

# Prevalence and risk factors of chronic wounds in nursing homes in Germany

## A Cross-Sectional Study

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### Abstract

The burdens caused by chronic wounds on the affected persons themselves and also on the health care system are well recognised. The aim of this study was to investigate the prevalence and risk factors of chronic wounds in German nursing homes. An annual cross-sectional study was conducted in nursing home residents from 2012 to 2018. The proportion of men affected by chronic wounds was to some extent higher than that of women, 9.0% males vs 7.5% females. In total, 7.8% of all residents were affected by chronic wounds. Of all residents with a chronic wound, 50.5% were affected by pressure ulcer. Male residents were twice as often affected by diabetic foot ulcer than female residents (18.0% vs 8.9%;  $P = 0.002$ ). Bivariate analysis showed that chronic wounds were highly associated with poor nutrition, urinary incontinence, stool incontinence, diabetes mellitus, and limited mobility ( $P = 0.000$ ). According to multivariate analysis, the strongest predictors for chronic wounds were limited mobility and diabetes mellitus. The highest prevalence of chronic wounds was in residents who were not restricted in their mobility, had diabetes, were male, and lived in a metropolitan region (23.7%). This study identified the prevalence and risk factors of chronic wounds in nursing home residents. Further research is needed to identify causal factors of the gender difference in the prevalence of chronic wounds. This may have an impact on the choice of prophylactic and therapeutic measures.

### KEYWORDS

chronic wounds, diabetes mellitus, limited mobility, nursing homes, pressure ulcer

## 1 | INTRODUCTION

Chronic wounds are a serious, protracted, and costly health problem and occur in all health care settings.<sup>1</sup> Every chronic wound affects the quality of life of the persons affected in physical, emotional, social, and functional terms.<sup>2</sup>

An often-cited definition of chronic wounds is from Lazarus, Cooper<sup>3</sup>: “Chronic wounds have failed to proceed through an orderly and timely process to produce anatomic and functional integrity, or proceeded through the repair process without establishing a sustained anatomic and functional result”.<sup>4-6</sup> The two most commonly used definitions in Germany are: Wounds are defined as chronic if they “show no signs of healing within 4–12 weeks of the wound developing under professional therapy.”<sup>7</sup> or according to the Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften e.V. - German Working Group of the Scientific Medical Societies (AWMF) S3 guideline “as loss of integrity of the skin and one or more underlying structures with a lack of healing within eight weeks”.<sup>8</sup> Various wound types that often count as chronic wounds are pressure ulcer (PU), lower leg ulcer (LLU), wounds caused by peripheral arterial occlusive disease (PAOD), and diabetic foot ulcer (DFU).

The causes of impaired wound healing are often multifactorial.<sup>9</sup> Local and systemic factors can contribute to the appearance of a wound and make it chronic.<sup>10,11</sup> Local factors (directly in the wound area) are a lack of oxygen supply to the skin (disturbance of blood circulation) and wound infections. Systemic (concerning the organism) factors are among others overweight, smoking, malnutrition, impaired mobility, diabetes, and sex.<sup>10-13</sup> Gender-specific hormones have a special effect on wound healing. For example, oestrogens have a positive and testosterone rather a negative influence on wound healing.<sup>14-16</sup> Diabetes is highly associated with chronic wounds and impairs wound healing at all phases.<sup>17,18</sup> It interferes with the restoration of the vascular system and the regeneration of new tissue.<sup>17</sup> Insufficient nutrition is also associated with chronic wounds. The need for energy and nutrients is essential for the formation of new tissue.<sup>19</sup> Renner, Garibaldi<sup>20</sup> discovered that people with LLU are often obese but frequently malnourished. Significantly higher vitamin D deficiency is explained by reduced mobility.<sup>20</sup> Mobility is another factor associated with chronic wounds, particularly PU.<sup>21</sup> Multiple studies have classified immobility as one of the most common risk factors for geriatric syndromes such as pressure injuries, falls, and urinary incontinence.<sup>22,23</sup> Persons who are few physically active have a 1.5 to 2.3 times higher risk of a non-healing wound.<sup>24</sup> Limited mobility can be the cause<sup>24</sup> or consequence<sup>1</sup> of chronic

### Key Messages

- the burdens caused by chronic wounds on the affected persons themselves and also on the health care system are well recognised
- the aim of this study was to investigate the prevalence and risk factors of chronic wounds in German nursing homes
- an annual cross-sectional study was conducted in nursing home residents from 2012 to 2018. A total of 7405 residents,  $\geq 60$  years were included in the study. 75% of the residents surveyed were female. Mean age was 85 years with women being 5 years older than men. The average BMI was 25.6, and 25% of the residents had diabetes
- the proportion of men affected by chronic wounds was to some extent higher than that of women, 9.0% males vs 7.5% females. The type of chronic wounds with the highest number of residents of those being affected was pressure ulcer with 50.5%. The highest prevalence of chronic wounds was in residents who were not restricted in their mobility, had diabetes, were male and lived in a metropolitan region (23.7%)

wounds. Furthermore, patients with cardiovascular and/or neurological diseases are more susceptible to impaired wound healing.<sup>11,25</sup>

Meaningful data regarding the prevalence of chronic wounds in long-term care are currently available to a limited extent only. Rondas, Schols<sup>6</sup> found a prevalence of 4.2% in 21 Dutch nursing homes. A study carried out in France reported a prevalence of 8.3%.<sup>26</sup>

In Germany, 24% (818.000) of all care-dependent people live in nursing homes. The total number has increased by 4.5% compared to 2015.<sup>27</sup> For this population, there is no current information available on prevalence and risk factors. Although there are some data available on prevalence from the German Medical Advisory Service of the National Association of Statutory Health Insurance Funds (“MDK”),<sup>28</sup> these data are collected for quality assurance purpose only. However, these data do not comprise any information about the distribution of relevant risk factors in German nursing homes.

Therefore, the aim of this study was to determine the prevalence and risk factors of chronic wounds in German nursing homes.

## 2 | MATERIALS AND METHODS

A secondary analysis of the data from seven consecutive annual cross-sectional studies in German nursing homes was carried out. Residents who were  $\geq 60$  years old were included. These originally individual studies were conducted from 2012 to 2018. The annual prevalence studies, which focus on different nursing problems, have been conducted since 2001. From 2012 onwards, the topic of chronic wounds and their different types was included in the survey. Nursing homes throughout Germany were invited to participate in the surveys in the respective years. If an institution decided to participate, it received all necessary material (information sheets, training material, and questionnaires) and a guide, in which all variables were defined and explained. On the day of the survey, nurses trained by a site coordinator performed a physical examination of residents after the participant or a proxy provided informed consent. All residents who were present in the participating nursing homes on the day of the survey were potentially eligible for study participation; patients 18 years or younger were excluded from participation. Trained nursing staff completed the questionnaire. Data collection was organised and carried out by the institutions themselves. Since higher prevalence of certain nursing problems (e.g. PU) is generally considered to be a lack of nursing quality, the survey was conducted anonymously. This was intended to counteract possible distortions caused by under-reporting. Study procedures were reviewed and approved by the Ethical Medical Committee of Berlin (consent no: Eth837-262/00).

Chronic wounds were defined as all wounds "... which do not show any healing tendencies within 4 - 12 weeks after wound formation under professional therapy".<sup>7</sup> Wounds that largely meet the above criteria are LLUs, PU, wounds caused by PAOD, and DFU. All other chronic wounds were categorised under "others". Pressure ulcer was defined, following the European Pressure Ulcer Advisory Panel (EPUAP) definition, as "... localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear".<sup>29</sup> Two nurses should carry out the assessment of the PU. This procedure reduces the risk of incorrect assessments. The socio-demographic data comprised age, sex, weight, height, region, and sponsorship of the nursing home. Regions were divided into metropolitan ( $>100.000$  residents), urban (20.000-100.000 residents), and rural ( $<20.000$  residents). The Body-Mass-Index (BMI) was calculated from height and weight and used for the variables obese (BMI  $> 30$ ) and poor nutrition (BMI  $< 20$ ). The Care Dependency Scale (CDS) item mobility was used to calculate the variable limited mobility. Mobile residents were categorised in three groups of

people, who were partially dependent, almost independent, and completely independent. Residents with limited mobility were those who were completely or almost dependent. The main diagnosis (diabetes mellitus, heart/vascular disease), urinary incontinence, and stool incontinence were recorded.

Data analysis was conducted using the statistics programmes SPSS 24. The Descriptive evaluation was carried out in absolute and relative frequencies. Mean values (mean) and standard deviations (SD) were calculated for metric data. Statistically significant differences were presented using Chi-square according to Pearson. For all statistical tests, an  $\alpha = 0.05$  two-sided was considered to be statistically significant. The Wilson method was used to calculate the 95% confidence interval (CI).<sup>30,31</sup>

For the multivariate analysis of the data, we used the Classification and Regression Trees modelling procedure (CRT). The CRT algorithm determines for each node the specific variable from the total of all included independent variables with the strongest difference regarding the prevalence of the outcome variable, which is in our study the prevalence of chronic wounds. The following nodes must be statistically significantly better than the node before.

This calculation method can be used to describe possible risk groups.

## 3 | RESULTS

### 3.1 | Prevalence of chronic wounds

Between 2012 and 2018 a total of 7662 residents were included in the study. The mean age was 85 years; women were on average 5 years older than men (86.4 years vs 80.9 years). 75% of the participating residents were female. 25% of the residents were suffering from diabetes.

The prevalence of chronic wounds was 7.8% (Table 1). The most common type was PU (4.0%).

**TABLE 1** Frequency of chronic wounds and their various types

	n (%; CI)
Chronic wounds	588 (7.8%; 7.2% to 8.4%)
PU	303 (4.0%; 3.5% to 4.4%)
LLU	71 (0.9%; 0.7% to 1.2%)
DFU	45 (0.6%; 0.4% to 0.8%)
PAOD	74 (1.0%; 0.8% to 1.2%)
Other	129 (1.7%; 1.4% to 2.0%)

Abbreviations: DFU, diabetic foot ulcer; LLU, lower leg ulcer; PAOD, peripheral arterial occlusive disease; PU, pressure ulcer.

**TABLE 2** Influencing factors of chronic wounds

		Chronic Wounds n (%; CI)	(Chi <sup>2</sup> to Pearson)
Sponsorship	Public	444 (7.6%; 6.9% to 8.3%)	<i>P</i> = 0.171
	Private	144 (8.6%; 7.3% to 10.0%)	
Region	Metropolitan	143 (7.2%; 6.2% to 8.5%)	<i>P</i> = 0.416
	Urban	197 (7.7%; 6.7% to 8.7%)	
	Rural	248 (8.2%; 7.3% to 9.3%)	
Sex	Female	413 (7.4%; 6.8% to 8.2%)	<i>P</i> = 0.041
	Male	165 (8.9%; 7.7% to 10.3%)	
Poor nutrition (BMI < 20)	No	472 (7.2%; 6.6% to 7.9%)	<i>P</i> = 0.000
	Yes	93 (10.8%; 8.9% to 13.0%)	
Obese (BMI > 30)	No	465 (7.6%; 7.0% to 8.3%)	<i>P</i> = 0.900
	Yes	100 (7.7%; 6.4% to 9.3%)	
Urinary incontinence	No	113 (4.9%; 4.1% to 5.9%)	<i>P</i> = 0.000
	Yes	435 (8.8%; 8.1% to 9.7%)	
Stool incontinence	No	269 (5.7%; 5.1% to 6.4%)	<i>P</i> = 0.000
	Yes	304 (11.1%; 10.0% to 12.3%)	
Diabetes mellitus	No	375 (6.6%; 5.9% to 7.2%)	<i>P</i> = 0.000
	Yes	213 (11.6%; 10.2% to 13.2%)	
Limited mobility	No	232 (5.0%; 4.4% to 5.7%)	<i>P</i> = 0.000
	Yes	350 (12.3%; 11.1% to 13.5%)	
Heart/vascular disease	No	65 (6.4%; 5.1% to 8.1%)	<i>P</i> = 0.045
	Yes	181 (8.5%; 7.4% to 9.8%)	

### 3.2 | Bivariate analysis on influencing factors of chronic wounds

Bivariate associations of factors influencing the occurrence of chronic wounds are shown in Table 2. Significant differences were found with regard to poor nutrition (7.2% vs 10.8%), urinary incontinence (4.9% vs 8.8%), stool incontinence (5.7% vs 11.1%), diabetes mellitus (6.6% vs 11.6%), and limited mobility (5.0% vs 12.3%).

### 3.3 | Multivariate analysis regarding chronic wounds

Figure 1 shows the relationship between the independent variables and the dependent variable “chronic wound” and describes different risk groups. The strongest predictor in this analysis was limited mobility followed by diabetes mellitus.

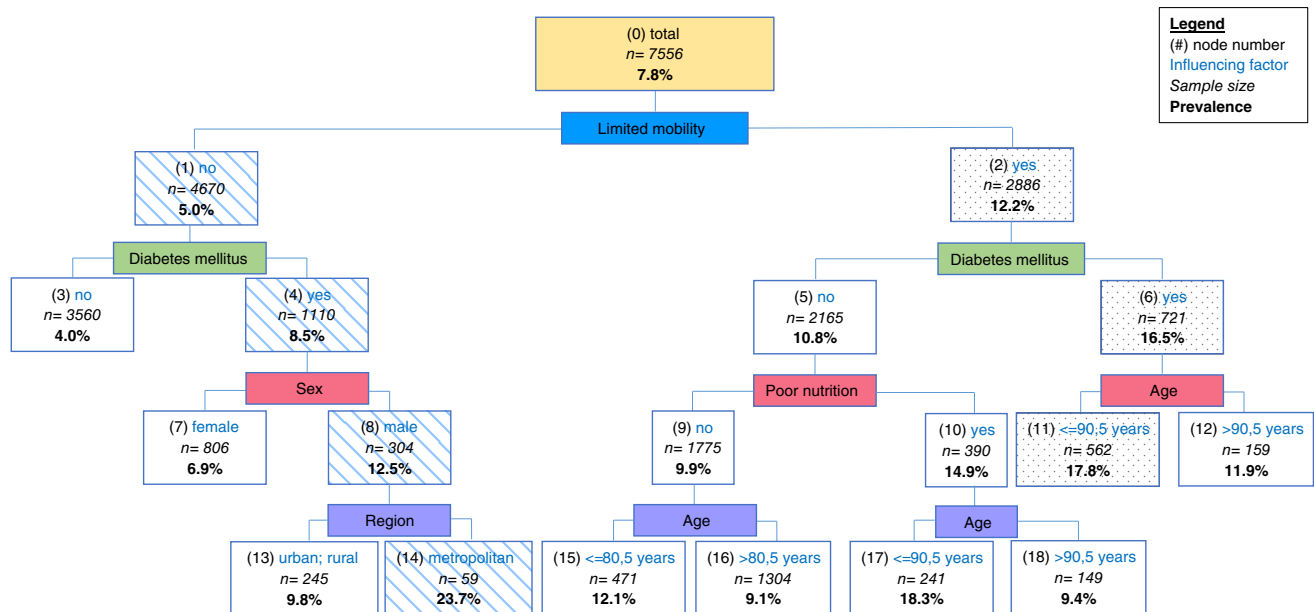
In the group of residents with limited mobility, diabetes, and aged under 90.5 years (nodes 2, 6, 11 → speckled) 17.8% had a chronic wound. 23.7% of all residents who were not restricted in their mobility, had diabetes,

were male, and lived in a metropolitan region (nodes 1, 4, 8, 14 → striped) had a chronic wound.

## 4 | DISCUSSION

The present study investigated the prevalence and risk factors of chronic wounds in nursing homes in Germany. 7.8% of all residents had at least one chronic wound. Similar results were also found in other studies.

The proportion of men affected by chronic wounds was to some extent higher than that of women, 9.0% males vs 7.5% females. However, as the minimum age of the population studied was 60 years, these effects<sup>15</sup> were not relevant in this study. Moreover, male residents were twice as often affected by DFU than female residents. The male gender was confirmed as a risk factor in the meta-analyses of Zhang, Lu<sup>32</sup> and Huang, Li.<sup>33</sup> In the study by Engberg, Kirketerp-Moller,<sup>34</sup> men also had a significantly higher risk of DFU. Different psychological and physiological states and anatomical structures, health behaviour, environmental experiences, reactions to stress events, and differences in risk behaviour can cause these differences.<sup>35,36</sup>



**FIGURE 1** Multivariate analysis on influencing factors of chronic wounds and possible risk groups

More than half of all chronic wounds found in this study were PU. In the study by Rondas, Schols,<sup>6</sup> which was also conducted in nursing homes, PU was found to be the most common (46%) chronic wound. Furthermore, studies in other settings also resulted in PU as one of the most frequent chronic wounds.<sup>37,38</sup>

The influencing factors highlighted in other studies<sup>10-13,17,18</sup> were also found to be significant in the present study. Bivariate analysis showed that chronic wounds were highly associated with poor nutrition, urinary incontinence, stool incontinence, diabetes mellitus, and limited mobility.

According to multivariate analysis, the strongest predictors for chronic wounds were limited mobility and diabetes mellitus. Residents with limited mobility and diabetes were about twice as often affected by chronic wounds compared to residents with diabetes alone. Special focus should be placed on these groups of people and the nursing staff should be specially trained on these phenomena.

The highest prevalence of chronic wounds was in residents who were not restricted in their mobility, had diabetes, were male, and lived in a metropolitan region. It is remarkable that the highest prevalence of diabetics without mobility limitations was more than twice as high among men living in a large city compared to male diabetics without mobility limitations living in a rural area. These findings raise the question, if living in a rather anonymous environment might favour the occurrence of diabetes. Furthermore, the group with the highest prevalence of chronic wounds (residents who

were not restricted in their mobility) is also the group with the lowest n by far, compared to all other nodes on this level. Even though only one (diabetes mellitus) of the highly associated factors from the bivariate analysis is true for this group, it reveals to be the one with the highest prevalence. Due to the small n, this group does not occur in bivariate analysis indicating the necessity to run a multivariate analysis in order to reveal the group's importance.

Our sample of 7405 residents drawn from nursing homes throughout Germany reflects a robust variety of settings within the German republic. Selection bias may have occurred due to the voluntary participation for institutions. However, in the survey by the Medical Advisory Service of the National Association of Statutory Health Insurance Funds, a prevalence of 7.3% was found in German nursing homes,<sup>28</sup> which is comparable to our study result. In addition, the cross-sectional study design did not allow us to reach conclusions about causal relationships between chronic wounds and gender-related differences. As is often the case in secondary data analyses, not all relevant risk factors, such as specific chronic conditions that compromise the immune system or lifestyle habits, (i.e. smoking) could be included in the model.

This study identified the prevalence and risk factors of chronic wounds in nursing home residents. Further research is needed to identify causal factors of the gender difference in the prevalence of chronic wounds. This may have an impact on the choice of prophylactic and therapeutic measures.



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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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