Pressure ulcer prevalence and its relationship to comorbidity in nursing home residents: results from phase 1 of the PRIME Trial

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Abstract

Pressure ulcers are a significant cause of morbidity and mortality in the aged care population with prevalence rates reported to be as high as 43% in some aged care facilities. The PRIME Trial was designed to investigate the effectiveness of an integrated pressure ulcer management system in reducing pressure ulcer prevalence and incidence in nursing homes. A total of 1956 residents from 23 nursing homes in NSW, Vic, SA and WA were enrolled in this Commonwealth funded study.

This paper presents the results from phase 1 of the trial and indicates that the prevalence of pressure ulcers in the cohort of 1956 residents was 25.9%. Significant associations between the development of a pressure ulcer and comorbidity level (Charlson Index) ($p=0.01$), risk assessment level (Braden Scale) ($p=0.00$) and the lack of appropriate equipment ($p=0.00$) were detected. Residents who developed a pressure ulcer whilst in an acute hospital showed a trend to develop more than one ulcer and ulcers that were of higher severity than those developed in a nursing home.

The results from phase 1 of the PRIME Trial suggest that emphasis needs to be given to appropriate risk assessment of the elderly nursing home resident that should include comorbidity status and the provision of suitable pressure relieving equipment.

Key words: Pressure ulcer, prevalence, nursing home, comorbidity. Primary Intentions 2005: 13(3): 107, 109-110,112,114-115.

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Competing interests

None of the authors hold competing interests in the design, methods or results of this study

Introduction

Pressure ulcers are a major iatrogentic contributor to morbidity, mortality and decreased quality of life in the nursing home sector [1,2]. The frail elderly resident is at particular risk of developing a pressure ulcer if immobile, incontinent and cognitively impaired [3]. However the relative contribution to pressure ulcer risk of comorbidity in the frail elderly is not well understood. Intuitively, health practitioners believe that the presence of one or more comorbidities may increase pressure ulcer risk, however the actual comorbidities involved and their potential interactions have not been investigated to a great degree in the aged care sector.

This study is part of a larger interventional study known as the PRIME Trial, which investigates the effectiveness of an integrated pressure ulcer prediction, prevention and management system. The PRIME system includes a substantial education program [1,4], dissemination of the Australian Wound Management Association's [5] clinical guidelines for the prediction and prevention of pressure ulcers, the Alfred/Medseed Wound Imaging System [6], an electronic incidence database and the use of the PURA and PURAMS instruments [1].

The objective of this study, which forms phase 1 of the PRIME Trial was to firstly investigate the prevalence of pressure ulcers in a cohort of 1956 nursing home residents and secondly, to explore the possible relationships between comorbidity and the development of pressure ulcers.

Prevalence is defined as the proportion of individuals in a population who have the disease in question at a specific instant and provides an estimate of the probability (risk) that an individual will be ill at this point in time [7]. Prevalence as a measure provides a snapshot of the overall problem within a population and includes old and new cases [8].

International estimates of pressure ulcer prevalence in nursing homes vary greatly due to methodological issues, differing pressure ulcer classification systems used and under reporting [9]. Prevalence rates have been reported in the ranges of 11.2% to 23% in the USA [10-12] and in the UK from 4.6 to 7.5% [13-14]. European studies have reported rates as high as 83.6% in nursing homes [15-21]. Recent Australian research in the home care sector detected a rate of 42% in these patients [1].

The role of comorbidity status in the development of pressure ulcers in nursing home patients has not been specifically investigated, however a number of studies have been conducted that prospectively investigated the spectrum of risk factors associated with pressure ulcer development [22]. Specific risk factors include age, mobility, activity, poor nutrition and low serum albumin levels [23-25]. We believed that given the chronic disease burden found in nursing home patients it would be worthwhile investigating the relative contribution made by comorbidities to pressure ulcer formation risk. A number of comorbidity indices have been developed predominantly for the acute care sector and include instruments such as the Index of Coexisting Comorbidity (ICED) and the Cumulative Illness Rating Scale (CIRS) [26] however the Charlson Index (CI) [27] is the most extensively studied index with high validity and reliability [26]. The CI produces three main scores being; weighted index of comorbidity (WIC), Charlson Comorbidity and Age Related Index which is an age adjustment applied to the WIC. Finally the CI calculates the 10-year survival probability expressed as the percentage of individuals expected to be alive in 10 years based on the particular age and comorbidity profile.

The objective of this study was to investigate the prevalence of pressure ulcers in Australian nursing homes and explore the possible relationship between prevalence rate and comorbidity status. The following research questions were formulated:

1. What is the prevalence rate of pressure ulcers in frail elderly nursing home residents?

2. Do relationships exist between comorbidity and the prevalence of pressure ulcers?

3. What other pressure ulcer risk factors exist within this group of residents?

Methods

Design

We conducted a prospective point prevalence survey in 23 nursing homes classified as 'High Care' facilities in four Australian states (2 VIC, 13 WA, 1 SA and 7 NSW) during September to November 2004 following institutional human research ethics committee approval. Subjects consisted of all consenting residents in each facility (n = 1956).

Instrumentation, data collection and interrater reliability

Three main data collection instruments were used in this phase of the study. Pressure ulcer prevalence was assessed using methods adopted from Prentice [4] and the Silver Chain Pressure Ulcer Risk Assessment (PURA) [1] which includes a Braden Score and Carer Support Score. Comorbidity was

assessed from the residents' clinical record with the Charlson Index [27]. The third area of data collected was resident demographics, use of steroid medication (systemic, inhaled or topical) smoking status and the presence of lymphoedema.

Prior to data collection all prevalence surveyors participated in an education program[14] provided by three of the research team (KC, JP & NS) covering study protocol, pressure ulcer aetiology, pathology, staging and instrument use. Each surveyor was then tested to ensure pressure ulcer staging interrater reliability with a minimum pass requirement of 85% on a standardised interrater test. Data collection was then undertaken by the surveyors working in pairs in each facility according to methods defined by Prentice, Stacey and Lewin[4].

Statistical analysis

All statistical analyses were undertaken using SPSS V12. Demographic and prevalence data were explored using descriptive statistics. Relationships between variables were analysed using Pearsons product moment correlation coefficients and differences between groups were investigated with t tests for independent groups. In all cases significance was set at 0.05.

Table 1. Comorbidity profile

Comorbidity	n	%
Dementia	1140	62.4
Cerebrovascular disease	663	36.3
Chronic heart failure	364	19.9
Diabetes	338	18.5
Chronic obstructive pulmonary disease	276	15.1
Hemiplegia	269	14.7
Tumour	135	7.4
Renal disease	175	9.6
Peripheral vascular disease	102	5.6
Myocardial infarction	96	5.3
Liver disease	77	4.2
Lymphoedema	26	1.4
Leukaemia	10	0.5
Malignant lymphoma	12	0.7

NB only valid percentages are reported in all tables

Results

Subject demography

The mean age of the cohort was 82.8 years (range 56 – 103) with 35.9% (n=639) of residents being male and 64.1% (n=1140) female. The mean Resident Classification System (RCS) category of the cohort was 1.8 with a median of 1 that was consistent with the "high care" classification of the participating nursing homes.

Table 2.
Charlson Comorbidity Scores for the total cohort

Variable	Mean	SD
WIC	2.65	2.14
CC&ARI	6.41	2.12
10-Year survival	12.70	22.01

Table 2 reveals that the cohort has a significant comorbidity burden in the CC&ARI and WIC indices and that as a cohort has a 22% chance of being alive in ten years. It should be noted that ten-year survival predictions are generally only used in individual prediction of survival rather than group.

Pressure ulcer prevalence

The total pressure ulcer prevalence for the cohort was 25.9% (n=471) with a range of 0-53.5%.

Table 3. Pressure ulcer aetiology

Cause	n	%
Pressure	305	67.5
Shear	112	24.8
Friction	8	1.8
Unknown	27	6.0

Table 4. Anatomical site of primary pressure ulcer

Site	n	%
Sacrum	218	46.7
Posterior heel	47	10.1
Lateral malleolus	35	7.5
Toe	26	5.6
Medial heel	18	3.9
Trochanter	16	3.4
Lateral heel	14	3.0
Spine	13	2.8
Elbow	9	1.9
Ear	9	1.9
Other	62	13.2

Table 4 presents the anatomical distribution of detected pressure ulcers and reveals that more than half (56%) were either sacral or heel ulcers.

Table 5. Pressure ulcer stage

Stage	n	%
1	205	44.1
2	204	43.9
3	26	5.6
4	30	6.5

Table 6. Prevalence of multiple pressure ulcer

Number of ulcers	n	%
1	291	16
2	115	6.3
3	35	1.9
4	14	0.8
5	8	0.4
6	3	0.2
8	2	0.1

Table 6 indicates those residents with up to two pressure ulcers made up nearly one quarter (24.2%) of the cohort with a pressure ulcer.

Relationships between individual factors and the development of a pressure ulcer

We posed the question of what individual resident factors may be associated with developing a pressure ulcer. To begin the exploration of this question we calculated Pearsons product moment correlation coefficient for all variables collected for each resident. Table 7 presents a correlation matrix of significant relationships between the presence of an ulcer and a range of individual resident variables and one organisational variable. The two factors with the greatest association with the presence of a pressure ulcer were the residents' Braden Scale risk score and the availability of appropriate equipment in the aged care facility. Two of the Charlson Index comorbidity scores (CC&ARI and 10-year survival) were also significantly correlated with pressure ulcer presence. Of note was that the weighted index of comorbidity was not correlated to the development of an ulcer. We also note that there was a clear significant inverse relationship between the development of an ulcer and decreased weight.

Table 7. Correlations between pressure ulcer formation and individual resident variables

Variable	r	p
Weight	-.152	0.020
CC&ARI	0.05	0.016
10 year survival	-.060	0.015
Equipment	-.198	0.000
Braden score	-.235	0.000

Table 8. Differences between residents with and without a pressure ulcer

Variable	t	p	mean difference	95% CI
Weight	2.33	0.02	0.28	0.44 - 0.51
CC&ARI	2.43	0.01	-0.28	-0.50 - 0.054
10-year survival	2.40	0.01	2.92	0.054 - 5.31
Braden score	10.15	0.00	2.08	1.67 - 2.48
Equipment	7.94	0.00	0.22	0.16 - 0.27

A slightly different perspective is gained when the question is; are there differences between residents that have an ulcer and those that do not?

Table 8 presents the significant differences between these two groups of residents when all variables are used to compare the groups using a t test for independent groups. Once again Braden Scale risk score and availability of appropriate equipment are the most different between the groups however CC&ARI, 10-year survival and weight are also significantly different.

We explored the type of facility where pressure ulcers that were detected in the survey occurred. Table 9 demonstrates that 12.5% of ulcers were acquired in an acute health care facility.

Table 9. Facility where the pressure ulcer was developed

Facility	n	%
Nursing home	391	83.0
Acute hospital	56	11.8
Unknown	24	5.0

To investigate the possibility that there were differences between the residents who developed an ulcer in an acute facility and those that developed one in their nursing home we separated the two groups and compared the residents on the parameters of CC&ARI and Braden Score because our earlier findings indicated that these variables were associated with ulcer development.

We reasoned that these two variables might indicate if these residents are different in terms of ulcer risk and comorbidity

Table 10. Number of pressure ulcers based on facility where ulcer was acquired

Facility	Number of ulcers	n	%
Nursing home	1	253	67.4
	2	93	23.8
	3	27	6.9
	4	9	2.3
	5	5	1.3
	6	3	0.8
	8	1	0.3
Hospital	1	28	50.0
	2	16	28.6
	3	5	8.9
	4	4	7.1
	5	3	5.4

to those that did not go to hospital. T tests on these variables produced a non significant difference between the groups, CC&ARI, t = .826, p 0.49 (95%CI -.945 to .385) and Braden, t = .657, p 0.51 (95% CI –1.30 to .649).

Whilst the prevalence of pressure ulcers that were acquired in an acute hospital is relatively low, the characteristics of the ulcers are different compared to those acquired in an aged care facility. Table 10 reveals that residents that acquired their ulcer in an acute hospital tended to develop more than one ulcer.

Table 11. Stage of pressure ulcers based on facility where ulcer was acquired

Facility	Stage	n	%
Nursing home	1	191	48.8
	2	165	42.2
	3	15	3.8
	4	20	5.1
Hospital	1	8	14.5
	2	28	50.9
	3	9	16.4
	4	10	18.2

When the groups were compared with t tests for number of ulcers (t = 38.5, p 0.000 (95%CI -1.80 to –1.63) and severity of ulcers (t = -1.94, p 0.01 (95%CI -.344 to -.033) there are strongly significant differences between the groups that support the above data on frequency.

Discussion

The demography and comorbidity profile of the cohort was believed to be generally representative of the 'high care' segment of the nursing home sector in Australia. We are therefore confident about the generalisability of our results in this group of 1956 frail elderly residents.

The prevalence rate detected in this study of 25.9% was similar to that reported by the Victorian Quality Council[28] for acute facilities and generally consistent with international studies employing similar methodology. Our results demonstrated a wide variance of prevalence of between 0% to 53.5%, across the 23 participating nursing homes. The reason for his degree of variability is unknown and beyond the scope of the present study yet will be explored in greater depth in the overall results of the PRIME Trial once complete.

The anatomical sites of detected pressure ulcers was also believed to be consistent with other prevalence studies,

however the number of stage 2 ulcers found within the cohort was higher than expected based on the prevalence literature.

The results demonstrated the clear relationships between comorbidity status as measured by the Charlson Index and pressure ulcer prevalence. We are not aware of other studies to date that have explored this relationship. It is interesting to note that none of the individual comorbidities correlated with prevalence, yet when using a weighted index such as the Charlson significant relationships did emerge. We believe that this suggests that it is the combination and severity of comorbidities that is more meaningful than simply the presence or absence of a comorbid condition.

Notably only the age-adjusted index (CC&ARI) and 10-year survival prediction were significantly associated with prevalence. It should be stressed that the 10-year survival predictor in the Charlson Index is not intended to be used to predict group survival, therefore we believe that this finding should be treated with caution. The finding that the age adjusted comorbidity index (CC&ARI) provides a potentially meaningful predictive risk factor for pressure ulcer formation indicates a direction for future research.

We note the strongly significant associations between pressure ulcer risk level as measured by the Braden Scale and formation of an ulcer. We believe that the performance of the Braden Scale in this study supports its continued development and use in the prediction and prevention of pressure ulcers in the clinical setting. Similarly, the availability of appropriate pressure relieving equipment was strongly associated with pressure ulcer prevalence in this study. This finding is logically appealing and consistent with the recommendations of the AWMA guidelines for the prediction and prevention of pressure ulcers[5].

Our findings relating to the differences between the number and severity of pressure ulcers developed in acute care facilities versus those developed in nursing homes was surprising. Our results demonstrate that there was no difference between the residents on the study variables of Braden Scale risk and CC&ARI yet the group that developed ulcers in the acute hospital setting demonstrated a trend to develop more ulcers and ulcers of greater severity that the nursing home group. This finding should be treated with some caution due to the relatively small number of residents in the acute care group and the lack of data relating to the reason for being in the acute hospital. One interpretation of this finding could be that the acute care facilities that these residents attended were less focused on pressure ulcer

prevention than the nursing homes that participated in this study. The availability of appropriate pressure relieving equipment in the acute settings is also unknown, therefore it is difficult to attempt to determine causal relationships based on our data, yet we believe that this finding warrants further investigation.

Limitations

This study has a number of limitations including the fact that the 23 nursing homes that participated in the research volunteered to be involved after initial contact from the research team. It could be argued that this might have introduced a degree of bias because these nursing homes may be more motivated in their efforts to predict and prevent pressure ulcers than others who were not approached.

Conclusion

The prevention of pressure ulcers in the frail elderly nursing home population is a constant challenge for clinical staff. Pressure ulcer prevention requires constant vigilance by well educated clinical staff using valid and reliable predictive methods and the deployment of appropriate equipment. Our results suggest that comorbidity as measured by the Charlson Index may be added to existing methods such as the Braden Scale to determine risk in the nursing home population. The findings stress the important role played by pressure relieving equipment in the prevention of ulcer formation. This study has also identified the need to more thoroughly investigate the issue of pressure ulcers that are developed by nursing home residents during an acute hospital admission. We believe that this is an area of pressure ulcer research that requires urgent investigation due to the potential for morbidity and mortality in this frail population.

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