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Dermatological Disease in the Older Age Group – A Cross-Sectional Study in Aged Care Facilities

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DERMATOLOGICAL DISEASE IN THE OLDER AGE GROUP – A CROSS-SECTIONAL STUDY IN AGED CARE FACILITIES

ABSTRACT

Background:

Older people living in aged care facilities face multiple potential barriers to accessing dermatological care including physical and/or cognitive disability. This group is therefore at risk for undiagnosed and untreated dermatological disease including inflammatory dermatoses and skin cancer.

Methods:

Two large aged care facilities providing both low level (residential) and high level (hospital) care were selected for this cross-sectional study. Each participant underwent a full dermatological examination. In addition, functional and cognitive status were assessed using the Rehabilitation Complexity Scale and Abbreviated Mental Test score.

Results:

88 participants were recruited and 81.8% were found to have at least one significant condition. Inflammatory disease was more common in those with little physical disability compared to those with serious physical disability (odds ratio 3.69; 95% CI 1.1-12.6, p=0.04). No significant association was found between skin disease and cognitive impairment.

Conclusion:

A high rate of dermatological disease was found. Findings ranged from frequent but not life-threatening conditions (e.g. onychomycosis), to those associated with a significant morbidity (e.g. eczema, lichen sclerosus and bullous pemphigoid), to potentially life-threatening (e.g. squamous cell carcinoma, melanoma and breast cancer). Those with less significant physical impairment were found to be at greater risk of inflammatory dermatoses. This could be because they receive less direct assistance or prompting from staff with regard to managing

inflammatory dermatoses. A greater level of care provided to those with significant physical impairment may result in fewer inflammatory dermatoses.

ARTICLE SUMMARY

Strengths and limitations of this study

- Cross sectional observational study
- Facilities were not chosen at random but allowed access to significant numbers of patients with a range of physical and intellectual disability
- All clinical examinations undertaken by dermatologist or dermatology trainee
- Full skin examination undertaken in all subjects and genital examination permitted in 55 residents (62%)
- Approximately half of the residents were not able to be examined therefore selection bias cannot be excluded

INTRODUCTION

Residents in long term residential care for older people are a vulnerable group in the community that is growing with ageing of the population. In New Zealand the 65+ age group will form 23% of the population by 2036 (1) and therefore the requirements for residential care will increase as the proportion of the older people in the population rises.

Older people living in long-term residential care may face multiple barriers to receiving appropriate care for dermatological disease not least of which include physical disease and cognitive deficits. Aged care facilities may not have optimal surroundings in which to undertake a comprehensive skin check, primary care physicians may lack dermatological training or confidence in dermatological examination and visits to such care facilities by dermatologists may be infrequent. In addition older individuals may also have difficulty in obtaining transportation to dermatology clinics or face financial barriers to accessing care in the private health sector.

There are few well-planned studies on the prevalence of dermatological disease in the older people, however the data that exist suggest a high prevalence of both inflammatory dermatoses and skin cancer (2). In a study published in 2003 carried out in Tampa, Florida the most common dermatological diagnosis was “pruritus and other related diseases” but basal cell and squamous cell carcinoma were also recorded (3). A review of 61 reports from 12 countries examining the prevalence of skin disease among older people in different clinical environments reported a 57% prevalence of onychomycosis affecting nursing home residents (4).

Skin disorders can significantly limit quality of life and, in the cognitively impaired, symptoms such as pruritus and pain may lead to behavioural disturbances. Older people with dermatological disease experience a higher rate of depression (5).

Managing skin cancer in the setting of a long-term residential care facility in the face of multiple comorbidities can be challenging, as treatment decisions will differ compared to a young and healthy patient. Therefore an accurate diagnosis is essential.

Greater knowledge about the burden of disease in this vulnerable group will lead to better planning and delivery of dermatological care. This study sought to investigate the prevalence of dermatological conditions in residential care and test the hypothesis that those with the greatest physical or cognitive impairment would have the greatest dermatologic disease burden.

METHODS

Aims and Hypotheses

The study aimed to estimate the prevalence of newly diagnosed dermatological disease in two aged care facilities and to examine the hypotheses that there was an association

between cognitive or physical disability and undiagnosed dermatological disease in this population.

Design

A cross-sectional survey was conducted in two aged care facilities.

Participants and recruitment

All 161 residents of two large aged care facilities in South Auckland, New Zealand were invited to participate in the study between December 2012 and November 2013. These facilities were selected as they provided low level care (where residents are partly mobile and require assistance with instrumental activities of daily living (IADLS) and one or two basic activities of daily living (ADLs)), called rest homes in New Zealand (NZ), hostels in Australia, residential homes in the United Kingdom (UK), assisted living in the United States of America (USA) to high level care (where most residents are dependent on 24 hour nursing care and are dependent in most ADLs), called hospital level care in NZ, nursing homes in UK, USA and Australia. The residents were approached by letter and by personal invitation from the staff and researchers. However if the resident was not able to give consent to the study the next of kin or legally designated enduring power of attorney was approached. The consent included a request to undertake a genital examination, which could be declined or accepted. A genital examination was not undertaken or discontinued if it was deemed to be too distressing for the resident. The consent also permitted access to the clinical records.

Disease outcomes

The primary outcome was defined as the presence of any significant skin disease. A first set of secondary outcomes were defined as presence of a significant skin disease in one of the following categories: solar damage-related condition; infection or infestation; inflammatory disease; congenital disease; circulation or vascular disease; apocrine or sebaceous disease; immunobullous disease; any other disease; and any disease. The disease subgroups consisting of all tinea, and of all eczema respectively, were also added to the list of secondary outcomes. For the purposes of the study “significant” was defined as dermatological disease

that needed treatment in the opinion of the investigators, or if the disease was already under treatment was not optimally controlled.

Disability risk factors

The cognitive assessment was undertaken using the Abbreviated Mental Test score (AMTS), which consists of 10 questions to assess memory, a score smaller than 8 suggesting cognitive impairment (6). For analytical purposes, the AMT score was categorised into three groups (0-3 = serious impairment, 4-8 = impairment and 9-10 = no impairment). The physical assessment was by the Rehabilitation Complexity Scale (RCS) validated and used previously in residential care research in NZ to reflect physical disability (7-11). The RCS assesses 19 functions of older people amongst which are mobility, use of toilet, dressing, self-care appearance, and showering/bathing. Each component is graded and the final figure is a summation of all the grades with a score of 19 the least disability and 76 the highest disability. The RCS was categorised into three groups (0-29 = little impairment, 30-39 = moderate impairment and 40+ = serious impairment). Individual items of the RCS were also examined as specific risk factors.

Assessments

All the assessments were undertaken by a dermatologist (PJ) or a senior trainee (MD) and all significant dermatological disease was recorded. All significant dermatologic disease was reported by letter to the primary care physician and access to publically funded treatment was made available if needed. The study was approved by the Health and Disability Ethics Committees of the Ministry of Health, New Zealand (reference number 12-NTA-36).

Statistical analysis

Descriptive analyses were carried out. Inferential analyses were carried out using logistic regression. Each disease category (including the primary outcome of “any disease”) was dichotomised and regressed on each of the two categorised risk factors. Both risk factors, as well as their interaction, were fitted together in other models. Results were reported as newly

diagnosed disease odds ratios under serious vs. low or no impairment, along with 95% confidence intervals.

The potential confounders identified a priori were gender, age group and aged care facility. Age group and facility were considered distal risk factors compared with impairment level, and were not retained for adjustment. Gender was assessed as a potential confounder for each outcome and impairment type combination by considering the relative difference between the adjusted and unadjusted log-odds ratio estimates associated with impairment and the significance level of the added gender term. Any relative difference of 10% accompanied by an observed significance level of 0.20 or less led to the reporting of a gender-adjusted odds ratio.

As further exploratory analyses, hypothesised relationships between specific disease categories and individual items on the RCS were also examined, as well as interactions between cognitive and physical disability as disease category predictors. Unadjusted observed significance levels were reported. The level of significance where applicable was set at 5% against two-sided alternatives, with a Bonferroni adjustment accounting for the two primary hypotheses used in the sample size calculation. Data were analysed using SAS software (SAS version 9.3 for Windows).

RESULTS

Patient characteristics

There were a potential 161 residents, and in total 88 patients were examined (50%). The average age was 87.1 years (SD 5.5 years) and fifty-five patients consented to a genital examination. The study group was comprised of 66 females (75%) and 22 males (25%). Eighty two participants were of European ethnicity (93.2%), four of Maori ethnicity (4.6%), and two participants were of Asian/Indian ethnicity (2.8%) (Table 1).

Table I: Summary of Ethnicity and Gender of participating residents

Ethnicity			Gender	
European	Maori	Asian/Indian	Female	Male
82 (93.2%)	4 (4.6%)	2 (2.8%)	66 (75%)	22 (25%)

The results relating to Abbreviated Mental Test score were as follows: 21 participants (25.9%) were designated as having no impairment, 35 participants (43.2%) had impairment, and 25 participants (30.9%) had serious impairment (Table 2).

Results relating to the Rehabilitation Complexity Scale were as follows: little impairment was recorded in 42 participants (47.7%), moderate impairment in 18 participants (20.5%) and serious impairment in 28 participants (31.8%). The Spearman correlation coefficient between the AMTS and RSC was -0.63 (95% CI [-0.74,-0.47]) (Table 2).

Table 2: Summary of AMTS and RCS scores.

AMTS Score			RSC Score		
No impairment	Impairment	Serious impairment	Little impairment	Moderate impairment	Serious impairment
21 (25.9%)	35 (43.2%)	25 (30.9%)	42 (47.7%)	18 (20.5%)	28 (31.8%)

AMT (Abbreviated mental Score Test). RSC (Rehabilitation Complexity Scale)

Dermatological Diseases

Eighty-eight residents were examined and 72 (81.8%) were found to have a significant dermatological disease. The number of diagnoses and their frequency are summarised in **Error! Reference source not found.**3.

Table 3: Number of Dermatological Diagnoses

Number of Dermatological Diagnoses	Frequency	Percent
0	15	17.1

1	26	29.6
2	24	27.3
3	14	15.9
4	6	6.8
5	3	3.4

The dermatological disorders are summarised in Table 4. The most common disorders were onychomycosis 42 (47.7%), basal cell carcinoma 13 (14.8%), asteototic eczema (12.5%) and squamous cell carcinoma in situ 9 (10.2%). Other significant findings were invasive squamous cell carcinoma 7 (8%), bullous pemphigoid 2 (2.3%), lichen sclerosus 2 (2.3%), and carcinoma of the breast 1 (1.1%) No cases of scabies were diagnosed. Of those who consented to the genital examination, 2 were found to have lichen sclerosus.

Table 4: Summary of all diagnoses

Diagnosis	**n**	**%**
Infections		
Onychomycosis	42	47.7
Candida/Intertrigo	9	10.2
Tinea pedis	5	5.7
Tinea corporis	3	3.4
Folliculitis	1	1.1
Tinea cruris	1	1.1
Inflammatory		
Eczema asteototic	11	12.5
Eczema lichen simplex chronicus	5	5.7
Eczema varicose	4	4.6
Psoriasis vulgaris	3	3.4
Chondrodermatitis helicis	2	2.3

nodularis		
Eczema contact irritant	2	2.3
Psoriasis scalp	2	2.3
Eczema contact allergic	1	1.1
Eczema discoid	1	1.1
Eczema seborrhoeic	1	1.1
Psoriasis pustular localised	1	1.1
Solar damage and skin cancer		
Squamous cell carcinoma (in situ)	9	10.2
Squamous cell carcinoma (invasive)	7	8
Actinic keratosis	4	4.6
Atypical/naevus exclude melanoma	3	3.4
Malignant melanoma	2	2.3
Porokeratosis	1	1.1
Basal cell carcinoma	13	14.8
Circulatory/Vascular		
Capillaritis	2	2.3
Ulcers Venous	2	2.3
Ulcers Arterial	1	1.1
Ulcers Mixed	1	1.1
Ulcers Pressure	1	1.1
Apocrine/Sebaceous		
Acne excoriee	3	3.4
Immunobullous		
Bullous pemphigoid	2	2.3
Congenital		
Ichthyosis NOS	1	1.1

Other		
Vitiligo	3	3.4
Lichen sclerosus	2	2.3
Breast cancer	1	1.1
Epidermoid cyst	1	1.1
Favre-Racouchot syndrome	1	1.1
Web space fissuring	1	1.1

Confounding by gender

Adjustment by gender caused relative changes of 10% or less in the odds ratios for both mental and physical impairment, and significance for gender of more than 0.20, in all but two combinations of outcomes and impairment. The exceptions were the combinations of the infection/infestation outcome with both types of impairment. The relative changes in odds ratio exceeded 70% and the significance of gender was 0.01 in both cases. Gender-adjusted impairment odds ratios were not significantly different from 1 in either case.

Association of disease groups with cognitive or physical disability

A comprehensive analysis was undertaken to examine groups of diseases, as well as specific diseases against the AMT and RCS total and specific scores. No associations were found between total dermatologic disease burden and cognitive impairment (OR 1.5, 95% CI [0.30, 7.4] p=0.88 no impairment vs. serious impairment, any diagnosis) or physical impairment (OR 0.92 95% CI [0.27, 3.2] p=0.97) little impairment vs. serious impairment, any diagnosis). However examination of all inflammatory diseases showed that those with the least physical impairment had more inflammatory disease than those patients with the most physical impairment (OR 3.69, 95% CI [1.08, 12.61], p=0.04). Significantly more inflammatory disease was found in those with less physical impairment. Separate items of the RCS examined showed that those who were independent in self-care (compared with those that were dependent), and independent in toileting (compared with dependent) were more likely to have eczema. Separate items of the RCS indicating awareness and increased night care also

showed that those who were fully aware and did not need night care were more likely to have eczema. The relevant findings are summarised in Table 5.

Table 5: Significant associations between inflammatory disease and RCS

Disease category or specific disease	Risk factor	Contrast	Prop.	OR	95% CI	p-value
Inflammatory disease (all types)	RCS	Little impairment	38.1%	3.7	1.1-12.6	0.04
		Serious impairment	14.3%	ref		
	Self-care of appearance	Independent	39.5%	4.9	1.0-24.2	0.05
		Requires assistance	11.8%	ref		
Eczema (all types)	RCS	Little impairment	35.7%	4.6	1.2-17.9	0.05
		Serious impairment	10.7%	ref		
	Self-care of appearance	Independent	34.9%	3.5	1.2-10.1	0.02
		Requires assistance	13.3%	ref		
	Use of toilet	Uses without help	34.8%	3.9	1.2-13.0	0.03
		Needs assistance	12.1%	ref		
	Awareness	Fully aware	35.2%	6.2	1.3-29.4	0.02
		Sometimes unaware	8.0%	ref		
	Night care	Care never/rarely needed	32.5%	2.9	1.0-8.4	0.05
		More attention needed	14.3%	ref		

ref (Reference level) – Note: p-values are not corrected for multiple testing.

CONCLUSION

There was a high rate of undiagnosed and untreated dermatological disease in the study population with 81.8% having one or more significant finding. The disease types varied from the frequent but not life-threatening (e.g. onychomycosis), to those associated with a significant morbidity that may be hidden from carers (e.g. lichen sclerosus), to potentially life-threatening (e.g. squamous cell carcinoma, melanoma and breast cancer). In this study over 25% of the residents had 3 or more dermatological diagnoses. Those with less physical disability had a higher rate of inflammatory dermatoses. No significant association was found between dermatological disease and level of cognitive impairment.

DISCUSSION

There is a significant burden of unrecognised and inadequately treated dermatologic disease in older people living in aged residential care facilities. This study did not show the expected correlation between dermatologic disease burden and physical or cognitive ability but showed a significant association between being physically independent and having inflammatory skin disease. A potential explanation is that those residents needing and receiving a higher level of attention by the attending staff because of a significant physical disability had a greater level of incidental observation, and therefore treatment of dermatologic conditions. This hypothesis is consistent with high-quality care. Potentially, better education of residents and assistance with application of creams for those who carry out self-care may be important. In addition those residents with a mild physical disability who may be perceived by the residential care staff to be more independent in self cares than those with a significant disability may require more help from the staff than anticipated to reduce their inflammatory disease burden. Since this study suggests that those with less severe physical disability are at greater risk of dermatologic disease, this group may benefit from periodic skin reviews.

The aged care facilities were not randomly selected but chosen because they gave access to significant numbers of patients with a spectrum of physical and cognitive disease, ranging from low to high level care. Half of the potential patients were not enrolled due to a combination of inability to obtain suitable consent, frailty, declining participation and difficulty scheduling convenient appointment times. These factors may have lead to selection bias towards those with dermatological symptoms, those who had received less recent dermatological care and/or those patients who were expected by their next of kin to be more amenable to undergoing examination, although bias may well have lain in the other direction. Nevertheless, the gender and ethnic characteristics of the study group suggest that the findings are likely to be generalisable to a number of centres.

Older people living in aged care facilities have a significant incidence of undetected disease and with anticipated demographic changes there will be challenges managing this problem both for the patient and dermatologist. Those who were more independent in residential care had more inflammatory skin disease, suggesting that greater treatment of inflammatory skin disease was offered to those with greater dependency.

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CONTRIBUTORSHIP STATEMENT

All authors listed contributed significantly to the study design, data collection and analysis and production of this manuscript.

COMPETING INTERESTS

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DATA SHARING STATEMENT

Unpublished data, though minimal, are available by request to study authors.

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-4
Bias	9	Describe any efforts to address potential sources of bias	3
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4
		(*b*) Describe any methods used to examine subgroups and interactions	4
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	4
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5, 7
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	5, 7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9

		(*b*) Report category boundaries when continuous variables were categorized	3-4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	5
Discussion			
Key results	18	Summarise key results with reference to study objectives	5
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	6
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	6
Generalisability	21	Discuss the generalisability (external validity) of the study results	6
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Dermatological Disease in the Older Age Group – A Cross-Sectional Study in Aged Care Facilities

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DERMATOLOGICAL DISEASE IN THE OLDER AGE GROUP – A CROSS-SECTIONAL STUDY IN AGED CARE FACILITIES

ABSTRACT

Objectives

To estimate the prevalence of dermatological disease in aged care facilities, and the relationship between cognitive or physical disability and significant disease.

Setting

Two large aged care facilities in Auckland, New Zealand each providing low and high level care.

Participants

All 161 residents of the facilities were invited to participate. The only exclusion criterion was inability to obtain consent from the individual or designated guardian. 88 participants were recruited - 66 females (75%), 22 males (25%) with average age 87.1 years (SD 5.5 years).

Primary and secondary outcome measures

Primary - Presence of significant skin disease (defined as that which in the opinion of the investigators needed treatment or was identified as a patient concern) diagnosed clinically on full dermatological examination by a dermatologist or dermatology trainee.

Secondary - functional and cognitive status (Rehabilitation Complexity Scale and Abbreviated Mental Test score).

Results:

81.8% were found to have at least one significant condition. The most common disorders were onychomycosis 42 (47.7%), basal cell carcinoma 13 (14.8%), asteototic eczema (12.5%) and squamous cell carcinoma in situ 9 (10.2%). Other findings were invasive squamous cell carcinoma 7 (8%), bullous pemphigoid 2 (2.3%), melanoma 2 (2.3%), lichen

sclerosus 2 (2.3%), and carcinoma of the breast 1 (1.1%). Inflammatory disease was more common in those with little physical disability compared to those with serious physical disability (odds ratio 3.69; 95% CI 1.1-12.6, p=0.04). No significant association was found between skin disease and cognitive impairment.

Conclusion:

A high rate of dermatological disease was found. Findings ranged from frequent but not life-threatening conditions (e.g. onychomycosis), to those associated with a significant morbidity (e.g. eczema, lichen sclerosus and bullous pemphigoid), to potentially life-threatening (e.g. squamous cell carcinoma, melanoma and breast cancer). Those with less significant physical impairment were found to be at greater risk of inflammatory dermatoses.

ARTICLE SUMMARY

Strengths and limitations of this study

- Cross sectional observational study design facilitating assessment of prevalence of dermatological disease in the older age group living in aged care facilities
- Facilities were not chosen at random but allowed access to significant numbers of patients with a range of physical and intellectual disability
- All clinical examinations undertaken by a dermatologist or dermatology trainee; confirmatory laboratory testing was not undertaken but all significant clinical disease was reported to the General Practitioner
- Full skin examination undertaken in 88 participants and genital examination permitted in 55 residents (62%)
- Approximately half of the residents were not able to be examined therefore selection bias cannot be excluded

INTRODUCTION

Residents in long term residential care for older people are a vulnerable group in the community that is growing with ageing of the population. In New Zealand the 65+ age group will form 23% of the population by 2036 (1) and therefore the requirements for residential care will increase as the proportion of the older people in the population rises.

Older people living in long-term residential care may face multiple barriers to receiving appropriate care for dermatological disease not least of which include physical disease and cognitive deficits. Aged care facilities may not have optimal surroundings in which to undertake a comprehensive skin check, primary care physicians may lack dermatological training or confidence in dermatological examination and visits to such care facilities by dermatologists may be infrequent, although these factors will vary from country to country. In addition older individuals may also have difficulty in obtaining transportation to dermatology clinics or face financial barriers to accessing care in the private health sector. In New Zealand it is not routine for specialist dermatological care to be provided in the setting of an aged care facility; rather, specialist dermatological care is accessed outside the facility, in the public or private sector outpatient clinics.

There are several studies on the prevalence of dermatological disease in the older people but none from New Zealand. The data that exists suggest a high prevalence of both inflammatory dermatoses and skin cancer (2-5). In a study published in 2003 carried out in Tampa, Florida the most common dermatological diagnosis was “pruritus and other related diseases” but basal cell and squamous cell carcinoma were also recorded (6). A review of 61 reports from 12 countries examining the prevalence of skin disease among older people in different clinical environments reported a 57% prevalence of onychomycosis affecting nursing home residents (7).

Skin disorders can significantly limit quality of life and, in the cognitively impaired, symptoms such as pruritus and pain may lead to behavioural disturbances. Older people with dermatological disease experience a higher rate of depression (8).

Managing skin cancer in the setting of a long-term residential care facility in the face of multiple comorbidities can be challenging, as treatment decisions will differ compared to a young and healthy patient.

Greater knowledge about the burden of disease in this vulnerable group will lead to better planning and delivery of dermatological care. This study sought to investigate the prevalence of dermatological conditions in residential care and test the hypothesis that those with the greatest physical or cognitive impairment would have the greatest dermatologic disease burden.

Aims and Hypotheses

The study aimed to estimate the prevalence of newly diagnosed dermatological disease in two aged care facilities and to examine the hypotheses that there was an association between cognitive or physical disability and undiagnosed dermatological disease in this population. In New Zealand, the elderly who reside in these facilities are usually either significantly physically and/or cognitively impaired.

METHODS

Design

A cross-sectional survey was conducted in two aged care facilities.

Participants and recruitment

All 161 residents of two large aged care facilities in South Auckland, New Zealand were invited to participate in the study between December 2012 and November 2013. These

facilities were selected as they provided low level care (where residents are partly mobile and require assistance with instrumental activities of daily living (IADLS) and one or two basic activities of daily living (ADLs)), called rest homes in New Zealand (NZ), hostels in Australia, residential homes in the United Kingdom (UK), assisted living in the United States of America (USA) to high level care (where most residents are dependent on 24 hour nursing care and are dependent in most ADLs), called hospital level care in NZ, nursing homes in UK, USA and Australia. The residents were approached by letter and by personal invitation from the staff and researchers. However if the resident was not able to give consent to the study the next of kin or legally designated enduring power of attorney was approached. The consent included a request to undertake a genital examination, which could be declined or accepted. A genital examination was not undertaken or discontinued if it was deemed to be too distressing for the resident. The consent also permitted access to the clinical records.

Disease outcomes

The primary outcome was defined as the presence of any significant skin disease. A significant condition was defined as a dermatological disease that in the opinion of the investigators needed treatment or was identified during the assessment as a patient concern. A first set of secondary outcomes were defined as presence of a significant skin disease in one of the following categories: solar damage-related condition; infection or infestation; inflammatory disease; congenital disease; circulation or vascular disease; apocrine or sebaceous disease; immunobullous disease; any other disease. The disease subgroups consisting of all tinea, and of all eczema respectively, were also added to the list of secondary outcomes.

Disability risk factors

The cognitive assessment was undertaken using the Abbreviated Mental Test score (AMTS), which consists of 10 questions to assess memory, a score smaller than 8 suggesting cognitive impairment (9). For analytical purposes, the AMT score was categorised into three groups (0-3 = serious impairment, 4-8 = impairment and 9-10 = no impairment). The physical assessment was by the Rehabilitation Complexity Scale (RCS) validated and used previously

in residential care research in NZ to reflect physical disability (10-14). The RCS assesses 19 functions of older people amongst which are mobility, use of toilet, dressing, self-care appearance, and showering/bathing. Each component is graded and the final figure is a summation of all the grades with a score of 19 the least disability and 76 the highest disability. The RCS was categorised into three groups (0-29 = little impairment, 30-39 = moderate impairment and 40+ = serious impairment). Individual items of the RCS were also examined as specific risk factors.

Assessments

All the assessments were undertaken by a dermatologist (PJ) or a senior trainee (MD) and all significant dermatological disease was recorded. All significant dermatologic disease was reported by letter to the primary care physician and access to publically funded treatment was made available if needed. The study was approved by the Health and Disability Ethics Committees of the Ministry of Health, New Zealand (reference number 12-NTA-36).

Statistical analysis

Descriptive analyses were carried out. Inferential analyses were carried out using logistic regression. Each disease category (including the primary outcome of “any disease”) was dichotomised and regressed on each of the two categorised risk factors. Both risk factors, as well as their interaction, were fitted together in other models. Results were reported as newly diagnosed disease odds ratios under serious vs. low or no impairment, along with 95% confidence intervals.

The potential confounders identified a priori were gender, age group and aged care facility. Age group and facility were considered distal risk factors compared with impairment level, and were not retained for adjustment. Gender was assessed as a potential confounder for each outcome and impairment type combination by considering the relative difference between the adjusted and unadjusted log-odds ratio estimates associated with impairment and the significance level of the added gender term. Any relative difference of 10% accompanied by an observed significance level of 0.20 or less led to the reporting of a gender-adjusted odds

ratio. Participant records with missing AMT or RCS information were removed from the analysis set for the affected analyses only.

As further exploratory analyses, hypothesised relationships between specific disease categories and individual items on the RCS were also examined, as well as interactions between cognitive and physical disability as disease category predictors. Unadjusted observed significance levels were reported. The level of significance where applicable was set at 5% against two-sided alternatives, with a Bonferroni adjustment accounting for the two primary hypotheses used in the sample size calculation. Data were analysed using SAS software (SAS version 9.3 for Windows).

RESULTS

Patient characteristics

There were a potential 161 residents, and in total 88 patients were examined (50%). The average age was 87.1 years (SD 5.5 years) and fifty-five patients consented to a genital examination. The study group was comprised of 66 females (75%) and 22 males (25%). Eighty two participants were of European ethnicity (93.2%), four of Maori ethnicity (4.6%), and two participants were of Asian/Indian ethnicity (2.8%) (Table 1).

Table I: Summary of Ethnicity and Gender of participating residents

Ethnicity			Gender	
European	Maori	Asian/Indian	Female	Male
82 (93.2%)	4 (4.6%)	2 (2.8%)	66 (75%)	22 (25%)

The results relating to Abbreviated Mental Test score were as follows: 21 participants (25.9%) were designated as having no impairment, 35 participants (43.2%) had impairment, and 25 participants (30.9%) had serious impairment (Table 2).

Results relating to the Rehabilitation Complexity Scale were as follows: little impairment was recorded in 42 participants (47.7%), moderate impairment in 18 participants (20.5%) and serious impairment in 28 participants (31.8%). The Spearman correlation coefficient between the AMTS and RCS was -0.63 (95% CI [-0.74,-0.47]) (Table 2).

Table 2: Summary of AMTS and RCS scores.

AMTS Score			**RCS Score**		
No impairment	Impairment	Serious impairment	Little impairment	Moderate impairment	Serious impairment
21 (25.9%)	35 (43.2%)	25 (30.9%)	42 (47.7%)	18 (20.5%)	28 (31.8%)

AMT (Abbreviated mental Score Test). RCS (Rehabilitation Complexity Scale)

Dermatological Diseases

Eighty-eight residents were examined and 72 (81.8%) were found to have a significant dermatological disease. The number of diagnoses and their frequency are summarised in Table 3.

Table 3: Number of Dermatological Diagnoses

Number of Dermatological Diagnoses	**Frequency**	**Percent**
0	15	17.1
1	26	29.6
2	24	27.3
3	14	15.9
4	6	6.8
5	3	3.4

The dermatological disorders are summarised in Table 4. The most common disorders were onychomycosis 42 (47.7%), basal cell carcinoma 13 (14.8%), asteototic eczema (12.5%) and squamous cell carcinoma in situ 9 (10.2%). Other significant findings were invasive squamous

cell carcinoma 7 (8%), bullous pemphigoid 2 (2.3%), lichen sclerosus 2 (2.3%), and carcinoma of the breast 1 (1.1%) Of those who consented to the genital examination, 2 were found to have lichen sclerosus.

Table 4: Summary of all diagnoses

Diagnosis	n	%
Infections		
Onychomycosis	42	47.7
Candida/Intertrigo	9	10.2
Tinea pedis	5	5.7
Tinea corporis	3	3.4
Folliculitis	1	1.1
Tinea cruris	1	1.1
Total infections	61	
Inflammatory		
Eczema asteototic	11	12.5
Eczema lichen simplex chronicus	5	5.7
Eczema varicose	4	4.6
Psoriasis vulgaris	3	3.4
Chondrodermatitis helicis nodularis	2	2.3
Eczema contact irritant	2	2.3
Psoriasis scalp	2	2.3
Eczema contact allergic	1	1.1
Eczema discoid	1	1.1
Eczema seborrhoeic	1	1.1
Psoriasis pustular localised	1	1.1
Total inflammatory	33	
Solar damage and skin cancer		
Squamous cell carcinoma (in situ)	9	10.2
Squamous cell carcinoma (invasive)	7	8
Actinic keratosis	4	4.6
Atypical/naevus exclude melanoma	3	3.4
Malignant melanoma	2	2.3
Porokeratosis	1	1.1
Basal cell carcinoma	13	14.8
Total solar damage and skin cancer	39	
Circulatory/Vascular		
Capillaritis	2	2.3
Ulcers Venous	2	2.3
Ulcers Arterial	1	1.1
Ulcers Mixed	1	1.1
Ulcers Pressure	1	1.1
Total circulatory/vascular	7	
Apocrine/Sebaceous		
Acne excoriee	3	3.4
Immunobullous		
Bullous pemphigoid	2	2.3
Congenital		
Ichthyosis NOS	1	1.1
Other		
Vitiligo	3	3.4
Lichen sclerosus	2	2.3
Breast cancer	1	1.1
Epidermoid cyst	1	1.1
Favre-Racouchot syndrome	1	1.1
Web space fissuring	1	1.1
Total other	9	

Confounding by gender

Adjustment by gender caused relative changes of 10% or less in the odds ratios for both mental and physical impairment, and significance for gender of more than 0.20, in all but two combinations of outcomes and impairment. The exceptions were the combinations of the infection/infestation outcome with both types of impairment. The relative changes in odds ratio exceeded 70% and the significance of gender was 0.01 in both cases. Gender-adjusted impairment odds ratios were not significantly different from 1 in either case.

Association of disease groups with cognitive or physical disability

A comprehensive analysis was undertaken to examine groups of diseases, as well as specific diseases against the AMT and RCS total and specific scores. No associations were found between total dermatologic disease burden and cognitive impairment (OR 1.5, 95% CI [0.30, 7.4] p=0.88 no impairment vs. serious impairment, any diagnosis) or physical impairment (OR 0.92 95% CI [0.27, 3.2] p=0.97) little impairment vs. serious impairment, any diagnosis). However examination of all inflammatory diseases showed that those with the least physical impairment had more inflammatory disease than those patients with the most physical impairment (OR 3.69, 95% CI [1.08, 12.61], p=0.04). Significantly more inflammatory disease was found in those with less physical impairment. Separate items of the RCS examined showed that those who were independent in self-care (compared with those that were dependent), and independent in toileting (compared with dependent) were more likely to have eczema. Separate items of the RCS indicating awareness and increased night care also showed that those who were fully aware and did not need night care were more likely to have eczema. The relevant findings are summarised in Table 5.

Table 5: Significant associations between inflammatory disease and RCS

Disease category or specific disease	Risk factor	Contrast	Prop.	OR	95% CI	p-value
Inflammatory disease (all types)	RCS	Little impairment	38.1%	3.7	1.1-12.6	0.04
		Serious impairment	14.3%	ref		
	Self-care of appearance	Independent	39.5%	4.9	1.0-24.2	0.05
		Requires assistance	11.8%	ref		
Eczema (all types)	RCS	Little impairment	35.7%	4.6	1.2-17.9	0.05
		Serious impairment	10.7%	ref		
	Self-care of appearance	Independent	34.9%	3.5	1.2-10.1	0.02
		Requires assistance	13.3%	ref		
	Use of toilet	Uses without help	34.8%	3.9	1.2-13.0	0.03
		Needs assistance	12.1%	ref		
	Awareness	Fully aware	35.2%	6.2	1.3-29.4	0.02
		Sometimes unaware	8.0%	ref		
	Night care	Care never/rarely needed	32.5%	2.9	1.0-8.4	0.05
		More attention needed	14.3%	ref		

ref (Reference level) – Note: p-values are not corrected for multiple testing.

DISCUSSION

There is a significant burden of unrecognised and inadequately treated dermatologic disease in older people living in aged residential care facilities. This study did not show the expected correlation between dermatologic disease burden and physical or cognitive ability but showed a significant association between being physically independent and having inflammatory skin disease. A potential explanation is that those residents needing and receiving a higher level of attention by the attending staff because of a significant physical disability had a greater level of incidental observation, and therefore treatment of dermatologic conditions. This hypothesis is consistent with high-quality care. Additionally, it is encouraging that in this study, no cases of scabies were diagnosed. Potentially, better education of residents and assistance with application of creams for those who carry out self-care may be important. In addition those residents with a mild physical disability who may be perceived by the residential care staff to be more independent in self cares than those with a significant disability may require more help from the staff than anticipated to reduce their inflammatory disease burden. Since this study suggests that those with less severe physical disability are at greater risk of dermatologic disease, this group may benefit from periodic skin reviews.

The aged care facilities were not randomly selected but chosen because they gave access to significant numbers of patients with a spectrum of physical and cognitive disease, ranging from low to high level care. Half of the potential patients were not enrolled due to a combination of inability to obtain suitable consent, frailty, declining participation and difficulty scheduling convenient appointment times. These factors may have lead to selection bias towards those with dermatological symptoms, those who had received less recent dermatological care and/or those patients who were expected by their next of kin to be more amenable to undergoing examination, although bias may well have lain in the other direction. Nevertheless, the gender and ethnic characteristics of the study group suggest that the findings are likely to be generalisable to a number of centres. Additionally, the diagnoses were made on a clinical basis but by a dermatologist working closely with a dermatology

trainee. All significant diagnoses were reported to the General Practitioner. The remit of the study did not permit laboratory testing.

Older people living in aged care facilities have a significant incidence of undetected disease and with anticipated demographic changes there will be challenges managing this problem both for the patient and dermatologist. There may be benefit from provision of visiting specialist services to this group. Alternatively teledermatology could be considered (15-16). Those who were more independent in residential care had more inflammatory skin disease, suggesting that greater treatment of inflammatory skin disease was offered to those with greater dependency.

CONCLUSION

There was a high rate of undiagnosed and untreated dermatological disease in the study population with 81.8% having one or more significant finding. The disease types varied from the frequent but not life-threatening (e.g. onychomycosis), to those associated with a significant morbidity that may be hidden from carers (e.g. lichen sclerosus), to potentially life-threatening (e.g. squamous cell carcinoma, melanoma and breast cancer). In this study over 25% of the residents had 3 or more dermatological diagnoses. Those with less physical disability had a higher rate of inflammatory dermatoses. No significant association was found between dermatological disease and level of cognitive impairment.

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CONTRIBUTORSHIP STATEMENT

All of the listed authors meet the ICMJE criteria for authorship.

MD: contributions to study design, acquisition of data, interpretation of data, drafting article and final approval.

NK: contributions to conception and design, interpretation of data, revising the article and final approval

ACV: contributions to study design, analysis of data, revising the article and final approval

PJ: contributions to conception and design, data acquisition, analysis and interpretation, drafting and revising the article and final approval

COMPETING INTERESTS

The authors have no competing interests to declare.

DATA SHARING STATEMENT

No additional data available.

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	3
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-4
Bias	9	Describe any efforts to address potential sources of bias	3
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4
		(*b*) Describe any methods used to examine subgroups and interactions	4
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	4
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5, 7
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	5, 7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9

		(*b*) Report category boundaries when continuous variables were categorized	3-4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	5
Discussion			
Key results	18	Summarise key results with reference to study objectives	5
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	6
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	6
Generalisability	21	Discuss the generalisability (external validity) of the study results	6
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.