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Five-layer border dressings as part of a quality improvement bundle to prevent pressure injuries in US skilled nursing facilities and Australian nursing homes: A cost-effectiveness analysis

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Abstract

The BORDER III trial found that five-layer silicone border dressings effectively prevented pressure injuries in long-term care, but the value of this approach is unknown. Our objective was to analyse the cost-effectiveness of preventing facility-acquired pressure injuries with a quality improvement bundle, including prophylactic five-layer dressings in US and Australian long-term care. Markov models analysed the cost utility for pressure injuries acquired during long-term care from US and Australian perspectives. Models calibrated outcomes for standard care compared with a dressing-inclusive bundle over 18 monthly cycles or until death based on BORDER III outcomes. Patients who developed a pressure injury simulated advancement through stages 1 to 4. Univariate and multivariate probabilistic sensitivity analyses tested modelling uncertainty. Costs in 2017 USD and quality-adjusted life years (QALYs) were used to calculate an incremental cost-effectiveness ratio (ICER). Dressing use yielded greater QALYs at slightly higher costs from perspectives. The US ICER was $36 652/QALY, while the Australian ICER was $15 898/QALY, both of which fell below a willingness-to-pay threshold of $100 000/QALY. Probabilistic sensitivity analysis favoured dressings as cost-effective for most simulations. A quality improvement bundle, including prophylactic five-layer dressings, is a cost-effective approach for pressure injury prevention in all US and Australia long-term care residents.

KEYWORDS

long-term care, nursing home, pressure injury, pressure ulcer, prophylactic dressing, skilled nursing facility

1 | INTRODUCTION

Pressure injuries (PrIs) are costly to health care facilities and lethal to patients. Nonetheless, most PrIs are preventable. In the United States, about 2.5 million patients develop PrIs, resulting in over 60 000 deaths per year.[1] This adds up to $26.8 billion in the United States annually.[2] In Australia, the mean prevalence among health systems is 13.6%.[3] Although a decreasing trend of PrI prevalence has been observed, the estimated total cost of PrIs reached $1.8 billion (AUS) in 2013.[4,5]

US and Australian facilities face reduced reimbursements and penalties when patients develop stages 3 and 4 and

unstageable PrIs not present on admission (POA).[4,6] In the case of post-acute care, US Medicare covers the entire cost of the first 20 days and then reimburses $167.50 per day for the next 100 days at a skilled nursing facility (SNFs).[7] PrIs could prolong SNF stays by 6+ months, which could place a financial burden on facilities, patients, and families.[8] The final reimbursed amount is adjusted based on performance, including risk-adjusted hospital readmission, discharge to the community, or change in functional status during the stay.[7] As stages 3 and 4 and unstageable PrIs often require surgery and intensive care, such occurrences could reduce reimbursements for US post-acute care. Similar payment policies also exist in Australia; while the government takes full responsibility for payments to nursing homes (NHs), performance adjustments still apply.[9]

Given the patient-centred and financial incentives that US SNFs and Australian NHs have to prevent PrIs, following international guidelines for PrI prevention could help reduce risk. However, current guidelines do not address most new technologies for PrI prevention introduced in the last 3 to 5 years as part of quality improvement (QI) bundles, which could improve patient outcomes in long-term care, especially facilities that face compounded risk caused by critical illness, immobility, malnourishment, and older age. One such technology, five-layer silicone border foam dressings applied prophylactically, is recommended to "protect skin from medical devices."[10] A recent series of randomised controlled trials, called the "BORDER" trials, identified the efficacy of these five-layer foam dressings on the sacrum at reducing PrIs by 70% to 80% in acute care, and an observational study found reductions exceeding 30% across 1 million patients.[11,12] However, the impact that these prophylactic dressings had on long-term care was not previously explored.

From February, 2016 to August, 2017, the BORDER III trial evaluated the efficacy of prophylactic border dressings in Australian NHs.[13] The BORDER III trial was performed in a randomised controlled setting whereby patients in certain NH units continuously received prophylactic dressings during their 4-week stay. All patients received the Standardized Pressure Injury Prevention Protocol (SPIPP), consistent with international guidelines, in addition to randomisation of prophylactic five-layer border dressings on sacrum and heels as part of a QI bundle.[14] Results of the BORDER III trial showed that dressings on sacrum and heels significantly reduced the risk of PrIs inline with previous reports in acute care.[15,16]

Information gleaned from the BORDER III Trial can be used to simulate the cost-effectiveness of a QI bundle, including prophylactic five-layer dressings used on all patients in long-term care facilities (eg, US SNFs and Australian NHs). We conducted a cost-effectiveness analysis using modelling approaches developed in previous studies to reflect the value of PrI prevention in US and Australian health care.[17-21] We hypothesised that prevention guidelines, including dressings, was cost-effective relative to paying for PrI treatment at a willingness-to-pay (WTP) threshold of $100 000 per quality-adjusted life year (QALY).

Key Messages

- facility-acquired pressure injury care can be costly for skilled nursing facilities (SNFs) in the United States and nursing homes in Australia as the most national payers in both countries reduced reimbursements for facility-acquired conditions
- the BORDER III trial highlighted the clinical efficacy of five-layer silicone border dressings to reduce pressure injury risk in long-term care patients in Australia; the potential clinical value of these prophylactic dressings to long-term care could be extrapolated in both Australia and the United States, as well as other countries
- the consistent use of dressings as a prophylactic measure against pressure injuries in long-term care residents comes at a slightly higher cost and much greater effectiveness, providing a cost-effective outcome relative to standard care without dressing use

2 | METHODS

2.1 | Study design

We developed two Markov models to evaluate the cost-effectiveness of prophylactic dressings applied to all patients in US SNFs and Australian NHs as part of a QI bundle compared with standard care (ie, international guidelines without dressings). The analysis was conducted from US and Australian societal perspectives to measure overall resource utilisation, financial burden on the society, and health effects. Payments to facilities were assumed to be constant regardless of payer type (eg, commercial payer, U.S. Medicare, Australian Health Service, or patient out-of-pocket expenses).

The models simulated elderly populations based on the average ages at the two types of facilities. The weighted mean age was 82.86 years in the BORDER III trial at Australian NHs and was assumed to be 70.64 years at US SNFs.[13,22] The 18-month time horizon for both models reflected the duration of follow-up in the BORDER III Trial, and the model simulated outcomes in 1-month cycles. All

costs were presented as inflation-adjusted USD 2017. We measured effectiveness in units of QALYs.[23] A 3% annual discount rate was applied to costs and QALYs.

2.2 | Data sources

The Australian model used outcomes according to the BORDER III trial in an NH setting. US model data were collected from Medicare and the US Department of Health and Health Service (HHS), as well as existing published literature.[17] Other data parameters for the Australian model came from existing literature, the Australian Institute of Health and Welfare (AIHW), and the Independent Hospital Pricing Authority (IHPA).

2.3 | Model

These Markov models simulated care processes at SNFs and NHs. In both models, patients started without PrIs and then moved to PrIs of different stages, discharge/recovery, or death (Figure 1). Discharge applied to US SNFs as patients exited, whereas Australian NH patients remained in residence following recovery. Current international guidelines for PrI prevention were simulated in both comparators, including the addition of five-layer border dressings as part of a QI bundle in both the prevention stage and treatment stage in comparators. Patients could remain in the model with a staged PrI over multiple cycles. As cohort models, no new patients could enter the model after the beginning of the 18-month time horizon.

2.4 | Prevention

Common elements in the models' standard care arms included current international guidelines for PrI prevention defined in SPIPP (eg, nursing care and education, skin check and risk assessment, repositioning, managing moisture and incontinence, best support surfaces, and nutrition).[10,14] Support surface costs (eg, beds and mattress toppers) were different between US and Australian models. We applied Group II hospital beds and chair cushions at SNFs, while air mattresses and air chairs were used at NHs.[17,21,24] For the comparator to standard care, apart from these elements involved in SPIPP, the application of five-layer dressings for sacrum and heels was added. Patients could develop PrIs during the first cycle and be treated by subsequent cycles. The overall probabilities and cumulative incidence of PrIs in the dressing arm were less than for standard care based on the BORDER III trial findings. For example, in Australian NHs, the monthly probability of developing a stage 2 PrI decreased by approximately 68.94% in the dressing arm compared with standard care.[13]

2.5 | Model Parameters

2.5.1 | Prevention costs

We applied micro-costing methods to calculate the cost of prevention in SNFs and NHs (Table 1). Nursing time costs were estimated based on national average hourly wage rates in 2017 and time spent conducting assessments and repositioning. Because of the special needs of the study population, frail elderly, we included the cost of skin care management related to moisture and incontinence. Costs of nutritional supplements, including protein, vitamin, zinc, and copper, were included for managing malnourishment. The costs of support surfaces (eg, beds, mattress toppers, seat cushions) were based on the Medicare daily rental rates. Furthermore, an extra 25% of total standard care cost was added to the final amount of both standard care and dressing arms.[17] This was to account for any costs overlooked in the calculation.

We referenced the listed acquisition prices of Mepilex® Border Sacrum and Mepilex® Heel (manufacturer: Mölnlycke Health Care, Norcross, GA) to represent the cost per dressing in the QI bundle as these were the types of prophylactic five-layer dressings tested in The BORDER III trial. The mean cost was $18 per dressing in the US model and $12 per dressing in the Australian model based on listed acquisition prices.[12,25] A prophylactic foam dressing could be used continually for 3 to 4 days, so the daily costs of dressing including nursing time were $6 at SNFs and $4 at NHs.[26] The total prevention costs per day were $109 and $64 for standard care and $115

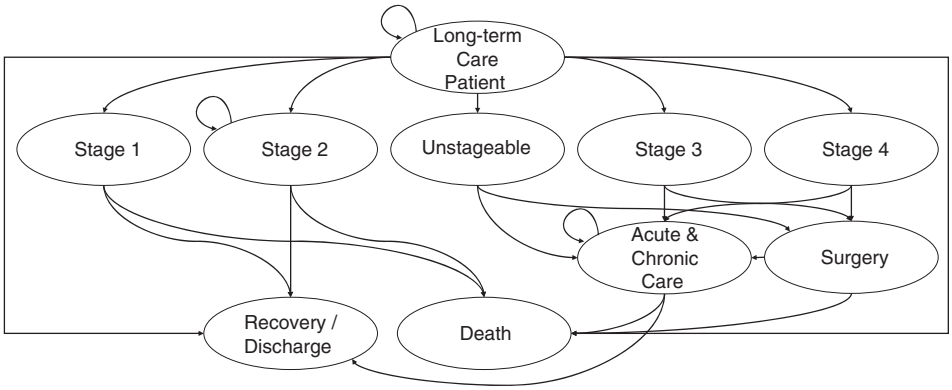

FIGURE 1 Markov model of the prevention of pressure injuries in long-term care facilities. The terminal states of "Discharge" (US SNFs) and "Recovery" (Australian NHs) are meant to differentiate the two models being evaluated

TABLE 1 Estimated values used to estimate the daily cost of prevention using a micro-costing approach

Intervention	Daily cost	Source
Values for Micro-costing of care in US SNFs		
Average hourly rate of registered nurse	$31.14	39
Risk Assessment (4 minutes)	$2.08	17,39
Skin Assessment (15 minutes)	$7.78	17,39
Nutritional Screening (4 minutes)	$2.08	17,39
Repositioning	$17.76	17,39
Group II hospital bed	$24.75	17
Chair cushion	$0.33	17
Managing moisture/incontinence	$31.14	17
Nutrition	$1.30	17
Nursing education	$0.01	17
Unforeseen costs without dressing (25%)	$21.81	*Assumption*
Dressing (3 days per dressing)		
Mepilex Border Sacrum	$10.90	39
Mepilex Heel	$24.59	
Cost of Nursing time per dressing application/change (2 minutes)	$1.04	39
Values for Micro-costing of care in Australian NHs		
Average hourly rate of aged care worker	$15.99	12
Risk Assessment (4 minutes)	$1.07	12
Skin Assessment (15 minutes)	$4.00	12
Nutritional Screening (4 minutes)	$1.07	12
Repositioning	$13.68	33
Alternating air mattress	$6.04	33
Air chair	$1.82	40
Managing moisture/incontinence	$15.99	17
Nutrition	$7.39	33
Unforeseen costs without dressing (25%)	$12.76	*Assumption*
Dressing (3 days per dressing)		
Mepile Border Sacrum	$12.30	12,40
Mepilex Heel	$10.70	12,40
Cost of nursing time per dressing application/change (2 minutes)	$0.53	12

Note: Costs are adjusted to 2017 USD.

and $68 for prevention protocol, respectively, for the United States and Australia (Table 2).

2.5.2 | Treatment cost

In the US model, the treatment cost of stages 1 and 2 per day included skin checks, repositioning, supporting surfaces, nutrition, topical antibiotics, and an extra 25% of the sum of the above cost.[17] Apart from these costs, more material and labour costs were involved in acute and chronic care treatment.[17] We assumed an average length of stay (LOS) for stages 1 and 2 of 8 days per cycle and 4 days per cycle for stages 3 and 4 and unstageable PrIs. The average total treatment cost of stages 1 and 2 was $8454 per cycle and $22 852 per cycle for stages 3 and 4 and unstageable PrIs. Surgery costs were $142 633, which comprised hospital accommodation, operating room services, pathology, etc.[27]

In the Australian model, treatment costs for staged wounds consisted of equal material and labour as in the United States.[24] We used weighted arithmetic means to calculate LOS for each stage per month. Average LOS was 2.08 days for stage 1, 6.98 days for stage 2, 9.43 days for stage 3, 11.51 days for stage 4, and 10.47 days for unstageable PrIs.[21] The treatment costs per cycle, excluding accommodation costs, were $76.17 for stage 1, $337.97 for stage 2, $553.77 for stage 3, $1716.38 for stage 4, and $500.05 for unstageable PrIs. Regarding the surgery cost for full-thickness PrIs, we used Australian Refined Diagnostic Related Group (AR-DRG) J01A, J08B and J60B, which totalled $48 654.10.[28]

2.6 | Probabilities

In the US model, the monthly probabilities of acquiring different staged PrIs at SNFs were adjusted for national prevalence (Table 2).[29] The probability of death without PrIs within 30 days at SNFs was 4.7% based on the national Medicare data.[30] The annual rate of discharge of the community in 2017 was 33.2%; after 1 year, around 23% of SNF patients were discharged, and about 39% of patients had died.[7] Patients in the prevention protocol group were assumed to be 67% less likely to develop stage 1 or 2 PrIs and 47% less likely to develop full-thickness PrIs compared with the standard care group.[13]

In the Australian model, we utilised the incidence rate of an randomized controlled trial (RCT) at NHs to estimate the monthly probabilities of PrIs. Approximately 29% of patient in the standard care group and 23% in the prevention protocol group died after a year in NHs.[13] With the additional implementation of dressings, the probabilities of developing stages 1 and 2 and full-thickness PrIs were reduced by 64%, 69%, and 46%, respectively. After 18 months, the number of patients in the standard care group was about 32% less than the number in the prevention protocol group.

Patients with higher staged PrIs had a greater risk of death. We assumed that 2 of 1000 patients with stage 1 PrIs would die in 1 month. The monthly mortality rate of stage 2 was about 9%.[31] Approximately 10% of patients with full-thickness PrIs would be sent for acute and chronic care, and 90% of patients who had undergone surgery would be

TABLE 2 Model parameters

Parameter	Base case value	Range for sensitivity analysis		Source
		Lower bound	Upper bound	
Costs for pressure injury care in US SNFs				
Daily SNF Stay	$564	490	644	7
Daily cost of standard prevention	$109	92	128	17,39
Daily prevention with Dressings	$115	97	135	17,39
Pressure injury cost, per day				
Stage 1 or 2	$949	810	3542	7,17
Stage 3, 4 or unstageable	$4156	3542	3542	17
Daily acute and chronic care	$1557	1321	1813	41
Cost of surgery and postoperative care	$142 633	122 386	164 577	29
Paramedic transport	$387	329	448	CMS
Costs for pressure injury care in Australian nursing homes				
Daily nursing home stay	$38	33	43	ACG
Daily cost of standard prevention	$64	54	75	12,20,21,40
Daily prevention with Dressings	$68	58	79	12,20,21,40
Pressure injury cost, per day				
Stage 1	$37	32	41	20
Stage 2	$48	42	56	20
Stage 3	$59	50	69	20,21
Stage 4	$62	52	73	20
Unstageable	$48	41	55	20,21
Daily acute and chronic care	$770	654	894	42
Cost of surgery and postoperative care	$48 654	41 363	56 459	28
Paramedic transport	$500	425	581	ACT
Transition probabilities in US SNFs				
Stage 1	0.0017	0.0002	0.0050	29,43,44
Stage 2	0.0063	0.0024	0.0119	29,44
Stage 3	0.0028	0.0006	0.0068	29,43,44
Stage 4	0.0038	0.0010	0.0085	29,43,44
Unstageable	0.0011	0.0000	0.0039	29,43,44
Hazard ratio of stages 1 and 2	0.3275	0.2661	0.4011	17,19
Hazard ratio of stages 3 and 4 and unstageable	0.5250	0.4657	0.5919	12,45
Discharge without pressure injuries	0.0273	0.0182	0.0382	7
Death without pressure injuries	0.0470	0.0347	0.0610	30
Discharge after stage 1	0.1436	0.0951	0.2397	33
Death after stage 1	0.0020	0.0002	0.0056	Assumed
Discharge after stage 2	0.1407	0.0884	0.2246	33
Death after stage 2	0.0859	0.0322	0.1709	31
Acute and chronic care				
Stage 3	0.1040	0.0646	0.1917	32
Stage 4	0.1040	0.0490	0.1673	32
Unstageable	0.1040	0.0356	0.1409	32

(Continues)

TABLE 2 (Continued)

Parameter	Base case value	Range for sensitivity analysis		Source
		Lower bound	Upper bound	
Death from surgery	0.1040	0.0927	0.1158	45
Remaining in acute and chronic Care				
Stage 3	0.2949	0.2665	0.3155	13,32
Stage 4	0.3932	0.3553	0.4207	13,32
Unstageable	0.1147	0.1036	0.1227	
Discharge at acute care Facility for stages 3 and 4, and unstageable	0.0709	0.0559	0.0876	26,33
Death at acute care facility for stages 3 and 4 unstageable	0.1264	0.0726	0.2022	32,43
Transition probabilities in Australian nursing homes				
Standard care				
Stage 1	0.0600	0.0281	0.1041	13
Stage 2	0.0467	0.0190	0.0860	13
Stage 3	0.0133	0.0016	0.0369	*Assumption*
Stage 4	0.0067	0.0017	0.0359	*Assumption*
Unstageable	0.0004	0.0002	0.0239	*Assumption*
Prevention protocol				
Stage 1	0.0217	0.0046	0.0518	13
Stage 2	0.0145	0.0018	0.0399	13
Stage 3	0.0072	0.0002	0.0258	*Assumption*
Stage 4	0.0072	0.0002	0.0262	13
Unstageable	0.0036	0.0000	0.0178	*Assumption*
Death without pressure injuries	0.0145	0.0026	0.0548	46–48
Remaining in acute and chronic care				
Stage 3	0.3214	0.2906	0.3441	13,32
Stage 4	0.3214	0.2906	0.3441	13,32
Unstageable	0.1607	0.1453	0.1720	13,32
Quality-adjusted life years (QALYs) in US SNFs				
Patients without PrIs	0.7640	0.6761	0.8416	34
Patients with stage 1 or 2 PrI	0.7187	0.6266	0.8024	17,34
Patients with stages 3 and 4 or unstageable PrI	0.5515	0.4517	0.6451	17,34
Utility reward for using Mepilex dressing in prevention	0.0111	0.0004	0.0391	17,34
Disutility for Surgery	−0.1550	−0.2316	−0.0912	17
Disutility for acute and chronic care	−0.0150	−0.0463	−0.0011	17
Disutility for transitioning from surgery to acute and chronic care	−0.0150	−0.0473	−0.0011	17
Quality-adjusted life years (QALYs) in Australian nursing homes				
Patients without PrIs	0.703	0.6104	0.7875	35
Patients with stage 1 or 2 PrI	0.6613	0.5652	0.7486	17,35
Patients with stage 3 or 4 or unstageable PrI	0.5075	0.4114	0.6052	17,35
Utility rewarded for using Mepilex dressing in prevention	0.0102	0.0003	0.0362	17,35
Disutility for surgery	−0.155	−0.2306	−0.0915	17

(Continues)

TABLE 2 (Continued)

Parameter	Base case value	Range for sensitivity analysis		Source
		Lower bound	Upper bound	
Disutility for acute and chronic care	−0.015	−0.0456	−0.011	17
Disutility for transitioning from surgery to acute and chronic care	−0.015	−0.0478	−0.001	17

transmitted to acute and chronic care.[32] The weighted mean annual discharge rate after acute and chronic care was administered was 58%, and the estimated mortality rate was 13% within 1 month.[26,32,33]

2.7 | Utilities

The utilities of various health statuses in the two models were based on SF-6D scores ranging from 0.0 to 1.0, representing death and full health (Table 2). The mean utility of Americans aged older than 55 years was 0.76 QALYs.[34] The average utility of Australians aged older than 71 years was 0.703.[35] We assumed that, compared with people without PrIs, the utility of people with stage 1 or 2 PrIs was 6% lower and would be further reduced by another 22% if they had higher-stage PrIs.[17] For patients who recovered, we assumed that they would return to the same utility without a PrI.

Patients who required surgery or acute and chronic care received a − 0.155 disutility.[17] Patients who received a proper prevention bundle, including a dressing, received a + 0.01 utility reward. An annual 3% discount rate was applied to all utilities. Although the remaining life expectancy was not considered in our calculation of QALYs, the gender-adjusted average life expectancy was 79.33 years in the US model and 83.81 years in the Australian model.[36] Thus, patients discharged from SNFs had a longer expected survival than NH residents.

2.8 | Modelling assumptions

Several assumptions were made in the two models. First, all patients were assumed to have equal baseline risk of developing a PrI. Second, the transition probabilities from "Long-term Care" to other status were different for the two models, but the other transition probabilities were assumed to be the same or adjusted to the initial probabilities of developing PrIs at both SNFs and NHs. Third, we assumed that the stage of a PrI was final in both the models, so there was no transition between stages of PrIs. Fourth, patients with stage 1 or 2 PrIs were assumed to be treated with nursing and skin monitoring at SNFs and NHs, respectively, which meant that there were no transition costs. Fifth, two treatment options were provided for patients with stages 3 and 4 or unstageable PrIs: surgery or acute and chronic care. We assumed a cost for paramedic transportation from SNFs or NHs to other facilities for surgery or acute and chronic care. In both models, patients could not be discharged immediately following surgery but had to be held at an acute care facility for postoperative care. Seventh, in the US model, the daily treatment costs were assumed to be the same for stages 1 and 2, as well as for stages 3 and 4 and unstageable PrIs. Nevertheless, treatment cost was increased with higher PrI staging.

2.9 | Sensitivity analysis

Univariate and probabilistic sensitivity analyses tested model uncertainty. We applied a ± 15% range to the expected value of each parameter when a distribution was not reported in the literature. We ran 10 000 Monte Carlo simulations in the Bayesian multivariate probabilistic sensitivity analysis (PSA). The PSA used beta distributions ($0.0 \leq x \leq 1.0$) for both transition probabilities and utilities, lognormal distribution ($0.0 < x$) for hazard ratios, and Gamma distribution ($0.0 \leq x$) for costs.

3 | RESULTS

3.1 | Expected results

The prevention protocol with the application of prophylactic dressings was a cost-effective strategy at a WTP threshold of $100 000/QALY (Table 3). The addition of five-layer foam dressings resulted in a higher total cost but greater effectiveness in both the US and Australian models. At the end of the study, the cumulative mortalities in the group of prevention protocol were 0.88% lower at SNFs and 22.81% lower at NHs with the QI bundle. The added cost of prevention saved on treatment costs. For instance, the model indicated $7915 in savings on treatment per patient in the US model and $6756 per patient in the Australian model.

3.2 | Sensitivity analysis

We identified two parameters that impacted the ICER: daily cost of standard care and daily cost of prevention. Varying the cost of standard care by +15%,or reducing the cost of the prevention protocol by −15% produced a negative ICER, which indicated that prevention was a dominant, cost-saving strategy. In addition, a lower cost of stay at SNFs, higher

TABLE 3 Expected model results

Perspective	Comparators	Cost ($)	dCost	QALYs	dQALY	ICER ($/QALY)
The United States	Standard prevention	211 116.51		0.7647		
	Prevention protocol	211 695.96	579.45	0.7805	0.0158	36 652.23
Australia	Standard prevention	58 496.99		0.7874		
	Prevention protocol	59 410.67	913.69	0.8449	0.0575	15 898.83

Abbrevbiations: ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life year.

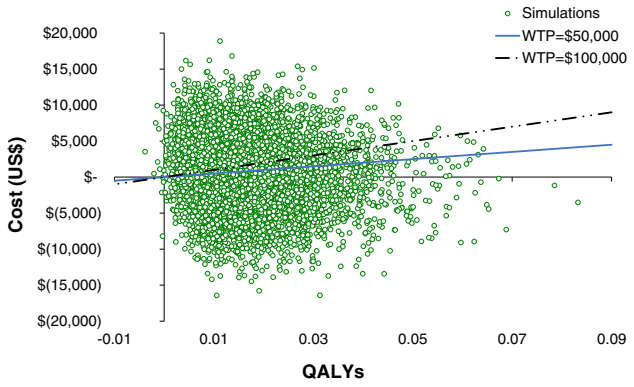

FIGURE 2 Results of the probabilistic sensitivity analysis with 10 000 Monte Carlo simulations plotted on the cost-effectiveness plane from the perspective of the US model

treatment cost of full-thickness PrIs, higher surgery cost, or higher probabilities of developing full-thickness PrIs in the standard care group improved the value of a QI bundle with dressing use.

Specific to the Australian model, if the probability of developing a stage 3 or 4 PrI increased under standard care or decreased with the QI bundle, the ICER would become negative, thereby resulting in the dominance of the QI bundle with prophylactic dressings. The thresholds of these probabilities for a negative ICER were 17% for both stages 3 and 4 with the standard care and 24% and 23% for stages 3 and 4 with the QI bundle, respectively.

PSAs for both perspectives favoured the QI bundle with dressings over standard care. In the US model, 58.30% of simulations identified prevention with dressings as cost-effective or dominant at the WTP threshold of $100 000/QALY. Likewise, 61.50% of simulations in the Australian model favoured prevention with dressings as cost-effective or as dominating standard care. Figure 2 illustrates the acceptability curve for the US model.

4 | DISCUSSION

In this study, we evaluated the cost-effectiveness of including the five-layered silicone foam dressings on the sacrum and heels as part of a QI bundle for PrI prevention relative to standard care for the post-acute care and residential elderly care facilities in the United States and Australia. This is the first such cost-effectiveness analysis of PrI prevention conducted alongside a clinical trial using the latest available technology specified in the SPIPP checklist.[14] We found that a QI bundle including sacral and heel five-layer dressings was a cost-effective or potentially dominant proposition for the majority of elderly patients given the high risk of PrI in SNFs and NHs in these countries.

These results reaffirm previous economic findings of PrI prevention, where more care is not necessarily wasteful care when it comes to patient safety.[18] All patients in NHs and SNFs are at continuous risk of PrI, and using one to two dressings per week on all patients may significantly offset the cost of treating one or several full-thickness wounds. Not only is it cost-effective for a long-term care facility but, based on these conservative model estimates, could be cost savings as the model parameters represent a lower bound of the total net monetary benefit. Overall, the tactics included in this QI bundle are the right thing to do for the patient, regardless of cost, considering the detrimental harm that a patient can face as a result of a PrI, including death.

The results provided several additional insights with respect to reimbursement policies instituted by the US CMS and Australian payers for a QI bundle with new preventive technologies for long-term care patients. First, better preventive care of PrIs might shorten the average LOS, decrease litigation costs, and counteract increased expenditures. In 2016, 1.6 million US Medicare fee-for-service beneficiaries were allocated to SNFs, which incurred $29.1 billion Medicare spending; the projected saving on the treatment of PrIs would be $7915 per patient/year and about $12.7 billion in total costs.[7] Similarly positive outcomes could be projected in Australia as 15% of Australians are older than 65 years, and the AIHW estimates that the elderly population is growing - there will be >18% of people about 65years old in 2026 and > 20% by 2046.[37] This increase in elderly population could exert a huge financial burden for long-term care on the government. The savings from preventing PrIs could offset the expected rising burden to some extent. Reimbursement coverage for a comprehensive QI bundle to prevent PrI in these populations would represent good value for money and

should be planned out now to address rising expenditures in the future.

This study has several limitations. First, some data are not nationally representative to US and Australian populations as they are derived from clinical trials with narrower scopes. Second, United States-based transition probabilities for staging after acquiring PrIs were used in both models, but we know these values to be skewed between the United States and Australia and are less likely representative of Australian outcomes in general. For example, the mortality rate of acute and chronic care and surgery might be higher for the Australian model than the US model because of the elderly subjects. Third, utilities for patients with PrIs were estimated based on previous cost-utility analyses in acute care.[17,18] There are currently no new health utilities that assess PrI utility in long-term care. Nonetheless, the probabilistic sensitivity analysis showed that there were minimal impacts on the results.

This cost-effectiveness analysis provides a value assessment of add-on dressings as part of a PrI prevention bundle. The current indications of these dressings are to replace them every 3 to 7 days; however, the international guidelines for PrI prevention offer little guidance on the exact qualifications for replacing a dressings or the procedure that a skilled nurse must follow to replace the dressing. Furthermore, many "me-too" dressings have become available on the market, without guidance from the international guidelines about differences in product lines either, although Schwartz and Gefen have identified biomechnical differences between some products. Overall, the field could benefit from additional research to pinpoint the timing of dressing changes, amount of time invested by skilled labour, and head-to-head comparative effectiveness research on dressings to enhance our understanding of the economic value of the QI bundle represented in the BORDER III trial.

In conclusion, PrI prevention that follows evidence-based guidelines and includes new technology in a QI bundle, such as five-layer silicone foam dressings for sacrum and heels, is calculated to be a cost-effective strategy for US SNFs and Australian NHs. The economic justification for adding a non-trivial cost of a disposable technology to a QI bundle for PrI prevention such as dressings is important as facility budgets are limited. However, upfront investment in dressing technology today is likely to provide facilities with cost savings in the future from avoided, costly PrI cases, in addition to the mitigation of patient harm. Such savings could be used in the future to expand financial bandwidth for QI in other areas (eg, fall prevention, infection control), such that overall quality and performance will improve in long-term care based on a nudge from one simple technology.[38]

CONFLICT OF INTEREST

W. P. and N. S. are paid consultants on the global scientific advisory board of Molnlycke Health Care. There are no other perceived conflicts of interest to report.

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