer quality collaborative. *Cost Effectiveness and Resource Allocation, 8*(1), 11.

Power, M., Fogarty, M., Madsen, J., Fenton, K., Stewart, K., Brotherton, A., … Provost, L. (2014). *Learning from the design and development of the NHS Safety Thermometer. *International Journal for Quality in Health Care, 26*(3), 287–297. http://doi.org/10.1093/intqhc/mzu043

Qaseem, A., Mir, T. P., Starkey, M., Denberg, T. D., & Clinical Guidelines Committee of the American College of Physicians. (2015). Risk assessment and prevention of pressure ulcers: a clinical practice guideline from the american college of physicians. *Annals of Internal Medicine, 162*(5), 359–369. http://doi.org/10.7326/M14-1567

Reddy, M., & Gill, S. S. (2014). The effectiveness of pressure ulcer risk assessment instruments and associated intervention protocols remains uncertain. *Evidence-Based Medicine, 19*(3), 93. http://doi.org/10.1136/eb-2013-101497

Reswick, J. B., & Rogers, J. (1976). Experiences at rancho Los Amigos hospital with devices and techniques to prevent pressure sores. In In R.M. Kenedi, J.M. Cowden and J.T. Scales, editors. *Bed sore Mechanics* (pp. 301–310). The Macmillan press Ltd.

Schoonhoven, L., Haalboom, J. R. E., Bousema, M. T., Algra, A., Grobbee, D. E., Grypdonck, M. H., … prePURSE study group. The prevention and pressure ulcer risk score evaluation study. (2002). Prospective cohort study of routine use of risk assessment scales for prediction of pressure ulcers. *BMJ (Clinical Research Ed.), 325*(7368), 797.

Stekelenburg, A., Strijkers, G. J., Parusel, H., Bader, D. L., Nicolay, K., & Oomens, C. W. (2007). Role of ischemia and deformation in the onset of compression-induced deep tissue injury: MRI-based studies in a rat model. *Journal of Applied Physiology (Bethesda, Md.: 1985), 102*(5), 2002–2011.

Strating, M. M. H., Nieboer, A. P., Zuiderent-Jerak, T., & Bal, R. A. (2011). *Creating effective quality-improvement collaboratives: a multiple case study. *BMJ Quality & Safety, 20*(4), 344–350. doi:10.1136/bmjqs.2010.047159

Strating, M. M., & Nieboer, A. P. (2013). *Explaining variation in perceived team effectiveness: results from eleven quality improvement collaboratives: Effectiveness quality improvement collaboratives. *Journal of Clinical Nursing, 22*(11-12), 1692–1706. doi:10.1111/j.1365-2702.2012.04120.x

Visscher, M., & Taylor, T. (2014). Pressure ulcers in the hospitalized neonate: rates and risk factors. *Scientific Reports, 4*, 7429. http://doi.org/10.1038/srep07429

Waters, T. M., Daniels, M. J., Bazzoli, G. J., Perencevich, E., Dunton, N., Staggs, V. S., … Shorr, R. I. (2015). *Effect of Medicare's Nonpayment for Hospital-Acquired Conditions: Lessons for Future Policy.* JAMA Internal Medicine. http://doi.org/10.1001/jamainternmed.2014.5486

Weststrate, J., & Adams, K., 2009, (n.d.). Prevention is critical in aged care. *Kai Tiaki Nursing New Zealand, 19*(10), 26–28

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APPENDICES

APPENDIX 1
PI EXPERIENCE IN NEW ZEALAND

This appendix provides an overview of PI programmes in existence in New Zealand.

The First Do No Harm Group (www.firstdonoharm.org.nz) is a patient safety campaign initiative of the four Northern DHBs. Among a number of goals, reducing harm from PI is one of them. The group supports healthcare facilities (hospital and aged and residential care facilities) in their efforts to reduce the number of client's with PI. The support they provide includes education, introducing and translating evidence-based and best practice interventions to local situations, but also in more structure related aspects by assisting facilities with measuring PI prevalence/ incidence. They do this by organising workshops and providing individual support to healthcare facilities. Their approach is very much based on the improvement methodology as developed by the Institute for Healthcare Improvement (IHI).

Another important player in the prevention of PI is the New Zealand Wound Care Society (www.nzwcs.org.nz). This Society first alerted the MoH in 2007 to the importance to prevent Pressure Injuries in New Zealand. They have a PI working group which meets regularly. Every two years they organise a conference in which the topic of pressure injuries prevention plays an important role. At regularly-held regional education sessions and PI prevention days, they teach registered nurses and other allied health professionals about the prevention of Pressure Injuries.

The healthcare system in New Zealand is divided into 20 District Health Boards (DHBs), and each DHB is responsible for developing their own PI prevention initiative. For example, Auckland DHB randomly selects five patients on every ward each month and assesses them for the presence of pressure injuries. Based on the data collected a controlled chart was constructed to provide participants with information on trends in PI prevalence. Auckland is one of the few DHBs which also reports category III and IV PI as serious adverse events. In an effort to learn from these "never events", they submit these to a root cause analysis process to find out how the PI could have been prevented.

A 2011 survey among the different DHBs showed that nine DHBs do not conduct a PI prevalence audit in their hospitals. Eight conduct audits annually, and three audit quarterly. Canterbury DHB audits every three months. Their 2013 report illustrates a dramatic reduction in the prevalence of Pressure Injuries, from 39% in 2011 down to 17 % in 2013 (category I-IV). There are other DHBs that have conducted their own PI prevalence studies, but their results have not been made publicly available.

The NSCI-NZ survey was introduced to New Zealand in 2009. This survey is based on the LPZ (landelijk prevalentieonderzoek zorgproblemen) survey of the Maastricht University in the Netherlands. It measures the prevalence of Pressure Injuries, malnutrition, falls, incontinence and malnutrition.

Their approach is based on Donabedian's quality model of structure, process and outcomes. The NSCI-NZ not only measures outcomes, but also 1) to what extent organisational structures are in place that support outcomes, and 2) the compliance with evidence-based guidelines and best practices to prevent Pressure Injuries. This approach creates a more comprehensive picture of why Pressure Injuries develop within a facility, compared to just looking at the outcome. Since 2009 this yearly survey was most frequently carried out in hospitals and aged care facilities in Hawkes Bay DHB, Whanganui DHB and Capital and Coast DHB. In 2014 this number increased to all 6 DHBs from the central North Island participating (Weststrate & Adams, n.d.). This time the survey assessed the care problems of over 1300 patients, of which 50% were coming from the aged care sector and the other 50% from the DHB hospitals.

In conclusion, a substantial number of DHBs in New Zealand are involved in measuring PI prevalence within their DHB. Some only measure PI outcome indicators and some measure structure and process indicators as well. The method of data collection and the criteria differ as well. As PI prevention is a worldwide issue, it is recommended we follow the international guidelines and recommendations on this issue. Joining international approaches connects New Zealand with the rest of the world, but also connects DHBs on a national level and creates learning opportunities.

APPENDIX 2
NATIONAL CARE INDICATORS

The department of Health Care and Nursing Science at the University of Maastricht in the Netherlands designed the National Survey Care Indicators in 1998. The survey is based on the principles of Donabedian's quality model, which claims that in order to get a good outcome, it is of critical importance to have good (context) structures and processes in place. Therefore to assess the effect of quality improvement, it is essential to evaluate whether the outcomes are supported by the right and sustainable processes and structures (based on evidence and international best practices). The National Survey Care Indicators is based on this principle. Next to the topic of Pressure Injuries, the survey also investigates the prevalence of malnutrition, incontinence, falls and the use of restraints. Other than in The Netherlands and New Zealand, the survey is regularly carried out in Austria and Switzerland.

Outcome

In November 2014 the Central Region (six DHBs) took part in the survey. In total 1331 clients from hospitals and nursing homes participated in the survey. A total of 105 clients had 121 Pressure Injuries. The majority of PI (67%) were located at the sacrum and heels of clients. 80% of the wounds originated in the current facility, and 62% existed for less than two weeks.

Process

Assessing the clients' risk of developing a PI is a critical part of the process in preventing PI. The prevalence of PI (Grade II-IV) in patients with a high risk of developing one was on average 11% (hospital and nursing home combined). Of the 827 clients at risk of developing a PI 45had no preventive interventions in place. Of 29 clients with PI identified indicated that PI caused them pain, with a pain score range between 1 and 9 and a mean of 4.3.

Structure

Participating DHBs demonstrate a high compliance with the structural indicators. This was less obvious at department level, with an average compliance of 78%. Three of the eight indicators were below the mean, these were:

- the presence of a PI prevention link nurse (65%)
- performing regular PI audits (76%)
- providing clients at risk of developing a PI with information on how to prevent Pressure Injuries (17%).

Conclusion

In conclusion, the outcomes of the National Survey Care Indicators provides New Zealand with a comprehensive set of information about the prevalence of Pressure Injuries across the central North Island region. It assesses and evaluates all aspects of the prevention process (structure, process and outcomes) that need to be in place at a healthcare facility to effectively prevent the development of pressure injuries. A full report of the 2014 survey is expected at the end of March 2015.

APPENDIX 3
WHAT IS HAPPENING INTERNATIONALLY?

Across the world, various PI prevention initiatives are initiated. Many of those are local initiatives, within a healthcare facility following a specific PI prevention programme. Although the programmes may differ in content and approach, measurement to evaluate the effect of the programme is part of every programme. Reports of larger programmes that work across a number of healthcare facilities are involved can be found in the literature. These are often more complicated, as they work across different organisations with each one having its own organisational culture. We mention four large initiatives that worked across a large number of healthcare facilities focusing on the prevention of Pressure Injuries, among other patient safety topics.

Power et al (Power et al, 2014) describe the development of the NHS Safety Thermometer with the goal of measuring the prevalence of harm from Pressure Injuries and three other patient safety issues as part of a learning collaborative across 161 healthcare organisations. During a 17-month period, monthly (random day) PI prevalence measurements in the United Kingdom, were carried out across all patients involved. Their assessment for Pressure Injuries was outcome-related (reporting the category of the PI and where it developed). They concluded that obtaining national PI prevalence data is possible through the aggregation of data collected at the point of care by trained staff from all participating healthcare facilities. Among the lessons learned were the sampling strategy, training of data collectors, and caution with the interpretation of the data. Currently the NHS Safety Thermometer is continuing collecting data evaluating the impact of (local) PI prevention programmes (http://www.safetythermometer.nhs.uk/).

A unique aspect of this thermometer is use of statistical process controls for analysing the data.

This method is widely supported to evaluate quality improvement initiatives. The Victorian Quality Council in Melbourne, Australia carried out three large pressure ulcer prevalence studies in 2003, 2004 and 2006 in which they evaluated the prevalence of Pressure Injuries among 7000 patients each time. Over the three measurements, they monitored a decrease in the prevalence of PI from 26.5% to 17.6 %. Based on these outcomes the Victoria Quality Council developed an online education programme for clinicians and residential aged care workers, a PI clinical data set and a consumer information brochure. The outcomes also initiated a two million, State-wide mattress replacement programme. Unfortunately, the PUPPS measurements have not been repeated since.

Another large multi-million euro quality improvement programme was carried out in the Netherlands between 2006 and 2012, and focussed on the aged care sector (Strating, Nieboer, Zuiderent-Jerak, & Bal, 2011). Next to Pressure Injuries a large number of other preventable harm issues were part of the programme. The PI prevention programme duration was one year and existed out of four workshops and four monthly mentoring meetings a year.

The prevalence of pressure injuries was measured ever three months. The outcome of this intensive programme was that of the 16 evaluated facilities, six improved, nine stayed the same and one deteriorated. It was concluded that the effectiveness of the quality improvement programme is strongly associated with the efforts of local programme managers in the facilities. Secondly, a crucial task for the local programme managers is to create measurability of the topic under investigation. The University of Maastricht carries out another long running program measuring the prevalence of Pressure Injuries at a national level. They conduct the LPZ survey (landelijk prevalentie onderzoek orgproblemen) each year and have done since 1998. This survey focuses on measuring the prevalence and incidence of five care problems; Pressure Injuries, incontinence, falls, malnutrition and the use of restraints. Although this is not an improvement programme as such, it monitors the prevalence of pressure injuries nationwide. Since 1998 a dramatic decrease in the prevalence of pressure injuries has been identified in hospitals, nursing homes and the community.

APPENDIX 4
CASES ASSESSED BY THE HEALTH AND DISABILITY COMMISSIONER (HDC)

This appendix summarises cases in which clients died as a result of a PI. Two reports taken from the Health and Disability Commissioner's website display the lethal consequences of Pressure Injuries for the elderly. Death as a result of an infected PI is well-documented in the literature (Redelings, Lee, & Sorvillo, 2005).

Although these reports are publically available on the Health and Disability Commissioner's website, we have removed names of facilities and persons from the summaries below.

Case: 10HDC01286

When she was 38 years of age, Ms A had a stroke and was left paralysed on her left side, with urinary incontinence, seizure activity and cognitive disruption. Two years later, she was admitted to a nursing home. The staff at the facility included a Facility Manager, a Clinical Manager, and registered and enrolled nurses. During her time at the nursing home, Ms A received care and treatment related to a number of health issues, including neurological assessments related to seizure activity, behavioural and psychiatric assessments for low mood, and dietician input for weight management. In late 2009, Ms A's pressure ulcer risk was evaluated and found to be high. However, no preventative measures were taken in response to the risk. Ms A's condition began to deteriorate in 2010. She reported nausea, at times she was reluctant to eat and drink, and she was noted to have a low mood. Ms A developed sacral pressure ulcers twice in 2010. The second pressure ulcer did not heal, and became infected and necrotic. Ms A was admitted to a public hospital with a high fever. She was noted to be hypotensive and in renal failure, and was provided with palliative care only. Sadly, she died of sepsis secondary to her sacral pressure ulcer.

Case: 07HDC18556

This report focuses on the care provided to Mrs B by a nursing home and Registered Nurse and Hospital Services Manager Mrs C, in mid-2007. Of particular concern to her Whānau, Mrs B developed a large sacral pressure sore while she was a patient during this period. Mrs B was transferred to a larger hospital, and on arrival, her sacral pressure sore was described as very large, infected, and necrotic. Despite treatment, Mrs B's condition deteriorated and she died.

Reference: Redelings, M. D., Lee, N. E., & Sorvillo, F. (2005) Pressure ulcers: more lethal than we thought? *Advances in Skin & Wound Care, 18*(7), 367–372.

APPENDIX 5
STOCHASTIC MODEL METHODOLOGY

A. INTRODUCTION

The purpose of the Pressure Injury (PI) simulation model (the "Model") was to estimate the number of people receiving one or more PI annually, and then estimate the expected return on investment (ROI) from a national PI prevention and reduction programme. This required the development of a simulation model to estimate the volume and impact of PI by PI grade, and by patient type.

B. METHODOLOGY

The methodology of the Model can be summarised as follows:

- **STEP 1:** Collect and calculate prevalence data for population by PI grade
- **STEP 2:** Categorise population by patient type
- **STEP 3:** Estimate prevalence parameters by PI grade, by patient type
- **STEP 4:** Estimate costs of PI by grade
- **STEP 5:** Simulate occurrence and costs of PI from population data, prevalence parameters and costs of PI set in the previous steps
- **STEP 6:** Estimate return on investment using base case of the simulation output.

C. DETAILS OF EACH STEP

STEP 1: Prevalence data for population by PI grade

STEP 1A: Prevalence Data Collection:

The base prevalence data by PI grade used was:

- **First Do No Harm:** The data was collected from Northern Region DHBs, average monthly hospital point prevalence between March 2012 and August 2014. This was derived from a single point prevalence study in four DHBs (Northland, Waitemata, Auckland, and Counties Manukau).
- **National interRAI data for Home Care:** The data represented information collected from September 2012 survey using the interRAI-Home Care (HC) assessments.
- **National interRAI data for Long Term Care Facility (LTCF):** The data represented information collected from the March 2014 survey using interRAI-LTCF assessments.

STEP 1B: Prevalence data calculation:

Hospital Care:

The prevalence data from four DHBs was selected as the base prevalence for hospital care population. PI prevalence data from four DHBs are as follows:

- Grades I-II prevalence: 4.5%
- Grades III-IV prevalence: 0.24%

To derive prevalence for all four grades the following exponential function was used (y=0.16392xexp-148575). This function was derived by combining and interpolating the following data:

- PI prevalence data from data from four DHBs
- PI prevalence data by grade from Canadian and Netherlands studies
- Relative difference between grades from the Central region study.

This resultant prevalence's used in the simulation model were:

- Grades I prevalence: 3.710%
- Grades II prevalence: 0.840%
- Grades III prevalence: 0.190%
- Grades IV prevalence: 0.043%

Home Care and Long Term Care Facility:

National InterRAI data was used without modification.

STEP 2: Population by patient type

Population by patient type:

Risk factors identified in the literature and NMDS data definitions were used to group patients by different PI risk categories. Key factors for the risk categories are:

- Age group
- Patient Comorbidity and Complexity Level (PCCL)
- The presence of an admission to an Intensive Care Unit (ICU)
- The presence of a surgical event
- Extended Length of Stay (LOS)
- Discharge speciality e.g. Neonatal Intensive Care (NICU) or Assessment Treatment and Rehabilitation (ATR)
- The presence or absence of a PI by grade (LTCF and HC only).

Patient Population

Type	Total number of population	Source
Hospital care	1,085,501	Patients Admitted and discharged from hospitals or healthcare institutions and recorded in the National Minimum Data Set (NMDS) for 2013/2014 year
Home care	31,468	National interRAI data for Home Care from September 2012 survey
Long Term Care Facility	110,500	National interRAI data for Long Term Care Facility from March 2014 survey
Total	**1,227,469**	

STEP 3: Prevalence parameters by PI grade, by patient type

Hospital Care:

Relative weightings were allocated to patient types to make the overall average close to PI prevalence averages by grade calculated in Step 1.

Home Care and Long Term Care Facility:

For Home Care and Long Term Care Facility, PI prevalence averages by grade and age group calculated in Step 1 were used as on the right.

Home care

Age Cat	Grade I	Grade II	Grade III	Grade IV
0-64	3.3%	2.4%	0.6%	0.3%
65-74	2.6%	2.2%	0.4%	0.2%
75-79	2.7%	2.2%	0.5%	0.1%
80+	2.7%	0.5%	0.1%	0.1%

Long Term Care Facilities

Age Cat	Grade I	Grade II	Grade III	Grade IV
0-64	4.7%	2.9%	0.9%	0.6%
65-74	3.1%	3.4%	0.5%	0.3%
75-79	3.8%	3.6%	0.5%	0.3%
80+	4.6%	3.0%	0.6%	0.3%

For the purpose of the model, standard deviation is estimated as 50% of the mean.

STEP 4: Cost estimate by PI grade

The costs of PI were identified as either direct or indirect.

- **Direct Costs:**
  - Daily direct treatment costs were sourced from providers. This included the direct costs of labour by professional group, and treatment consumables. No overhead allocation was added in order to reflect the marginal cost of PI care.
  - Direct additional rehabilitation costs for hospital patients were included. These were defined as readmission to hospital for repair of PI, utilising Australian Revised Diagnostic Related Groups (AR-DRG) and Weighted Inlier Equivalent Separations (WIES) cost weights.
  - Additional length of stay (ALOS) for hospital patients was calculated as the difference between the 95th percentile for PI patients and non PI patients by AR-DRG. No additional ALOS was included for LTCF or Home Care (HC) patients.
- **Indirect Costs:**
  - The indirect costs of PI were based on loss of Quality Adjusted Life Years (QALY), utilising NZ life tables (male and female combined), and loss estimates from international literature.

STEP 5: Simulation of occurrence and costs of PI from population data

The simulation model estimated the total number of PI cases by patient type for hospital care and by age group for HC and LTCF. Main features of the simulation model are as follows:

- Randomly allocating patients to a patient type
- Based on mean and standard deviation allocated to the patient type and age group (Step 3), calculating a chance of the patient subject to PI Grade I, II,III & IV
- Summing up the result
- Applying PI cost per patient by grade (Step 4) to the result
- Running the simulation 10,000 time
- Calculating the mean distribution of PI from simulated results.

STEP 6: Return on Investment (ROI) calculation

The ROI from an investment in a PI prevention and reduction programme was based on the direct investment in the programme and expected benefits over a 10 year period.

Benefits from a PI prevention and reduction programme were calculated as follows:

- Used averages of PI cases and costs by grade from Step 5 as a base case
- Assumed 15% reduction in PI cases per year
- Assumed no inflation
- Calculated benefits by comparing the base case and reduced PI cases year by year
- Calculated direct cost saving to providers from reduced PI cases
- Calculated indirect benefits to individuals and society using life tables and Quality Adjusted Life Years (QALY) gains.

An important feature is the use of a tiered reduction programme for PI within the simulation model. This is reflected by Grade IV reductions in any one year, translating to a gain in Grade III, and reduction in Grade III becoming a gain in Grade II, and so on.

Sensitivity test on the ROI were conducted at PI reduction rates of 5% and 10% per annum respectively.

D. LIMITATIONS TO THIS APPROACH

The key limitations of the simulation model can be summarised as follows:

- **Single point prevalence sample –** The model relied on single point prevalence data from the Northern Region DHBs. The data was based on a monthly sample of just 100 patients over a two year period. A national PI prevalence survey over a broader number of patients, by patient type and by PI grade would improve this result. It is recognised that a similar approach is used in the Canterbury DHB annual prevalence study.
- **PI grading –** A limitation to the First Do No Harm data is that PI prevalence is grouped by Grade I-II, and Grade III-IV. Collecting prevalence for each grade would provide a richer basis for targeting prevention.
- **Compliance with international guidelines –** To ensure internationally relevant comparisons future studies and information systems should align with the PI grading definitions agreed in the 2014 international guidelines. This guideline is the result of a collaborative effort among the National Pressure Ulcer Advisory Panel (NPUAP), European Pressure Ulcer Advisory Panel (EPUAP) and Pan Pacific Pressure Injury Alliance (PPPIA).

APPENDIX 6
INVESTMENT BY RECOMMENDATION AND HEALTHCARE AGENCY

				1	2	3	4	5	6	7	8	9	10
Solution Set	Recommendation	Description	Investor	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
A	1	Develop Assessment at a Glance	HQSC	50,000	50,000	25,000	12,500	6,250	3,125				
A	1	Develop Assessment at a Glance	MoH	50,000	50,000	25,000	12,500	6,250	3,125				
A	1	Develop Assessment at a Glance	ACC	50,000	50,000	25,000	12,500	6,250	3,125				
A	1	Develop Assessment at a Glance	DHB	50,000	50,000	25,000	12,500	6,250	3,125				
A	1	Develop Assessment at a Glance	Aged Care	25,000	25,000	12,500	6,250	3,125	1,563				
A	1	Develop Assessment at a Glance	Home and Community Health	25,000	25,000	12,500	6,250	3,125	1,563				
A	1	Develop Assessment at a Glance	Industry										
A	2	Place Responsibility on the Carer Receiving	HQSC	50,000	50,000	50,000	50,000	50,000	25,000	25,000	25,000	25,000	
A	2	Place Responsibility on the Carer Receiving	MoH	25,000	25,000	25,000	25,000	25,000	12,500	6,250	3,125	12,500	9,375
A	2	Place Responsibility on the Carer Receiving	ACC	100,000	100,000	100,000	100,000	100,000	50,000	50,000	50,000	50,000	
A	2	Place Responsibility on the Carer Receiving	DHB	50,000	50,000	50,000	50,000	50,000	25,000	25,000	25,000	25,000	9,375
A	2	Place Responsibility on the Carer Receiving	Aged Care	25,000	25,000	25,000	25,000	25,000	12,500	12,500	12,500	12,500	5,000
A	2	Place Responsibility on the Carer Receiving	Home and Community Health	25,000	25,000	25,000	25,000	25,000	12,500	12,500	12,500	12,500	
A	2	Place Responsibility on the Carer Receiving	Industry	25,000	25,000	25,000	25,000	25,000	12,500	12,500	12,500	12,500	
A	3	Engage Families in the Prevention Process	HQSC										25,000
A	3	Engage Families in the Prevention Process	MoH	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	12,500
A	3	Engage Families in the Prevention Process	ACC	100,000	100,000	100,000	100,000	50,000	25,000	12,500	6,250	3,125	50,000
A	3	Engage Families in the Prevention Process	DHB	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	25,000
A	3	Engage Families in the Prevention Process	Aged Care										12,500
A	3	Engage Families in the Prevention Process	Home and Community Health										12,500
A	3	Engage Families in the Prevention Process	Industry										12,500
A	4	Promote Regular Rounding	HQSC										
A	4	Promote Regular Rounding	MoH	150,000	150,000	150,000	75,000	37,500	18,750	9,375	9,375	9,375	25,000
A	4	Promote Regular Rounding	ACC										1,563
A	4	Promote Regular Rounding	DHB	150,000	150,000	150,000	75,000	37,500	18,750	9,375	9,375	9,375	50,000
A	4	Promote Regular Rounding	Aged Care	20,000	20,000	20,000	20,000	10,000	10,000	10,000	10,000	5,000	
A	4	Promote Regular Rounding	Home and Community Health										
A	4	Promote Regular Rounding	Industry										
B	5	Authorise Carers to Order Equipment	HQSC										
B	5	Authorise Carers to Order Equipment	MoH										
B	5	Authorise Carers to Order Equipment	ACC										
B	5	Authorise Carers to Order Equipment	DHB	1,190,000	1,190,000	1,190,000	1,190,000	1,190,000	1,190,000	1,190,000	1,190,000	1,190,000	1,190,000
B	5	Authorise Carers to Order Equipment	Aged Care	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000
B	5	Authorise Carers to Order Equipment	Home and Community Health	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000	850,000
B	5	Authorise Carers to Order Equipment	Industry										
B	6	Make Access to Equipment Easy	HQSC										
B	6	Make Access to Equipment Easy	MoH										
B	6	Make Access to Equipment Easy	ACC										
B	6	Make Access to Equipment Easy	DHB										
B	6	Make Access to Equipment Easy	Aged Care										
B	6	Make Access to Equipment Easy	Home and Community Health										
B	6	Make Access to Equipment Easy	Industry	720,000	720,000	720,000	720,000	720,000	425,000	425,000	425,000	425,000	425,000
B	7	Use Treatment Bundles of Care	HQSC	25,000	25,000	12,500	12,500	6,250	6,250	3,125	3,125		
B	7	Use Treatment Bundles of Care	MoH	25,000	25,000	12,500	12,500	6,250	6,250	3,125	3,125		
B	7	Use Treatment Bundles of Care	ACC	50,000	50,000	25,000	25,000	12,500	12,500	6,250	6,250		
B	7	Use Treatment Bundles of Care	DHB	25,000	25,000	12,500	12,500	6,250	6,250	3,125	3,125		
B	7	Use Treatment Bundles of Care	Aged Care	10,000	10,000	5,000	5,000	2,500	2,500	1,250	1,250		
B	7	Use Treatment Bundles of Care	Home and Community Health	10,000	10,000	5,000	5,000	2,500	2,500	1,250	1,250		
B	7	Use Treatment Bundles of Care	Industry	10,000	10,000	5,000	5,000	2,500	2,500	1,250	1,250		
B	8	Streamline Range of Equipment	HQSC	10,000	10,000	5,000	5,000	2,500	2,500	1,250	1,250		
B	8	Streamline Range of Equipment	MoH										
B	8	Streamline Range of Equipment	ACC										
B	8	Streamline Range of Equipment	DHB										
B	8	Streamline Range of Equipment	Aged Care										
B	8	Streamline Range of Equipment	Home and Community Health										
B	8	Streamline Range of Equipment	Industry	10,000	10,000	5,000	5,000	2,500	2,500	1,250	1,250		
B	9	Ensure Equipment Moves with the Patient	HQSC										
B	9	Ensure Equipment Moves with the Patient	MoH										
B	9	Ensure Equipment Moves with the Patient	ACC	425,000	425,000	425,000	425,000	425,000	425,000	425,000	425,000	425,000	425,000
B	9	Ensure Equipment Moves with the Patient	DHB	425,000	425,000	425,000	425,000	425,000	425,000	425,000	425,000	425,000	425,000
B	9	Ensure Equipment Moves with the Patient	Aged Care										
B	9	Ensure Equipment Moves with the Patient	Home and Community Health										

				1	2	3	4	5	6	7	8	9	10
Solution Set	**Recommendation**	**Description**	**Investor**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
B	9	Ensure Equipment Moves with the Patient	Industry										
C	10	Create Grade III and IV as "Never Events"	HQSC	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	156
C	10	Create Grade III and IV as "Never Events"	MoH	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	156
C	10	Create Grade III and IV as "Never Events"	ACC	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	78
C	10	Create Grade III and IV as "Never Events"	DHB	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	78
C	10	Create Grade III and IV as "Never Events"	Aged Care	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	20
C	10	Create Grade III and IV as "Never Events"	Home and Community Health	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	20
C	10	Create Grade III and IV as "Never Events"	Industry	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
C	11	Include PI as a National Quality Indicator	HQSC	40,000	40,000	20,000	10,000	5,000	2,500	1,250	625	313	5,000
C	11	Include PI as a National Quality Indicator	MoH	40,000	40,000	20,000	10,000	5,000	2,500	1,250	625	313	5,000
C	11	Include PI as a National Quality Indicator	ACC	20,000	20,000	10,000	5,000	2,500	1,250	625	313	156	5,000
C	11	Include PI as a National Quality Indicator	DHB	20,000	20,000	10,000	5,000	2,500	1,250	625	313	156	5,000
C	11	Include PI as a National Quality Indicator	Aged Care	5,000	5,000	2,500	1,250	625	313	156	78	39	5,000
C	11	Include PI as a National Quality Indicator	Home and Community Health	5,000	5,000	2,500	1,250	625	313	156	78	39	5,000
C	11	Include PI as a National Quality Indicator	Industry										5,000
C	12	Use Stories to Make Relevant	HQSC	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
C	12	Use Stories to Make Relevant	MoH	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
C	12	Use Stories to Make Relevant	ACC	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
C	12	Use Stories to Make Relevant	DHB	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
C	12	Use Stories to Make Relevant	Aged Care										
C	12	Use Stories to Make Relevant	Home and Community Health										
C	12	Use Stories to Make Relevant	Industry										
C	13	Commit to a ten year Programme	HQSC										15,000
C	13	Commit to a ten year Programme	MoH										
C	13	Commit to a ten year Programme	ACC										15,000
C	13	Commit to a ten year Programme	DHB										30,000
C	13	Commit to a ten year Programme	Aged Care										5,000
C	13	Commit to a ten year Programme	Home and Community Health										5,000
C	13	Commit to a ten year Programme	Industry										5,000
C	14	Teach PI Prevention in Vocational Courses	HQSC										
C	14	Teach PI Prevention in Vocational Courses	MoH	20,000	20,000	20,000	20,000						
C	14	Teach PI Prevention in Vocational Courses	ACC										
C	14	Teach PI Prevention in Vocational Courses	DHB										
C	14	Teach PI Prevention in Vocational Courses	Aged Care										
C	14	Teach PI Prevention in Vocational Courses	Home and Community Health										
C	14	Teach PI Prevention in Vocational Courses	Industry										
D	15	Improve Clinical Recording	HQSC										
D	15	Improve Clinical Recording	MoH										
D	15	Improve Clinical Recording	ACC										
D	15	Improve Clinical Recording	DHB	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
D	15	Improve Clinical Recording	Age Care										
D	15	Improve Clinical Recording	Home and Community Health										
D	15	Improve Clinical Recording	Industry										
D	16	Use Technology to Trigger Prevention	HQSC	20,000	20,000	20,000	20,000	20,000	10,000	10,000	10,000	5,000	5,000
D	16	Use Technology to Trigger Prevention	MoH										
D	16	Use Technology to Trigger Prevention	ACC										
D	16	Use Technology to Trigger Prevention	DHB	50,000	50,000	33,500	33,500	22,445	22,445	15,038	15,038	10,076	10,076
D	16	Use Technology to Trigger Prevention	Aged Care	10,000	10,000	6,700	6,700	4,489	4,489	3,008	3,008	2,015	2,015
D	16	Use Technology to Trigger Prevention	Home and Community Health	10,000	10,000	6,700	6,700	4,489	4,489	3,008	3,008	2,015	2,015
D	16	Use Technology to Trigger Prevention	Industry	10,000	10,000	6,700	6,700	4,489	4,489	3,008	3,008	2,015	2,015
D	17	Improve PI incl. in Discharge Letters & Coding	HQSC										
D	17	Improve PI incl. in Discharge Letters & Coding	MoH										
D	17	Improve PI incl. in Discharge Letters & Coding	ACC										
D	17	Improve PI incl. in Discharge Letters & Coding	DHB	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	
D	17	Improve PI incl. in Discharge Letters & Coding	Aged Care										
D	17	Improve PI incl. in Discharge Letters & Coding	Home and Community Health										
D	17	Improve PI incl. in Discharge Letters & Coding	Industry										
D	18	Make Treatment Injury Claims	HQSC										
D	18	Make Treatment Injury Claims	MoH										
D	18	Make Treatment Injury Claims	ACC	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
D	18	Make Treatment Injury Claims	DHB										
D	18	Make Treatment Injury Claims	Aged Care										
D	18	Make Treatment Injury Claims	Home and Community Health										
D	18	Make Treatment Injury Claims	Industry										
D	19	Promote the use of Point Prevalence Studies	HQSC	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	
D	19	Promote the use of Point Prevalence Studies	MoH										5,000
D	19	Promote the use of Point Prevalence Studies	ACC	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	
D	19	Promote the use of Point Prevalence Studies	DHB	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	
D	19	Promote the use of Point Prevalence Studies	Aged Care	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
D	19	Promote the use of Point Prevalence Studies	Home and Community Health	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
D	19	Promote the use of Point Prevalence Studies	Industry	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
D	20	Make Equipment part of Certification Audits	HQSC										
D	20	Make Equipment part of Certification Audits	MoH	30,000	30,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
D	20	Make Equipment part of Certification Audits	ACC										
D	20	Make Equipment part of Certification Audits	DHB										200,000
D	20	Make Equipment part of Certification Audits	Aged Care										
D	20	Make Equipment part of Certification Audits	Home and Community Health										
D	20	Make Equipment part of Certification Audits	Industry	30,000	30,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
	Total Investment			**6,580,000**	**6,580,000**	**6,226,100**	**5,981,100**	**5,717,162**	**5,175,912**	**5,084,999**	**5,073,592**	**5,039,012**	**5,036,941**

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