

## RESEARCH

# Prevalence and risk factors for chronic lower limb oedema in the older population – a community cohort study

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## Abstract

Older people are at risk of chronic oedema that increases morbidity and reduces quality of life. This retrospective study aimed to explore the prevalence, characteristics, and risk factors for chronic oedema in older community-dwelling people.

**Methods** Non-health professionals completed routine screening of older people receiving community-age care between 2020 and 2022, including a 10-second pitting test to detect foot and ankle oedema, age, gender, comorbidities, mobility and care levels. Participant characteristics were described, and unadjusted analyses and logistic regression were completed to explore factors associated with oedema.

**Results** There were 459 older adults receiving community care with a mean age of 80.3 years (SD 7.4), and 68.6% were female. Prevalence of chronic oedema was 38.1% (n=175) and 85.4% (n=147) had bilateral oedema. An increased risk of oedema was associated with having chronic heart failure (OR:3.73, CI 2.41, 5.79) and using a mobility aid (OR: 2.38, CI 1.51, 3.75).

**Conclusion** Older people are at risk of chronic oedema and early detection may prevent complications. Non-health professionals can perform screening, boosting workforce capacity.

**Keywords** ageing population, oedema, edema, heart failure, lymphedema, lymphoedema

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## Introduction

Chronic oedema has been defined as the presence of oedema for more than three months.<sup>1</sup> Chronic oedema can lead to reduced quality of life and side effects such as wounds<sup>2</sup> and cellulitis<sup>3</sup>, which can significantly impact the health of the older individuals.<sup>4</sup> Wounds are common in the presence of chronic oedema. A large international study of 7077 patients with chronic leg oedema reported that 12.7% had wounds with risk factors including a history of cellulitis in the past 12 months, age over 85 years, and reduced mobility.<sup>2</sup> Additionally, well-controlled oedema was associated with a 50% reduction in the risk of wounds.<sup>2</sup> Chronic oedema increases the risk of recurrent cellulitis, and cellulitis exacerbates chronic oedema.<sup>5</sup> Controlling oedema,

such as by using compression therapy, can reduce the risk of cellulitis and associated complications.<sup>6</sup> Routine screening for chronic lower limb oedema in the older population could enable early detection and implementation of management strategies to reduce oedema progression, prevent cellulitis and wounds, and help maintain people's quality of life.

Globally, the reported prevalence of chronic lower limb oedema varies in the community-based older population.<sup>1,7</sup> The prevalence rates range from 2.6%<sup>4</sup> to 56.7%<sup>1</sup>. This could be due to variations in population demographics of the recruited samples or methodological factors, such as variations in the identification method of chronic oedema.<sup>1,4,7</sup> This makes knowledge synthesis challenging. The reliance

on prevalence data arising from specific and limited patient populations, such as those attending a vascular clinic<sup>4</sup> or those receiving community nursing<sup>1</sup>, may also limit translation to the broader ageing population.

Australian research on the prevalence of chronic lower limb oedema in older adults is limited to a single study. Data for this study are drawn from four settings; a community aged care service, a chronic wound service, a residential aged care facility, and a hospital inpatient service.<sup>8</sup> The overall prevalence of lower limb oedema reported across the four settings was 51%.<sup>8</sup> However, this study was limited by the data being drawn from different populations, some with small sample sizes. Prevalence rates across the four settings varied, ranging from 28% for hospital inpatients to 100% for the chronic wound service,<sup>8</sup> making it difficult to understand overall prevalence rates of lower limb chronic oedema in Australian community-dwelling older people.

Current literature suggests that chronic lower limb oedema in the older population is associated with increasing age,<sup>7</sup> obesity,<sup>1</sup> reduced mobility<sup>1</sup> and comorbidities such as diabetes<sup>7</sup> and heart failure.<sup>1</sup> The characteristics of people with lower limb chronic oedema and reported risk factors vary across studies, making it difficult to interpret the relevance of results for older cohorts.<sup>1,2,4,7</sup> Additionally, some studies investigate both upper and lower-limb chronic oedema and do not disaggregate the data by limb type.<sup>8,9</sup>

The routine screening of chronic lower limb oedema could be appropriate for older adults living in community settings and requires investigation. Screening for chronic oedema is common in the cancer population, particularly breast cancer.<sup>10</sup> Prospective surveillance following breast cancer management led to an increase in the detection of chronic oedema, known in this cohort as lymphoedema.<sup>10</sup> Surveillance of breast cancer-related lymphoedema has found that detecting lymphoedema early can enable the implementation of risk reduction strategies which can help alleviate symptoms and potentially prevent the lymphoedema from advancing to an irreversible stage.<sup>10</sup> It is reasonable to suggest that similar benefits might be possible if routine screening in older adults living in the community was undertaken.

A common surveillance method available is the pitting test.<sup>11</sup> Pressure is applied to the area of chronic oedema and a positive test is recorded if a dent is visible.<sup>11</sup> The pitting test is easy and quick to perform, requiring no implementation equipment, which could make the test suitable for use across a broad workforce. Addressing workforce capacity is crucial to facilitate routine screening. With the World Health Organization projecting a shortfall of 18 million health workers by 2030,<sup>12</sup> it is imperative that research explores the potential for non-healthcare workers to participate in routine oedema screening.

This study will evaluate findings from routine screening in a community-dwelling population of older people and has three aims:

1. What is the prevalence of chronic leg oedema among older adults living in the community, as identified through routine screening.
2. What are the characteristics of older people with chronic leg oedema living in the community?
3. What factors are associated with an increased risk of chronic oedema for older people living in the community?

## Methods

### Study design

This is a retrospective analysis of routinely collected data from home care clients of a single home care provider in Sydney, Australia. Australian Catholic University Human Research Ethics Committee approved this study (HREC Number 2023-3360N). All participants agreed to the assessment as part of the care delivered by the home care provider. The study has been reported against the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Checklist.<sup>15</sup>

### Participants and site

Client data were eligible for inclusion in the study if the client received government subsidised age care in the home from the participating provider between February 2020 and April 2022 and were 60 years old or older.

The home care provider delivers care to people in their homes in an area of Southwest Sydney. The 2021 Australian census found that in Southwest Sydney, 52.7% of people were born outside Australia, and 34.9% only spoke English at home.<sup>13</sup> The socioeconomic profile of the area was diverse, ranging from relatively advantaged to relatively disadvantaged.<sup>14</sup> At the time of the data collection, the provider employed 15 case managers, including eight from culturally and linguistically diverse backgrounds.

### Data collection

De-identified data were extracted from the provider's database. The data were collected by non-health professional case managers for routine initial and annual client review assessments regarding their general health and care needs. The care managers developed or updated each individual's care plan, including the necessary services and referrals following these routine assessments.

Data extracted included demographic information such as age, gender and level of care. Client comorbidities, including diabetes mellitus, hypertension, heart failure/ischaemic heart disease, dementia, history of cellulitis, presence of a wound, and use of a mobility aid were also extracted. The level of home care funding a person received ranged from Level 1, the lowest entry-level of support at home, to Level 5, which indicates high-level care needs based on an Australian context of government-subsidised age care in the home.

### Oedema screening

Fifteen trained case managers completed the oedema screening using a standard tool. A healthcare professional with

expertise in chronic oedema management trained all the case managers in the pitting test procedure before they completed the screening. The healthcare professional assessed the competence of each case manager by observing them administer the screening tool with one client and recording the results in the client management system.

The oedema identification screening tool was designed for the service to be user-friendly, quick to implement, and feasible for use by non-health professionals (Figure 1). It consists of two key components: observation of the feet and ankles<sup>15,16</sup> and the pitting test<sup>11</sup> (Figure 2). The client was referred for appropriate management if lower limb oedema was identified.

### Outcomes

The primary outcome was the presence of oedema, which was considered present if marks or indentations were observed on the client's skin below the knee, and/or a positive pitting test in one or more locations.

### Data analysis

All data from the single dataset were exported into SPSS V29 for analysis. Ineligible cases were excluded. Descriptive statistics were used to describe the cohort and compare the characteristics of participants with and without oedema. Results were reported as frequencies (percentages) and mean and standard deviation (SD) as appropriate for the data. Differences between those with and without oedema were assessed using the Chi-Square test of independence or Fisher's Exact test for categorical data and independent sample T-test for continuous data.

Step-wise binary logistic regression was used to determine the optimal model to predict chronic oedema. Independent variables of age, dementia, gender, hypertension, diabetes, chronic heart failure/ ischaemic heart disease, use of mobility aid and level of home care were included in the analysis if  $p < 0.05$  and excluded if  $p > 0.10$ . Wounds and cellulitis were not included in the logistic regression due to very small numbers. Level of care was dichotomised into low care support (Levels 1–3) and high care (Levels 4 and 5). Results were reported as odds ratio (OR) with 95% confidence intervals (CI).

### Results

Data were extracted for 460 participants. One participant was excluded as no home care assistance was provided and they did not meet the study's inclusion criteria, leaving data from 459 participants available for analysis.

Participant characteristics are reported for the whole sample and for those with and without oedema (Table 1). Most participants were females (N=315, 68.6%), and the mean age was 80.34 (SD 7.4) years. The prevalence of lower limb oedema was 38.1% (N=175). Oedema was more common in both legs (N=150, 85.7%,  $p < 0.001$ ) than in a single leg (N=25, 14.3%). The most common characteristics were having hypertension (69.30%) and walking with an aid (67.10%).

In unadjusted analyses, there was no statistically significant difference for age, gender, dementia, hypertension, diabetes, or the level of home care support in those with and without

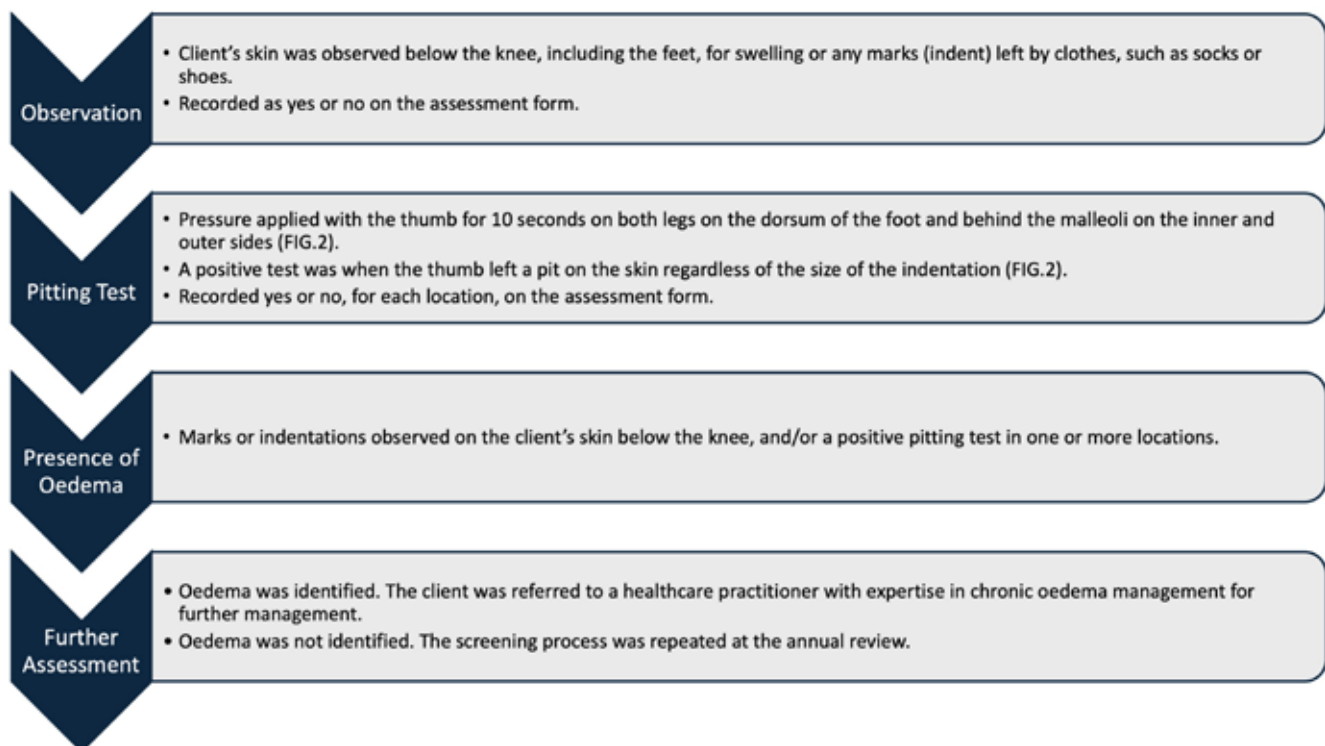


Figure 1. Oedema identification screening tool

chronic oedema. There were statistically significant higher rates of chronic heart failure/ischaeamic heart disease (N= 86, 49.1%, p<0.001), use of a mobility aid (N=139, 79.4%, p<0.001), presence of a leg wound (N=18, 10.3%, p<0.001) and a previous episode of cellulitis (N=12, 6.9%, p<0.001) in people who had oedema compared to those without oedema (Table 1).

Table 2 outlines the factors associated with chronic oedema. In the final model, the factors associated with a higher risk of chronic oedema in this cohort of older adults were chronic heart failure/ischaeamic heart disease, use of a mobility aid and female gender. Dementia was associated with a lower risk of chronic oedema. The level of home care was not retained in the final model. The model's accuracy was

70.6%, with a sensitivity to detect chronic oedema of 40.6% and a specificity of 89.1%.

**Discussion**

This study demonstrated that chronic lower limb oedema is common in the community-dwelling older population who receive home care. Characteristics of those older adults with lower limb oedema included they were more likely to have a history of chronic heart failure or ischaemic heart disease, a wound, cellulitis and to use a mobility aid. Risk factors for chronic oedema were chronic heart failure/ischaeamic heart disease, the use of mobility aid and being female. Dementia was associated with a lower risk of chronic oedema. The level of care funding a person receives was not associated with this risk of oedema in this study. In Australia, the level

Table 1. Characteristics of participants

Characteristic	Total N = 459	No oedema (N = 284)	Oedema present (N = 175)	p-value
Age* in years: mean (SD)	80.3 (7.4)	80.0 (7.2)	81.0 (7.7)	0.154
Gender^: N_(%)				
Female	315 (68.6)	191 (67.3)	124 (70.9)	0.419
Male	144 (31.4)	93 (32.8)	51 (29.1)	
Dementia^: N_(%)	87 (19.0)	61 (21.5)	26 (14.9)	0.079
Hypertension^: N_(%)	318 (69.3)	191 (67.3)	127 (72.6)	0.230
Diabetes^: N_(%)	151 (32.9)	91 (32.0)	60 (34.3)	0.619
Chronic heart failure / ischaemic heart disease^: N_(%)	148 (32.2)	62 (21.8)	86 (49.1)	<0.001
Wound#: N_(%)	19 (4.1)	1 (0.4)	18 (10.3)	<0.001
Cellulitis#: N_(%)	13 (2.8)	1 (0.4)	12 (6.9)	<0.001
Mobility – Aid^: N_(%)	308 (67.1)	169 (59.5)	139 (79.4)	<0.001
Level of home care support^: N_(%)				
Level 1	72 (15.7)	49 (17.3)	23 (13.1)	0.377
Level 2	18 (3.9)	13 (4.6)	5 (2.9)	
Level 3	144 (31.4)	89 (31.3)	55 (31.4)	
Level 4	145 (31.6)	90 (31.7)	55 (31.4)	
Level 5	80 (17.4)	43 (15.1)	37 (21.1)	

\*Independent Samples T-test, ^ Chi-Square Test of Independence, #Fisher's Exact test



Figure 2. Pitting test locations repeated on both legs

of aged care funding may not reflect their care needs or the level of care they actually received. This study is novel as it represents the first known and largest documented research on routine clinical screening for chronic lower limb oedema by non-health professionals in older adults within an Australian community setting. The current study used clinical assessment of chronic oedema to screen all older adults receiving community care from the participating aged care provider and provides a realistic finding of the prevalence of chronic oedema in older adults living in the community.

Nearly 40% of this sample were identified as having chronic lower limb oedema. Previous research has reported the prevalence rates of oedema in community-dwelling older adults ranges from 20% in the United States of America<sup>7</sup> to 60% in the United Kingdom.<sup>1</sup> This variation may relate to differences in the target population and reporting methods. For example, low prevalence (20%) was self-reported by a retirement population<sup>7</sup> while the high prevalence (60%) was based on clinical nursing assessments of older adults living in the community.<sup>1</sup> The findings from the current study align with the only other Australian study of community aged care service recipients, which reported a prevalence of approximately 34% in a small sample of a similar cohort.<sup>8</sup>

Routine screening for chronic oedema of the feet and ankles with the pitting test should be considered for all older people with chronic heart failure and/or ischaemic heart disease. Consistent with previous research, this study demonstrated that cardiac disease was associated with chronic lower limb oedema in older people living in the community.<sup>1,2,17</sup> Swollen ankles and legs can be one of the first signs of right-sided or biventricular heart failure.<sup>18,19</sup> A positive pitting test has previously been shown to be a predictor in assessing for heart failure.<sup>20</sup> A common cause of heart failure is ischaemic heart disease, often associated with hypertension<sup>21</sup> so it is perhaps not unexpected that the current study found that

people with oedema were more likely to have chronic heart failure or ischaemic heart disease.

Using a mobility aid appears to be also associated with chronic oedema, and the ageing person with mobility issues should be screened for chronic lower limb oedema. Nearly 80 percent of people with chronic oedema in the current study used a walking aid. The use of a mobility aid has previously been associated with chronic oedema, though the prevalence was lower, and the study cohort also included chair-bound and bed-bound individuals.<sup>1,2</sup> It is unclear why using a mobility aid may be a risk factor for chronic oedema, and further investigation is needed to enable targeted management. Reasons could include a reduction in the skeletal muscle pump lymph flow activation<sup>22</sup> or a reduction in venous return due to an inefficient calf muscle pump.<sup>23</sup> It is also possible that reduced physical activity levels, common in the older population, could lead to increased time sitting and contribute to dependency oedema<sup>24</sup> and changes in gait patterns<sup>25</sup> that could lead to an inefficient calf muscle pump.<sup>23</sup>

In this study, dementia was associated with a lower risk of lower limb oedema. This is a unique finding of this current study but requires further investigation. One possible reason is that wandering, common in people with dementia<sup>26</sup>, provides physical exercise<sup>27</sup> and may assist lymphatic and venous flow.<sup>23</sup> However, this may depend on the level of dementia and the individual's physical activity, which wasn't collected in the current study.

Few individuals (less than 5%) in the study cohort had an episode of cellulitis or had a leg wound. However, of these, virtually all had chronic oedema. Previous studies have found cellulitis, or the presence of a wound, associated with chronic oedema.<sup>1-3,28</sup> The current study's low prevalence of cellulitis and wounds could be due to less severe lower limb oedema in the cohort. Early identification of chronic

Table 2. Factors associated with chronic oedema in older adults

Variables in the Equation	Initial Model		Final Model	
	Odds Ratio (95%CI)	p-value	Odds Ratio (95%CI)	p-value
Chronic heart failure/ischaemic heart disease	3.70 (2.36, 5.79)	<0.001	3.73 (2.41, 5.79)	<0.001
Uses mobility aid	2.34 (1.47, 3.70)	<0.001	2.38 (1.51, 3.75)	<0.001
Gender (female)	1.54 (0.97, 2.44)	0.069	1.52 (0.96, 2.40)	0.076
Dementia	0.52 (0.30, 0.91)	0.023	0.59 (0.35, 1.01)	0.056
Higher level of home care funding	1.33 (0.87, 2.03)	0.192		
Hypertension	1.08 (0.68, 1.70)	0.747		
Age	1.00 (0.98, 1.04)	0.534		
Diabetes	0.88 (0.56, 1.38)	0.574		



lower limb oedema in the older population using a screening program may assist in reducing the risk of a wound or an episode of cellulitis, which can significantly impact the individual's quality of life.<sup>29,30</sup>

Strengths of the current study include screening of the entire population of community-based older individuals from an aged care provider by trained non-health professionals using a quick, cost-effective screening tool. The prevalence of chronic oedema is likely to be more accurate as it was identified using a clinical assessment, instead of potentially less reliable methods, such as self-report. The study demonstrated that it is feasible for trained non-health professional case managers to efficiently complete routine screening and refer people with oedema to a health professional for management.

Limitations of the current research include a lack of psychometric testing of the screening tool. However, the pitting test component has been validated.<sup>11</sup> With further investigation of the screening tool's psychometric properties and clinical utility, the tool may be an option for widespread chronic lower limb oedema screening in the older population. The current study included data collected as part of routine clinical practice by unqualified but trained staff, which may be considered a limitation, but this enabled the unique opportunity to analyse data from chronic oedema screening that is routine practice within the community.

Future research should consider a longitudinal study incorporating routine screening, with data compared over time at each review. More detailed information about the participants, the nature and severity of their oedema and general health and care needs would improve the clinical relevance and interpretation of study findings. Further research is needed into the prevalence and contributing factors of chronic lower leg oedema in older Australians living in the community without home care, as well as those in residential aged care as these areas remain largely unexplored.

## Conclusions

Chronic lower limb oedema in the older population living in the community is a significant global problem. Aged care providers and health professionals should screen their elderly clients for chronic lower limb oedema, especially if they have a history of heart failure and mobility issues. Screening can be performed by non-health professionals, which could assist workforce capacity. Early detection is crucial for initiating timely management, potentially reducing the risk of complications that further diminish the quality of life and independence in this vulnerable population.

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## Conflict of interest

The authors declare that they have no conflicts of interest related to this research paper.

## Ethics statement

The data utilised in the submitted manuscript have been lawfully acquired in accordance with The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity. Australian Catholic University Human Research Ethics Committee approved this study (HREC Number 2023-3360N).

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## Author contribution

Maree O'Connor led the conception, design, data acquisition, analysis, and interpretation of the work, drafted the manuscript, approved the final version, and took responsibility for its integrity. Suzanne Kuys, Michael Steele, and Helen Badge each significantly contributed to data analysis and interpretation, critically reviewed the work for intellectual content, approved the final version, and agreed to ensure accuracy and integrity across all aspects. Kerryn Tutt also led the conception, design, data acquisition, reviewed the work for intellectual content, approved the final version, and agreed to ensure accuracy and integrity across all aspects.

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# WPR

## Wound Practice and Research



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