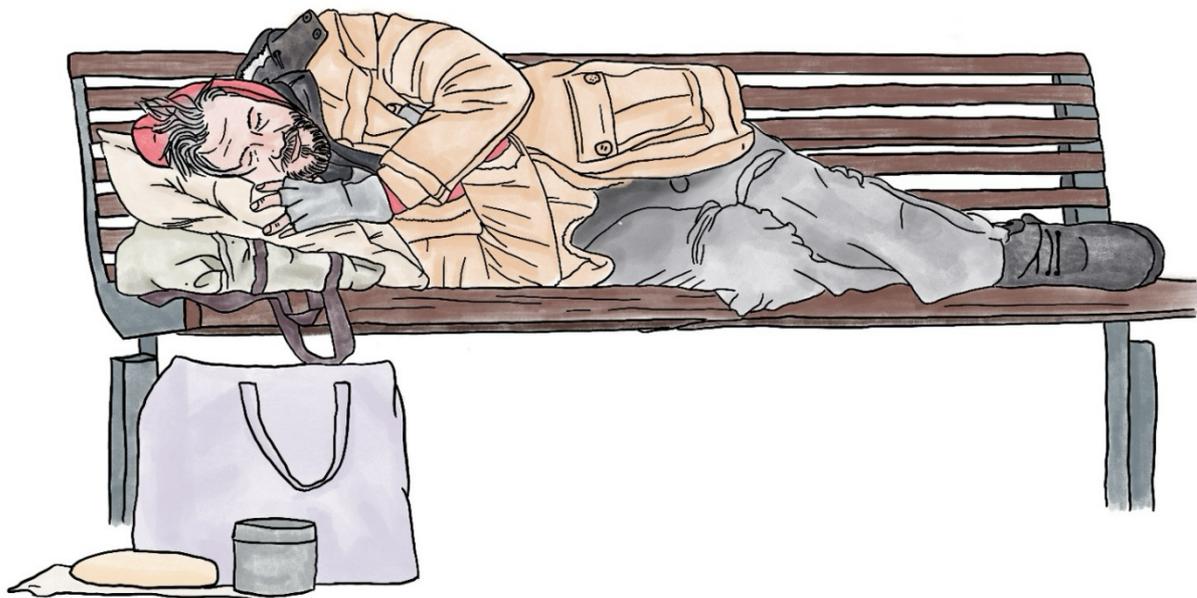


# THE NATURE AND EXTENT OF PRIMARY CARE PROVIDED IN DUTCH STREET MEDICINE PRACTICES



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# Abstract

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## Introduction

Despite high rates of multimorbidity, people experiencing homelessness in the Netherlands face significant barriers to regular healthcare. Street practices provide essential medical services, yet a knowledge gap exists regarding the actual care they deliver. Therefore, this study aims to characterize the nature and extent of care provided in Dutch street medicine practices during 2023–2024.

## Methods

This descriptive, cross-sectional, retrospective study analyzed anonymized data from patients at eight diverse Dutch street practices between 2023 and 2024. Using a standardized protocol, data on demographics, diagnoses (ICPC codes), and prescriptions (ATC codes) were extracted from various electronic medical record systems. Diagnoses and prescriptions were categorized into broader groups. A descriptive statistical analysis was performed using SPSS to summarize frequencies and percentages.

## Results

This study included 10,723 patients, who were predominantly male (62.5%), aged 20-45 (61.1%), uninsured (86.5%), and non-EU migrants (67.9%). Infectious diseases and chronic conditions were the most registered diagnoses. Key pharmacological treatment rates included 79.9% for cardiovascular disease, 63.7% for infectious diseases, 32.9% for psychiatric disorders, and 8.9% for analgesics following trauma. Overall, 59.1% of the total study population received at least one prescription, with penicillin being most common.

## Conclusion

This study reveals a significantly lower prevalence of chronic conditions in street practices, likely due to underregistration in a population that primarily seeks care for acute symptoms. This leads to a significant undertreatment of preventive medications, compared to regular practices. More structured data registration is crucial to assess true prevalence and optimize care for this vulnerable population.

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## Introduction

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The Dutch healthcare system is internationally renowned for its high quality. The role of the general practitioner as a gatekeeper to specialist care contributes to an effective healthcare system. This is reflected in international rankings, where the Netherlands scores highly for access to care (1, 2). However, well-organized healthcare is not a given for all Dutch citizens.

A group that consistently falls outside regular healthcare systems is people experiencing homelessness. This population often lacks health insurance or a fixed address, which prevents them from being registered with a general practitioner (3). For people experiencing homelessness, street practices often represent the most accessible form of medical care. A street practice is a general practitioner's facility specifically focused on providing care to people without a fixed abode who, due to financial problems, bureaucratic barriers and stigma, cannot find their way to a regular general practitioner or cannot be helped there (4, 5). These practices are essential in the Netherlands where an estimated 33,000 people are experiencing homelessness, a number that has also shown an upward trend in recent years (6). The official figures are even an underestimation of the true scale of the problem, as they often exclude forms of hidden homelessness (7).

Previous international studies have shown that people experiencing homelessness are consistently characterized by high rates of multimorbidity, with mental and substance use disorders being most prevalent (8-10). Poor living conditions, such as poor nutrition, exposure to the elements and lack of sleep causes early onset of chronic diseases such as hypertension (12.8-22%), diabetes (8.9%), COPD (6-6.4%) and cardiovascular disease (7.2%) (8, 11). In addition, studies show that people experiencing homelessness often need medical care for injuries and trauma, like falls, cold-related injuries, burns, assaults brain injuries and self-harm (9, 12). In Dutch street practices, 10-32% of patients report injuries and trauma, and 26% of all deaths are trauma related (13). On top of that, due to harsh living conditions, people experiencing homelessness are more prone to infections, with tuberculosis (0-8%), hepatitis C (4-36%), HIV (0-21%), hepatitis B (17-30%), and scabies (4-56%) all reported at far higher rates than in the general population (8, 11, 12).

Although numerous international studies have documented the prevalence of health problems and their barriers in accessing regular (primary) care among people experiencing homelessness, there is a significant lack of insight into the care street practices actually provide. It is known that a combination of practical, systemic and financial barriers leads to very low adherence to therapy in this population, but it remains unclear whether the care they receive in street practices align with their health complaints and how they compare to care delivered in regular general practices (5, 8, 14, 15). This highlights a need for more current data on the nature and extent of care provided by street practices. Therefore, the research question of this study is: 'What is the nature and extent on care provided in Dutch street medicine practices during 2023 and 2024?'

# Methods

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## *Study Population*

The study population consists of all patients who had consulted one of the participating street practices between January 1, 2023 and December 31, 2024.

## *Design and Setting*

This study used a descriptive, cross-sectional, retrospective design.

Eight street practices across eight different cities in the Netherlands were purposively selected and recruited by the Dutch Street Doctors Groep (NSG), seeking diversity in organizational structure, patient population and geography. Two of these practices, in Dutch cities with the largest homeless population, exclusively focus on the homeless population and maintain separate EMR (Electronic Medical Record) systems. They represent the largest part of the study population (N=9502). In the other six cities, care is delivered by general practitioners from regular practices who provide outreach services at local homeless shelters. The method of data registration differs among these practices. Some maintain a separate EMR system exclusively for their street patients, while others integrate this data into the main EMR system of the general practice. These practices represent a total of 1221 patients within the study population and vary per practice between 38 and 384 patients.

## *Data Collection*

The researcher personally extracted data from six of the practices on location. The final two practices extracted their own data following the guidance of the researcher. The researcher signed a confidentiality agreement and privacy guarantee prior to data extraction. To safeguard patient privacy, all directly identifiable information (e.g., name, date of birth, citizen service number) was removed and replaced by a unique, non-traceable study ID prior to analysis. A total of five different EMR systems were in use within the eight street practices.

A standardized data extraction protocol was used to ensure consistency across the five different EMR systems (see appendix 1). If it was not possible to extract the data via the standardized protocol, contact was made with the helpdesk of the EMR system to extract the correct data. Medication prescriptions (ATC codes) and demographic characteristics were successfully extracted from all practices. All data is downloaded in Excel files.

## **Demographic characteristics**

Demographic characteristics (gender, age, native country, and insurance status) were collected from all patients who had at least one contact with one of the eight street practices. Age was calculated by subtracting the date of birth from the start date of the study period and categorized into four groups: '<20 years', '20-45 years', '46-65 years', and '>65 years'. Native countries were extracted from the EMR system and subsequently categorized by the researcher into 'the Netherlands', 'EU/EER', and 'non-EU'. Insurance status was documented as 'insured' or 'uninsured'. All missing data was documented as 'unknown'.

## **Diagnoses**

In Dutch general practice, all consultations are being classified using the International Classification of Primary Care (ICPC). All ICPC codes in contacts in 2023 and 2024 were included only once per patient, although there might be more than 1 episode with the same diagnoses.

After data collection and prior to analysis, all ICPC codes were reduced to ICPC groups (see appendix 2): psychiatric disorders (including neurocognitive problems), addiction, intellectual disability, chronic conditions (subdivided into diabetes, cardiovascular, COPD/asthma, abdominal, neurological disorders and physical disability), malignancies, infectious diseases, injuries and trauma, and social problems.

## **Pharmacological treatment**

All medical prescriptions are registered using the Anatomical Therapeutic Chemical (ATC) codes. All ATC codes for patients in 2023 and 2024 were included only once per patient, although there might be more than one prescription for the same medicine. One practice provided incomplete data and was therefore partially excluded from the analysis.

After data collection and prior to analysis, all ATC codes were reduced to ATC groups (see appendix 3): Psychiatry (subdivided into sedatives, antidepressants, and antipsychotics), Addiction (subdivided into drugs used in addiction), Diabetes (subdivided into oral antidiabetics and insulin), Cardiovascular disorders (subdivided into antihypertensives, lipid lowering agents and antithrombotics), Infection (comprising all antimicrobial agents) and Injuries and trauma (comprising all analgesics). Only one prescription of a group for each unique patient during the study period was included.

## *Analysis*

A descriptive statistical analysis was performed to characterize the study sample and summarize the key variables. Given the categorical nature of the data, the analysis focused on frequencies and percentages. No statistical inference was conducted as the objective was solely to describe the collected data. The analyses were performed using IBM SPSS Statistics version 29.0.

To ensure anonymity of the street medicine practices, all data shown here represent all patients analyzed as one study population. However, analysis per practice is available.

## *Ethical Statement*

The Medical Ethics Review Committee (METC) Oost-Nederland has declared that this study is exempt from the Medical Research Involving Human Subjects Act (WMO). Ethical approval has been waived by the Medical Ethical Committee (CMO) of the RadboudUMC (Project number: 2025-1845).

# Results

## Demographic Characteristics

The study included 10,723 patients, representing nearly 50,000 contacts from 8 street practices. As detailed in Table 1, the population was predominantly male, aged 20-45, of non-EU origin, and uninsured. Differences were also observed between practice types: the outreach practice population had a higher proportion of insured males, while dedicated practices served more uninsured, non-EU patients (Appendix 4.1).

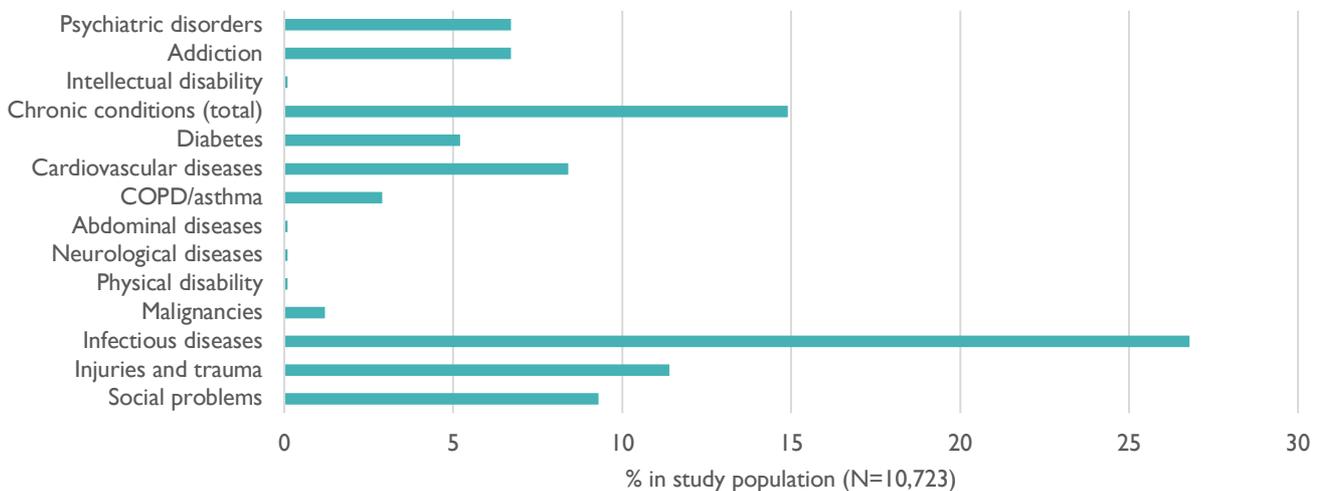
Demographic characteristics		N	%	Min-Max (%) <sup>1</sup>
<b>Gender</b>	Female	3999	37.3	(14.0-41.4)
	Male	6698	62.5	(57.4-86.0)
	Unknown	26	0,2	(0.0-8.3)
<b>Age group</b>	<20 years	503	4,7	(1.4-11.0)
	20-45 years	6547	61.1	(48.4-66.0)
	46-65 years	3271	30.5	(20.1-41.9)
	>65 years	390	3.6	(1.4-5.9)
	Unknown	12	0.1	(0.0-8.3)
<b>Native country</b>	Netherlands	600	5.6	(3.5-42.1)
	EU/EER	1350	12.6	(7.9-19.8)
	Non-EU	7279	67.9	(47.4-83.7)
	Unknown	1494	13.9	(0.8-100)
<b>Insurance status</b>	Insured	1212	11.3	(12.9-96.8)
	Uninsured	9280	86.5	(3.2-100)
	Unknown	231	2.2	(0.0-100)

**Table 1:** Demographic characteristics of the street medicine population, including gender, age, native country, and insurance status (N=10723).

1. Range (%) between the different street practices

## Diagnoses

Infectious diseases and chronic conditions were the most common registered diagnoses (Figure 1). However, outreach practices had significantly higher registration rates for psychiatric disorders (13.2% vs. 5.9%), addiction (20.1% vs. 5.0%), injuries (18.8% vs. 10.4%), and social problems (20.4% vs. 7.8%) compared to dedicated practices. Rates for other diagnostic groups were similar across both practice types (Appendix 4.3).



**Figure 1:** Distribution of patients by diagnosis group, based on ICPC codes. The bar chart shows the percentage of patients with at least one diagnosis in each category. For counts and percentages see Table 6 in appendix 4.2.

## **Psychiatric Disorders, Addiction and Intellectual Disability**

'Depressive disorder' (2.0%), 'Anxiety disorder/anxiety state' (1.7%), and 'Post traumatic stress disorder' (1.4%) were the most common psychiatric diagnoses in the total study population. Of the 718 patients with a psychiatric diagnosis, patients had an average of 1.2 diagnoses and 32,9% was prescribed at least one psychiatric-related drug. As seen in table 3, antidepressants were most prescribed, followed by antipsychotics and sedatives.

'Drug abuse' (3.7%) and 'Chronic alcohol abuse' (2.7%) were the leading addiction diagnoses in the total study population. Among the 720 patients in the addiction group, 8.8% received addiction-related medication. Intellectual disability was registered in 0.1% of the study population.

An intellectual disability was only registered in 0.1% of the total study population.

## **Chronic Conditions**

'Uncomplicated hypertension' (6.7%), 'Diabetes mellitus' (5.3%), and 'Asthma' (2.3%) were the most registered chronic conditions in the total study population. Observations across the eight practices reveal significant variation in the prevalence of registered chronic conditions, with percentages ranging from 4.8% to 23.7%. A particularly large discrepancy is noted within the COPD/asthma group, where the prevalence ranges from 1.4% to 15.8%.

In the group with registered diabetes (N=554), 74,7% was prescribed at least one diabetes-related drug, with oral antidiabetics prescribed most often (Table 3). In the group with registered cardiovascular disease (N=897), 79.9% received a cardiovascular-related drug. As shown in Table 3, antihypertensives were prescribed most often, followed by lipid-lowering agents and antithrombotics.

## **Malignancies**

'Malignant neoplasm breast (female)' (0.2%), 'Malignant neoplasm of colon/rectum' (0.2%), and 'Malignant neoplasms of trachea/bronchus/lung' (0.1%) were the most registered malignancies in the total study population.

## **Injuries and Trauma**

'Laceration/cut' (2.4%), 'Other specified accident/injury' (1.5%), and 'Other injury musculoskeletal system' (1.4%) were the most common registered injuries and trauma in the total study population. In the population with a registered injury or trauma (N=872), 8.9% were prescribed an analgesic drug.

## **Infectious Diseases**

'Acute upper respiratory infection' (3.6%), 'Dermatophytosis' (2.9%), and 'Cystitis/other urinary infections' (2.3%) were the most registered infectious diseases in the total study population. In the population with a registered infectious disease (N=2871), 63.7% were prescribed an antimicrobial drug.

## **Social Problems**

The social problems 'Problems housing/neighbourhood conditions' (4.3%), 'problems social, cultural system/migration' (2.2%), and 'problems resulting from assault/harmful events' (0.8%) were the most registered in the total study population.

	Psychiatric disorders		Addiction		Diabetes Mellitus		Cardiovascular disorders		Infectious diseases		Injuries and trauma	
	N = 718		N = 720		N = 554		N = 897		N = 2871		N = 872 <sup>c</sup>	
	N	%	N	%	N	%	N	%	N	%	N	%
Antipsychotics	102	14,2%										
Antidepressants	160	22,3%										
Sedatives	41	5,7%										
Drugs used in addictive disorders			63	8,8%								
Oral antidiabetics					358	64,6%						
Insulin					112	20,2%						
Antihypertensives							693	77,3%				
Antithrombotics							147	16,4%				
Lipid lowering agents							208	23,2%				
Antimicrobial agents									1829	63,7%		
Analgesics											109	8,9%

**Table 2:** Counts and percentages of patients with at least one prescribed medication, by diagnosis group.

c. One practice is excluded from this population, since data on analgesics were missing

### Pharmacological Treatment

Within the 8,056 patients from 7 different street practices, 4,762 patients had at least one medical prescription (59,1%). In this group, the total number of medical prescriptions was 11,319. As seen in table 4, the most common prescribed medication was penicillin.

Prescription rates for specific medications peaked in different age groups (Appendix 4.5), with antibiotics being most common in the 20-45 group (12.5%), medications for stomach and heartburn in the 46-65 group (6.7%), and lipid-lowering agents in the >65 group (7.4%).

ATC group	Description	N	%
J01C	Oral antibiotics (penicillin)	824	10.2%
M01A	Anti-inflammatory and pain relief medicine (like ibuprofen)	750	9.3%
A02B	Stomach and heartburn medicine	516	6.4%
D07A	Skin creams with steroids	411	5.1%
A06A	Laxatives	313	3.9%
D01A	Hormonal birth control	289	3.6%
G03A	Allergy pills	289	3.6%
R06A	Blood pressure medication	286	3.6%
C08C	Cholesterol-lowering medication	281	3.5%
R03A	Inhalers for breathing problems	272	3.4%
A10B	Oral diabetes medicine	270	3.4%
C10A	Moisturizers and skin protectants	239	3.0%
D02A	Nasal spray	235	2.9%
R01A	Antidepressants	215	2,7%

**Table 3:** Distribution of the top 15 most frequently prescribed medication groups (N=8,056).

One practice was excluded from this population since a complete medication overview was missing.

## Discussion

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This study analyzed the nature and extent of care provided for the 10,723 patients who visited one of the eight participating street practices in 2023-2024.

### *Key Findings*

The population in our study (N=10,723) was predominantly male (62.5%), in the age group 20-45 years (61.1%), from a non-EU country (67.9%) and uninsured (86.5%).

The most registered diagnoses were infectious diseases (26,8%), in particular acute upper respiratory infection and dermatophytosis. Within this group, 63.7% was prescribed at least one antimicrobial drug. The prevalence of at least one chronic condition was 14,9%, with cardiovascular diseases in 8.4% and diabetes in 5.2% of the population. In these groups, 79.9% of patients with cardiovascular diseases were prescribed a cardiovascular-related drug and 74.7% of diabetes patients were prescribed a diabetes-related drug. Injuries and trauma were registered in 11.4% of the population, with only 8.9% of these patients being prescribed an analgesic. Psychiatric disorders and addiction were equally registered at 6.7% of the population, of whom 32.9% were prescribed at least one psychiatric-related drug. Social problems were registered in only 9.3% of the population, while malignancies and intellectual disabilities were at the bottom with 1.2% and 0.1%, respectively.

In total, 59.1% of the patients were prescribed at least one medication, with penicillin (10.2%), anti-inflammatory and pain relief medication (9.3%), and stomach and heartburn medication (6.4%) being the most prescribed.

### *Comparison with Existing Literature*

#### **Demographic Characteristics**

The demographic characteristics of our study population align with existing literature on people experiencing homelessness in the Netherlands (5, 16, 17). However, the native country distribution in our study may be skewed due to the fact that the largest contributing practice is primarily focused on providing care to uninsured and undocumented individuals (18, 19). When comparing our data to Nivel data, which represents data of 426 regular general practices in the Netherlands, a notable difference in demographic characteristics is evident, particularly in the age distribution. While the 18–44 age group constitutes approximately one-third of the patient population in regular practice, it makes up two-thirds of the population in street care practices (20).

#### **Number of Patient Contacts**

The observed mean of 5 patient contacts over a two-year period is considerably lower than the rate found in conventional general practices, which typically average 5 contacts per patient annually (20). Several factors may account for this discrepancy. These include a reluctance among homeless or uninsured individuals to seek care, often resulting in delayed consultations (15). Furthermore, maintaining patient follow-up is challenging due to competing survival priorities and high patient mobility, as individuals may relocate and continue their treatment in other healthcare settings (12). Nevertheless, this finding indicates that low-barrier, free-of-charge access to street medicine does not necessarily lead to a high volume of unnecessary visits.

#### **Diagnoses and Pharmacological Treatment**

Consistent with previous literature, infectious diseases were the most registered diagnoses, with a prevalence of 26.8% and up to 31.6%, respectively (21). A discrepancy was observed in the prescription rates for antibiotics in our study population (11.5%) versus regular general practices (17.0%) (see

appendix 4.5). This finding could be attributed to the larger proportion of older patients in regular general practice. Prescription of antibiotics shows a clear age-related trend in regular general practice, with the highest rates observed in patients over 65, which is consistent with an increased risk of infection by age. In contrast, our study population shows a peak in the 20-45 age group (20). This difference is likely a direct result of factors such as poor living conditions and inadequate access to hygiene facilities, which increases vulnerability for infectious diseases (12).

The prevalence of chronic conditions in our study population (14.9%) was notably lower than the 31% observed in the regular general practitioner population. This difference was most pronounced in the >65 age group, with a prevalence of 40.3% in our study versus 61.2–81% in regular practice (Appendix 4.6) (22). This discrepancy may be attributed to underdiagnoses, as people experiencing homelessness often seek care only for acute symptoms, which is why many asymptomatic diseases, like chronic conditions, remain undiagnosed (5, 23).

In addition, while the prevalence of chronic conditions in our population's 46-65 age group (28.9%) appears comparable to that of the general practice population (23.7-51%), a notable discrepancy exists in prescribing preventative medications (22). Specifically, our population exhibits significantly lower prescription rates for lipid-lowering drugs (5.2% vs. 13.4%) and antithrombotics (2.7% vs. 8.9%) (20). This suggests that despite a similar prevalence, there may be under-prescription of these specific preventative medications within our population. These prescribing decisions may be influenced by the anticipated challenges of medication adherence in a population with unstable living conditions (8, 14).

Furthermore, a discrepancy in the registration of psychiatric disorders and addiction was observed between the two practice types. While dedicated practices reported 5.9 for psychiatric disorders and 5.0% for addiction, outreach practices registered considerably higher prevalences of 13.2% and 20.1%, respectively. This is considerably lower than the 42.6% reported in previous Dutch literature (24). This discrepancy may be attributed to the mostly chronic nature of psychiatric disorders and addiction, which means that the diagnoses were registered prior to the study period. Another reason could be a substantial underreporting of psychiatric disorders. This is even more pronounced with the registration of intellectual disability, which was registered in only 0.1% of our patient population despite an expected prevalence of around 30% (25).

Another discrepancy exists regarding the prescription of benzodiazepines. With a prescription rate of 6.5%, outreach street doctors prescribed these medications to a notably larger percentage of their patients compared to both dedicated street practices (0.7%) and regular general practices (2.7-5.0%) (see appendix 4.5) (20). However, this represents a downward trend compared to previous Dutch literature, in which benzodiazepines were prescribed to 25% of the street practice population (26).

A notable difference between the two types of street practices was observed in the prevalence of injuries and trauma. The prevalence in dedicated street practices was 10.4%, while it was considerably higher at 18.8% in outreach street practices. A potential explanation for this finding is the difference in the number of undocumented individuals within the two types of practices. Undocumented people visit street practices as they are not insured and often dare not to approach regular primary care, due to concerns about deportation and the high cost of treatment. However, their way of life is often not on the streets and therefore they are less prone to accidents and (addiction related) violence than people experiencing homelessness (27). With a mortality rate that is 15 times higher than the general population and accounting for 26% of all deaths, injuries and trauma highlight a significant impact on this population (13, 21). Given the absence of high-quality, comparable data on injuries and trauma from regular general practices, it was not possible to conduct a comparison.

While previous self-perceived literature documents a high prevalence of financial issues, unemployment, and social isolation among people experiencing homelessness, our study reveals that

these issues were registered in only 9.3% of our study population (5, 16). Although this is slightly higher than the prevalence in regular general practices (6.3%), this number likely indicates an underestimation in our available data.

## *Strengths and Limitations*

### **Limitations Data Registration**

The data reliability in our study is limited by the fact that Electronic Medical Record (EMR) systems are designed for clinical care, not research, which results in inconsistencies in data (28). The use of diagnostic codes can vary by diagnoses, physician and institution, and may be over- or underestimated depending on whether a physician records a suspected condition or leaves the record uncodified (28-30). This potential for underestimation is especially relevant in street medicine, where one-time consultations may prevent a doctor from fully identifying all relevant diagnoses, causing the data to reflect use of medical services more than actual disease prevalence (31). In addition, our study faced challenges with information on native country of patients. This information was either missing or in a free-text format, which prevented its inclusion in our analysis.

### **Limitations Data Extraction**

The primary limitation in our data extraction was the variety of EMR systems used across the eight participating street practices, making it impossible to apply a consistent data extraction method. This was most noticeable in three regular general practices where street medicine patients were integrated in the same EMR system as their regular patients. In these cases, we had to select patients based on predominantly homeless shelter addresses. This method likely led to exclusion of eligible patients and introduces potential selection bias into our findings.

In addition, it appeared to be not feasible to extract automated data on other treatments and referrals. As we preferred for this study to obtain data of as many patients as possible, we refrained from going over each individual medical record to extract these data.

### **Limitations Data Analysis**

To standardize the datasets across all practices, we had to limit our analysis by including each unique ICPC and ATC code only once per patient. This approach meant that we could not account for recurring diagnoses and repeat prescriptions. As a result, we could not accurately determine the true prevalence of certain conditions or the long-term or repeated use of specific medications, which likely led to an underestimation of the true prevalence within the street medicine population.

## *Implications for Future Research*

Our study provides insight into the nature and extent of care provided in street practices. To better evaluate street medicine outcomes relative to regular primary care, a case-control methodology is proposed. Additionally, future research should explore using AI for large-scale data extraction to better quantify clinical activities, such as referrals (32).

Unfortunately, a limitation of our study was the inability to measure adherence. In further research, it would be valuable to investigate whether the prescribed medication is also collected and used by this population. To address medication non-adherence due to financial constraints, medication donation initiatives could be considered. This is particularly relevant given that an estimated 95 million euros worth of medicine are discarded by pharmacies, representing a potential resource for patients in need (33).

To effectively assess the management of a chronic condition like diabetes, additional patient data is required, specifically recent blood glucose levels and HbA1c values. Only with this information can

conclusions be drawn about the chosen treatment and whether it deviates from regular general practices.

### *Implications for Practice*

An important limitation in this study was registration bias. For optimal data extraction in future research, it is crucial that street medicine practices have a separate EMR system for their street medicine patients, with a separate file for each individual patient. Furthermore, in our study, we examined the care needs and diagnoses for which patients presented for consultation. However, chronic conditions are often long-term diagnoses that may not have been fully recorded within the study period. To obtain a more accurate picture of the prevalence of diseases in the street medicine population, a system where each new diagnosis is recorded as a new episode would be beneficial. Episodes should be closed when the diagnosis is no longer active. This would allow for the extraction of a comprehensive patient episode list, enabling the accurate tracking and separate reporting of recurrent issues, such as infections.

In addition, the implementation of a structured approach to demographic data registration is crucial. This would allow the data to be easily extracted for research purposes, thereby providing a more accurate representation of the study population.

## Conclusion

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This study offers initial insight into the nature and extent of diagnoses and pharmaceutical interventions in street medicine practices in the Netherlands.

The results show a significantly lower prevalence of registered chronic conditions in street practices. Patients experiencing homelessness often present with urgent issues like infections or injuries, leaving asymptomatic diseases such as hypertension unaddressed and therefore unregistered. Consequently, this leads to significant undertreatment with crucial preventive medications, specifically lipid-lowering agents and antithrombotics, when compared to regular practices. This gap in preventative care places an already vulnerable population at a higher risk for future cardiovascular events.

The findings of this study highlight the need for structured data recording to accurately assess the true prevalence of conditions and to optimize care for this vulnerable population. Future research should prioritize addressing the registration and treatment of chronic conditions in street practices compared to regular primary care to gain further insight into the differences.

## References

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1. Health Consumer Powerhouse. Euro Health Consumer Index 2018. Health Consumer Powerhouse Ltd.; 2019.
2. Blumenthal D, Gumas ED, Shah A, Williams II RD, Gunja MZ. Mirror, Mirror 2024: A Portrait of the Failing U.S. Health System — Comparing Performance in 10 Nations. The Commonwealth Fund; 2024 September 19.
3. Slockers M, Zia Z, van Dijk T, van Laere I. Een protocol helpt bij zorg aan onverzekerden. Medisch Contact. 2019;74(33-34):41-3.
4. Doctors for Homeless. Straatzorg n.d. [Available from: <https://straatdokter.nl/straatzorg/>].
5. Verheul M, Van Laere I, Van Genugten W, M VdM. Self-perceived health problems and unmet care needs of homeless people in the Netherlands : the need for pro-active integrated care. Journal of Social Intervention: Theory and Practice. 2020;29(1):19.
6. Centraal Bureau voor de Statistiek. 33 duizend mensen dakloos begin 2024 CBS2024 [Available from: <https://www.cbs.nl/nl-nl/nieuws/2025/05/33-duizend-mensen-dakloos-begin-2024>].
7. Schel S, Wewerinke D, Kuijpers M, Scheepers A, Scholten L, Akkermans C, et al. Iedereen telt mee! : Hogeschool Utrecht, Lectoraat Wonen en Welzijn 2024.
8. Keogh C, O'Brien KK, Hoban A, O'Carroll A, Fahey T. Health and use of health services of people who are homeless and at risk of homelessness who receive free primary health care in Dublin. BMC Health Services Research. 2015;15.
9. Stenius-Ayoade A, Haaramo P, Erkkila E, Marola N, Nousiainen K, Wahlbeck K, et al. Mental disorders and the use of primary health care services among homeless shelter users in the Helsinki metropolitan area, Finland. BMC Health Services Research. 2017;17.
10. Cronin T, Healy D, McCarthy N, Smith SM, Travers J. Prevalence and risk factors of frailty in people experiencing homelessness: A systematic review and meta-analysis. J Frailty Aging. 2025;14(2):100029.
11. Calvo F, Carbonell X, Johnsen S. Health, mortality, and migration: A 15-year follow-up cohort of persons experiencing homelessness. Am J Orthopsychiatry. 2025.
12. Fazel S, Geddes JR, Kushel M. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. Lancet. 2014;384(9953):1529-40.
13. Slockers MT, Nusselder WJ, Rietjens J, van Beeck EF. Unnatural death: a major but largely preventable cause-of-death among homeless people? Eur J Public Health. 2018;28(2):248-52.
14. Zeitler M, Williamson AE, Budd J, Spencer R, Queen A, Lowrie R. Comparing the Impact of Primary Care Practice Design in Two Inner City UK Homelessness Services. J Prim Care Community Health. 2020;11:2150132720910568.
15. Ashwell G, Williamson AE, Pattinson M, Hwang SW. Caring for patients experiencing homelessness. Bmj. 2025;388:e080768.
16. Schel SHH, van den Dries L, van der Laan J, van de Mheen D, Wolf J. Initially homeless people in the Netherlands: housing status, prevalence of risk factors and changes in this prevalence 5.5 years after shelter entry. Journal of Social Distress and the Homeless. 2025;34(1):50-62.
17. van Dongen SI, van Straaten B, Wolf J, Onwuteaka-Philipsen BD, van der Heide A, Rietjens JAC, et al. Self-reported health, healthcare service use and health-related needs: A comparison of older and younger homeless people. Health & Social Care in the Community. 2019;27(4):E379-E88.
18. Kruispost.nl. Kruispost biedt zorg voor onverzekerden 2025 [Available from: <https://kruispost.nl/over-ons/>].
19. Open Research Amsterdam. Bevolking in cijfers 2024 [Available from: <https://openresearch.amsterdam/nl/page/117156/bevolking-in-cijfers>].
20. Terpstra N, Heins M, Weesie Y, van der Hout V, Baarda E, Hasselaar J, et al. Zorg door de huisarts: Nivel Zorgregistraties Eerste Lijn: jaarcijfers 2024 en trendcijfers 2020-2024. Utrecht; 2025.

21. Aldridge RW, Story A, Hwang SW, Nordentoft M, Luchenski SA, Hartwell G, et al. Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: a systematic review and meta-analysis. *Lancet*. 2018;391(10117):241-50.
22. Vz Info. Chronische aandoeningen en multimorbiditeit | Leeftijd en geslacht | Chronische aandoeningen 2025 [Available from: <https://www.vzinfo.nl/chronische-aandoeningen-en-multimorbiditeit/leeftijd-en-geslacht/chronische-aandoeningen>].
23. Argintaru N, Chambers C, Gogosis E, Farrell S, Palepu A, Klodawsky F, et al. A cross-sectional observational study of unmet health needs among homeless and vulnerably housed adults in three Canadian cities. *BMC Public Health*. 2013;13:577.
24. Slockers MT, van Laere IRA, van der Gevel AR, Slockers CG, van Marlen-Bos C, Mackenbach JP, et al. [Homeless patients in Rotterdam with a need for medical care: data from the Rotterdam Street Doctors' office in the years 2006-2017]. *Ned Tijdschr Geneesk*. 2020;164.
25. Van Straaten B, Schrijvers CTM, Van der Laan J, Boersma SN, Rodenburg G, Wolf J, et al. Intellectual Disability among Dutch Homeless People: Prevalence and Related Psychosocial Problems. *Plos One*. 2014;9(1).
26. Rabelink S, van den Muijsenbergh M. Social and medical problems of homeless people as presented to street doctors in the Netherlands and the healthcare provided by these doctors: a descriptive pilot study. 2017.
27. Schoevers MA, Loeffen MJ, van den Muijsenbergh ME, Lagro-Janssen AL. Health care utilisation and problems in accessing health care of female undocumented immigrants in the Netherlands. *Int J Public Health*. 2010;55(5):421-8.
28. Coleman N, Halas G, Peeler W, Casacang N, Williamson T, Katz A. From patient care to research: a validation study examining the factors contributing to data quality in a primary care electronic medical record database. *BMC Fam Pract*. 2015;16:11.
29. Hjerpe P, Merlo J, Ohlsson H, Bengtsson Boström K, Lindblad U. Validity of registration of ICD codes and prescriptions in a research database in Swedish primary care: a cross-sectional study in Skaraborg primary care database. *BMC Med Inform Decis Mak*. 2010;10:23.
30. Olaker VR, Fry S, Terebuh P, Davis PB, Tisch DJ, Xu R, et al. With big data comes big responsibility: Strategies for utilizing aggregated, standardized, de-identified electronic health record data for research. *Clin Transl Sci*. 2025;18(1):e70093.
31. Slockers M. Mortality, Health Problems and Access to Care for Homeless People Rotterdam: Erasmus University Rotterdam; 2021.
32. Guevara M, Chen S, Thomas S, Chaunzwa TL, Franco I, Kann BH, et al. Large language models to identify social determinants of health in electronic health records. *NPJ Digit Med*. 2024;7(1):6.
33. Schrader W, Van Rijn J, Mellink B, Farih N, Eekhof J. Pilotonderzoek toont onverwachte omvang en kosten van vernietigde medicijnen. *Huisarts & Wetenschap*. 2024.

## Appendix 1 – Data Extraction Protocol

### Demographic Characteristics

- Extraction from all patients (including transient patients, deceased and deregistered):
  - o Patient ID
  - o Age or birthyear
  - o Native country
  - o Insurance UZOVI number

All unique patient ID's with at least one consultation or medical prescription in one list, filter doubles. Remove all demographic characteristics from patient who had no consultation or medical prescription in study period.

Demographic characteristics are being anonymized after data extraction and in the regarding street medicine practice.

- Patient ID → Case number

Age_group	Years	Birth year
1	<20	>2003
2	20-45	1978-2003
3	46-65	1957-1977
4	>65	<1957
9	Unknown	

Code	Gender
1	Female
2	Male
9	Unknown

Code	Country
1	Netherlands
2	EU/EER
3	Non-EU
9	Unknown

Code	Status
1	Insured
2	Uninsured
9	Unknown

### Diagnoses

- Extraction all consultations (if possible, only from 2023-2024, if not then all consultations)
  - o Date of consultation
  - o Patient ID
  - o ICPC

In powerquery Excel

*Longlist ICPC:*

- Filter on date, only consultations from 2023-2024.
- Make a table with 2 columns, patient ID and ICPC
- Filter on the ICPC codes from the list of ICPC groups, remove other.
- Filter and remove all double ICPC codes per unique patient

*List per diagnoses group*

- Start with the longlist ICPC
- Link the ICPC codes to the diagnoses groups (columns: patient ID, ICPC, diagnoses group)
- Remove ICPC column
- Filter and remove all double diagnoses groups per unique patient

- Make a pivot table, so you have a table with the patient ID and diagnoses groups as columns. Use 0 for no diagnoses in group and 1 for at least one diagnoses in group

### **Medical Prescriptions**

- Extraction all ATC codes (if possible, only from 2023-2024, if not then all ATC codes)
  - o Date of prescription
  - o Patient ID
  - o ATC code

#### *Longlist ATC:*

- Filter on date, only prescriptions from 2023-2024.
- Make a table with 2 columns, patient ID and ATC
- Filter on the ATC codes from the list of ATC groups, remove other.
- Filter and remove all double ATC codes per unique patient

#### *List per medication group*

- Start with the longlist ATC
- Link the ATC codes to the medication groups (columns: patient ID, ATC, medication group)
- Remove ATC column
- Filter and remove all double medication groups per unique patient
- Make a pivot table, so you have a table with the patient ID and medication groups as columns. Use 0 for no prescription in group and 1 for at least one prescription in group

Merge the demographic characteristics, list per diagnoses group and list per medication group.

## Appendix 2 – List of ICPC Groups

ICPC group	ICPC code
Psychiatric disorders (including neurocognitive problems)	P02.01; P70; P73; P74; P75; P76; P77; P78; P79; P80; P99
Addiction	P15; P17; P18; P19; P80.02
Intellectual disability	P85; A90.01
Diabetes Mellitus	T90; F83.03; W84.02
COPD/asthma	R95; R96
Cardiovascular disorders	K74; K75; K76; K77; K86; K87; K89; K90
Abdominal disorders	D94
Neurological disorders	N86; N87
Physical disability	A28
Malignancies	A79; B72; B73; B74; F74.01; D74; D75; D76; D77; H75.01; K72.01; L71.01; N74; R84; R85; S77; T71; U75; U76; U77; W72; X75; X76; X77; Y77; Y78
Injuries and trauma	A80; A81; A82; D79; D80; F75; F76; F79; H76; H77; H78; H79; L72; L73; L74; L75; L76; L77; L78; L79; L80; L81; L96; N79; N80; N81; R87; R88; S14; S15; S16; S17; S18; S19; U80; X82; Y80
Infectious diseases	A03; A70; A71; A72; A73; A74; A75; A76; A77; A78; B70; B90; D22; D70; D71; D72; D73; F70; F72; F73; H70; H71; H74; L70; N70; N71; N72; N73; R70; R71; R72; R73; R74; R75; R76; R77; R78; R79; R80; R81; R82; R83; S09; S10; S11; S70; S71; S72; S73; S74; S75; S76; S97; U70; U71; U72; W70; W71; W84.01; W94; X70; X71; X72; X73; X74; X84; X85; X90; X91; X99.04; X99.06; Y70; Y71; Y72; Y73; Y74; Y75; Y76; Y99.03
Social problems	Z01; Z03; Z04; Z04; Z05; Z06; Z07; Z08; Z09; Z10; Z11; Z12; Z13; Z14; Z15; Z16; Z17; Z18; Z19; Z20; Z21; Z22; Z23; Z24; Z25; Z26; Z27; Z28; Z29

## Appendix 3 – List of ATC Groups

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ICPC group	ATC group	ATC code
Psychiatric disorders (including neurocognitive problems)	Antidepressants	N06A
	Antipsychotics	N05A
	Sedatives	N05C
Addiction	Drugs used in addictive disorders	N07B
Diabetes Mellitus	Insuline	A10A
	Oral antidiabetics	A10B
Cardiovascular disorders	Antihypertensives	C02; C03; C07; C08; C09
	Lipid lowering agents	C10
	Antithrombotics	B01
Infectious diseases	Antimicrobial agents	J01; J02; J04; P01A; P02; P03; D01; D06A; D06C; D07C; D08A; G01; S01A; S01C; S02A; S02C; S03A; S03C
Injuries and trauma	Analgesics	N02; M01AE

## Appendix 4 – Supplementary Tables

### 4.1 Demographic Characteristics per Street Practice Type

		Street practices that exclusively focus on the homeless population N = 9502		General practitioners from regular practices who provide outreach services N = 1221		Total N = 10,723	
		N	%	N	%	N	%
<b>Gender</b>	Female	3721	39,20%	278	22,80%	3999	37,30%
	Male	5781	60,80%	917	75,10%	6698	62,50%
	Unknown	0	0,00%	26	2,10%	26	0,20%
<b>Age group</b>	<20 years	437	4,60%	66	5,40%	503	4,70%
	20-45 years	5880	61,90%	667	54,60%	6547	61,10%
	46-65 years	2828	29,80%	443	36,30%	3271	30,50%
	>65 years	357	3,80%	33	2,70%	390	3,60%
	Unknown	0	0,00%	12	1,00%	12	0,10%
<b>Native country</b>	Netherlands	584	6,10%	16	1,30%	600	5,60%
	EU/EER	1347	14,20%	3	0,20%	1350	12,60%
	Non-EU	7261	76,40%	18	1,50%	7279	67,90%
	Unknown	310	3,30%	1184	97,00%	1494	13,90%
<b>Insurance status</b>	Insured	559	5,90%	653	53,50%	1212	11,30%
	Uninsured	8943	94,10%	337	27,60%	9280	86,50%
	Unknown	0	0,00%	231	18,90%	231	2,20%

**Table 4:** Distribution of demographic characteristics per type of street medicine practice

### 4.2 Diagnosis Groups in Total Population

Diagnoses group	N <sup>a</sup>	% <sup>b</sup>	
<b>Psychiatric disorders</b>	718	6,7	(5.0-29.0)
<b>Addiction</b>	720	6,7	(1.7-57.9)
<b>Intellectual disability</b>	12	0,1	(0.0-2.6)
<b>Chronic conditions</b>	1601	14,9	(4.8-23.7)
Diabetes Mellitus	554	5,2	(3.3-7.2)
Cardiovascular diseases	897	8,4	(0.0-10.7)
COPD/asthma	313	2,9	(1.4-15.8)
Abdominal diseases	16	0,1	(0.0-0,5)
Neurological diseases	6	0,1	(0.0-0.3)
Physical disability	9	0,1	(0.0-0.5)
<b>Malignancies</b>	129	1,2	(0.0-1.9)
<b>Infectious diseases</b>	2871	26,8	(11.7-55.3)
<b>Injuries and trauma</b>	1221	11,4	(9.4-27.6)
<b>Social problems</b>	992	9,3	(4.8-60.4)

**Table 6:** Distribution of patients by diagnosis group

a. Since patients could have multiple diagnoses, the counts do not add up to the total number of patients (N=10,723).

b. In some patients no diagnosis was registered, which is why the percentages do not sum to 100%.

## 4.2 Diagnosis Groups per Street Practice Type

	Street practices that exclusively focus on the homeless population		General practitioners from regular practices who provide outreach services	
	N	%	N	%
<b>Psychiatric disorders</b>	557	5,90%	161	13,20%
<b>Addiction</b>	474	5,00%	246	20,10%
<b>Intellectual disability</b>	6	0,10%	6	0,50%
<b>Chronic conditions</b>	1424	15,00%	177	14,50%
Diabetes Mellitus	500	5,30%	54	4,40%
Cardiovascular diseases	823	8,70%	74	6,10%
COPD/asthma	242	2,50%	71	5,80%
Abdominal disorders	11	0,10%	5	0,40%
Neurological disorders	5	0,10%	1	0,10%
Physical disability	6	0,10%	3	0,20%
<b>Infectious diseases</b>	2537	26,70%	334	27,40%
<b>Injuries and trauma</b>	991	10,40%	230	18,80%
<b>Social problems</b>	743	7,80%	249	20,40%

**Table 7:** Distribution of dedicated street practices (N=9,502) and outreach practices (N=1,221) by diagnosis group.

## 4.4 Diagnosis Group per Age Group

	<20 years		20-45 years		46-65 years		>65 years	
	N	%	N	%	N	%	N	%
<b>Psychiatric disorders</b>	13	2,60%	472	7,20%	201	6,10%	32	8,20%
<b>Addiction</b>	4	0,80%	428	6,50%	270	8,30%	18	4,60%
<b>Intellectual disability</b>	1	0,20%	8	0,10%	2	0,10%	1	0,30%
<b>Chronic conditions</b>	16	3,20%	483	7,40%	944	28,90%	157	40,30%
Diabetes Mellitus	3	0,60%	121	1,80%	362	11,10%	68	17,40%
Cardiovascular diseases	0	0,00%	214	3,30%	587	17,90%	96	24,60%
COPD/asthma	14	2,80%	155	2,40%	129	3,90%	14	3,60%
Abdominal disorders	0	0,00%	12	0,20%	4	0,10%	0	0,00%
Neurological disorders	0	0,00%	3	0,00%	2	0,10%	1	0,30%
Physical disability	0	0,00%	4	0,10%	4	0,10%	1	0,30%
<b>Infectious diseases</b>	165	32,80%	1805	27,60%	808	24,70%	91	23,30%
<b>Injuries and trauma</b>	50	9,90%	779	11,90%	360	11,00%	32	8,20%
<b>Social problems</b>	37	7,40%	530	8,10%	374	11,40%	51	13,10%

**Table 8:** Distribution of age groups (<20 years N=503, 20-45 years N=6,547, 46-65 years N=3271, >65 years N=390) by diagnosis group.

#### 4.5 Pharmacological Treatment per Age Group

	N05BA - Benzodiazepines		J01 - Antibiotics		A02 – Heartburn and stomach medication		C10A – Lipid-lowering agents	
	Study population	Nivel	Study population	Nivel	Study population	Nivel	Study population	Nivel
<20 years	0.6%	0.2%	11.1%	12.1%	0.8%	0.7%	0%	<0.1%
20-45 years	1.3%	2.7%	12.5%	14.1%	4.5%	6.1%	0.7%	0.8%
46-65 years	1.7%	5.0%	10.2%	17.2%	6.7%	18.0%	5.5%	13.4%
>65 years	0.8%	6.2%	7.9%	22.9%	6.4%	32.5%	7.4%	35.0%
<b>Total</b>	<b>1.4%</b>	<b>3.7%</b>	<b>11.5%</b>	<b>17.0%</b>	<b>5.1%</b>	<b>14.9%</b>	<b>2.4%</b>	<b>11.6%</b>

**Table 9:** Distribution of prescription rates for selected medication classes in the study population and the Nivel cohort by age group.

#### 4.6 Chronic Conditions per Age Group

	N	%	Nivel
<20 years	16	3,18%	9,80%
20-45 years	483	7,38%	10-18,2%
46-65 years	944	28,86%	23,7-51%
>65 years	157	40,26%	61,2-81%

**Table 10:** Distribution of chronic conditions in the study population and the Nivel cohort by age group.

		K86		T90	
		Hypertension		Diabetes	
		per 1000 patients	%	per 1000 patients	%
<b>Nivel data</b>	20-24 years	3,5	0,35	7,1	0,71
	25-29 years	7,6	0,76	8,7	0,87
	30-34 years	15,2	1,52	11,7	1,17
	35-39 years	27,6	2,76	16,9	1,69
	40-44 years	48,7	4,87	25,5	2,55
	<b>Total</b>		<b>0,4-4,9%</b>		<b>0,7-2,6%</b>
	45-49 years	81,4	8,14	39,4	3,94
	50-54 years	136,7	13,67	63,3	6,33
	55-59 years	201,1	20,11	87,8	8,78
	60-64 years	271,4	27,14	116,7	11,67
	<b>Total</b>		<b>8,1-27,1%</b>		<b>3,9-11,7%</b>
	<b>Studypopulation</b>	20-45 years		2,6	
46-65 years			13,6		11,1

**Table 11:** Distribution of hypertension and diabetes in the study population and the Nivel cohort by age group.