Master Thesis

Mobility in older adults (80+)

Secondary data analysis

Submitted by

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Zusammenfassung

Einleitung: Die Bevölkerung in Österreich wächst rapide, wobei ein signifikanter Anstieg an Personen über 80 Jahren erwartet wird. Es wird mit einem Wachstum dieser Population von 5.9 % auf 12.1 % bis 2070 gerechnet. Da muskuloskelettale Erkrankungen zu fast jeder zehnten Hospitalisierung führen und die Hälfte der Rehabilitationen auf sie zurück zu führen sind, ist es von besonderer Wichtigkeit den möglichen Einfluss auf die Pflegeabhängigkeit und mobilitätsbezogenen Gesundheitsfolgen zu untersuchen. Diese Studie untersucht die Prävalenz muskuloskelettaler Erkrankungen bei Personen ab 80 Jahren und innerhalb der Altersgruppen 80–84, 85–89 und ≥ 90 Jahren, sowie den Zusammenhang zwischen diesen Erkrankungen und dem Gesamtscore der Pflegeabhängigkeitsskala (CDS), beziehungsweise den Items „Körperhaltung“ und „Mobilität“.

Methode: Es wurde eine Sekundärdatenanalyse mit österreichischen Daten der Pflegequalitätserhebung (PQE) 2.0 aus den Jahren 2009 bis 2023 durchgeführt. Der Datensatz umfasst Personen im Alter von 80 Jahren und älter (n = 15,980). Zur Berechnung der Prävalenzen sowie zur Ermittlung signifikanter Unterschiede zwischen Personen mit und ohne muskuloskelettalen Erkankungen im gesamten Sample und den Altersgruppen (80–84, 85–89 und 90+ Jahre) wurden deskriptive Statistiken und Chi²–Tests angewendet. Die Analyse beschäftigt sich zusätzlich mit dem Zusammenhang zwischen muskuloskelettalen Erkrankungen und dem Gesamtscore der CDS sowie den beiden Items „Körperhaltung“ und „Mobilität“.

Ergebnisse: 38,1 % der 15,980 Personen im Alter von 80 Jahren und älter wiesen eine muskuloskelettale Erkrankung auf. Die Prävalenz stieg von 34,1 % in der Altersgruppe 80–84 Jahre auf 43,1 % in der Gruppe der über 90–Jährigen. Signifikante Unterschiede zeigten sich zwischen dem Vorliegen muskuloskelettaler Erkrankungen und einer höheren Pflegeabhängigkeit in fast allen Gesamtscores der CDS, als auch den Items „Körperhaltung“ und „Mobilität“. Bei Personen zwischen 80–84 Jahren waren 39 % derjenigen ohne muskuloskelettalen Erkrankungen im Item “Mobilität” “völlig pflegeunabhängig”, im Vergleich dazu lag der Wert bei Personen mit einer Erkrankungen bei nur 28.2 %. Ähnliche Tendenzen konnten auch im Item “Körperhaltung” beobachtet werden, wo 30.6 % der Personen ohne

Erkankung “völlig pflegeunabhängig” waren, während es bei Personen mit einer Erkrankung 21.2 % waren. Gleiche Muster wurden auch in den anderen Altersgruppen beobachtet. Die Anteile vollständig abhängiger Personen sind zwischen Personen mit und ohne muskuloskelettalen Erkrankungen in den meisten Scores nur geringfügig unterschiedlich und wiesen keine statistische Signifikanz auf. Insgesamt wiesen Personen mit muskuloskelettalen Erkrankungen jedoch höhere Werte auf der Pflegeabhängigkeitsskala auf, was auf eine Tendenz zu erhöhter Abhängigkeit hinweist, ohne dabei vollständig pflegeabhängig zu sein.

Diskussion: Muskuloskelettale Erkrankungen stehen in Zusammenhang mit einer erhöhten Pflegeabhängigkeit und einer verringerten Selbstständigkeit im Bereich der Mobilität. Auch wenn sie selten zu vollständiger Abhängigkeit führen, verschiebt sich der Score tendenziell in Richtung größerer Abhängigkeit und erhöht somit den Unterstützungsbedarf. Da sowohl die Zahl hochaltriger Menschen als auch die Prävalenz muskuloskelettaler Erkrankungen mit steigendem Alter zunehmen, gewinnen Prävention und Strategien zum Erhalt der Mobilität an Bedeutung. Dies ist vor allem deshalb wichtig, um die individuelle Belastung der betroffenen Personen einer höheren Abhängigkeit zu reduzieren. Außerdem muss die steigende Belastung für das Gesundheitspersonal, die Pflegeeinrichtungen und die öffentliche Sozialversicherung, die von Staat und Bundesländern finanziert wird beachtet werden.

Abstract

Introduction: The aging population in Austria is growing rapidly, with a significant increase expected in individuals aged 80 and older, rising from 5.9% to 12.1% by 2070. As musculoskeletal disorders are leading to hospitalization in almost every 10th case and half of rehabilitations are due to them, it is of high importance to investigate their potential impact on care dependency and mobility–related health outcomes. This study investigates the prevalence of musculoskeletal disorders among people aged 80 and above and within the age groups 80–84, 85–89, and 90+. Furthermore, it explores the association between these disorders and the overall score of the Care Dependency Scale (CDS), and the items “Mobility” and “Body posture”.

Methods: A secondary data analysis was conducted using data from the Nursing Quality Measurement 2.0 (NQM), collected between 2009 and 2023 in Austria. The dataset included individuals aged 80 years or older (n = 15,980). Descriptive statistics and chi–square tests were used to calculate prevalences and analyze group differences between individuals with and without musculoskeletal disorders in the whole sample and across three age groups (80–84, 85–89, and 90+ years). The analysis furthermore focuses on the association between musculoskeletal disorders in relation to the overall CDS score, and the items “Mobility” and “Body posture”.

Results: Among 15,980 individuals aged 80 and older, 38.1% had a musculoskeletal disorder, with prevalence rising from 34.1% in the 80–84 group to 43.1% in the 90+ group. Significant associations were found between musculoskeletal disorders and higher care dependency across almost every CDS overall score and the items “Mobility” and “Body posture”. In the 80–84 age group, 39% of individuals without a musculoskeletal disorder were rated as “completely independent” in the item “Mobility”, compared to only 28.2% with a disorder. Similar patterns were seen in the item “Body posture”, where 30.6% of individuals without a disorder were fully independent, compared to 21.2% with a disorder. Consistent findings also occurred in the other age groups. The proportion of “completely dependent” individuals differed only slightly and mostly not in a statistically significant manner. Those with musculoskeletal conditions were more

frequently categorized with higher levels of dependency, indicating a shift towards greater care needs without necessarily leading to full dependency.

Discussion: Musculoskeletal disorders are linked to increased care dependency and decreased independence in mobility–related items of the CDS and the CDS itself. While they rarely cause total dependence, they often elevate individuals to higher levels of care. With the growing number of elderly people and the increased prevalence of musculoskeletal issues with age, prevention and mobility support strategies are crucial. This is especially important to reduce the individual burden of people affected by a higher dependency. Furthermore, the growing burden on healthcare professionals, care facilities, and public social insurance funded by both the state and the federal government has to be taken into account.

Table of Contents

List of Abbreviations

1RM	One Repetition Maximum
ADL	Activities of Daily Living
AWMF	Association of the Scientific Medical Societies in Germany
BMI	Body Mass Index
CDS	Care Dependency Scale
EU	European Union
EURECARE	European Research Group in Healthcare
GDP	Gross Domestic Product
HDL	Housekeeping Daily Life–Activities
HLE	Healthy Life Expectancy
ICD–10	International Classification of Diseases – 10th Revision
ICF	International Classification of Functioning, Disability and Health
MUST	Malnutrition Universal Screening Tool
NQM	Nursing Quality Measurement (2.0)
OECD	Organisation for Economic Co–Operation and Development
PSC	Physical Component Summary
PST	Physical Stress Theory
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organisation

List of Tables

List of Figures

1 Introduction

Many demographic and population structure projection studies have shown a rise in the number of people aged 80 years or older, as well as an overall aging of the population (1–3). The EU Aging Report 2024 predicts a percentage increase of elderly people (80+) in Austria from 5.9% in 2022 to 12.1% in 2070 (4). This corresponds to growth from 544,570 individuals in 2024 to over 1 million by 2070. According to Statistik Austria, however, the population aged 80 years or older is expected to reach 1 million even earlier. From 2046 onwards, Austria is expected to have more than 1 million individuals in this age group on a long-term basis. Not only the population aged 80+ years is going to rise, but also those aged 65 years an older. Their proportion is projected to rise from 20.5% in 2025 to 27.9% in 2050 and 29.1% in 2080 (1). For now, we are only experiencing the beginning of demographic change. The primary reason for this development, aside from the rising life expectancy, is that the baby–boom generation from the 1960s is now slowly reaching older ages. The peak of growth is expected around 2050, when all baby boomers will have reached the age of 80 years or older. Nevertheless, the increase of this population does not stop there but continues until 2100. The long-term development until 2100 is also illustrated in Figure 1, where women are shown in green and men in blue. The darker colors display the population in 2025, while the brighter colors illustrate the expected population in 2100.

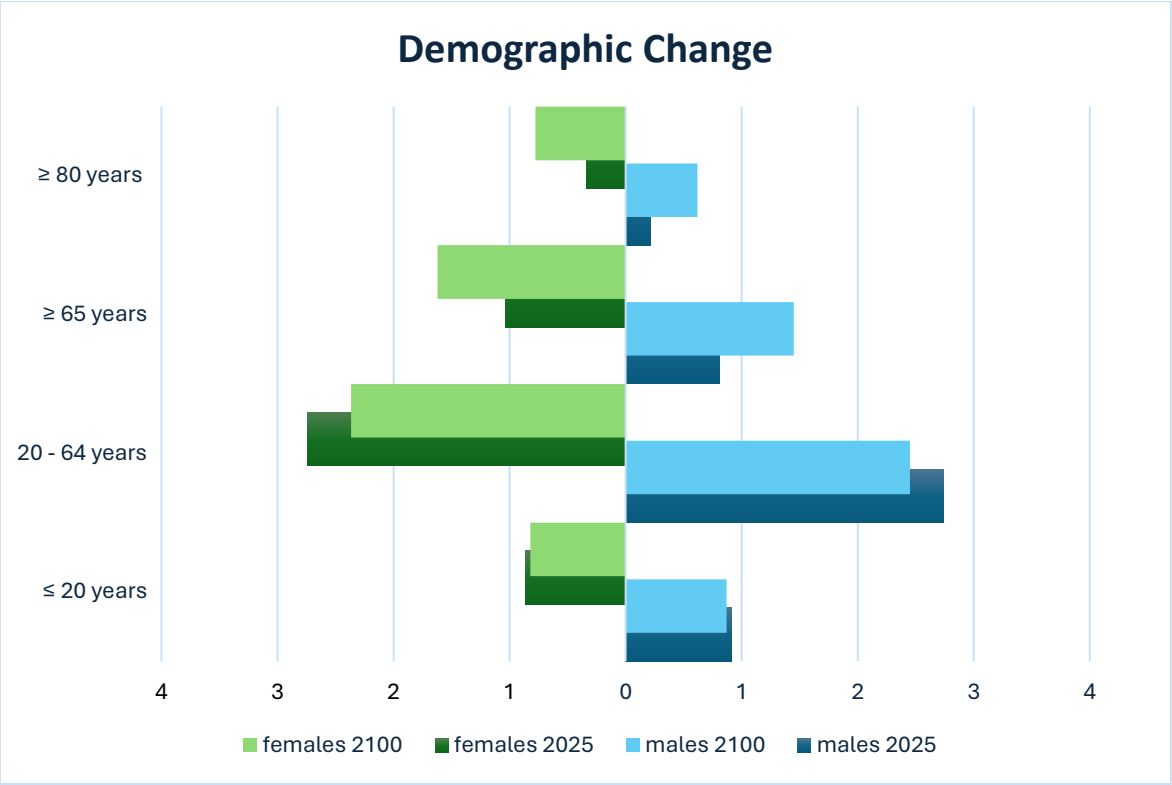

Figure 1: Demographic change in age groups 2024–2100 in Million (1)

In 2022, according to the European Commission, the life expectancy at birth in Austria was 79.5 years for males and 84.6 years for females. It is expected to climb up to 86.3 years (males) and 90.2 years (females) by 2070. Furthermore, the life expectancy of 65-year-olds in Austria is expected to increase by 4.9 years (males) and 4.8 years (females). Leading to a life expectancy of 23.5 and 26.6 years, respectively, by 2070 at 65 years of age (4).

However, life expectancy is neither the only nor the most comprehensive measure for characterizing an aging population. An additional and equally important aspect is Healthy Life Expectancy (HLE). The European Commission defines the HLE as “the number of years a person is expected to remain in good health.” HLE is calculated at birth and the age of 65 (5). The advantage of the HLE is that it also incorporates mortality, morbidity and disabilities. Therefore, it provides a more comprehensive method of determining whether rising life expectancy is accompanied by a longer–lasting period of good health status (5).

The HLE at birth for Austrian men was 60.6 years, and 61.3 years for women, in 2022. At 65, the HLE was 9.4 years for men and 9.5 years for women. In both measuring methods, the years have been rising since 2015 (6). Most of the 20 Guiding Principles in the EU Global Health Strategy aim to improve the HLE, making it one of the main goals of the EU's health policy (7). Eurostat states that an increase in HLE would not only benefit individuals but also lower public healthcare expenditures (6).

While life expectancy and HLE are rising, there is an expected decline in the number of Austrian citizens in the working–age group (20–64 years) from 5.5 million in 2022 to 4.9 million by 2070. This will result in a decreasing ratio of working–age population to persons over 65 years of age, from 3.1 to 1.8 (2).

When talking about life expectancy, HLE, and aging in general, it is crucial to discuss the importance of defining and categorizing age groups. In most research conducted in recent years, old age is typically referred to as 65 and older, or sometimes even 60 and older (8–10). Due to the heterogeneity of this specific population, it is essential to differentiate between two subgroups within the population aged 65 and older. One approach is Laslett's (1989) Framework on the stages of life, particularly the theory of the Third and the Fourth Ages (11).

1.1 Stages of life

Examining the transition from the First to the Second Age, Laslett describes it as primarily defined by biological or social factors, as well as the calendar age. The first stage starts at birth and ends between 17 and 21 years. During that transition period, many events and developments occur. It includes the end of the biological process of growth, achieving full physical strength and intellectual capacity, which is closely tied to socialization. Additionally, legal factors, such as gaining the right to drive, vote and attaining a legal "majority", are taking place during this period (11). In contrast, the Third age is not wholly defined by chronological age, nor by social and biological factors. Although it is not linked to a specific age, it is based on the possibility of reaching an older age and an existing reasonable chance of onset after the second age. In Britain, the concept of the Third Age, as defined, was first

observed in the 1950s and became firmly established in the 1980s as the majority of people reached older age (11). In contrast, some African countries, such as Nigeria and Chad, where the life expectancy for women was still under 60 years in 2020, continue to struggle with the uncertainty of reaching older age. Therefore, Laslett's framework of the Third Age has not yet been established in those countries (12). Besides the factor of an aging population, the transition of the Third Age is more of a developmental process. Peter Laslett concludes that it is, above all, a personal occurrence and a matter of choice. For most people, the Third Age typically begins after retirement and the ending of family responsibilities, typically around the age of 65. A high activity level, good health, independence and the pursuit of individual goals for the future characterize the Third Age (11).

Laslett primarily focuses on the Third Age, characterized by the previously mentioned positive traits. Even if not described in detail in his book, it suggests that the following Fourth Age is characterized by the opposite: illness, dependency and low activity level (11). Furthermore, Gilleard et al. describe it with similar traits (13). Defining a starting point for the Fourth Age is even more challenging, but it is likely linked to an individual's mobility and health status. A decline in either of these factors may mark the transition into the Fourth Age. The age can vary to a high degree but is commonly associated with around 80 years of age, as shown in Figure 2 (11).

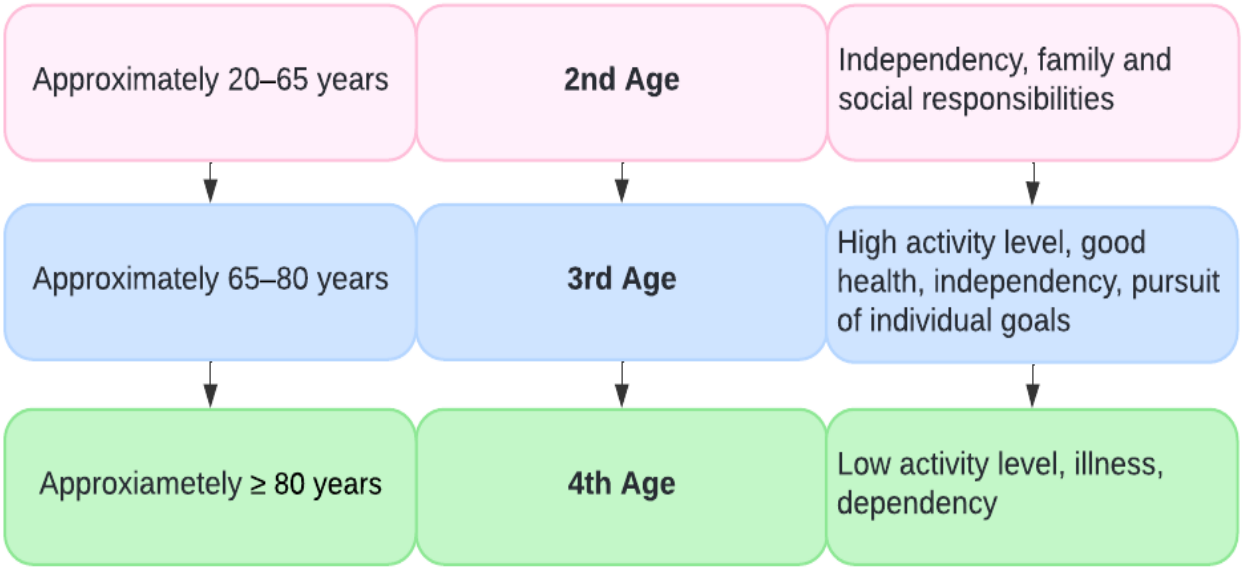

Figure 2: *Stages of Life, adapted from: Laslett, 1989 (10)*

Gilleard et al. describe the Fourth Age as a social imaginary. The distinction between the Third and Fourth Ages before the second half of the twentieth century was a difference between “the elderly” and “senility.” The fear of either the Fourth Age or “senility” remains the same and has gotten even worse due to high medicalization (13). A qualitative study by Ekerdt et al. confirms that people still in their Third Age abhor the dependence and the related burden of others associated with the Fourth Age. Some would even prefer death, which strengthens the theoretical considerations of Gilleard and Higgs (14). Despite all that Ekerdt et al. conclude, documentary studies of people in their Fourth Age have the potential to challenge existing thoughts about the Fourth Age and enhance perspectives (14).

1.2 Functional Decline and Disabilities

The process of aging can lead to a decline in physiological reserves, an increased risk of various diseases, and a general decline in intrinsic capacity and functional ability. These are consequences of molecular and cellular damage. Intrinsic capacity is a composite of physical and mental capacities, including mobility levels (1,15,16).

Various physiological changes occur during aging, one of which is a reduction in bone mass which can contribute to mobility loss. The highest bone density typically occurs around the age of 20. After that, it gradually begins to decline with a rapid acceleration in women starting 2–3 years before and continuing 3–4 years after menopause (17,18). For men, the acceleration of bone mass reduction begins at approximately 75 years of age (18). Besides aging, there are modifiable and non-modifiable risk factors for bone mass loss, which include:

- Calcium intake: 1200 mg/day or more is required
- Excessive alcohol intake: maximum allowable is not defined
- Smoking cigarettes
- Low body mass index (<18.5)
- Low estrogen: amenorrhea, anorexia
- Low estrogen: ovariohysterectomy
- Inactivity, immobilization

- Substituting soda for milk, especially among children
- Insufficient protein at all ages
- Inadequate vitamin D
- Hyperthyroidism
- Prednisone and cortisone use, hyperparathyroidism (19)

Among the modifiable factors addressed in physiotherapy, inactivity and immobilization represent the most crucial ones. Since muscle contractions generate pressure and mechanical load on bones, they can increase the bone density (43). The Association of the Scientific Medical Societies in Germany (AWMF) also highly recommends exercise therapy for men and women over 45 to maintain/increase bone density (20). The exercise program should be individualized and focused on strengthening, balance, reaction time, and coordination (21). This highlights the importance of staying active and mobile.

Muscle mass loss typically begins around the age of 50, marking another factor that contributes to declines in function and mobility. The median muscle mass loss reported by various studies is calculated separately for men and women. For men, it is 4.7% and for women, 3.7%, respectively, per decade (22). A study by Reid et al. shows that healthy older individuals have reduced muscle peak power, contraction velocity, and one-repetition maximum (1RM) strength compared to the healthy middle–aged participants. All three measurements were further reduced for mobility–limited older people, indicating that the loss of muscle function increases the risk of immobility, and that immobility, in turn, may further reduce muscle function (23). Even though the aging process varies in each individual and depends on many factors, everyone will face it at some point as they reach older age (1).

Another structural age–related change happens in connective tissues. One of them is the reduction of water bound by collagen in the extracellular matrix. That leads to height loss in vertebral discs or shrinkage of cartilage, for example. Additionally, the increasing number of cross–links between collagen molecules leads to greater tissue tension, making it harder to move, and can result in a loss of the full range of motion. A reduced percentage of elastin in various tissues also leads to a limited

function of tendons, ligaments and muscles, as well as weakness in tissues that hold internal organs in place (19).

The body's ability to maintain a stable internal environment, known as homeostasis, plays a crucial role in the aging process. Having a better ability to adapt to external physiological stressors while maintaining good health is known as adaptive homeostasis, which tends to decline in the aging process but remains modifiable through lifestyle changes (19).

Homeostasis is described by the Physical Stress Theory (PST) proposed by Müller and Maluf (24). They explain how a change in physical stress always leads to a predictable adaptive response in a majority of biological tissues. Physical stress can either "increase tolerance" or "decrease tolerance". While the increase/decrease windows always exist, the increase window gets smaller the older a person gets or the more chronic diseases occur. When physical stress occurs and it is higher than the capacity of the "increasing tolerance" window, injuries or even death can be observed. Physical activity, as an external stressor, can therefore always increase physical capacity. The intensity and inputs have to be chosen adequately. The risk of overstraining the body is higher with a smaller window, putting older individuals and individuals with chronic diseases at higher risk of moving into illness or death, due to too high external physical stress (eg.: fever, infections, (high)–intensity physical activity) (24). This makes promoting physical activity to maintain sufficient physical reserves and stay in homeostasis for as long as possible one of the key challenges in geriatric physiotherapy (19).

Adapting physical activity to the right intensity requires physiotherapists with experience, as well as guidelines on physical activity. There are numerous guidelines on physical activity from various organizations that aim to counteract mobility loss with optimal volume and intensity. With each of them reaching the same conclusions for older people, every guideline defines older people as individuals 65 years of age or older. None of them describes specific distinctions for people in the 4th age.

The recommended amount of physical activity in the guidelines by the WHO, the Physical Activity Guidelines for America, and the Austrian Physical Activity Guidelines for substantial benefits is at least 150–300 minutes of aerobic physical

activity with moderate intensity per week or 75–150 minutes or more of aerobic physical activity with vigorous activity per week, or an equivalent combination. Additionally, muscle-strengthening exercises for every muscle group are recommended at least twice a week, with moderate to high intensity. Multi–component physical activity, including functional balance training, is recommended at least 3 days/week. The effort for physical activity should always depend on the individual's fitness level and also consider any chronic diseases. (25–27)

According to Piercy et al., Bull et al., Titze et al. and Izquierdo et al. adhering to the previously described Guidelines on physical activity will lead to various potential health benefits (25–28).

"In older adults, physical activity confers benefits for the following health outcomes: improved all–cause mortality, cardiovascular disease mortality, incident hypertension, incident site–specific cancers, incident type–2 diabetes, mental health (reduced symptoms of anxiety and depression), cognitive health, and sleep; measures of adiposity may also improve. In older adults, physical activity helps prevent falls and falls–related injuries and declines in bone health and functional ability" (26).

As previously mentioned, increased risk for all those cited conditions can be associated with a failure to reach the recommendations. If the functional decline progresses to a level where holding certain body positions or doing self-care and daily activities independently becomes endangered, the risk of getting any of those diseases increases even further. For this very reason, maintaining mobility is part of the WHO's definition of healthy aging (1).

A study by Lahmann et al. describes immobility as a factor influencing various care–related issues, including urinary incontinence, pressure ulcers, malnutrition, falls and cognitive impairment in people who are on average over 80 years old. These findings support the statement that staying mobile is a key factor in delaying or even preventing the described conditions. The prevalence of immobility described in this study analyzing secondary data from German long-term care facilities was 29.5% in 2012 and is calculated by the outcome of the items "Mobility" and "Activity" of the Braden Scale, which can not be seen as a complete mobility assessment and should therefore be interpreted with caution due to potential risk of bias (29).

Slaug et al. indicate in an analysis of functional decline that, among all disabilities, mobility problems are most prevalent in people 80 years or older. Visual and hearing problems can later lead to further decline (30). Sensory difficulties, combined with a fear of falling, can increase the risk of mobility decline in older women (63–76 years) as well (31). Although the study focuses on women in the Third Age, similar or even greater effects can be expected in an older population.

A further increase in the prevalence of the listed conditions would also lead to a rise in the cost of long–term care. Oliveira Martins et al. simulated different scenarios for the increase in long–term care expenditure. Regarding the calculation by Oliveira Martins et al., the spending increase can range between 3.5% and 6% of the Gross Domestic Product (GDP) until 2050 in all OECD countries (32). The GDP describes the total value of all services and goods produced within a country, typically on an annual basis, and is a key indicator of a country's economic performance and growth (33). When examining Austria individually, it reveals an even broader spread, with numbers ranging from approximately 1.5% to 7.8% of GDP by 2050 (32). The European Commission expects an increase in costs from the aging population of 3.5% of Austrias GDP from 2022 to 2070 (4).

To gain an overall understanding of functional decline and disabilities, it is also essential to comprehend the classification of disabilities. Researchers and clinicians used to focus primarily on individual capabilities and tend to overlook the possibility of environmental modifications and external support (34). That's why an established, generally valid framework is necessary. The WHO has developed a classification system, "The International Classification of Impairments, Disabilities, and Handicaps" (ICIDH), which should parallel the "International Classification of Diseases" (ICD). Due to the individual and disability–focused view of the patient and a lack of consideration of environmental and external factors, the ICIDH was revised first to the ICIDH–2 and later to the "International Classification of Functioning, Disability and Health" (ICF). This classification is now used not only for people with disabilities, but for everyone (more on the ICD in Section 1.3) (19,35). The WHO urges all member states to use the revised ICF classification of 2001 in research and clinical practice (36).

1.2.1 International Classification of Functioning, Disability, and Health (ICF)

The ICF is classified into two main parts: the “Functioning and Disability” and the “Contextual Factors”. “Functioning and Disability” includes “Body Functions & Structures”, and “Activity & Participation”, whereas “Contextual Factors” include “Environmental” and “Personal Factors” (37).

1.3 International Classification of Diseases – 10th Revision (ICD–10)

Before examining the relevant disease category for this study, it is essential to provide an overview of the ICD–10 classification system. The ICD–10 provides a framework for classifying all diseases and conditions. It is also used to define diseases in data collection, thereby specifying specific variables used for statistical data exploration in the following chapters of this thesis. Austria’s government changed laws that obligate everyone to use the ICD coding in inpatient and outpatient treatment as of 1.1.2025 (38–40).

Every ICD–10 code consists of one or two letters in the first position, followed by up to three (in some instances, four) digits each ranging from 0 to 9. The last digit follows a decimal point, meaning the codes can vary from A00.0 to Z99.9.

The coding system is divided into 21 chapters. Every chapter begins with a letter in the first position. The two numbers after the first letter divide the chapters into blocks, where the first number, for example, in chapter A (certain infectious and parasitic diseases), refers to the mode of transmission, and the second divides it into different infecting organisms. In some cases, even a third number after a decimal point is added, allowing up to 10 subcategories to subdivide the main category. The fourth character or third number can be used differently in every code, ranging from localisations to variations within the diseases. In Chapters VIII, XIX, and XX, even a fourth number can be added for further description (e.g., anatomical site) (38).

1.3.1 Diseases of the musculoskeletal system and connective tissue

One diagnosis conducted in the Nursing Quality Measurement 2.0 (NQM) that is crucial for the following research project is the determination of diseases of the musculoskeletal system and connective tissue, which is labeled as motor disorder/disease in the NQM. Therefore, this chapter will provide more insights and a detailed description of ICD–10's Chapter VIII. The following enumeration is an excerpt from the chapter Diseases of the musculoskeletal system and connective tissue", which is marked with the letter M." The following two numbers divide them into blocks (38,41).

- M00–M25 Arthropathies
    - M00–M03 Infectious arthropathies
    - M05–M14 Inflammatory polyarthropathies
    - M15–M19 Arthrosis
    - M20–M25 Other joint disorders
- M30–M36 Systemic connective tissue disorders
- M40–M54 Dorsopathies
    - M40–M43 Deforming dorsopathies
    - M45–M49 Spondylopathies
    - M50–M54 Other dorsopathies

Each block has further subcategories. The list below shows a part of "M15–M19 Arthrosis" as an example. (41)

- M15 Polyarthrosis
    - M15.0 primary generalized (osteo)arthrosis
    - M15.1 Heberden nodes (with arthropathy)
    - M15.2 Bouchard nodes (with arthropathy)
    - M15.3 Secondary multiple arthrosis
      Post–traumatic polyarthrosis
    - M15.4 Erosive (osteo)arthrosis
    - M15.8 Other polyarthrosis

- M15.9 polyarthrosis, unspecified
  Generalized osteoarthritis NOS.

As already mentioned in 1.3, Chapter VIII has a fourth digit referring to anatomical localization, ranging from 0 to 9 (41).

0. multiple sites
1. pelvic region and thigh
2. shoulder region
3. lower leg
4. upper arm
5. ankle and foot
6. forearm
7. other
8. hand
9. site unspecified

In 2023, 1.9 million hospital stays were recorded in Austria. 158,346 (8.13%) of which had the primary diagnosis of the previously described diseases of the musculoskeletal system and connective tissue (42). Additionally, nearly half of inpatient rehabilitations are due to musculoskeletal diseases (43). Every inpatient healthcare institution, whether funded or unfunded by the regional health fund, had 60,306 available beds in 2023. The mean occupancy rate was 70.7% (42,44). Moreover, the most common chronic disease in the Austrian population is chronic back pain (26%). Neck pain (20%) and osteoarthritis (13%) are also among the most frequently occurring diseases. All of which are diseases of the musculoskeletal system and connective tissue (43). Furthermore, a Dutch study reveals that 20% of a random sample of the Dutch population suffers from a musculoskeletal disorder. Additionally, 56% of everyone who has multiple diseases had a musculoskeletal disorder, and individuals with a musculoskeletal disorder have more than 2 times higher three–month healthcare costs than people without. Only people with cancer show higher three-month healthcare costs than people with a musculoskeletal disorder (45).

2 Research gaps and aims

Laslett characterizes the Fourth Age (80+ years) as a stage of life associated with significant functional decline, increased disability, and poor health status (11). Slaug et al. further describe the rising prevalence of mobility impairments among individuals aged 80 and older (30). Various negative physiological changes that occur during the aging process have been thoroughly researched. Given that more people are reaching 80 years and older, the risk of immobility will become a significant issue that the healthcare sector must face (3,4). Since the prevalence of musculoskeletal disorders increases with age, it is of great interest to investigate the associations between musculoskeletal disorders and the Care Dependency Scale (CDS), particularly mobility–related items (46,47). The CDS is a tool that assesses the degree of a patient's dependency and indicates restrictions and disabilities that should receive more focus than others. The CDS includes various care-related Items. The items relevant to this research project are "mobility" and "body posture", as well as the overall score. Since the CDS can detect a higher and lower dependency in each item, it can highlight the impact of musculoskeletal disorders on mobility restrictions and the degree of functional decline. Chapter 3.2 further describes the CDS.

From an individual's perspective, it is of great interest to prevent mobility loss and, consequently, dependency in order to promote or preserve autonomy. The burden of being dependent on another person is a challenge that many people fear (14). From a socioeconomic perspective, targeted action is required to reduce the burden on the healthcare system and the state. Immobility has an impact on various care–related issues, ultimately leading to a worsening of the healthcare professional shortage and increased spending (29). For these very reasons, preserving mobility beyond the Fourth Age should be a focus of research. Furthermore, understanding the prevalence in the population, especially among older age groups, is crucial for planning necessary resources in the health sector.

This study aims to build a solid foundation and essential knowledge on this topic. It is vital to know the prevalence of individuals with mobility impairments or a disease of the musculoskeletal system or connective tissue, which can affect mobility. To date, no such data have been collected and analyzed for Austria. This analysis

further assesses potential associations between the Care Dependency Scale (CDS), especially the mobility–related items “Body posture” and “Mobility”, and diseases of the musculoskeletal system and connective tissues. The CDS will be explained in Chapter 3 (Methods). The analysis is conducted by a secondary data analysis of the Nursing Quality Measurement 2.0 (NQM). Therefore, the research questions of this study are:

1. What is the prevalence of individuals with a Musculoskeletal Disorder in individuals 80+ and the groups 80–85, 85–90, and 90+?
2. What is the association between the CDS overall score or the items ("Mobility” & “Body posture”) and Musculoskeletal Disorder in individuals 80+ and the groups 80–85, 85–90, and 90+?

3 Methods

The data used for the analysis were extracted from the Nursing Quality Measurement 2.0 (NQM) between 2009 and 2023. The Institute of Nursing Science at the Medical University of Graz made the data available. The following chapter aims to give insights into the structure of the NQM.

3.1 Nursing Quality Measurement 2.0 (NQM)

The NQM, as we know it today, is based on a pioneering quality assessment initially focused on pressure ulcers, which the University of Maastricht conducted as an annual cross–sectional study to measure prevalence rates. It began in 1998 in the Netherlands, initially under the Dutch name Landelijke Prevalentiemeting Zorgproblemen. It expanded to Austria, Switzerland, Turkey, the UK, and New Zealand over time, with now more than 400 institutions and over 40,000 patients participating (48–50). In 2009, under the same name, the subjects "falls", "restraints", "malnutrition", and "incontinence" were added to the questionnaire. In 2017, the subject “pain” completed the questionnaire, as we know it today (51,52).

In Austria alone, 32 hospitals and 3,554 participants participated in the second–to–last survey, conducted from November 8th to 10th, 2023. The corresponding report was published in 2024 and is the most current. The NQM aims to measure the quality of care in healthcare institutions and identify steps in the care process that require improvement (49,51). To achieve those objectives, it “assesses data referring to prevalence, prevention, and management of pressure ulcers, incontinence, malnutrition, falls and pain as well as the frequency, type, and justification restraining measure in healthcare facilities” (51).

The foundation of the survey, the so–called Quality of Care, builds on the model by Donabedian (1988). According to Donabedian, Quality in Health Care can be categorized into structure, process, and outcome. Structure refers to materialistic (e.g.: equipment, facilities) and human (e.g.: number of personnel) resources as well as the organizational structure that includes hierarchies and refunding methods. The process describes the services that patients receive and practitioners provide.

Lastly, the outcome determines the health benefits and effects for the patients, including overall health, health literacy, and satisfaction. All these factors influence the quality of care individually and collectively. Donabedian's framework is not only embedded in the NQM 2.0 but is also applied across different international settings (53–55).

3.1.1 Data collection

In Austria, every healthcare facility can voluntarily participate in the Nursing Quality Measurement 2.0, which is conducted annually. However, they must provide a fee per patient participating from their institution (50). Two nurses independently carry out the data collection. To increase objectivity and validity, one must be allocated from another ward, whereas the other one is from the ward where the data collection is conducted. The goal is to obtain the same answers for each question, if this is not the case, the answer given by the external nurse is the decisive one. Only data from patients who gave oral consent were gathered. Online software is used to collect data and present the results. After statistical analysis by the facility, which is presented in the form of tables and graphics, the institution receives the results both individually and in comparison to national scores. Each institution receives information and training sessions on data collection and the software in advance (51).

The instrument assesses the current situation in the observed healthcare facility, focusing on the three categories defined by Donabedian (structure, process, outcome). It includes questions about the type of institution (along with existing quality control measures), the ward (along with existing quality measures) and the patients themselves (53).

Questions about the patients can be separated into demographics (age, sex, body mass index {BMI}, operations {yes/no}, co–morbidities, Activities of Daily Living {ADL}, Housekeeping Daily Life–Activities {HDL}, and length of stay) and questions about medical diagnosis according to the ICD–10. Further questions refer to the prevalence, prevention, and management of the previously described nursing indicators (falls, restraints, malnutrition, pain, pressure ulcers, and incontinence).

The Malnutrition Universal Screening Tool (MUST) is used to assess the risk of malnutrition. The Care Dependency Scale (CDS) is used to determine care dependency, and the Braden Scale is used to evaluate the risk of pressure ulcers (50,51). The European Pressure Ulcer Advisory Panel, the National Pressure Injury Advisory Panel, and the Pan Pacific Pressure Injury Alliance describe limitations in the Braden Scale and therefore recommend visually examining the skin separately as part of the screening (51,56). Thus, this recommendation is also part of the pressure ulcer assessment in the NQM.

3.1.2 Psychometric properties

Only already existing risk assessment tools with scientifically recognized psychometric properties were used for the second part of the patient-centered questions. Additionally, national and international guidelines were followed in the development process, and the questionnaire demonstrated good validity after review by national and international experts (face validity). Therefore, decent reliability and validity of the NQM 2.0 can be assumed (57).

Since the research questions of this study focus on mobility in elderly individuals aged 80 years or older, only the mobility-related variables of the NQM will be used. These variables are motor disorder/disease, which is defined by the ICD–10 as a disease of the musculoskeletal system and connective tissue, and the CDS, especially the mobility-related items “Body posture” and “Mobility”. Therefore, these variables will be described in detail in the following chapters.

3.2 Care Dependence Scale (CDS)

To measure care dependency, the CDS is used as part of the NQM. Due to the lack of instruments to measure patient care dependency, a research team developed a risk assessment tool to assess patients' needs and dependencies. A Dutch team started the project in 1994. Three years later, in 1997, the European Research Group in Healthcare (EURECARE) was established to develop it further in an international context. EURECARE is a global, interdisciplinary network dedicated to enhancing care conditions in both the short and long term. The research group comprises not only healthcare professionals from European countries but also those from non–European countries. Besides the development of the CDS, they also published a manual on how the questionnaire and scoring are handled, as well as information about the concept and its psychometric properties (58).

Dijkstra et al. propose that the CDS should be used as part of the patient assessment in the first stage of patient care, before the development of the treatment plan. The authors describe the term care dependency as: "The professional support to a patient whose self-care abilities have decreased and whose care demands make him/her to a certain degree dependent. The aim of the support is to restore the patient's independence in performing self-care" (58). The term "dependency" often includes negative connotations and characteristics of individuals, which can also be found in common relationships (59). What makes it relevant and connected to professional healthcare is the term "care". It connects the concept of dependency in a patient-nurse/therapist situation (60). Henderson describes 14 essential factors that must be satisfied to transition patients from a dependent to an independent state, encompassing fundamental human needs (61) (**Table *1***).

Table 1: 14 Fundamental Human Needs (61)

• To breathe normally	• To keep the body clean and well groomed and to protect the integument
• To eat and drink adequately	• To avoid dangers in the environment and avoid injuring others
• To eliminate body wastes	• To communicate with others in expressing emotions, needs, fears, or opinions
• To move and maintain desirable postures	• To worship according to one's faith
• To sleep and rest	• To work in such a way that there is a sense of accomplishment
• To select suitable clothes – dress and undress	• To play or participate in various forms of recreation
• To maintain body temperature within normal range by adjusting clothing and modifying the environment	• To learn, discover, or satisfy the curiosity that leads to normal development and health and use the available health facilities

Although the CDS is unable to assess specific patients' conditions, it can indicate restrictions and disabilities that should receive more focus than others. In other words, it aims to provide an overview of patients' needs and the level of assistance they require. This applies to various items in different settings (community care, home care, and institutional care) and populations. After performing the CDS, the authors suggest an interdisciplinary consultation to determine which item obtains higher priority in treatment and care and should be focused on consequently. The CDS can also be used to monitor patients and observe changes over time. As it has been applied in the NQM, it is a tool for collecting data from different patients over time to evaluate the quality of care (58).

3.2.1 Structure, Items and Scoring System of the CDS

The CDS includes 15 items, each representing one of the 15 dimensions of care dependency. If used for research, a 16th item can be added to assess overall care dependency (60).

Table 2: Care Dependency Scale (CDS) – Items adapted from: Dijkstra, Smith and White, 2006 (58)

1. Eating and drinking	2. Avoidance of danger
3. Continence	4. Communications
5. Body posture	6. Contact with other
7. Mobility	8. Sense of rules and values
9. Day/night patter	10. Daily activities
11. Getting dressed and undressed	12. Recreational activities
13. Body temperature	14. Learning activities
15. Hygiene	

Each item is assessed on a 5–point Likert scale, with 1 indicating complete dependency and 5 indicating almost independent. Therefore, the lower the score, the greater the patients' dependency. The lowest possible score is 15 and the highest is 75. The gradation of the scale is as follows: 1 = completely care dependent, 2 = to a great extent care dependent, 3 = partially care dependent, 4 = to a limited extent care dependent and 5 = almost independent (58). The most important categories for this study are those that describe mobility: "Body posture" and "Mobility".

3.2.2 Presentation of CDS Score

The most common way to present the results is in the form of a circular scoring chart (**Figure *3***). This allows a clear and well–structured comparison between repeated measures. The following scoring chart demonstrates an imaginary example.

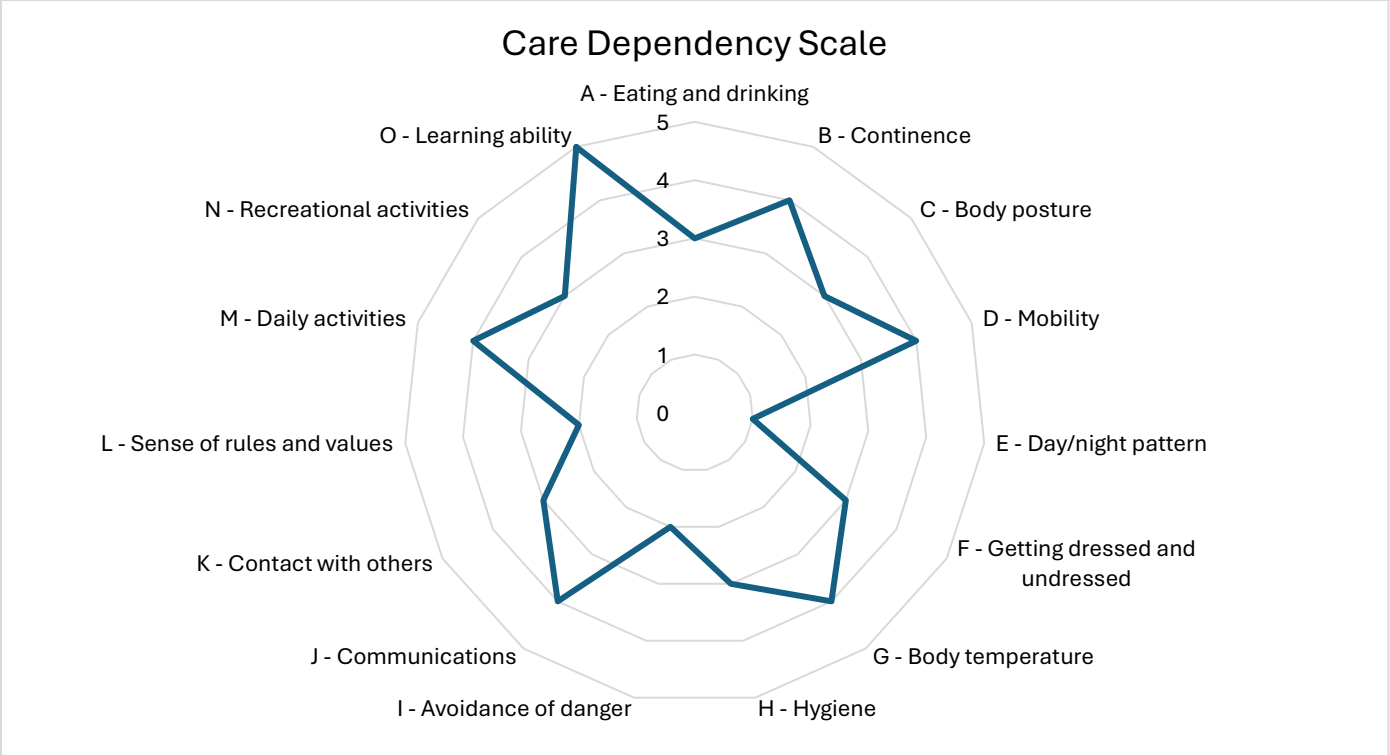

Figure 3: Scoring chart CDS (58)

Each score has specific requirements that must be met to get a score. Those are described in the following list.

1. “Completely care dependent
   (Missing all initiative to act, therefore, care and assistance are always necessary)
2. To a great extent care dependent
   (Many restrictions to act independently, therefore, to a great extent, dependent on care and assistance)
3. Partially care dependnet

(There are restrictions to act independently, therefore, partially dependent on care and assistance)

4. To a limited extent care dependent
   (Few restrictions to act independently, therefore, only to a limited extent dependent on care and assistance)
5. Almost independent
   (Almost everything can be done without assistance)" (58)

3.2.3 Conducting the CDS

There are two different ways in which the CDS can be used to collect data: the self–reported and the proxy measurement. The proxy, which means asking the question not to the patient but to others, should only be used if the patient is unable to answer the questions at all. If the patient has difficulty reading the questions or frequently forgets the answers, the questions can also be read aloud by another person. Since answers are always different when using a proxy, it is essential to state that the patients themselves do not provide them, especially when used for research (58). Due to difficulties in comparability, only results from patients who answer every question themselves are used for further study. The questions always refer to the period of the previous week. However, when using proxies, it can also be referred to as the period that the answering person can remember (58).

Considering the fact that the CDS appraises all dimensions of care dependency, it can be used in every healthcare setting (community care, home care, and institutional care) and for any patient (age group, gender, and type of condition/disability).

The internal consistency of the CDS was assessed using Cronbach's Alpha. It demonstrates high internal consistency in both individual countries and across all countries combined. Additionally, the inter–rater and test–retest reliability, as measured by Cohen's Kappa, reveals moderate to substantial reliability in every individual language/country (Canada, Germany, Italy, the Netherlands, Norway, Spain and the UK) and in total. Content validity was established in a Delphi survey by 44 experts. Construct validity was assessed through a factor analysis, which

indicates that all items load onto one factor, representing the care dependency concept (58).

Cross–validation was tested for cancer and intensive care units. Stability, concurrent validity and construct validity were assessed for neurorehabilitation. Construct validity was evaluated for the Nursing Care Dependency Scale (62–65).

3.3 Variables

The dataset, including individuals 80 years of age or older, was used to answer the research question. To analyze specific outcomes, new variables had to be calculated or existing ones transformed into new ones. To calculate prevalences for each pre–defined age group separately, a variable was added to divide the sample into age groups. People aged 80–84 years, 85–89 years and 90 years and older were separated into these groups. Moreover, institutions were clustered into hospitals and long–term care. The category “hospital” includes academic hospitals, general hospitals, rehabilitation centres, mental health facilities, private hospitals and geriatric hospitals. The category “long–term care”, on the other hand, consists of aged care facilities, institutions for people with mental disabilities, institutions for people with physical disabilities, home care, elder care residents, living-care-welfare institutions, aged care facilities and others. To calculate if there is a statistically significant difference between individuals with and without a musculoskeletal disorder within each CDS score, dummy variables for the overall CDS score and the items “Body posture” and “Mobility” were made. Each score in each item was transformed into its own variable.

Other essential variables for the data analysis are the CDS overall score, the items “Mobility” and “Body posture”, the presence of a musculoskeletal disorder, as well as age.

3.4 Ethical considerations

The Nursing Quality Measurement has had ethics approval from the Medical University of Graz since 2009. Additionally, a new proposal for approval is handed in every year. The number of the Ethical approval is 20–192ex08/09.

3.5 Data analysis

The analysis was conducted with IBM Statistical Package for the Social Sciences (SPSS) Statistics 29. To describe the demographic characteristics of the sample, descriptive statistics were used in the form of cross–tabulations and bar charts. To illustrate the differences between groups, chi–squared tests were performed. The significance level (α) was set at 0.05.

4 Results

4.1 Demographic characteristics

This chapter provides an overview of the results, beginning with the population characteristics presented in Table 3. Between 2009 and 2023, 68,375 persons participated in the NQM in Austria, with 15,980 of them being 80 years or older. 71.2% (11,375) of the sample are female. 39.9% (6,380) of the sample are between 80 and 84 years of age, 36.1% (5,769) are aged 85–89, and 24.0% (3,831) are 90 years or older. Regarding the type of institution where patients received care during data collection, the analysis revealed that 63.6% (10,160) of individuals over 80 were in a hospital, and 36.4% (5,820) were in a long–term care facility. The gender distribution within the institutions shows that 36.2% (3,676) of individuals in hospitals were male and 63.8% (6,484) were female. In long–term care, there were 16.0% (929) males and 84.0% (4,891) females. Calculating the gender distribution for each

age group separately, 63.7% of the 80–84 year-olds are women. Among the 85–89 year-olds, the rate is 73.4%, and among the 90+ year-olds, it is 80.3%.

Table 3: Demographic Characteristics (n=15,980)

		n	%
Age Groups			
80–84		6380	39.9
85–89		5769	36.1
≥ 90		3831	24.0
Gender			
male		4605	28.8
female		11375	71.2
Gender Distribution by Institution			
Hospital	male	3676	36.2
	female	6484	63.8
Long–term Care	male	929	16.0
	female	4891	84.0
Institution			
Hospital		10160	63.6
Long–term Care		5820	36.4

Regarding the prevalence of musculoskeletal disorders among individuals aged 80 years and older, results are summarized in Figure 4Figure 5. Overall, 38.1% of the total sample were diagnosed with a musculoskeletal disorder, whereas 61.9% showed no such diagnosis. When examining the age subgroups separately, the lowest prevalence was observed in the 80–84 years age group, at 34.1%. This was followed by those aged 85–89 years at 39.1%. The highest prevalence was found

among individuals aged 90 years or older, at 43.1%. A chi–square test revealed that the differences in prevalence across these age groups were statistically significant ($p < .001$).

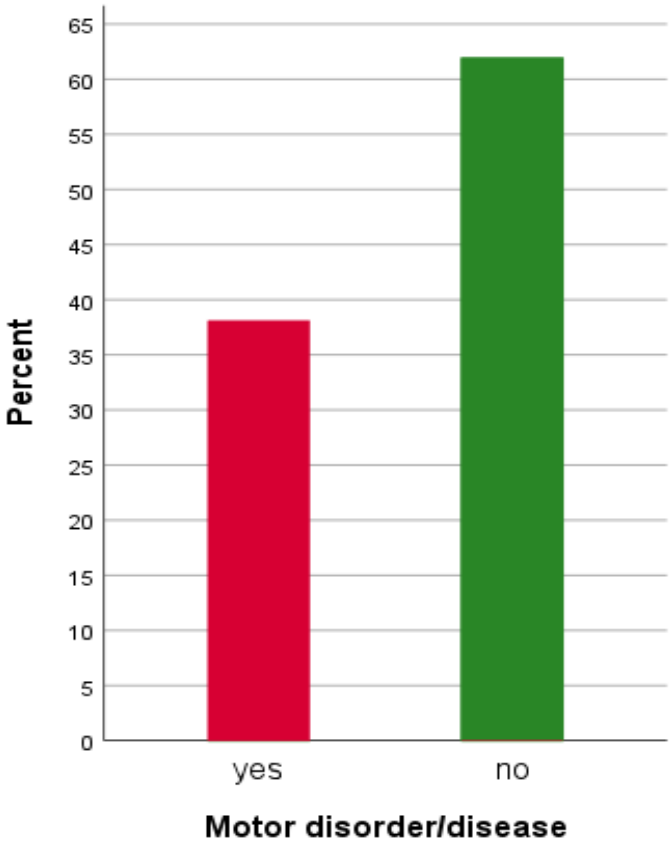

Figure 4: *Prevalence of Musculoskeletal Disorder in individuals 80+*

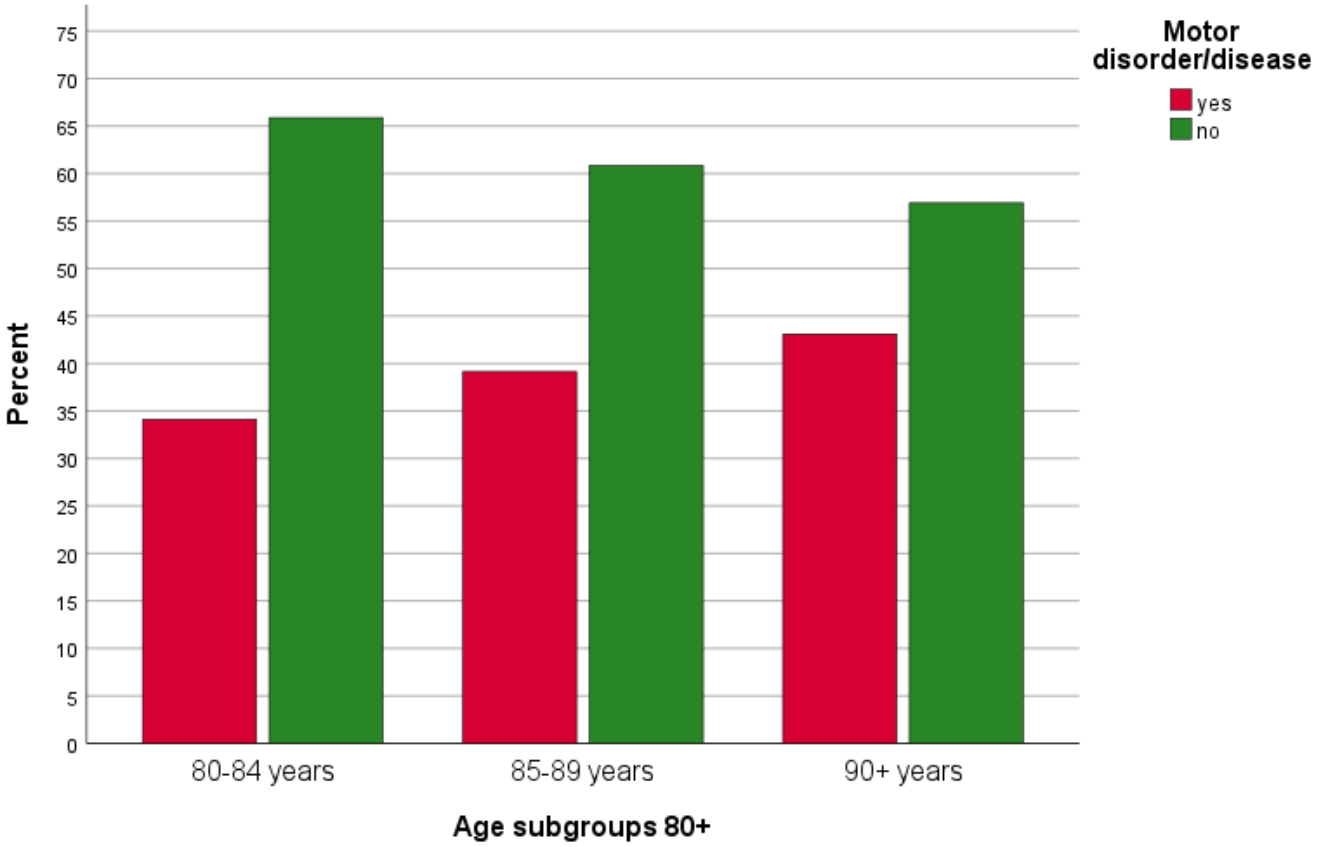

Figure 5: *Prevalence of Musculoskeletal Disorder in Age Groups*

The following chapters present the association between the CDS overall score and the items “Mobility” and “Body posture” individually and musculoskeletal disorders. Results for the whole sample but also for stratified age groups got calculated.

4.2 CDS Overall Score

Figure 6 presents the first part of the associational analysis. It examines the association between the CDS overall score and musculoskeletal disorders within the whole sample and the defined age groups. Among individuals aged 80+, 21.3% with musculoskeletal disorders were “completely independent.” In contrast, 29.5% without such disorders were “completely independent.” No difference was found for “complete dependency.” In both groups, 12.6% were “completely dependent”.

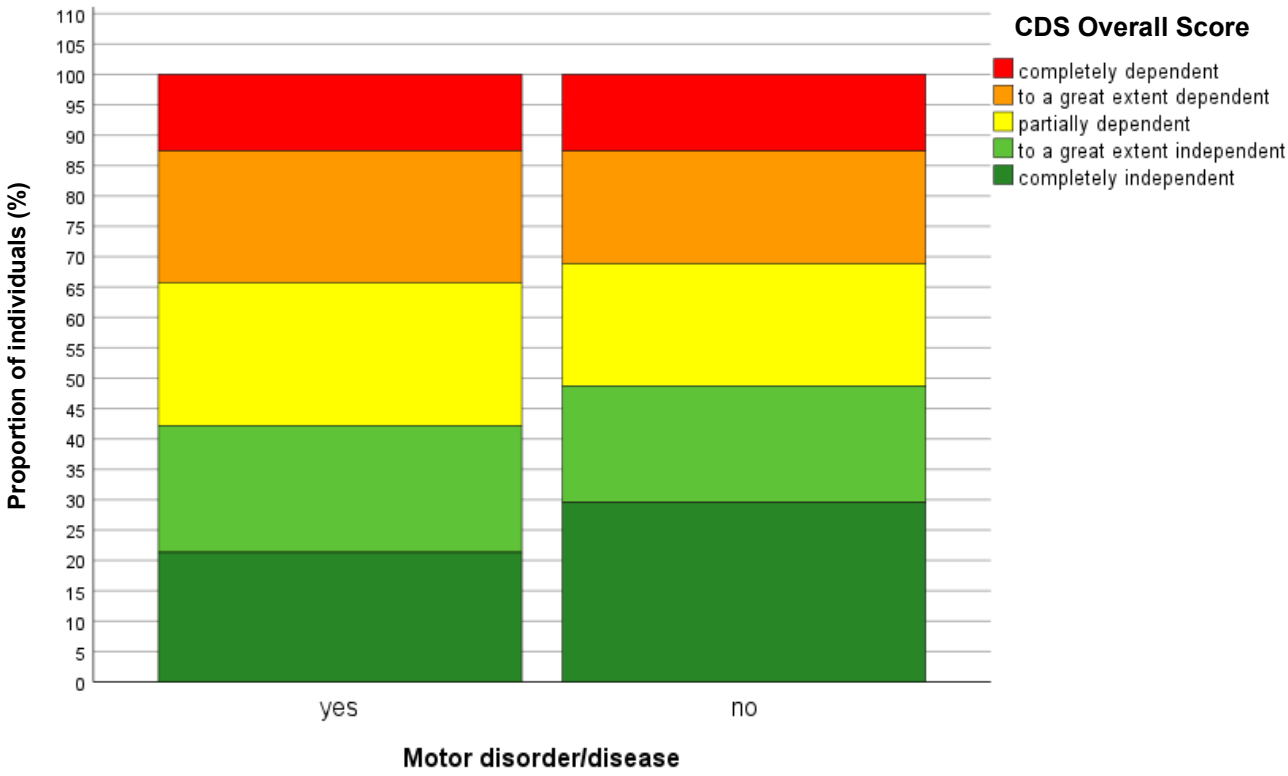

Figure 6: CDS Overall Score and Musculoskeletal Disorder in individuals 80+

4.2.1 Stratified by Age Groups

The score “to a great extent independent” increases up to age 85–89 and decreases in the 90+ group. The scores “completely dependent,” “to a great extent dependent” and “partially dependent” increase with age. The largest increase is seen in “to a great extent dependent.” Prevalence rises from 16.4% (80–84 years) to 22.5% (85–89 years) and 27.4% (90+ years).

The prevalence of “completely independent” decreases with age. There are 32.0% of individuals aged 80–84, 19.4% in those aged 85–89, and 9.9% in the 90+ group who are “completely independent”.

Figure *7* shows the change in CDS overall score with increasing age in individuals with musculoskeletal disorders.

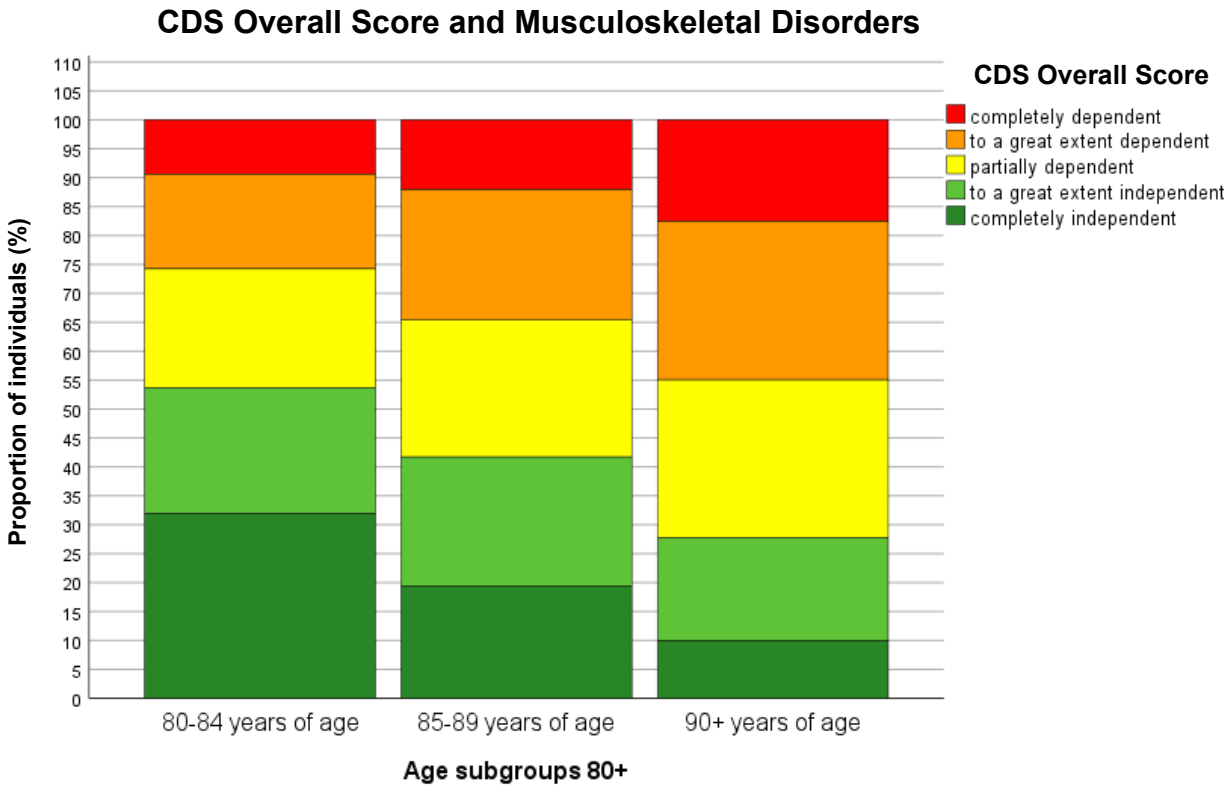

Figure 7: CDS Overall Score and Musculoskeletal Disorder in Age Groups

Looking at individuals without a musculoskeletal disorder, similar patterns are demonstrated in **Figure 8**. The proportion of individuals who are “completely independent” decreases with increasing age: 80–84 years of age (40.5%), 85–89 years of age (26.1%) and 90+ years of age (14%).

The score “to a great extent independent” peaks in the age group 85–89 at 20.8%. The highest prevalence of “to a great extent dependent” is also observed in this group, at 29.2%.

A rise in the scores “partially dependent” and “completely dependent” with age is noticeable. The prevalence of individuals who are “completely dependent” increases by 9.3% across all age groups.

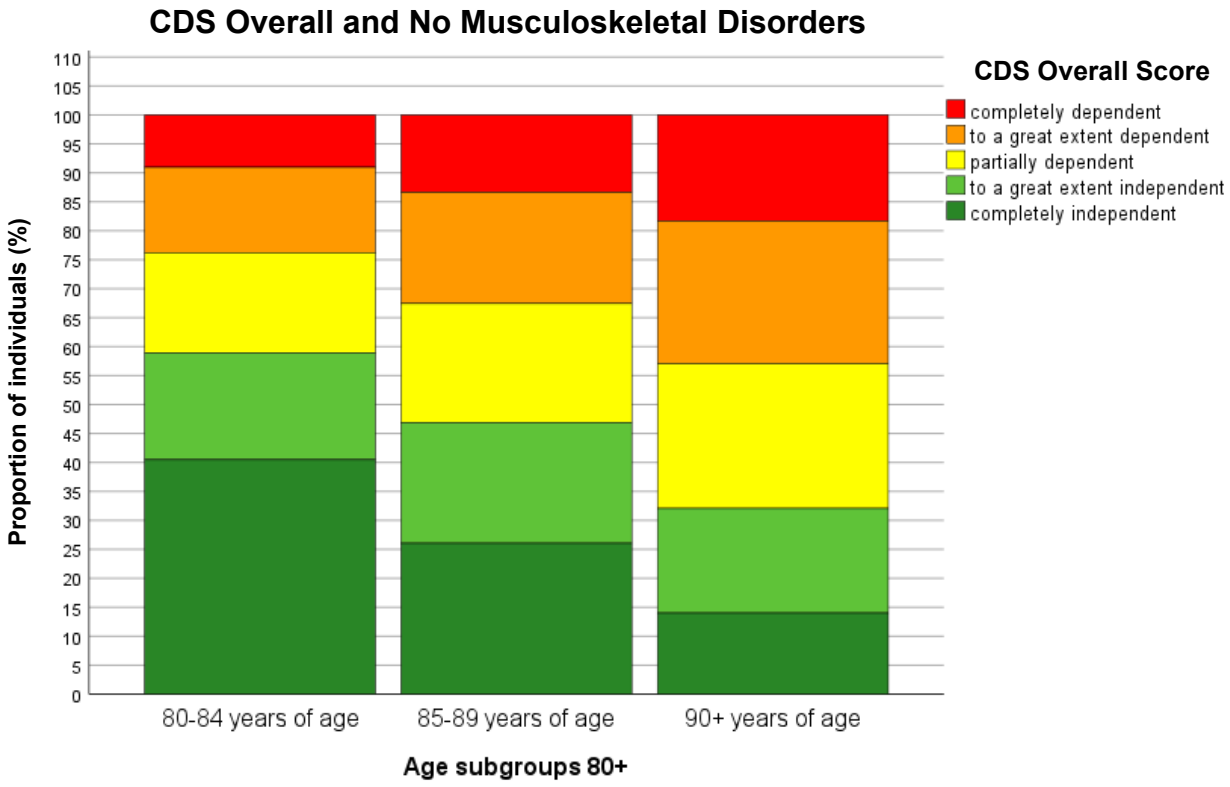

Figure 8: CDS Overall Score and No Musculoskeletal Disorder in Age Groups

When comparing both the samples with and those without musculoskeletal disorders with each other, differences in the CDS overall score are evident. The differences are displayed in **Table 4**. Among individuals aged 80–84 years, a lower proportion is classified as ‘completely independent’ when a musculoskeletal disorder is present (32.0%) compared to those without such a diagnosis (40.5%). A similar pattern is observed in the 85–89 age group, with 19.4% of individuals with a musculoskeletal disorder being ‘completely independent’ versus 26.1% of those without. This trend continues in participants aged 90 years and older (9.9% vs. 14.0%).

The score “completely dependent” did not show any statistically significant differences in any age group. Both scores, “partially dependent” and “to a great extent dependent”, demonstrate higher prevalences in people with musculoskeletal disorders. “To a great extent independent” has higher prevalences in those with musculoskeletal disorders in the groups 80–84 years and 85–89 years. In the 90+ years age group, the prevalence is higher in those without.

Table 4: CDS Overall Score and Musculoskeletal Disorder (yes/no)

	80+ years		80–84 years		85–89 years		90+ years	
	yes	no	yes	no	yes	no	yes	no
completely dependent	12.6%	12.6%	9.4%	9.0%	12.0%	13.4%	17.6%	18.3%
to a great extent dependent	21.6%**	18.5%	16.4%**	14.7%	22.5%**	29.2%	27.4%**	24.6%
partially dependent	23.6%**	20.1%	20.5%**	17.3%	23.7%**	20.5%	27.3%**	25.0%
to a great extent independent	20.9%*	19.2%	21.7%*	18.5%	22.3%*	20.8%	17.8%*	18.1%
completely independent	21.3%**	29.5%	32.0%**	40.5%	19.4%**	26.1%	9.9%**	14.0%

** $p<0.001$

* $p<0.05$

4.3 CDS Item Body Posture

Dijkstra et al. describe the item “Body posture” as the extent to which patients can adopt a position adequately for a certain activity (58).

The analysis of the association between the CDS item “Body posture” and musculoskeletal disorders is illustrated in **Figure 9**. Among individuals aged 80 and older with a musculoskeletal disorder, 34.0% are “completely independent” in the item “Body posture”.

The scores “to a great extent dependent,” “partially dependent” and “to a great extent independent” are significantly more frequent in individuals with a musculoskeletal disorder.
For the score “completely dependent,” no statistically significant difference has been observed between the two groups.

***Figure 9**: CDS (Body posture) Score and Musculoskeletal Disorder*

4.3.1 Stratified by Age Groups

The analysis of care dependency between the three age groups for the item body posture showed that the prevalence of “completely independent” decreases with age, similar to the changes in the CDS overall score (**Figure 10**). 42.6% of people aged 80–84 are “completely independent”. In the 85–89 group, it is 33.4% and in the 90+ group, it is 23.4%.

The prevalence of “to a great extent independent” peaks in individuals aged 85–89 years. The other scores show an upward trajectory with increasing age. Individuals aged 90 years and older demonstrate the highest prevalence in “partially dependent”, “to a great extent dependent” and “completely dependent”.

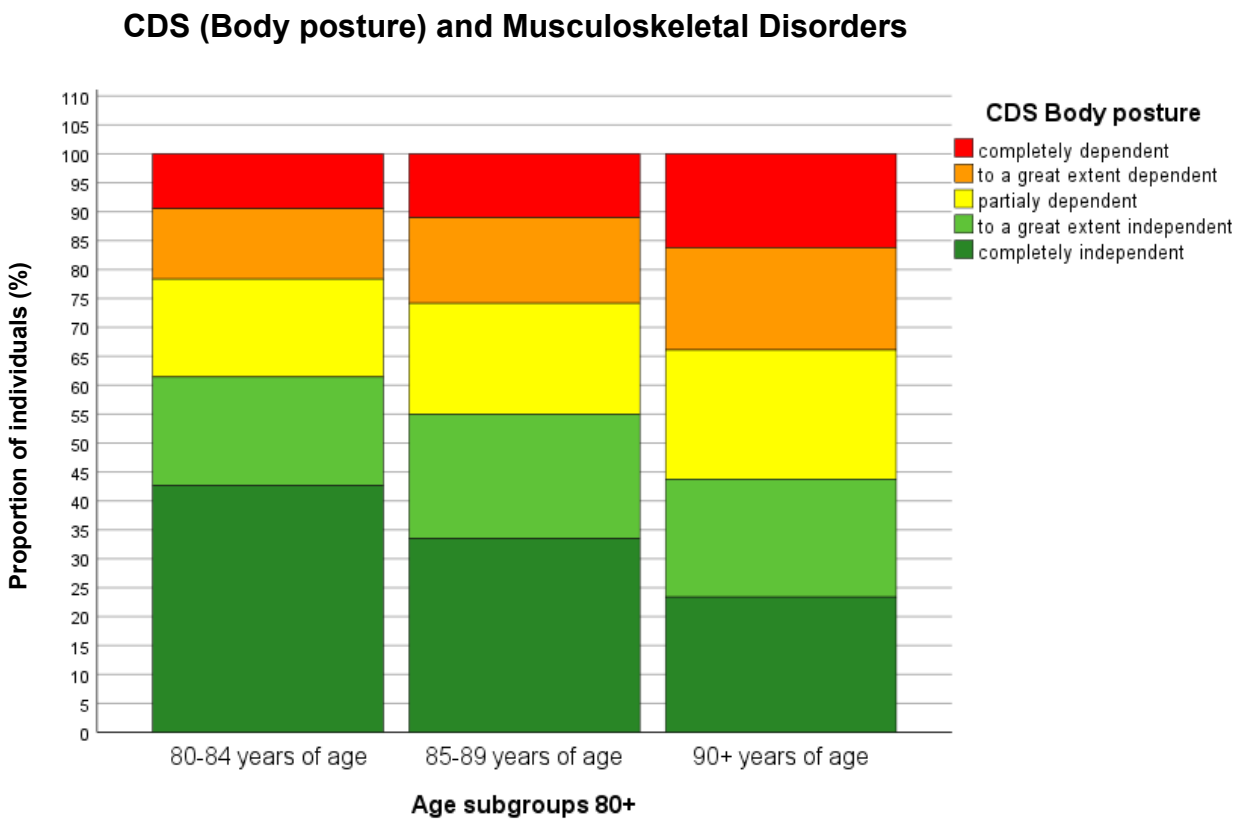

***Figure 10**: CDS (Body posture) Score and Musculoskeletal Disorder in Age Groups*

Figure 11 illustrates a shift towards higher prevalences in the CDS item “Body posture” with increasing age. In the 80 to 84 age group, 51.5% are completely independent. This drops to 37.9% in the 85 to 89 group and 26.1% among individuals aged 90 and older.

In contrast, the proportion of participants classified as “completely dependent” increases with age, rising from 9.5% in the 80–84 age group to 12.1% in the 85–89 group and 16.7% among those aged 90 years and older. A similar age-related trend is observed for individuals “to a great extent dependent” with percentages increasing from 10.3% (80–84) to 12.0% (85–89) and reaching 15.3% in the oldest subgroup.

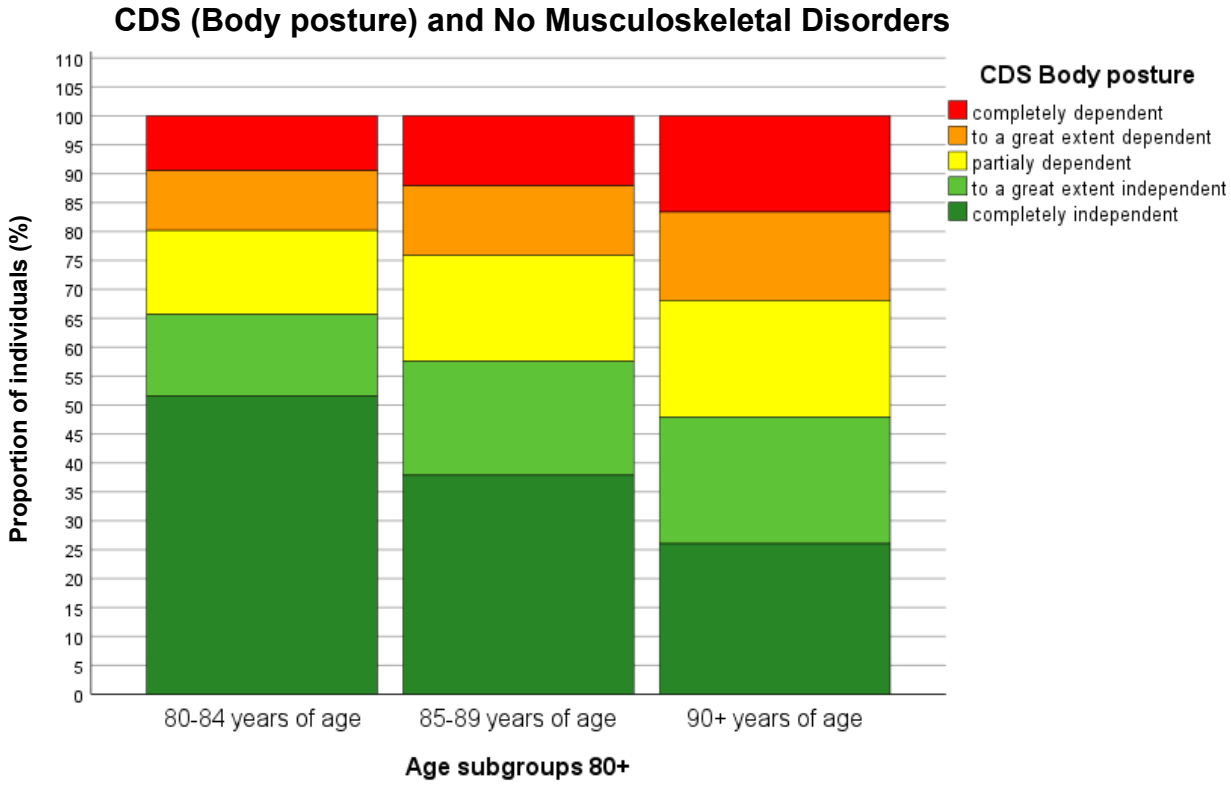

Figure 11: *CDS (Body posture) Score and No Musculoskeletal Disorder in Age Groups*

Among those aged 80–84 years, a higher proportion without a musculoskeletal disorder are “completely independent” compared to those with such a disorder (51.5% vs. 42.6%). Across all levels of dependency, musculoskeletal disorders are associated with equal or higher prevalence (**Table 5**).

The prevalence of “to a great extent dependent” (21.5% vs. 19.7%), “partially dependent” (19.2% vs. 18.4%) and “to a great extent independent” (14.8% vs. 12.0%) is higher among individuals with a musculoskeletal disorder. In the 85–89 age group, the proportion of individuals who are “completely independent” is also lower in those with a musculoskeletal disorder (33.4% vs. 37.9%).

In the 90+ group, the prevalence of being “completely independent” (23.4% vs. 26.1%) and “to a great extent independent” (20.4% vs. 21.8%) is lower in those with a musculoskeletal disorder. Conversely, higher proportions of “partially dependent” (22.4% vs. 20.2%) and “to a great extent dependent” (17.7% vs. 15.3%) are observed in people with musculoskeletal disorders.

Table 5: *CDS (Body posture) Score and Musculoskeletal Disorder (yes/no)*

	80+ years		80–84 years		85–89 years		90+ years	
	yes	no	yes	no	yes	no	yes	no
completely dependent	11.9%	12.0%	9.5%	9.5%	11.0%	12.1%	16.2%	16.7%
to a great extent dependent	14.6%**	12.0%	12.1%**	10.3%	14.8%**	12.0%	17.7%**	15.3%
partially dependent	19.3%**	17.2%	16.9%**	14.6%	19.2%**	18.4%	22.4%**	20.2%
to a great extent independent	20.2%**	17.8%	18.8%**	14.1%	21.5%**	19.7%	20.4%**	21.8%
completely independent	34.0%**	41.0%	42.6%**	51.5%	33.4%**	37.9%	23.4%**	26.1%

** p<0.001

* p<0.05

4.4 CDS Item Mobility

Lastly, the association between the CDS item “Mobility” and musculoskeletal disorders was analyzed in individuals aged 80 and older, as illustrated in **Figure 12:** CDS (Mobility) Score and Musculoskeletal Disorder. The Item “Mobility” is described as the extent to which the patient can move about unaided by Dijkstra et al. (58).

Among those with musculoskeletal disorders, 21.0% were classified as “completely independent”, compared to 29.7% without such disorders. All other dependency levels showed higher prevalence in individuals with musculoskeletal disorders: “completely dependent” (20.8% vs. 17.9%), “to a great extent dependent” (16.4% vs. 14.2%), “partially dependent” (20.9% vs. 19.9%) and “to a great extent independent” (20.9% vs. 18.3%).

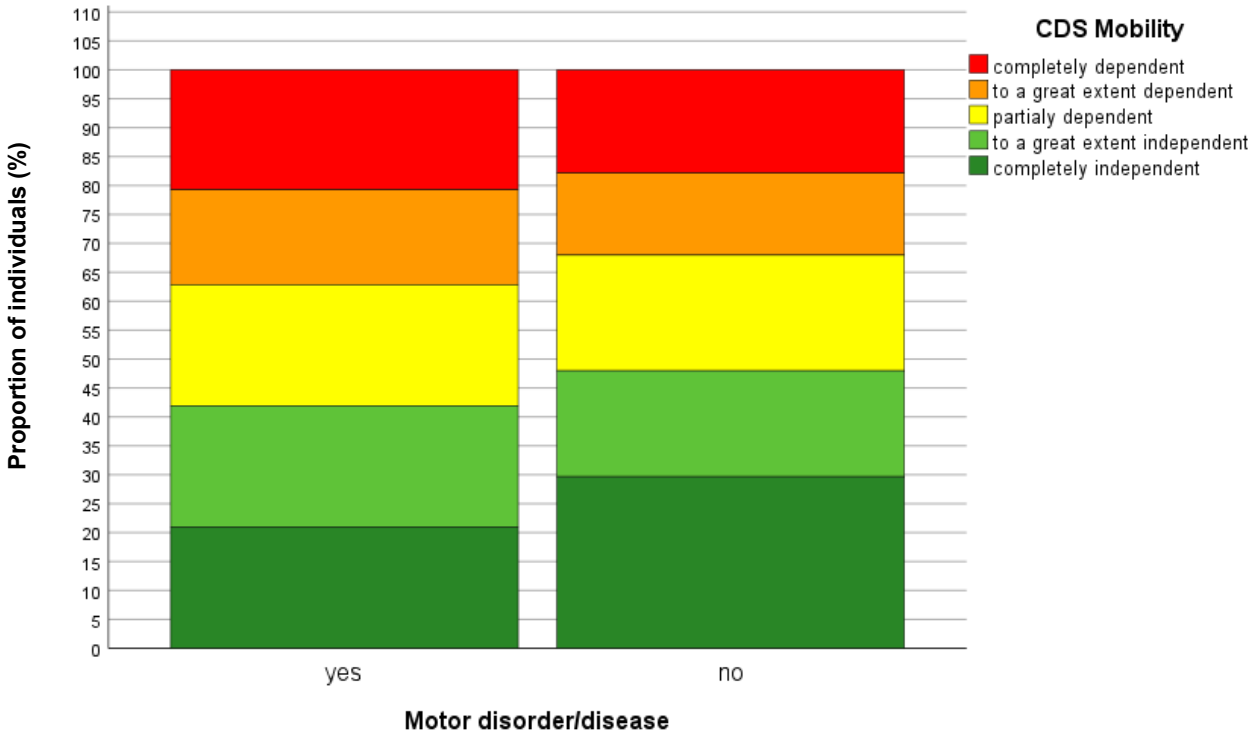

Figure 12: *CDS (Mobility) Score and Musculoskeletal Disorder*

4.4.1 Stratified by Age Groups

Among individuals with a musculoskeletal disorder aged 80–84 years, 28.2% are “completely independent”. This decreases to 20.1% in those aged 85–89 and to 12.8% in the 90+ group. The score, “to a great extent independent”, declines by 1.3% from the age group 80–84 to individuals 90+ years. In contrast, “partially dependent” increases overall by 1.9% across all three age groups. The prevalence of “to a great extent dependent” is 15.2% in the 80–84 age group, rising to 15.9% in the 85–89 group and 18.5% in those aged 90 and above. “Completely dependent” is observed in 15.9% of the youngest group, 20.6% in the middle group and 27.4% in the oldest. (**Figure 13**)

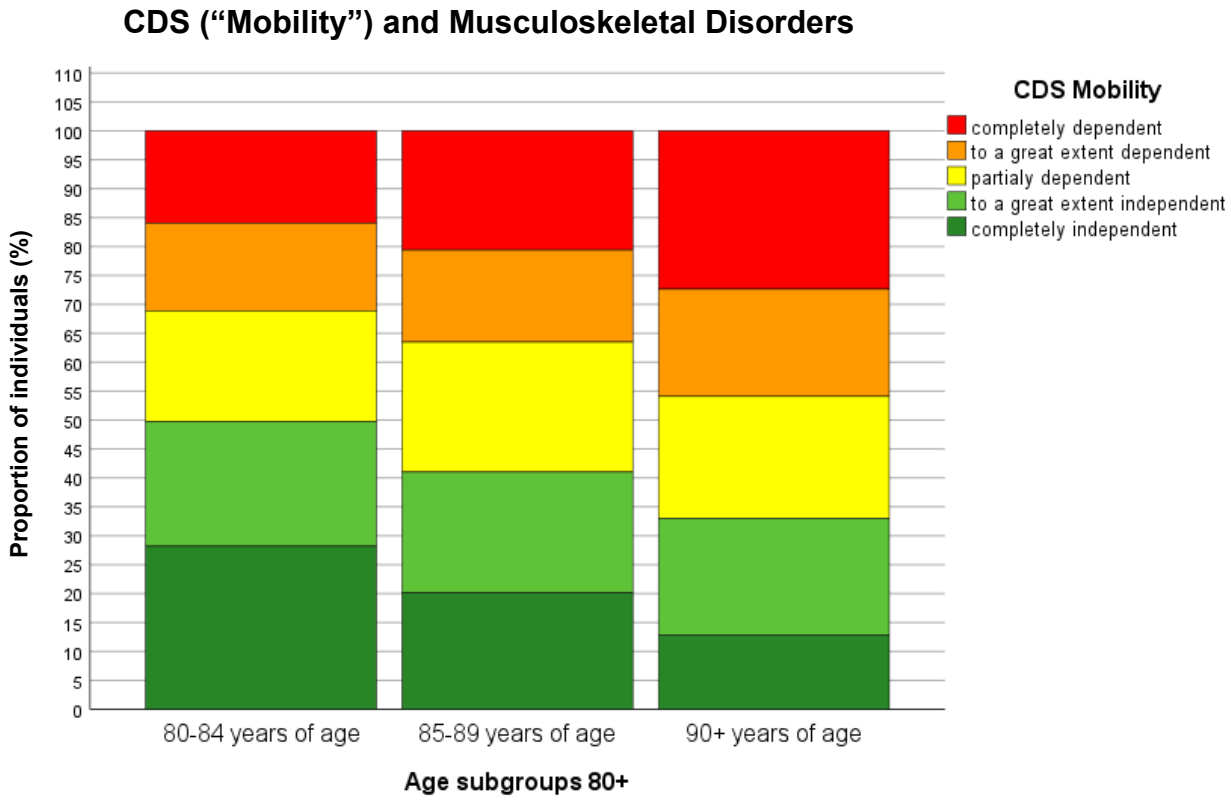

***Figure 13**: CDS (Mobility) Score and Musculoskeletal Disorder in Age Groups*

In those patients and residents who are not affected by musculoskeletal disorders, it was shown that individuals aged 80–84 years are “completely independent” in 39% of cases. (**Figure 14**) This proportion decreases to 26.5% in the 85–89 group and to 16.9% in individuals aged 90 and above. “To a great extent independent” shows a decline of 1.3 percentage points across the age groups. In contrast, “partially dependent” increases by 1.9 percentage points. Regarding the score “to a great extent dependent”, 12.9% of individuals aged 80–84 fall into this category. The prevalence rises to 14.0% in the 85–89 group and 16.9% in those aged 90+. “Completely dependent” is observed in 15.9% of the 80–84 group, 20.6% of the 85–89 group and 27.4% of individuals aged 90 and older.

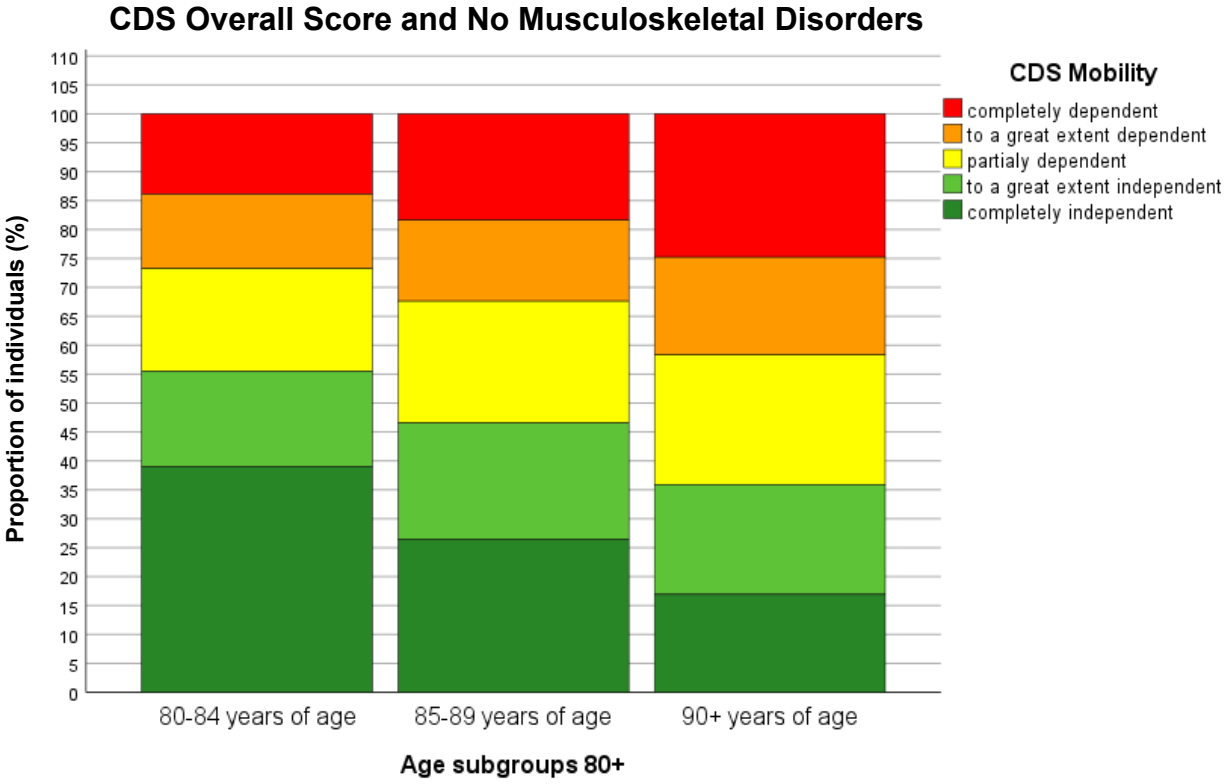

Figure 14: *CDS (Mobility) Score and No Musculoskeletal Disorder in Age Groups*

Table 6 presents differences in the CDS “Mobility” scores between individuals with and without musculoskeletal disorders. Among those aged 80–84 years, 28.2% with musculoskeletal disorders were “completely independent,” compared to 39.0% without. In the 85–89 group, this proportion was 20.1%, compared to 26.5%. Among those aged 90 and older, the rate was 12.8%, compared to 16.9%.

In the 80–84 age group, a higher proportion of individuals with musculoskeletal disorders were classified as “to a great extent dependent” (15.2% vs. 12.9%) and “completely dependent” (15.9% vs. 13.9%). Among individuals aged 90 and older, the prevalence of “to a great extent dependent” was also higher in those with musculoskeletal disorders (18.5% vs. 16.9%). In contrast, the proportion classified as “to a great extent independent” was slightly elevated in all age groups with musculoskeletal disorders, most notably in the 80–84 year old group (21.5% vs. 16.5%).

Table 6: *CDS (Mobility) Score and Musculoskeletal Disorder (yes/no)*

	80+		80–84		85–89		90+	
	yes	no	yes	no	yes	no	yes	no
completely dependent	20.8%**	17.9%	15.9%*	13.9%	20.6%*	18.4%	27.4%	24.8%
to a great extent dependent	16.4%**	14.2%	15.2%**	12.9%	15.9%**	14.0%	18.5%**	16.9%
partially dependent	20.9%	19.9%	19.2%	17.7%	22.5%	21.1%	21.1%	22.4%
to a grat extent independent	20.9%**	18.3%	21.5%**	16.5%	20.9%**	20.1%	20.2%**	19.0%
completely independent	21.0%**	29.7%	28.2%**	39.0%	20.1%**	26.5%	12.8%**	16.9%

** p<0.001
* p<0.05

5 Discussion

This study aims to investigate the prevalence of people older than 80 years with a musculoskeletal disorder and the association between the CDS overall score and the items “Mobility” and “Body posture” with a musculoskeletal disorder. Furthermore, the prevalences and associations are presented separately for the age groups 80–84, 85–89, and 90+ years. For implementing targeted actions and further research, it is essential to know this fundamental data about motoric diseases and whether they are related to the mobility–oriented CDS items.

The age group distribution within the sample differs from that of the general Austrian population. In the sample, 39.9% of individuals are aged 80–84 years, 36.1% are aged 85–89 years, and 24.0% are aged 90 years and older. In contrast, the proportions in the Austrian population for those older than 80 years in 2025 are 54.62%, 30.47%, and 14.91%, respectively. Furthermore, the sample has a higher proportion of females than males in that age group, with 71.2% being female, which exceeds the female representation in the Austrian population for 2025 (61.17%) (66) . One reason for the higher proportion of older individuals in the sample compared to the general Austrian population is the recruitment of participants within the framework of the NQM. Since data is only gathered from individuals in inpatient care, and the risk of hospitalization increases with age, it leads to an overrepresentation of people in higher age groups.

The difference in the gender distribution is not as clear or easy to explain as the age distribution, and various factors influence it. The Austrian Health Report 2022 presents that in Austrian hospitals, 55% of patients were female. Interestingly, women show higher inpatient care rates only between 15 and 59 years old, while men receive more inpatient care after age 60. One reason for the difference could be the hospitalisation due to giving birth. Nevertheless, this challenges the assumption of a generally higher prevalence among women, as evident in this data. It should be noted, however, that the oldest age group for which hospitalisation by gender is calculated is 75 and older, which could distort the data, as the female proportion increases, especially among older adults. In rehabilitation settings, women make up 49% of patients (43).

The Austrian Health Report 2022 adds furthermore that 63% of long-term care allowance recipients are female and 37% male and these women tend to be older (56% are 80 years or older). Women also use home care services more often than

men (43). A German study further supports this, indicating that institutionalization rates for those 80 years or older are 102% higher for women (69).

When examining how the gender distribution changes across the age groups, it becomes apparent that the difference between the proportion in the sample and the Austrian population in the lowest age group is less pronounced. In the sample, the percentage is 63.7%, while the Austrian population has a rate of 58.4% among those aged 80–84 years old. The difference between the sample and the population gets more substantial with higher age. 73.4% of the 85–89 year olds in the sample are women, compared to 62.9% in the population. Comparing the oldest age group, the difference becomes even more pronounced, with 80.3% in the sample and 69.1% in the population (66). As previously discussed, the older age groups also present higher proportions in the sample.

When examining the Healthy Life Expectancy (HLE), it initially seems counterintuitive that the proportion of women in hospitals and long-term care is higher than that of men in the NQM 2.0, as the HLE is higher for females (61.3) than for males (60.6) (6). This might suggest that females remain healthier for longer and therefore require less inpatient care. However, the life expectancy is also higher for women than for men (84.6 vs. 79.5) (4). When calculating HLE as a percentage of the overall life expectancy, females have lower scores than men (72.5% vs. 76.2%). In other words, females spend a larger proportion of their lives in poor health compared to males, which could have contributed to the observed differences

Taking all that into account, it is the overrepresentation of older age groups in general and the overrepresentation of women within these older age groups that leads to a higher proportion of women in the overall sample.

According to the data, aging is associated with an increased prevalence of musculoskeletal disorders. Nearly 4 out of 10 individuals aged 80 and older are affected. Among those over 90, the number rises to more than 4 out of 10. In percentage points, it is 9% higher than in the 80–84 age group.

Data from Statistik Austria also indicate that almost 1 in 10 hospitalizations is due to a disease of the musculoskeletal system (9.4%), making it the fourth most common cause of acute hospital admission in 2022 (70). Additionally, nearly half of all

rehabilitation stays in 2021 were related to diseases of the musculoskeletal system (45%) (43).

The higher prevalence observed in the sample is likely due to the setting. Many patients receiving inpatient care have comorbid musculoskeletal conditions in addition to their primary diagnosis. Although these are not the main reason for admission, they are still recorded in the NQM.

It is also important to note that this study exclusively includes the data of individuals aged 80 and above. Since the risk of developing a musculoskeletal disorder increases with advancing age, as observed in both this analysis and previous studies, the prevalence is likely also higher due to the sample. For example, Cai et al. report a rise in the prevalence of hallux valgus (M20) in older age groups (46). Similarly, Hitzl et al. found higher rates of osteoarthritis (M15–19) in older populations using data from the Austrian Health Interview Survey (47).

Nevertheless, the high prevalence of musculoskeletal disorders in both the study sample and the general Austrian population underscores their public health relevance and widespread occurrence.

When considering the overall score of the CDS concerning musculoskeletal disorders, no significant differences are observed among individuals classified as “completely dependent”. In contrast, all other CDS scores present a significant difference between those with and without a musculoskeletal disorder.

Notably, individuals aged 80–84 are less frequently “completely independent” when a musculoskeletal disorder is present (32.0% vs. 40.5%). A similar pattern is observed across other age groups, where the percentage of individuals who are “completely independent” is consistently higher among those without a musculoskeletal disorder. In every other score, the prevalence is higher in the group with a musculoskeletal disorder.

For example, the score category “partially dependent” shows noticeable differences in the 80–84 groups (20.5% with vs. 17.3% without a musculoskeletal disorder), indicating greater care dependency for those with musculoskeletal disorders. This further emphasizes the reduced independence associated with such conditions. Moreover, in the oldest age group (90+), the proportion of “to a great extent dependent”

individuals is markedly higher among those with musculoskeletal disorders (27.4% vs. 24.6%). All this supports the assumption that musculoskeletal disorders are associated with increasing care dependency in older age groups.

The Results show that care dependency rises with advancing age. This parallels the age-related increase in the prevalence of musculoskeletal disorders that is seen in this and previous studies. It further reinforces the observed associations between aging, functional decline, and care dependency (29,30).

Similar patterns are also observed in the CDS items, “Body posture” and “Mobility”, both of which demonstrate a shift to higher care dependency in the presence of a musculoskeletal disorder. In the item “Body posture”, no significant difference is found in the score “completely dependent”. However, the proportion of completely independent individuals is lower when a musculoskeletal disorder occurs. Nearly all other scores show higher prevalences in individuals with a musculoskeletal disorder. The only exception is the score “to a great extent dependent” in those aged 90 years or older.

A significant difference can be seen in the score “completely dependent” in the “Mobility” item when comparing individuals with and without a musculoskeletal disorder. People with a musculoskeletal disorder are more often completely dependent on this item across the age groups 80+, 80–84 and 85–89. However, the observed difference ranges only between 2% and 3%, which raises questions about its clinical relevance.

What appears more clinically relevant is the difference between completely independent individuals. In the 80–84 age group, the prevalence of being completely independent is up to 10.8% lower in people with a musculoskeletal disorder. As observed in “Body posture” and the overall CDS score, most of the remaining scores in the item “Mobility” also show higher prevalences in individuals with a musculoskeletal disorder. However, the difference between those with and without musculoskeletal disorders is not as pronounced in the other scores as it is in “completely independent”.

The data, therefore, indicates that diseases of the musculoskeletal system and connective tissue do not lead to a clinically relevant increase in the prevalence of complete dependency. Neither in the overall CDS score nor in the items “Body posture”

and “Mobility”. One explanation for this is the scoring system of the CDS. When someone gets rated as “completely dependent” in “Mobility”, the person is unable to move independently, even with walking aids (walker, rollator, cane, crutches). In the item “Body posture”, complete dependency implies the inability to hold a posture appropriate to the situation.

Although musculoskeletal disorders are associated with greater care dependency, as shown in this study, they do not always result in complete dependency. This is because most conditions within this ICD–10 chapter do not influence mobility to that extent. The broad category of diseases of the musculoskeletal system and connective tissue include major conditions, but also diseases such as rhizarthorsis (M18), hallux valgus (M20.1), wrist drop (M21.3), claw hand (M21.5), flat back syndrome (M40.4), scoliosis (M41), muscle injuries of the upper extremity (general), calcific bursitis (M71.4) and tendinitis of the biceps brachii muscle (M75.2). These conditions are unlikely to result in complete dependency and, in many cases, do not substantially affect independence as defined by the “Mobility” and “Body posture” scoring.

Since around 4 out of 10 individuals aged 80 years or older have a diagnosed musculoskeletal disorder, and care dependency is higher among those affected, it is crucial to prioritize the prevention of musculoskeletal disorders, both in elderly individuals and younger age groups. Although these disorders do not significantly increase the prevalence of complete dependency as much, they contribute to greater overall care needs.

Furthermore, van der Zee–Neuen et al. reported lower scores on the Physical Component Summary (PSC) among individuals with a musculoskeletal disorder (45). The PSC is a self–reported measure of general physical health, including aspects such as walking, climbing stairs, pain during daily activities, and limitations in usual work (72). Particularly in the presence of additional chronic diseases, the negative impact on physical health is amplified, regardless of how many comorbidities co-occurred (45).

As outlined in the introduction of this study, increased care dependency is consistently associated with higher demands on healthcare resources. These include human resources, such as qualified health professionals (eg., physiotherapists, nurses and occupational therapists) and physicians, as well as structural capacities like hospital

beds, long-term care and rehabilitation facilities. Notably, the average hospital bed occupancy in Austria is already at 70.7% (44). Financial resources are also under pressure, with projected healthcare expenditure expected to rise by 6.3 billion € before 2030 (4).

All of those factors are likely to be further impacted by demographic changes, particularly the growing proportion of elderly individuals, which will likely result in a higher absolute number of people living with musculoskeletal disorders.

5.1 Strengths and Limitations

The analysis in this study includes data from 14 years (2009–2023) and therefore provides a sample that enables subgroup analyses and leads to a high statistical power. Additionally, the study utilizes real–world data, meaning data collected directly from patients rather than estimated through a demographic projection, which leads to a high external validity.

Since the NQM applies standardised Instruments for data collection, comparison across institutions and participating countries would be possible. This could help identify differences in the prevalence of musculoskeletal disorders and care dependency as measured by the CDS. Calculating only prevalences contributes to the robustness of the findings, and, assuming consistency in the collection methods, these results can be used for longitudinal comparisons in future periods.

However, due to the cross-sectional study design, no conclusions regarding causality or risk factors can be made. The observed prevalences only suggest associative patterns between musculoskeletal disorder and the CDS overall score or the specific items “Body posture” and “Mobility”. To give statements about causal relationships, a different study design would be required and could be addressed in future research.

Moreover, the use of secondary data analysis already limits the study, as the primary data was not collected specifically to answer this study’s research questions. Nevertheless, secondary data analyses offer advantages such as being time- and cost-efficient, since no new data collection is needed.

It should also be noted that the data collection was restricted to hospitalized individuals. As a result, the findings are not generalizable to individuals outside inpatient care settings. This limitation is also reflected in the differences in prevalence between the study sample and the Austrian general population.

6 Implication for practice

To translate these findings into improvements in care, they must be applied in a practical context through evidence-informed interventions. As the data show a decline in physical function and an increase in musculoskeletal disorders with age, interdisciplinary collaboration must be prioritized. In particular, physiotherapists and occupational therapists should be integrated into long-term care structures to prevent or manage mobility impairments and to carry out interprofessional mobility assessments. Given the complex and often multimorbid functional profiles of older adults with musculoskeletal disorders, interprofessional approaches and shared decision-making are essential. Those should actively involve physiotherapists and occupational therapists to ensure that care goals are both functionally realistic and include patient preferences and priorities.

Furthermore, mobility preservation must become a routine in geriatric treatment and should start before the first signs of mobility restrictions even develop. Especially, fall prevention and strength training must be implemented in all inpatient care facilities. This would reduce the risk of functional decline and avoid secondary complications associated with falls. Achieving this requires regularly conducted mobility screening supported by standardised and structured programs for fall prevention and strength training. Moreover, they must be implemented as part of standard practice in routine care.

To enable these measures, healthcare policymakers must expand the capacity of rehabilitation services. Demographic projections predict a substantial rise in the number of elderly individuals requiring care. A proportional increase in trained physiotherapists and occupational therapists is therefore needed. At the same time,

working in geriatrics must become more attractive, especially for younger healthcare professionals, which can be achieved through improved training and support.

Finally, to reduce the burden on healthcare providers, educational programs for family members of patients must be integrated into multicomponent care strategies. These programs should cover the management of mobility limitations and emphasize the importance of structured evidence-based physical activity programs.

7 Conclusion

This study underscores the high prevalence of musculoskeletal disorders in individuals aged 80 years and older and their clear association with increased care dependency. While these disorders do not necessarily lead to complete dependency, they significantly reduce independence in key functional domains measured by the CDS, particularly mobility and body posture. These findings highlight the critical need for targeted preventive strategies and early interventions to maintain physical function and delay the onset of care dependency in older adults.

Given the aging population and the projected burden on the healthcare system, preserving musculoskeletal health and, consequently, mobility must become a central priority in public health planning. Promoting physical activity, fall prevention and access to rehabilitation care could help reduce the long-term burden on health services and improve the quality of life of the elderly.

The high prevalence of musculoskeletal disorder and their measurable impact on care dependency are a clear call to action for both policymakers and healthcare providers. As the proportion of older adults in the population continues to rise, failing to address musculoskeletal health is not an option. It would result in higher care costs and, equally important in reduced autonomy and well-being for the elderly, a fast-growing population of society.

Future Research should go beyond prevalence data and examine correlations between musculoskeletal disorders and care dependency, particularly the items “Mobility” and Body posture” by using longitudinal designs. Moreover, incorporating other tools assessing the mobility of individuals could enhance the understanding of

the impact of musculoskeletal disorders on independence and functional health. Additionally, the association between individual musculoskeletal and connective tissue diseases and mobility should be examined. Not every condition affects mobility to the same extent. Therefore, it is of interest to identify those with stronger correlations or even causal links in individuals aged 80 and older. This could support the development of more targeted preventive strategies even further.

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For linguistic and stylistic optimization, the following AI–based tool was used:

• Name and version: ChatGPT, GPT–4

• Provider: OpenAI

• Date of content generation: [27.08.2025]

• Address (URL): https://chat.openai.com”