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# CONFRONTING AGEISM IN HEALTHCARE

**GUPTA  
STRATEGISTS**



Edwards Lifesciences



**CONFRONTING AGEISM  
IN HEALTHCARE**



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# Executive summary

The Dutch population is experiencing a significant demographic shift, with the number of inhabitants aged 65 and above (currently ~3,5 million people) expected to increase by over one million in the next 20 years. Advances in healthcare and living conditions mean that those reaching 65 years of age today can, on average, expect to live into their 80s in good health. This extended lifespan introduces a third life phase, characterized by opportunities for continued participation in society and personal fulfillment.

As the population of the Netherlands ages, the healthcare system faces significant challenges in providing equitable and effective care to older patients. This paper investigates the impact of ageism on healthcare delivery, specifically focusing on the issues of underdiagnosis and undertreatment among individuals aged 65 and over – which appear to affect a significant proportion of this demographic.

By implementing targeted policy changes, awareness campaigns, educational reforms, and focused research, the healthcare system can better support the aging population, ensuring that the additional years of life are not just longer, but healthier and more fulfilling. This paper highlights the urgency of these actions and serves as a call to action for mitigating the impact of ageism on healthcare delivery.

## Key Insights

- **Scope of potential impact of ageism in health care**

- Just as in other parts of society, ageism is broadly present in healthcare. For example, we found that out of all 519 formally registered clinical guidelines, 62 provide recommendations that state that “age” or being “of older age” should be a variable in diagnostic or treatment choices. This likely reflects routine clinical practice, where perceptions and biases that may exist both in patients and health care professionals may lead to suboptimal care.
- Ageism in healthcare leads to inappropriate variations in care, significantly affecting the health outcomes and quality of life of older adults. Our study estimates that between 450-650k patients aged 65+ (representing 14-19% of this demographic group) may be affected by underusage of care - making it a critical public health issue.
- We estimate that underusage of care leads to a reduced contribution to GDP of between EUR6-9k per year per person, or EUR 3-6bln total in the Netherlands.
- This demographic group is also a major provider of informal care. Consequently, we estimate that underusage of care in this age group leads to a 10-15mln hours reduction in informal care potential, i.e. the equivalent of 6-9k fulltime workers.

- **Underlying causes of underusage of care due to ageism**
  - Misattribution of symptoms to ageing rather than to treatable disease (by patients or health care professionals) leads to missed or delayed diagnoses, significantly impacting health outcomes and quality of life for older patients.
  - Misconceptions about frailty. Importantly, while prevalence of frailty increases with age, most people at any age are not frail. Misjudging frailty can lead to suboptimal care, with non-frail individuals being denied beneficial interventions and frail individuals receiving overly aggressive treatments. Accurate frailty assessment informs better clinical decision-making, ensuring that care is matched to the patient's true health status rather than assumptions based on age alone.
  - We identified policy and resource allocation, awareness and communication barriers, insufficient training and underrepresentation in clinical trials as underlying causes.
- **Case in point: aortic valve stenosis**
  - A case study on aortic valve stenosis, a significant health concern for older adults in the Netherlands, shows that despite advancements in treatment, substantial gaps in diagnosis and treatment persist.
  - This case study also shows the difficulty of zooming in to this level – the evidence for underusage of care is there, but conclusively proving ageism as a causal factor for these effects is difficult with currently published research. As a future course of study, it would be very interesting to examine this causality further.
- **Mitigation strategies should focus on reducing the number of people affected by suboptimal care due to ageism**
  - **Policy recommendations:** develop and implement age-neutral healthcare policies that prioritize clinical need and potential benefit over age. Policies should ensure adequate resource allocation for care for older people, including funding for capacity-enhancing innovations (CEI). Promoting research into new medical technologies and treatments that address the specific health challenges faced by older people is crucial for driving progress in geriatric care.
  - **Awareness campaigns:** launch initiatives aimed at both healthcare providers and the general public to highlight the importance of equitable healthcare for older people and reduce ageist biases. Educational campaigns can inform about the value and contributions of older adults, encouraging more respectful and inclusive attitudes towards aging.
  - **Educational reforms:** integrate comprehensive geriatric care into medical curricula to improve diagnosis and treatment of older patients. This will ensure that healthcare providers are well-equipped to understand the complexities of aging, manage multiple comorbidities, and accurately assess and treat frailty.
  - **Focused research:** very often, older participants are excluded from research studies, even in some disease areas that affect them the most. It is essential to specifically include older adults in clinical trials to ensure treatment recommendations are relevant and effective for this growing age group. Guidelines should not position numerical age as a clinical decision factor if it can be avoided. Further, it would be valuable to specifically study the use of screening tools in non-frail populations, rather than applying age cut-offs.



CHAPTER 1

**Introduction**

## 1.1 We are living longer in good health – and massively so

The population of the Netherlands, like many other developed countries, is aging rapidly. This demographic shift presents significant challenges and opportunities for the healthcare system. With advancements in medical science and improved living conditions, people are not only living longer but are also enjoying extended periods of good health. As a result, those reaching 60 years of age today can expect to live well into their 80s, often with a good quality of life. Figure 1 shows that soon, both men and women aged 65 are projected to live on average another 20 years, of which 15 years without physical handicaps.

**Projections of healthy life expectancy for men and women aged 65**  
[CBS 1981-2023; extrapolated to 2030]

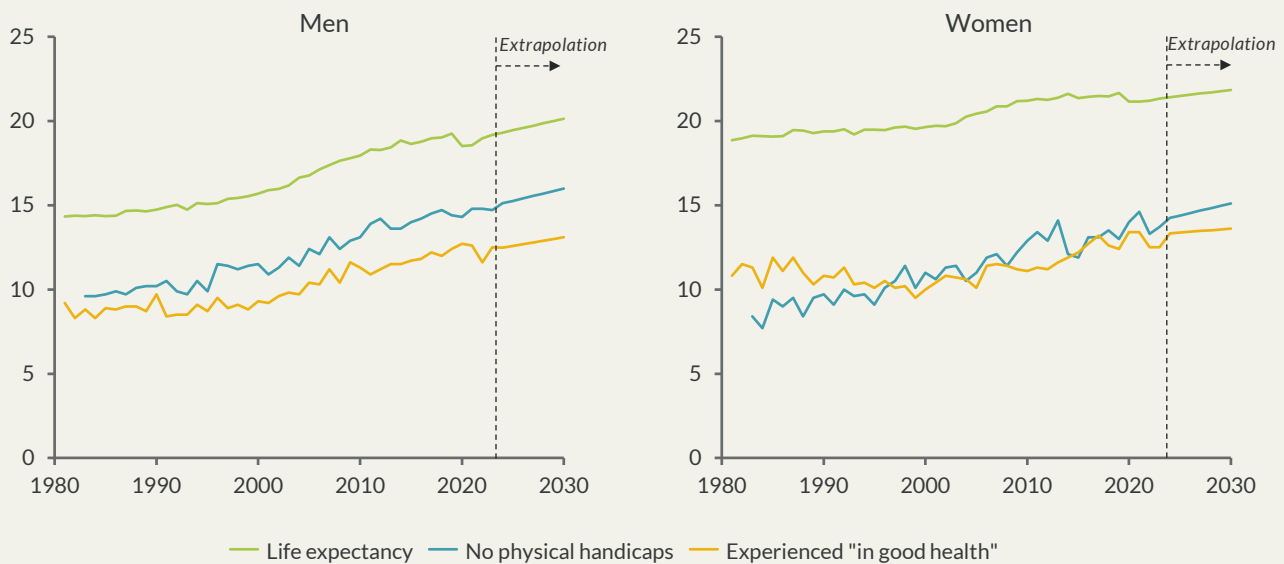


Figure 1: projections of healthy life expectancy for men and women aged 60. Source: [CBS](#)

The magnitude of the shift that is happening cannot be overstressed. Figure 2 shows that in the next 20 years, the Netherlands will see its populations of people aged 65+ grow by more than one million – while over the same time period, the rest of the population will barely grow.



### Population by age group [Million inhabitants]

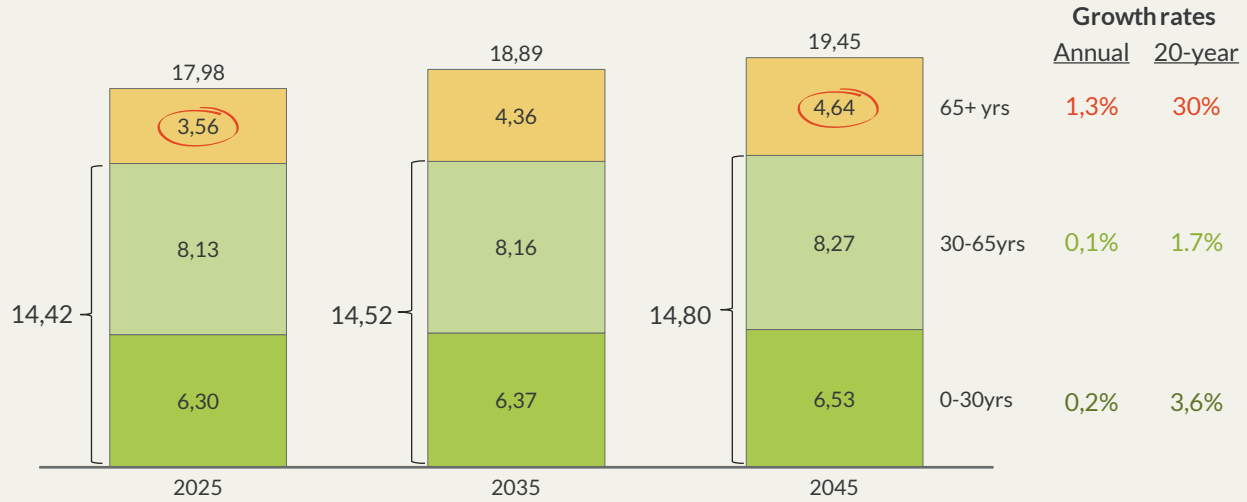


Figure 2: projected population in the Netherlands by age group. Source: [CBS](#)

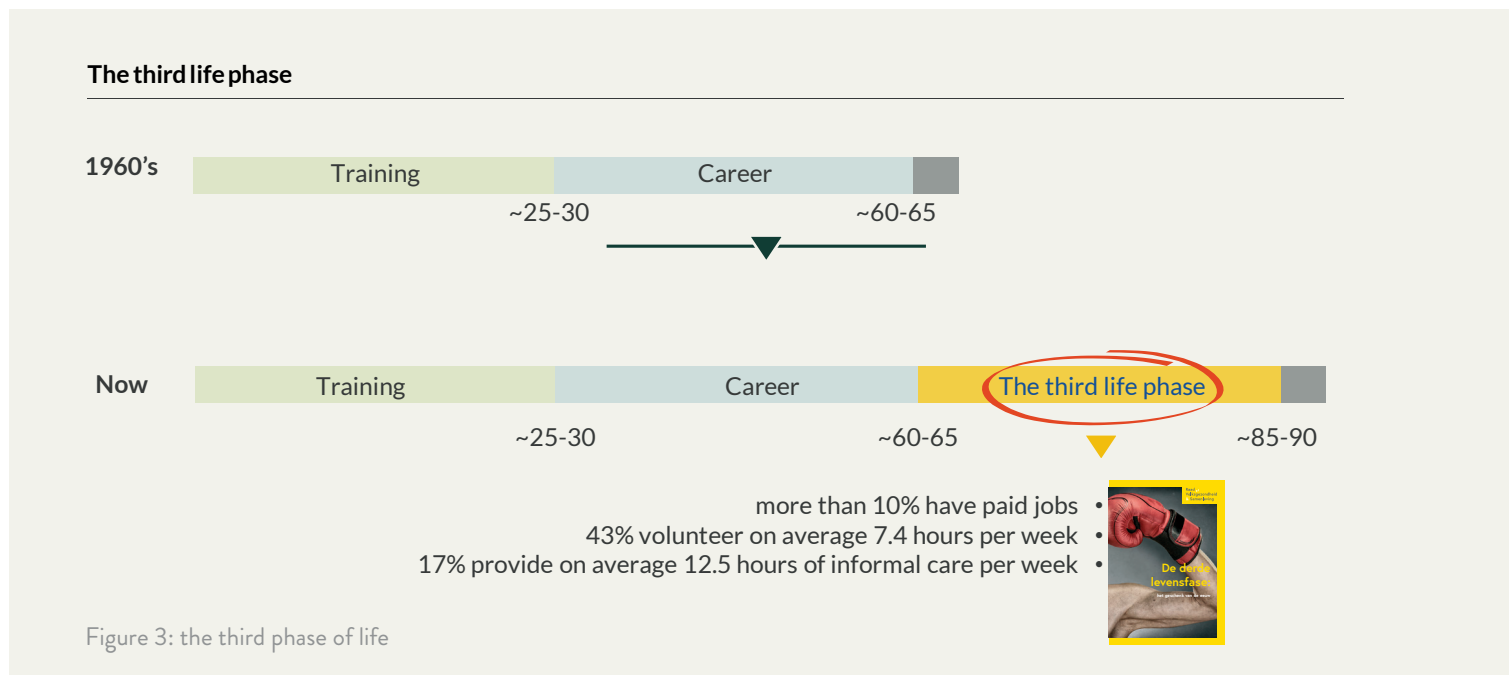
## 1.2 The third phase of life – gift of the century

In its report *The Third Phase of Life: the Gift of the Century*, the Dutch Council on Public Health and Society recognizes this trend, and analyzes that this ever-expanding period between our working life and the period of advanced old age and vulnerability implies that our society is being given a third phase of life.<sup>1</sup> Whereas in the past, people were often worn out after retirement, in poorer health and in need of rest, this is today no longer the case for many retired people. People are often still healthy and vital, and provide vast contributions to their environment through employment, volunteer work and caregiving.

The third life phase starts after retirement and eventually progresses to the fourth phase of life, as vulnerability and the need for help and care increase. The third phase of life is not strictly tied to ages. When it starts and how long it lasts varies from person to person.

At present, both policy and public opinion pay more attention to what older people need than to what older people can and want to contribute. In its report, the Council concludes that, “at present, the design of the third phase of life is seen primarily as an individual matter. Everyone shapes this period of life according to their own insights and within their own possibilities, or lack thereof. This leads to missed opportunities for young seniors’ participation in and contribution to society. Authorities, civil society organizations and companies can contribute to young seniors playing more social roles than they are currently doing. This can be done by removing thresholds to, for example, group living or continued paid work. A good third phase of life thus becomes more of a common responsibility.”

1 See [link](#), with English summary [here](#)



A previous report by Edwards Lifesciences, *Unifying Generations*, underscores these conclusions.<sup>2</sup> Based on a broad survey in several European countries, the report highlights how seniors, often seen as a burden, are in fact pivotal as carers, volunteers, and mentors. Their role in fostering intergenerational solidarity and providing essential support to families and communities is crucial. In its study on the Silver Economy<sup>3</sup>, the European Commission estimated that the segment of the population aged 50 and over will sustain approximately EUR 30k per person of GDP in 2025.

The report by the Dutch Council on Public Health and Society, referenced above, confirms these findings<sup>4</sup>. They found, for example, that 43% of people in their third life phase volunteer on average 7.4 hours per week, and over 10% of them have paid jobs.

In addition, 17% provide on average 12.5 hours of informal care per week. This translates to 7.5 million hours of care per week, which, if the current percentages remain true, will increase by an additional 2.3 million hours of informal care over the next 20 years – the equivalent of over 60k additional full time workers.

To fully benefit from this demographic shift, societal and policy perspectives must evolve to support the health, engagement, and well-being of older adults. A significant obstacle to doing so is coming to terms with, and then overcoming, ageism.

<sup>2</sup> See [link](#)

<sup>3</sup> See [link](#)

<sup>4</sup> See [link](#), with English summary [here](#)

### 1.3 Ageism is a significant barrier to benefitting from the third phase of life

In its *Global Report on Ageism*, the WHO defines ageism as stereotypes (how we think), prejudice (how we feel) and discrimination (how we act) towards people on the basis of their age.<sup>5</sup> Ageism can be institutional, interpersonal or self-directed. Institutional ageism refers to the laws, rules, social norms, policies and practices of institutions that unfairly restrict opportunities and systematically disadvantage individuals because of their age. Interpersonal ageism arises in interactions between two or more individuals, while self-directed ageism occurs when ageism is internalized and turned against oneself.

In its report, the WHO concludes that “Globally, one in two people are ageist against older people. In Europe, the only region for which we have data, one in three report having been a target of ageism, and younger people report more perceived age discrimination than other age groups. For older people, ageism is associated with a shorter lifespan, poorer physical and mental health, slower recovery from disability and cognitive decline. Ageism reduces older people’s quality of life, increases their social isolation and loneliness (both of which are associated with serious health problems), restricts their ability to express their sexuality and may increase the risk of violence and abuse against older people.”

Of note, ageism may be exacerbated by other sources of inequality. For example, the WHO concludes that “disparities have been documented in terms of older women’s access to preventive care and treatment. Multiple studies conducted in the United States have reported that older men generally receive more thorough medical examinations, more follow-up and more evidence-based medical care than women do, and men are also more likely to receive preventive care”

<sup>5</sup> See [link](#)

## 1.4 This study focuses on consequences of ageism in healthcare

Ageism in healthcare refers to the systematic application of age-related stereotypes and biases that lead to inappropriate variations in care. This can result in both overusage and underusage of healthcare for older adults:

- **Overusage:** the unnecessary or excessive application of medical interventions that may not benefit or could harm an older patient. This may occur, for example, when patient wishes are insufficiently known or taken into account, or frailty is not factored into decision making. For example, in a previous study on the value of palliative care, Gupta Strategists has reported that in the final phase of life there is too often a focus on curative care rather than palliative care, leading to suboptimal quality of life and, especially in the last 30 days before death, increased pressure on critical hospital capacity such as emergency care and intensive care units.<sup>6</sup>
- **Underusage** on the other hand, refers to the insufficient or delayed provision of necessary medical treatments, often based on assumptions about an individual's health or life expectancy due to their age.

The topic of overusage of care has already been significant focus of study and healthcare policy. Underusage as a consequence of ageism, however, is an equally important phenomenon that deserves more spotlight than is typically granted. This paper, therefore, focuses on the latter.

## 1.5 Objectives of this study

This study aims to investigate the impact of ageism on healthcare delivery in the Netherlands, specifically focusing on the issue of underusage of healthcare among individuals aged 65 and over. By analyzing the prevalence of common conditions and estimating the number of older patients affected by these issues, the study seeks to highlight the significant healthcare gap that needs to be addressed. Furthermore, it explores the underlying causes of ageism in healthcare and proposes mitigation strategies to improve healthcare equity for all ages.

<sup>6</sup> See [link](#)

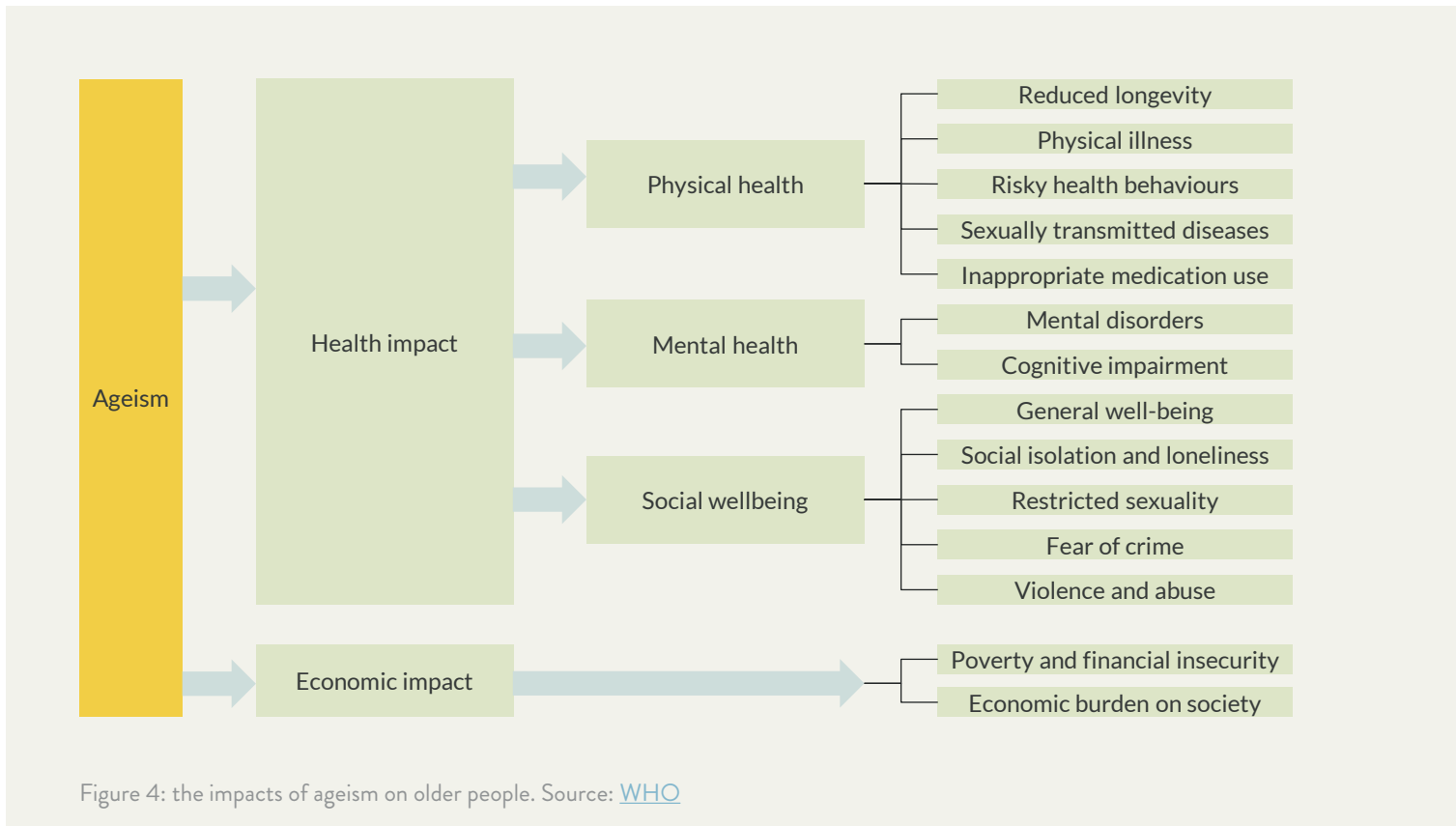


CHAPTER 2

**Ageism in healthcare**

## 2.1 Consequences of ageism in healthcare

Ageism has a serious impact on all aspects of health, which is defined by WHO as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (Figure 4).



A systematic review on the impacts of ageism on health which the WHO commissioned for its report found that in 96% (402 out of 405) of studies ageism was associated with worse outcomes in all of the health domains examined.<sup>7</sup> For example, it found that ageism was associated with earlier death – a finding consistent across 10 included studies. Ageism, it further concluded, is also linked to poorer physical health, and it impedes recovery from disability.

<sup>7</sup> For a report on this systematic review, see [link](#).

## 2.2 Advanced age does not equal frailty

To understand how age-related stereotypes and biases may lead to suboptimal care, and to devise mitigation strategies, it is important to understand the concept of frailty.

Frailty is a complex clinical syndrome characterized by decreased physiological reserve and increased vulnerability to stressors.<sup>8</sup> Frailty is associated with increased mortality, hospitalization, falls, and admissions to long-term care.

It is not synonymous with aging, but rather a distinct condition that can affect individuals differently depending on their overall health, lifestyle, and genetic factors. Frailty often presents on multiple dimensions, including physical weakness, slowed motor performance, unintended weight loss, exhaustion, and low physical activity levels. These characteristics make frail individuals more susceptible to stressors such as acute illnesses or surgeries, which can lead to severe complications, prolonged recovery times, or even mortality.

Assessing frailty in older patients is crucial for tailoring appropriate medical interventions and improving health outcomes. Various tools and methods have been developed to measure frailty, each with its unique focus and application. The most commonly used assessments include the Frailty Phenotype (FP) and the Frailty Index (FI).<sup>9</sup> The Frailty Phenotype, developed by Linda Fried and colleagues, identifies frailty based on five criteria: unintentional weight loss, self-reported exhaustion, weakness (measured by grip strength), slow walking speed, and low physical activity. An individual is considered frail if they meet three or more of these criteria. The Frailty Index, on the other hand, is a cumulative measure based on the proportion of health deficits an individual has out of a predetermined list, encompassing symptoms, diseases, and disabilities. Other tools such as the Clinical Frailty Scale (CFS) and the Tilburg Frailty Indicator (TFI) also provide valuable insights by combining clinical judgment with objective measurements.

A large study on Medicare data in the United States illustrates how frailty correlates with life expectancy at all ages (Figure 5). For example, at age 75, by far most non-frail persons have an average life expectancy of at least 10 years, whereas most frail persons do not.

<sup>8</sup> For a detailed review on the concept of frailty, see, for example, [link](#).

<sup>9</sup> See [link](#) and [link](#)

**10-year life expectancy by age and frailty**

[% surviving at least 10 years from given age, based on US Medicare data 1998-2014]

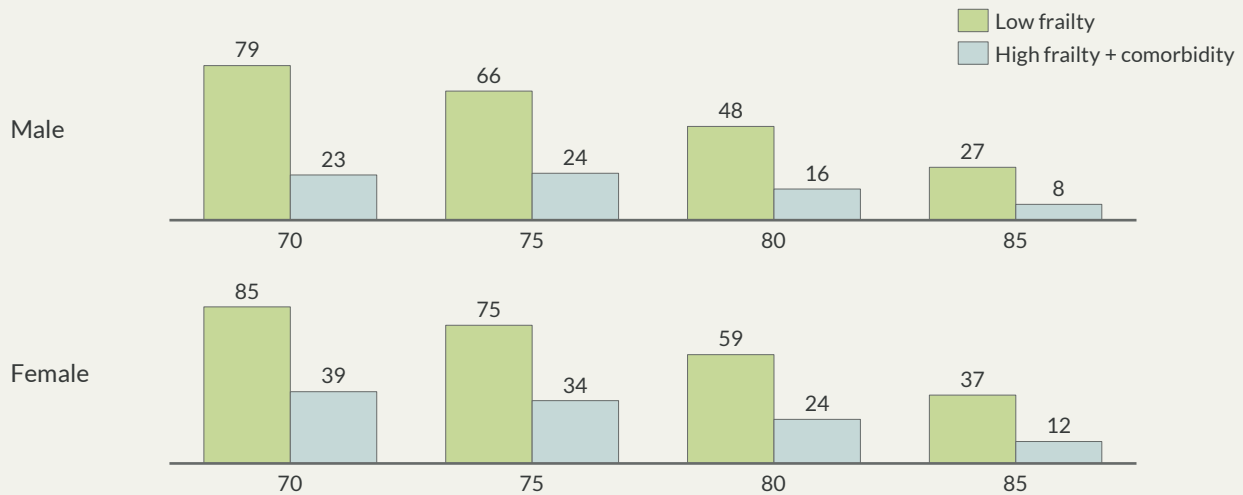


Figure 5: Even at very advanced age, a substantial proportion of non-frail persons can expect to live another 10 years. Source: [Schoenborn et al.](#)

Understanding frailty is crucial for addressing age-related stereotypes and mitigating their impact on healthcare delivery. Ageism often leads healthcare providers to assume that all older individuals are frail or incapable of benefiting from certain medical treatments, which can result in underdiagnosis and undertreatment. However, frailty is not an inevitable consequence of aging; many older adults maintain robust health and functional independence well into their later years. In fact, analysis by Vektis on routine healthcare data shows that, at any age, most people are not frail (Figure 6).



**Definition of frailty according to U-PRIM method**  
One of the following criteria apply...



**Multimorbidity**  
Frailty index > 0.20  
~ 7 multimorbidities from selection



**Polypharmacy**  
Chronical use of >5 types of medication



**Consultation gap**  
Not been seen by GP in > 3 years



**Geriatric giants**  
One or more geriatric giants apply  
E.g. incontinence, risk of falling

**Prevalence of frailty in Dutch population, living at home**  
[% frail, 2019]

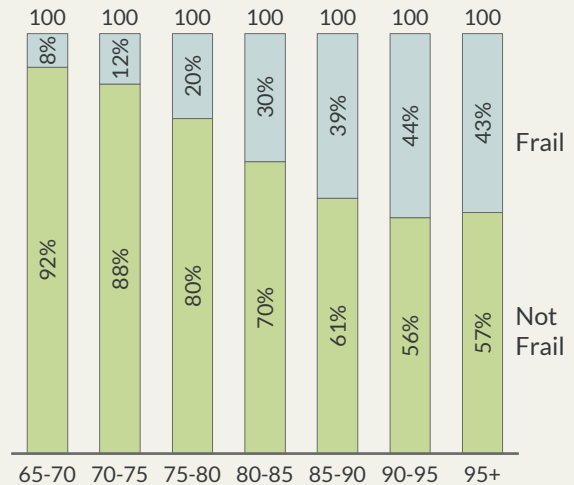


Figure 6: at any age, most people are not frail. Source: [Vektis](#).<sup>1</sup> For details on the U-PRIM measurement, see [link](#)

Misjudging frailty can lead to suboptimal care, where non-frail individuals are denied beneficial interventions, and frail individuals are subjected to overly aggressive treatments that pose greater risks than benefits.

Accurate assessment of frailty helps distinguish between older patients who can tolerate and benefit from intensive treatments and those who require more cautious, supportive care. It informs clinical decision-making, ensuring that interventions are appropriately matched to the patient’s physiological condition rather than their chronological age. By recognizing and addressing the nuances of frailty, healthcare providers can avoid the pitfalls of ageism, deliver more personalized and effective care, and ultimately improve the quality of life and health outcomes for older adults. This approach underscores the importance of comprehensive geriatric training and the integration of frailty assessments into routine clinical practice.

<sup>1</sup> Detailed analysis, available on the Vektis website, show that at any age, the percentage of women with frailty is slightly higher than the percentage of men with frailty. On average, frailty prevalence is 20% for women > 65 yrs, and 14% for men.

## 2.3 Nevertheless, age is often still a significant variable in clinical decision making

Despite substantial evidence that age does not equal frailty, and that prognosis and life expectancy is more dependent on other factors (such as frailty) than on mere numerical age, it is still often an important variable in clinical decision making.

To substantiate this, we evaluated the Dutch registry of hospital guidelines, and found that out of all 519 formally registered clinical guidelines, 62 provide recommendations that state that “age” or being “older” should be a variable in diagnostic or treatment choices (Figure 7)

### Analysis of all formally registered Dutch hospital care guidelines on the terms “age” or “being older” [n = 519 guidelines]

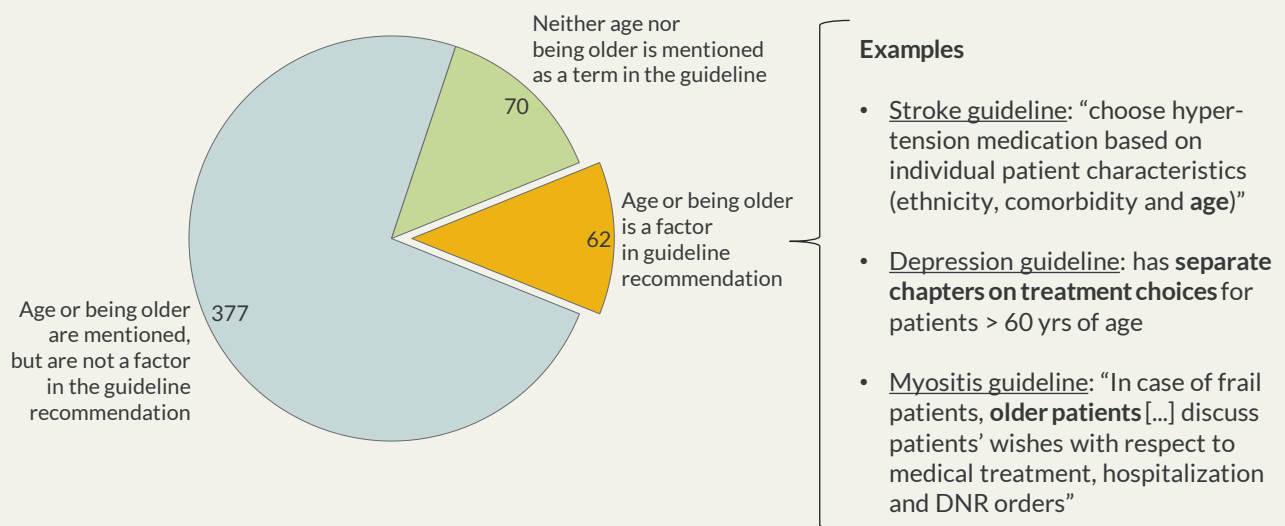


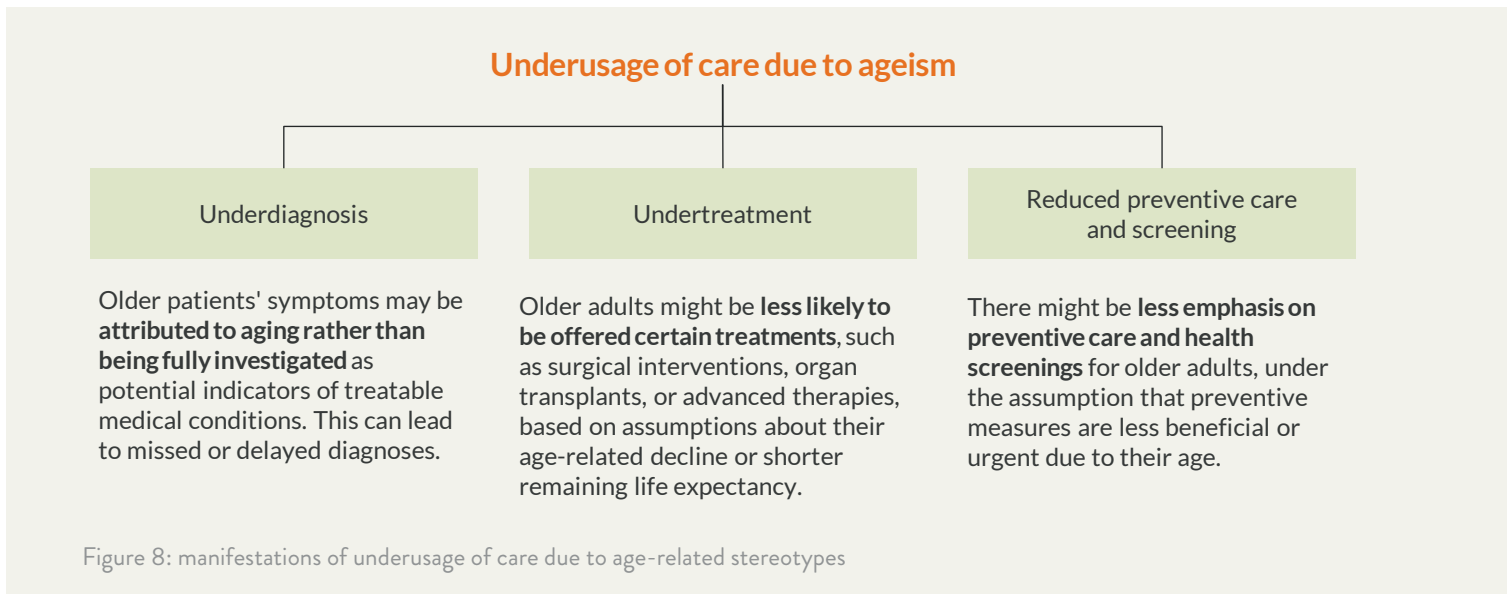
Figure 7: analysis of Dutch hospital care guidelines. Source: [Richtlijndatabase](#)

Thus, while there are also several examples of guidelines that explicitly state in their recommendations that age should not be considered as such, a substantial number of guidelines position age as an important clinical decision factor. This likely reflects routine clinical practice, where perceptions and biases that may exist both in patients and health care professionals may lead to suboptimal care.

## 2.4 There are three ways in which age-related stereotypes leads to under-usage

Conceptually, underusage of care due to age-related stereotypes can manifest in three ways:

- **Underdiagnosis:** symptoms in older adults are often misattributed to natural aging rather than being thoroughly investigated for underlying treatable conditions. This leads to missed or delayed diagnoses.
- **Undertreatment:** Older adults might be less likely to be offered certain treatments, such as surgical interventions, organ transplants, or advanced therapies, based on assumptions about their age-related decline or shorter remaining life expectancy.
- **Reduced preventive care and screening:** there is a lower emphasis on preventive measures and health screenings for older adults, stemming from the belief that these measures are less beneficial for this age group





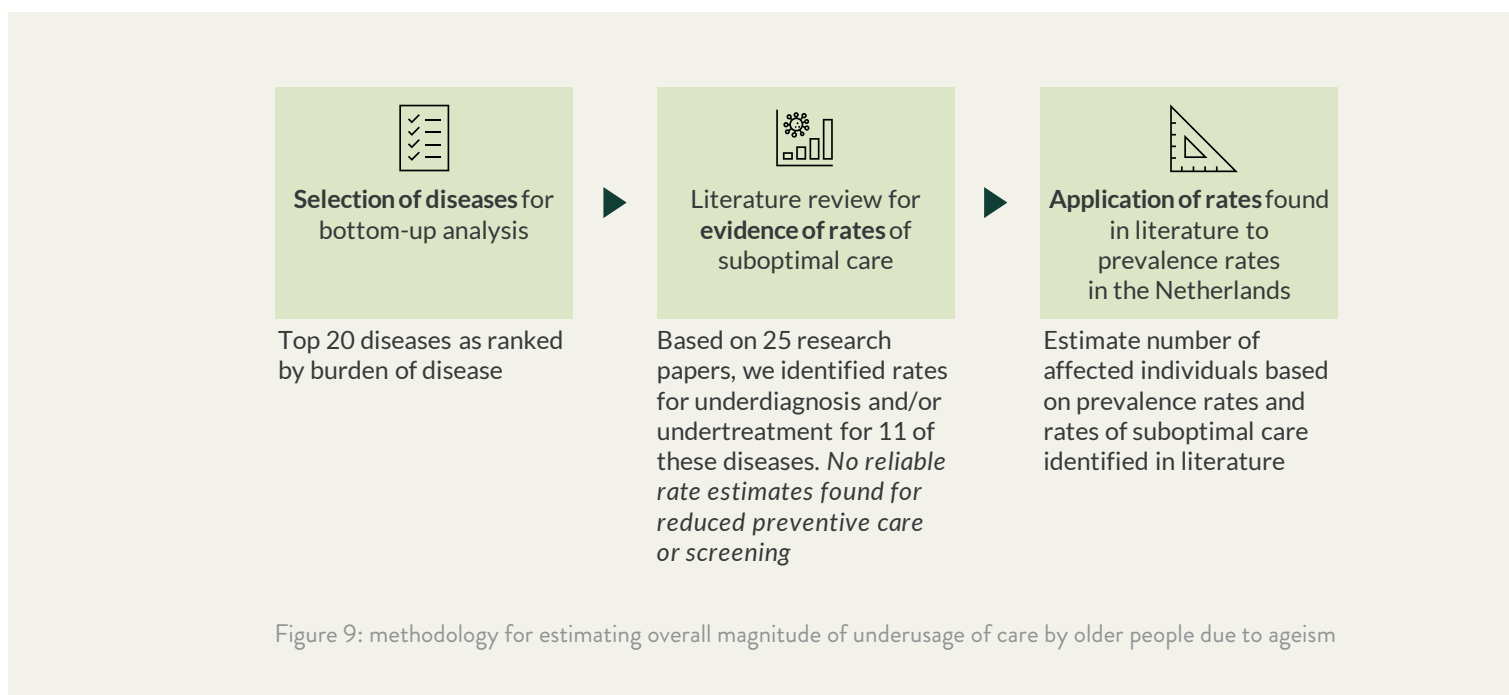
CHAPTER 3

**Estimating the impact  
of underusage of care  
due to ageism**

### 3.1 Methodology

To our knowledge, there are no comprehensive studies estimating the overall magnitude of underusage of care by older people due to ageism. Therefore, we have used available evidence in literature to provide such an estimate. The methodology for doing so involved the following steps:

- Selection of diseases for bottom-up analysis
- Literature review for evidence of rates of underdiagnosis, undertreatment and reduced preventive care or screening, and synthesis of findings
- Application of rates found in literature to prevalence rates in the Netherlands to estimate number of people affected



#### 3.1.1 Selection of diseases

We focused our research on the top 20 diseases in the Netherlands as ranked by burden of disease.<sup>10</sup> For example, conditions such as coronary artery disease (CAD), stroke, dementia, COPD, diabetes, and various cancers are prevalent among older adults and significantly affect their health outcomes.

<sup>10</sup> See [link](#)

### 3.1.2 Literature review for evidence of rates of underusage of care

For these top 20 diseases, we performed an extensive search on Pubmed and AI-assisted search in medical literature using EvidenceHunt<sup>11</sup> to identify papers that either directly or indirectly contain evidence for rates of underdiagnosis, undertreatment and/or reduced preventive care or screening in any of these 20 diseases.

We were able to identify 25 research papers that provide evidence of rates of underdiagnosis and/or undertreatment for 11 of the top 20 disease areas. These 11 disease areas represent about 58% of total disease burden in the population aged 65+ in the Netherlands. No reliable estimates were found for rates of reduced preventive care or screening.

A table with the 25 research papers used in this paper is provided in Appendix 1.

### 3.1.3 Application of rates found in literature to estimate number of people affected

Using prevalence data and reported rates of underdiagnosis and undertreatment, we extrapolated the findings to all older people in the Netherlands. This involved applying the average underdiagnosis and undertreatment rates to the estimated number of older people with each condition, providing a conservative estimate of those likely affected by these issues.

The estimates derived in this way provide a macrolevel view of the impact of underusage of care by older people. To also provide a microlevel view of how this methodology works at the level of individual diseases, we have explored a case study of a specific disease (aortic valve stenosis) in Chapter 4.

## 3.2 Total estimated impact: ~450-650k people affected, representing EUR3-6bn economic value

By following the methodology outlined in the previous paragraph, we estimate that ~450-650k people aged 65+ in the Netherlands are affected by underdiagnosis and/or undertreatment (Figure 10). This represents approximately 14-19% of people aged 65+, highlighting a significant healthcare gap.

The lower end of this range is based only on the 11 disease areas for which we could find evidence in literature. The top end of this range is calculated by extrapolating findings in these 11 disease areas to all non-researched disease areas outside of the top 20, excluding acute causes of disease burden such as injuries due to traffic accidents.

11 See [link](#)

**Estimations for prevalence, underdiagnosed cases and undertreated cases in population aged 65+ in the Netherlands**  
 [number of people x 1.000, based on prevalence estimated among population aged 65+]

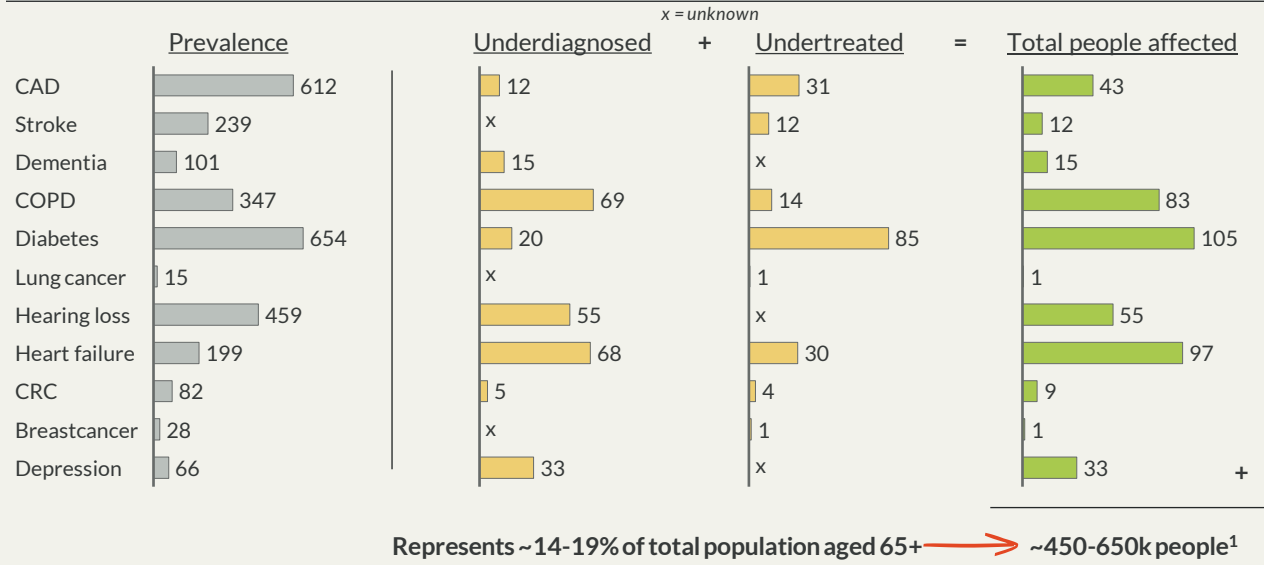


Figure 10: estimate of number of people aged 65+ in the Netherlands affected by underdiagnosis and/or undertreatment. Source: analysis by Gupta Strategists. Note: CAD = coronary artery disease

The largest number of affected people are found in heart failure and COPD, where underdiagnosis is a major factor, and diabetes, where undertreatment is the principle driver. Other large areas of potential underusage of care include hearing loss, depression and coronary artery disease.

The economic impact of this underusage of care is substantial. As we saw in paragraph 1.2, the European Commission, in its study on “the Silver Economy”,<sup>12</sup> estimated that the population aged 50+ sustains approximately EUR 30k of GDP per person in 2025. Assuming adequate care for the 450-650k people estimated in the above would have an impact of 0.2-0.3 QALY’s gained per person, this means we are leaving between EUR6-9k per person, or EUR 3-6bln of economic value on the table.

Furthermore, we saw in paragraph 1.2 that 17% of people in third phase of life provide on average 12.5 hours of informal care per week. Applying this to the estimates above, we estimate that approximately 10-15mln hours of informal care are lost as a consequence of underusage of care. This is the equivalent 6-9k full time workers.

In the next two paragraphs, we will go into more detail on the underlying estimates for underdiagnosis and undertreatment, and also address the need for a further study on preventive care and screening.

12 See [link](#)

### 3.3 Underdiagnosis

Underdiagnosis occurs when symptoms in older adults are misattributed to natural aging rather than being thoroughly investigated for underlying treatable conditions. This leads to missed or delayed diagnoses, significantly impacting health outcomes and quality of life for older patients. For instance, studies show that approximately 15% of dementia cases are underdiagnosed. Similar patterns are observed in other conditions, contributing to substantial healthcare gaps.

Of note here are COPD and heart failure, which are often confused in older patients. For heart failure, we found an estimated underdiagnosis rate of 34% based on an average of findings in three research articles.<sup>13</sup> The estimated affected patients in the Netherlands, 68k, is conservative relative to estimates by the Dutch Heart Association which recently estimated the number of undiagnosed patients in the Netherlands at 250k.<sup>14</sup>

Percentagewise, depression stands out as a major disease area where underdiagnosis occurs. The estimate we use here is, again, conservative, as we found three papers that provide much higher percentages (60-75%).<sup>15</sup>

### 3.4 Undertreatment

Undertreatment involves the insufficient or delayed provision of necessary medical treatments, often based on assumptions about an individual's health or life expectancy based on their age. For example, it is estimated that 20% of dementia cases go undertreated. This phenomenon can result in the progression of preventable diseases and higher rates of morbidity and mortality among the older patients.

It should be noted that finding rates of undertreatment attributable solely to ageism in literature is difficult. This is somewhat different from underdiagnosis, where it is possible to use a gold-standard diagnostic test on groups of individuals who were not previously known to have a disease. Studies on treatment choices will often report differences between age groups, for instance in a study on thrombolytic treatment for acute ischemic stroke and heart failure,<sup>16</sup> and while the relationship is statistically significant, it cannot be excluded that other non-studied factors such as patient preferences, assessment of frailty, etc. provide an explanation for the observed effect.

We have therefore used the most conservative estimates we could find, and in some instances applied (downward) correction factors on published figures to account for this (see Appendix 1 for details). For example, from findings in a study on incidence, prevalence, survival and initial treatment of lung cancer,<sup>17</sup> we calculated undertreatment of older patients as the difference between % treated under 65 vs. over 65 years of age, by stage, from 2.7% at stage 1 to 5% at stage 3b; in our analysis in Figure 10, we used 3.5% as an approximation.

13 See [link](#), [link](#) and [link](#)

14 See [link](#)

15 See [link](#), [link](#) and [link](#)

16 See [link](#)

17 See [link](#) (based on supplementary table e5)



While more targeted scientific studies specifically focused on this issue would of course be better as a next step, we believe the approach we used here is still helpful to provide a conservative macro-level estimate of the number of people affected by undertreatment.

### 3.5 Reduced preventive care or screening

In our literature search, we found no reliable estimates for the number or fraction of people affected by reduced preventive care or screening. Furthermore, any estimated that could be given or calculated here might overlap with estimates we found for underdiagnosis and undertreatment. However, we do believe that there is a potential for disparities in medical practices aimed at preventing disease or finding health issues early as a consequence of beliefs about benefits in relation to life expectancy.

For example, the American Cancer Society (ACS) guidelines on breast cancer screening states that screening should continue as long as a woman is in good health and is expected to live at least another 10 years.<sup>18</sup> In paragraph 2.3, we saw that about 80% of women at age 75-80 are not frail, and that about 75% of non-frail women at that age can expect to live at least another 10 years. That means that according to the ACS guidelines, about 60% of women aged 75-80 should still be screened for breast cancer. Yet, the Dutch breast cancer screening programming is limited to women between the ages of 55-75.<sup>19</sup>

Thus, while we did not attempt to provide quantification for this manifestation of underusage of care in older people, we do believe it merits further study and potentially mitigation. In particular, it would be valuable to specifically study the use of screening tools in non-frail populations, rather than applying cut-offs based on numerical age.

18 See [link](#)

19 See [link](#)



CHAPTER 4

**Case study –  
aortic valve stenosis**

## 4.1 Rationale for the case study

The estimates derived in the previous chapter provide a macrolevel view of the impact of underusage of care in older people. To also provide a view of how this methodology works at the level of individual diseases, we will explore a case study of a specific disease – aortic stenosis (AS). AS serves as a good case study for several reasons:

- **Prevalence amongst older people:** AS predominantly affects older adults, making it a relevant condition for studying the implications of ageism.
- **Severity and progression:** the condition has significant health implications if left untreated, leading to severe morbidity and increased mortality.
- **Difficult to diagnose:** symptoms are often atypical and/or might be attributable to other diseases (e.g. fatigue, shortness of breath and other COPD like symptoms, etc.).
- **Treatment options:** effective treatments like Aortic Valve Replacement (AVR) and Transcatheter Aortic Valve Implantation (TAVI) exist, yet many older patients do not receive them due to various biases and systemic issues.

By focusing on AS, we can illustrate the broader issues of ageism in healthcare and highlight the urgent need for targeted interventions. This case study also shows the difficulty of zooming in to this level – the evidence for underusage of care is there, but conclusively proving ageism as a causal factor for these effects is difficult with currently available evidence.

## 4.2 Introduction to aortic valve stenosis

Aortic valve stenosis is characterized by the narrowing of the aortic valve opening, which restricts blood flow from the left ventricle to the aorta. This condition leads to increased pressure within the heart and can cause significant symptoms such as chest pain, shortness of breath, and fainting. Without timely intervention, AS can progress to severe complications, including heart failure and death. The disease can be asymptomatic for a long time, but once onset of symptoms occurs it leads to death within a few years if left untreated.

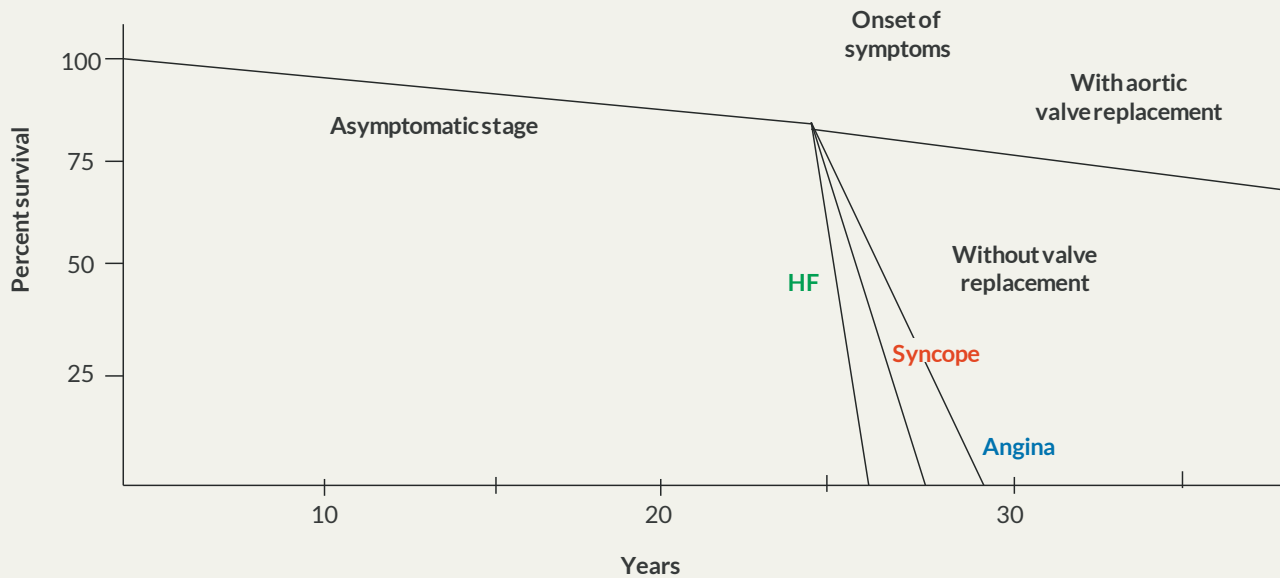


Figure 11: natural history of aortic valve stenosis. Source: Yeon S (eds). Indications for valve replacement in aortic stenosis in adults

Appropriate and timely treatment of AS, particularly through valve replacement, can dramatically improve patient outcomes and survival rates. There are two main types of valve replacement procedures:

- **Surgical Aortic Valve Replacement (AVR):** traditionally, this open-heart surgery has been the standard treatment for severe AS. However, it poses higher risks to frail patients due to its invasive nature.
- **Transcatheter Aortic Valve Implantation (TAVI):** TAVI has emerged as a less invasive alternative. This procedure involves inserting a replacement valve via a catheter, usually through the femoral artery, significantly reducing recovery time and associated risks compared to AVR. For example, hospital stay is reduced from 5-10 days down to 1-3 days, and length of ICU stay is reduced from, on average, 72 hours down to 2 hours.<sup>20</sup> The latest EU guidelines<sup>21</sup> recommend TAVI for all eligible transfemoral patients (75+), in high-risk patients, or in patients who are unsuitable for surgery

<sup>20</sup> See analysis in Appendix 1 of our previous study "Prevent the next wave" ([link](#))

<sup>21</sup> See [link](#)

### 4.3 Current treatment landscape in the Netherlands

In the Netherlands, TAVI has largely replaced AVR for patients aged 75 and older<sup>22</sup>. Approximately 2,400 valve replacement procedures are performed annually for this age group, of which about 2,350 are TAVI procedures (Figure 12).

**TAVI has largely replaced AVR for older patients**  
[# of procedures in patients aged 75+ in the Netherlands]

**But estimated number of candidates is still far greater** [modeled by Durko et al, 2018]

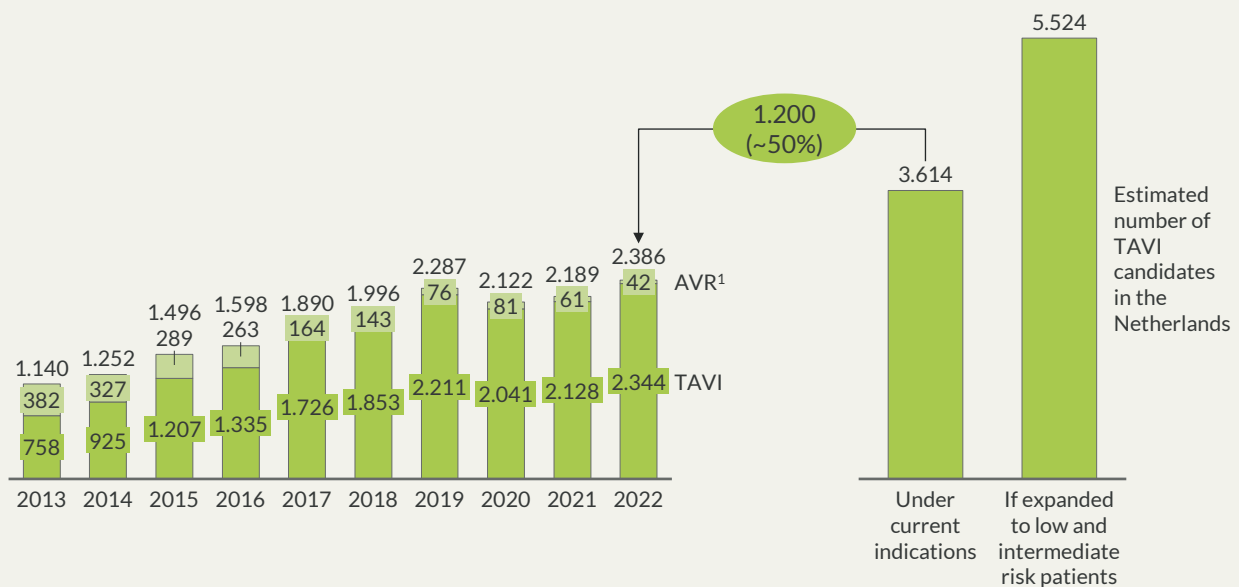


Figure 12: trends in modes of valve replacement for AS in the Netherlands, in relation to estimated number of candidates for valve replacement. Source: [Dutch Heart Registry](#) and [Durko et al.](#) (2018)

Based on estimates by Durko et al., who estimated the annual number of candidates for TAVI per country, there should be about 50% more patients undergoing this procedure given current indications, under which TAVI is limited to high-risk/inoperable patients. (If indications were to be expanded such that TAVI becomes standard of care also for low-/intermediate-risk older patients, the estimated number of candidates would of course be substantially greater).

It is difficult to prove that this undertreatment is squarely attributable to age-related biases. For example, factors such as patient preferences may play a role. Another underlying cause might be underdiagnosis, which may itself be partly caused by age-related biases. We will explore this further in the next paragraph.

<sup>22</sup> Note that in the Netherlands, TAVI is indicated for patients aged 80 years or older. The data-source referenced in the figure, however, only shows the 75+ age group.

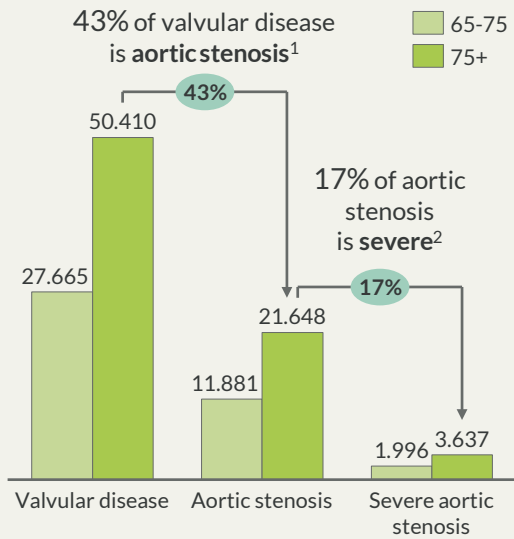
However, it is worth noting that indication guidelines themselves are based on hard cut-offs based on patient age. It is, therefore, certainly conceivable that for a significant number of patients, treatment choices are made based on the numeric value of their age rather than solely on their health status and preferences. But more research is needed to prove such a causality.

#### **4.4 Underdiagnosis as a potential explaining factor for undertreatment of AS**

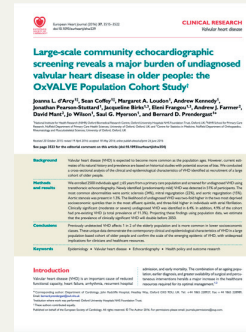
Based on analysis of routine healthcare data, we estimate that about 5.600 patients aged 65+ annually are diagnosed with severe AS, of whom about 3.600 are aged 75+ . However, data from the OxVALVE Population Cohort Study (Oxfordshire, UK) suggest that valvular heart disease is highly underdiagnosed. In this population-based study, involving 2.500 individuals aged 65+ years, participants were screened for undiagnosed valvular heart disease with transthoracic echocardiography. Although subjects with pre-existing valvular heart disease were excluded, a considerable number of AS patients were identified, predominantly in the lower socioeconomic classes. The study estimates that about 57% of patients with clinically significant valvular heart disease are undiagnosed.<sup>23</sup> Applying this to AS, it would imply that up to 7.500 people aged 65+ with clinically significant AS remain undiagnosed.

23 Specifically, the study states that “Clinically significant (moderate or severe) VHD was newly diagnosed in 6.4% of participants. Addition of the further 4.9% of subjects with pre-existing VHD from the overall study cohort (assuming that moderate or severe VHD would result in a clinical diagnosis) created a derived total population prevalence of moderate or severe VHD of 11.3%.” Thus, 6.4% out of 11.3%, i.e. 57%, were previously undiagnosed.

**Diagnosed patients, based on claims data**  
[#DBC registrations, 2019]



**Estimate for undiagnosed patients**



Estimated 57% of clinically significant valvular heart disease patients are undiagnosed

In the Netherlands, this would represent ~ 7.500 patients with severe aortic stenosis who remain undiagnosed

Figure 13: estimates for diagnosed and undiagnosed AS patients. Source: analysis by Gupta Strategists, [OxVALVE study](#). Footnotes: 1) Source: [UK cohort study](#) (2022), 2) Source: [U.S. cohort study](#) (2023)

A potential contributing factor to this underdiagnosis is likely that knowledge about symptoms of heart valve disease amongst patients is low, and stethoscope checks are relatively rare.<sup>24</sup> Especially patients with atypical symptoms, such as shortness of breath and fatigue (both of which may be interpreted as “normal” signs of aging), may thus go undiagnosed.

As with undertreatment, it is not known to what extent age-related biases contribute to this underdiagnosis. However, it is certainly conceivable that factors that are associated with age-related biases, such as the attribution of symptoms to age rather than disease, may play a role here. To explore this more conclusively would require targeted studies.

**4.5 Takeaways from this case-study**

In conclusion, aortic valve stenosis is a significant health concern for older people in the Netherlands. Despite advancements in treatment, substantial gaps in diagnosis and treatment persist. It is possible that this is at least partly due to ageism in healthcare. As a future course of study, it would be very interesting to examine this causality further. In particular, it would be interesting to study underdiagnosis and undertreatment of AS in the context of frailty status

24 For more details, see the European Heart Health Survey ([link](#))



CHAPTER 5

**Mitigation strategies**



## 5.1 Introduction

Addressing ageism in healthcare requires a multifaceted approach that targets the root causes of underdiagnosis and undertreatment of older patients (Figure 14).

Causes	Policy and/or resource allocation	<b>Age-based prioritization</b> might occur in resource-scarce situations, where younger patients are favored over older ones for the allocation of limited healthcare resources like ICU beds or ventilators.
	Awareness and communication barriers	Healthcare providers might communicate differently with older patients, using <b>oversimplified language</b> or <b>not fully involving them</b> in decisions about their care, potentially due to <b>stereotypical assumptions</b> about their cognitive abilities.
	Insufficient training	Insufficient training for healthcare providers in <b>recognizing and treating</b> conditions prevalent among older patients, and <b>incorporating frailty as a factor</b> into clinical decision making when weighing diagnostic and therapeutic options
	Underrepresentation in clinical trials	Older adults are often <b>underrepresented in clinical trials</b> , which affects the generalizability of treatment outcomes and efficacy data to this age group, potentially leading to suboptimal treatment recommendations for older patients.

Figure 14: root causes of underdiagnosis and undertreatment of older patients due to ageism

Mitigation strategies should focus on reducing the number of people affected by suboptimal care due to ageism. This chapter outlines various strategies that can help mitigate the impact of ageism in healthcare, focusing on educational reforms, focused research, awareness campaigns, and policy recommendations. By implementing these strategies, we can improve health outcomes and quality of life for the aging population.

## 5.2 Policy recommendations

Effective policies are essential to ensure that healthcare systems are equipped to meet the needs of an aging population without bias. It is important to remember that “more optimal care” does not always mean “less care.” A failure to remember that different people age in different ways, and that there are many trajectories that a person can traverse as they age, can at the individual level lead to problematic outcomes (particularly in a culture that is steeped in narratives of ageing as decline).<sup>25</sup>

25 For a review of ethical aspects related to healthcare policy and ageism, see [link](#)

At the macro-level, a policy focus of “doing less” is also too simplistic, especially given the substantial aging of the population. Rather than *doing less*, we should invest in innovation that allows us to *do more with less*. If more optimal care for a person aged 75 leads to years of additional healthy life and contribution to society, that is tremendously valuable and should be factored into policy as such.

Policy recommendations should therefore focus on creating a supportive framework for older patients that encompasses multiple facets:

- **Age-neutral healthcare policies:** implementing policies that prioritize clinical need and potential benefit over age is critical. This approach ensures that older adults receive the treatments they need without being unfairly deprioritized due to their age. For example, healthcare protocols should be revised to eliminate age-based thresholds that limit access to certain treatments or diagnostic procedures, and instead, focus on individual health status and potential benefit from medical interventions.
- **Capacity-enhancing innovation (CEI):** investing in a wide range of technological and medical innovations can significantly improve healthcare access and outcomes for older adults. In a prior joint study by Gupta Strategists and the FME<sup>26</sup>, it was estimated that capacity-enhancing innovation has the potential to free up 110k healthcare workers, which could solve almost the full personnel shortages anticipated in the Netherlands. For example, in a previous report<sup>27</sup> we showed that Transcatheter Aortic Valve Implantation (TAVI) is associated with an 80% productivity gain relative to the alternative of open-heart surgical valve replacement. Such advancements make it easier for older adults to access and benefit from healthcare services.
- **Resource allocation:** policies should ensure adequate resource allocation for care for older patients, including funding for advanced medical technologies, support services, and preventive care programs. This could involve increased government funding for geriatric healthcare services, subsidies for medications and treatments that are commonly needed by older adults, and investment in community-based programs that support aging in place. Additionally, funding research into new medical technologies and treatments that address the specific health challenges faced by older people is crucial for driving progress in geriatric care.
- **Incentives for geriatric training:** creating incentives for healthcare providers to pursue geriatric training can help increase the number of professionals skilled in care for older patients. Additionally, integrating geriatric education into the core curriculum of medical schools and continuing education requirements can ensure that all healthcare providers are equipped to meet the needs of an aging population.
- **Public awareness and education campaigns:** policies should also focus on raising public awareness about the importance of geriatric care and combating ageism. Educational campaigns that highlight the value and contributions of older adults can help change societal attitudes and reduce biases in healthcare settings. These campaigns can also provide information on preventive health measures and encourage older adults to seek regular medical care.

26 See [link](#)

27 See [link](#)

### 5.3 Awareness campaigns

Raising awareness about the importance of equitable healthcare for older patients can help combat ageism and change societal attitudes. Awareness campaigns should target both healthcare providers and the general public.

- **Healthcare provider campaigns:** educational initiatives aimed at healthcare professionals can highlight the importance of not dismissing symptoms in older adults as merely age-related and the necessity of thorough diagnostics and appropriate treatment.
- **Public awareness campaigns:** educating the public about the value of older adults and the significance of timely and appropriate healthcare can help reduce self-directed ageism and encourage older adults to seek care proactively.

### 5.4 Education

One of the primary barriers to effective healthcare for older patients is the lack of adequate training in geriatric care among generalist healthcare providers. In particular, it is important that awareness of biases and assessment of frailty is factored into clinical decision making.

Despite its importance, little attention has been given to the concept of frailty in family medicine. Frailty is easily overlooked because its manifestations can be subtle and slowly progressive, and thus dismissed as normal aging; and physician training has been focused on specific medical diseases rather than overall vulnerability.<sup>28</sup> If frailty is easily overlooked, then non-frailty can also be easily underestimated. It is important to remember that at any age, most people are not frail, and that this has significant impact on the outlook for quality of life and life expectancy.

28 See [link](#)

Enhancing educational curricula to include comprehensive geriatric training is essential.

- **Integrating geriatrics into medical education:** medical schools should incorporate more extensive geriatric training into their curricula. This includes understanding the complexities of aging, managing multiple comorbidities, and assessing frailty.
- **Continuing Medical Education (CME):** providing ongoing education for practicing healthcare professionals is crucial. CME programs focused on geriatric care can keep healthcare providers updated on the latest advancements and best practices in treating older adults

## 5.5 Focused research

Research plays a critical role in understanding and addressing the unique healthcare needs of the older patients. A large recent literature review on ageism in healthcare also addressed the exclusion of older patients from medical studies.<sup>29</sup>

It found that older persons were excluded from trials in cardiology, internal medicine, nephrology, neurology, preventive medicine, psychiatry, rheumatology, oncology, and urology. Most of these studies were based on global trial-registry data (81.7%) which included up to 206 countries.

For example, using an international registry of Parkinson's disease clinical trials, researchers found 49.0% of the clinical trials excluded older persons, even though this disease is more prevalent in later life. In oncology, the effect of interventions is often not adequately known in older patients.

There is a need for more inclusive research that specifically focuses on older adults.

- **Incorporation of frailty as a factor in clinical trials:** whereas trials often include age, or use it to scope the group of trial participants, frailty status is typically not included even though studies show that it is a significant prognostic factor independent of age and registered comorbidities.
- **Inclusive clinical trials:** ensuring that older adults are adequately represented in clinical trials can help generate data that are more applicable to this population. This can lead to better-informed treatment guidelines and practices.
- **Geriatric-specific studies:** funding and promoting studies that focus on common geriatric conditions and their management can provide valuable insights into improving care for older patients.
- **Guidelines** should not position numerical age as a clinical decision factor if it can be avoided.

29 See [link](#)



CHAPTER 6

**Conclusion**

## 6.1 Summary of findings

This study has provided an in-depth examination of ageism in healthcare and its substantial adverse impact on the diagnosis and treatment of older patients in the Netherlands. Ageism in healthcare leads to inappropriate variations in care, significantly affecting the health outcomes and quality of life of older adults. At the core, ageism is caused by misattribution of symptoms to ageing rather than to treatable disease (by patients or health care professionals), and/or by misconceptions about frailty. Importantly, while prevalence of frailty increases with age, at any age, most people are not frail.

Our study estimates that between 450,000 and 650,000 individuals aged 65+ in the Netherlands (representing approximately 14-19% of this segment of the population) are impacted by underdiagnosis and/or undertreatment – thereby making this a significant public health issue.

A case study on aortic valve stenosis, a significant health concern for older people in the Netherlands, shows that despite advancements in treatment, substantial gaps in diagnosis and treatment persist. It is possible that this is at least partly due to ageism in healthcare. As a future course of study, it would be very interesting to examine this causality further. In particular, it would be interesting to study underdiagnosis and undertreatment of AS in the context of frailty status.

## 6.2 Recommendations

Addressing ageism in healthcare requires a comprehensive and multifaceted approach involving policymaking, awareness campaigns, educational reforms, and focused research. The following recommendations outline the necessary steps to mitigate the impact of ageism and improve healthcare outcomes for older patients:

- **Policy changes:** develop and implement age-neutral healthcare policies that prioritize clinical need and potential benefit over age. Policies should ensure adequate resource allocation for care for older patients, including funding for capacity-enhancing innovations (CEI). Promoting research into new medical technologies and treatments that address the specific health challenges faced by older people is crucial for driving progress in geriatric care.
- **Awareness campaigns:** launch initiatives aimed at both healthcare providers and the general public to highlight the importance of equitable healthcare for older patients and reduce ageist biases. Educational campaigns can inform about the value and contributions of older adults, encouraging more respectful and inclusive attitudes towards aging.
- **Education:** integrate comprehensive geriatric care into medical curricula and provide ongoing education for practicing healthcare professionals. This will ensure that healthcare providers are well-equipped to understand the complexities of aging, manage multiple comorbidities, and accurately assess and treat frailty.
- **Focused research:** promote and fund inclusive clinical trials and geriatric-specific studies to generate data that are more applicable to older adults. This will lead to better-informed treatment guidelines and practices. Incorporating frailty as a factor in clinical trials will also provide more relevant insights into the health needs of older people. Guidelines should not position numerical age as a clinical decision factor if it can be avoided. In addition, it would be valuable to specifically study the use of screening tools in non-frail populations, rather than applying simple age cut-offs.

### 6.3 Call to action

Healthcare systems worldwide that are dealing with aging societies, including in the Netherlands, must recognize their growing older population and adapt accordingly. The significant proportion of the population reaching the third phase of life means that we should rethink what it means to grow old. This demographic represents a significant and valuable segment of the economy and society, and deserves respect, dignity, and high-quality healthcare.

By addressing ageism and implementing the recommended strategies, we can create a more equitable healthcare system that ensures older adults receive the care they deserve and can contribute to and participate in society.

It is imperative for policymakers, healthcare providers, educational institutions, and society at large to collaborate and take decisive action. Implementing these strategies will not only improve the health and well-being of older adults but also enhance their ability to contribute to society, thereby benefiting all generations.

# | About this study



This publication is the result of a co-production of Gupta Strategists and Edwards Lifesciences. We have joined forces and sought convergence of interests, driven by a shared curiosity regarding the impact and causes of ageism in healthcare.

For this publication, we interviewed various experts from the Dutch healthcare sector. The text in this publication is by no means intended as an exact representation of the contributions of individual participants. However, the insights gained from the conversations and discussions with these participants have enriched the text in many ways. We thank everyone for their voluntary contributions.

### **About Gupta Strategists and Edwards Lifesciences**

Gupta Strategists is an independent consultancy for organizations in the healthcare sector, both domestically and internationally. Everything we do is focused on demonstrably improving healthcare. A distinctive feature of our approach is that we combine in-depth knowledge with creativity and a practical perspective.

Edwards Lifesciences is a global leader in patient-focused innovations for heart valve diseases and hemodynamic monitoring. We are driven by a passion for patients. We collaborate with physicians and stakeholders across the healthcare landscape. With the increasing aging of the population, we see it as our responsibility to help improve people's lives and contribute to creating a more sustainable society. We continuously innovate to address life-threatening diseases, enable active and healthy aging, and transform healthcare systems by providing efficient, life-saving treatments.

Edwards Lifesciences funded the production of this publication.

## Contact us

The aim of this publication is to inspire everyone who is concerned about the future of our healthcare system, to offer reflection, and to provide perspective. We are eager to engage in discussions and work together with others. For inquiries or discussions, feel free to contact us:

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APPENDIX

**Overview of evidence in literature on rates of underdiagnosis and undertreatment**

In our search for evidence on rates of underdiagnosis in older patients, we identified and used the following studies:

Reference	Notes on conclusions we drew from this study
Faisal-Cury et al., Depression underdiagnosis: Prevalence and associated factors. A population-based study. <i>J Psychiatr Res.</i> Juli 2022; 151:157-165	63% of depression is underdiagnosed; age-effect is 3%
Bach et al., Diagnosis of depression in the elderly. The "Geriatric Depression Scale". <i>Z Gerontol Geriatr.</i> Jan-feb 1995; 28(1):42-6	Only 25% of patients with major depression disorder are detected
Scazufca et al., Identification and treatment of depression of older adults in primary care: findings from the São Paulo Ageing and Health Study. <i>Fam Pract.</i> Juni 2016;33(3):233-7	Only 4% of patients with ICD-10 depression were diagnosed as such; note: in low-income population
Barry et al., Under-treatment of depression in older persons. <i>J Affect Disord.</i> Feb. 2012 136(3):789-96	Of the 286 (27.9%) depressed participants, between 43% and 69% did not receive depression treatment during any 18-month interval. 30.5% of the 121 participants with persistent depression did not receive treatment during the study period.. We used estimate of 50%.
Skinner et al., Diagnostic errors in older patients: a systematic review of incidence and potential causes in seven prevalent diseases. <i>Int J Gen Med.</i> 2016 May 20;9:137-46	(review article) The highest quality study determined that in patients 65 years or older with symptoms of, risk factors for, and treatment consistent with COPD, the disease was undiagnosed in 35% of cases
Apostolovic et al., Frequency and significance of unrecognized chronic obstructive pulmonary disease in elderly patients with stable heart failure. <i>Aging Clin Exp Res.</i> Okt-dec. 2011;23(5-6):337-42	A study with 174 older patients with stable chronic heart failure found that 27.6% had previously unrecognized COPD
Skinner et al., Diagnostic errors in older patients: a systematic review of incidence and potential causes in seven prevalent diseases. <i>Int J Gen Med.</i> 2016 May 20;9:137-46	(review article) Four studies examining underdiagnosis in dementia calculated 1-Sn from 71% to 100% and 1-NPV from 10% to 11%. We used estimate of 15%.
Skinner et al., Diagnostic errors in older patients: a systematic review of incidence and potential causes in seven prevalent diseases. <i>Int J Gen Med.</i> 2016 May 20;9:137-46	(review article) Five studies on Parkinson's disease assessed underdiagnosis, with two clinicopathological studies reporting 1-Sn between 9% and 50% and 1-NPV between 1% and 10%. We used estimate of 7%..

Reference	Notes on conclusions we drew from this study
Skinner et al., Diagnostic errors in older patients: a systematic review of incidence and potential causes in seven prevalent diseases. <i>Int J Gen Med.</i> 2016 May 20;9:137-46	(review article) Underdiagnosis was assessed in four studies in which 1–Sn was 17.1% in one autopsy-based study <sup>8</sup> and much higher (62.5% and 70.6%) in two high-quality studies with guideline-endorsed clinical and echocardiographic reference criteria. We used estimate of 60%..
Rutten et al., Unrecognized heart failure in elderly patients with stable chronic obstructive pulmonary disease. <i>Eur Heart J.</i> 2005 Sep;26(18):1887-94	A study of older patients (aged 65+) with chronic obstructive pulmonary disease (COPD) found that 20.5% had previously unrecognized heart failure
Hancock et al., High prevalence of undetected heart failure in long-term care residents: findings from the Heart Failure in Care Homes (HFinCH) study. <i>Eur J Heart Fail.</i> 2013 Feb;15(2):158-65	In the Heart Failure in Care Homes (HFinCH) study, heart failure was diagnosed in almost a quarter (22.8%) of residents aged 65-100 years in long-term care facilities, with the majority of cases being undiagnosed previously
Skinner et al., Diagnostic errors in older patients: a systematic review of incidence and potential causes in seven prevalent diseases. <i>Int J Gen Med.</i> 2016 May 20;9:137-46	(review article) A study based on a clinical reference standard reported a 2% underdiagnosis rate for AMI (another study referenced found higher rates; we used the 2%). Underdiagnosis was less prevalent in higher volume emergency departments.
Skinner et al., Diagnostic errors in older patients: a systematic review of incidence and potential causes in seven prevalent diseases. <i>Int J Gen Med.</i> 2016 May 20;9:137-46	(review article) A single retrospective study involving 18,000 patients with diabetes from two cohorts revealed 1–PPVs of 2% and 4%.
Kirchgatterer et al., Colorectal cancer in geriatric patients: endoscopic diagnosis and surgical treatment. <i>World J Gastroenterol.</i> 2005 Jan 21;11(3):315-8	“Another study on geriatric patients (older than 80 years) undergoing lower gastrointestinal endoscopy found that colorectal cancer was diagnosed in 6% of all endoscopies, with a significant number of these patients undergoing successful surgery. This indicates that endoscopic diagnosis is crucial in detecting colorectal cancer in the elderly, which could otherwise be underdiagnosed.”
Trumble et al., Hearing loss in the elderly. A survey in general practice. <i>Med J Aust.</i> 1992 Sep 21;157(6):400-4	Reported underdiagnosis of hearing loss is 37%. Reference is quite old, for lack of better evidence we decided to use this paper as an indication, but applied a significant haircut on the reported rate – we used one third (12%) of the reported rate in our calculations

For evidence on rates of undertreatment in older patients, we identified and used the following studies:

Reference	Notes on conclusions we drew from this study
Ganti et al., Update of Incidence, Prevalence, Survival, and Initial Treatment in Patients With Non–Small Cell Lung Cancer in the US. <i>JAMA Oncol.</i> 2021 Dec; 7(12): 1–9	Calculated as difference between % treated < 65 vs over 65, by stage (based on supplementary table e5); from 2.7% at stage 1 to 5% at stage 3b; we used 3.5% as an approximation
Belgrano et al., Surgical oncology in the elderly. <i>Acta Chir Belg.</i> 2020 Dec;120(6):401-403	Rough estimate based on declining resection rates > 80 years is 20%; assume quarter of this effect is age-related undertreatment
Make et al., Undertreatment of COPD: a retrospective analysis of US managed care and Medicare patients. <i>Int J Chron Obstruct Pulmon Dis.</i> 2012; 7: 1–9	Difference in no long-term pharmacotherapy between commercial (age 54yrs avg) and medicare (age 75 yrs avg) population is 4%
Fairhead et al., Underinvestigation and undertreatment of carotid disease in elderly patients with transient ischaemic attack and stroke: comparative population based study. <i>BMJ.</i> 2006 Sep 9; 333(7567): 525–527	Difference in carotid endarterectomy for symptomatic patients = 80%; assume quarter of this effect is due to age-related undertreatment
Sanders et al., Acute Ischemic Stroke and Heart Failure: Stroke Risk Factors Associated with Exclusion from Thrombolytic Therapy. <i>Clin Appl Thromb Hemost.</i> 2022 Jan-Dec; 28	Difference in rt-PA between older and younger patients is 5%
Al-Musawe et al., Overtreatment and undertreatment in a sample of elderly people with diabetes. <i>Int J Clin Pract.</i> 2021 Nov;75(11):e14847	The study included 444 participants: potential overtreatment and undertreatment were found in 60.5% and 12.6% of the study population.
Stasinopoulos et al., Potential Overtreatment and Undertreatment of Type 2 Diabetes Mellitus in Long-Term Care Facilities: A Systematic Review. <i>J Am Med Dir Assoc.</i> 2021 Sep;22(9):1889-1897	Prevalence of potential undertreatment (1.4%-35%, n = 8 studies) varied widely among facilities and geographical locations, and according to definitions used. We used mid of that range
Massing et al., Lipid management among coronary artery disease patients with diabetes mellitus or advanced age. <i>Am J Cardiol.</i> 2001 Mar 1;87(5):646-9	Patients 65 years of age were 1.7 (95% confidence interval 1.6 to 1.8) times more likely to be prescribed lipid medications than older persons [ASSUME quarter = age-related undertreatment]

Reference	Notes on conclusions we drew from this study
Stolfo et al., Use of heart failure evidence-based therapy across age strata: data from the Swedish Heart Failure Registry. Abstract at Heart Failure 2021, European Society of Cardiology	Approximate differences in reported treatment rates for RASi, beta blocker and MRA between those aged <70 and those aged >80
Bastiaannet et al., Breast cancer in elderly compared to younger patients in the Netherlands: stage at diagnosis, treatment and survival in 127,805 unselected patients. Breast Cancer Res Treat. 2010 Dec;124(3):801-7	Results confirm the international data that indicate a higher stage at diagnosis, less aggressive treatment, less adherence to guidelines, and a decreased survival for older breast cancer patients in the Netherlands; numbers reported in this study are ~5-15%; assume low end

