

IPERTENSIONE NEL SUD DELLA SVIZZERA - PREVALENZA E EFFICACIA DELLA PRESA IN CARICO

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Riassunto

L'ipertensione, contribuendo in modo significativo alla morbilità e alla mortalità cardiovascolare, è una delle principali sfide per la salute pubblica a livello globale. Questo studio di popolazione ne analizza la prevalenza, la gestione medicamentosa e la sua efficacia nel cantone Ticino in Svizzera. Un totale di 1.202 individui ha partecipato allo studio, sottoponendosi a misurazioni della pressione arteriosa in ambulatorio e a monitoraggio pressorio delle 24 ore. I risultati indicano che oltre il 40% della popolazione esaminata presentava livelli di pressione arteriosa ipertensivi secondo le linee guida ESC 2024 e ESH 2023. Un risultato chiave è che un individuo su quattro con ipertensione in ambulatorio aveva un'ipertensione da camice bianco, evidenziando l'importanza dell'ABPM per distinguere le elevazioni contestuali dei parametri pressori dall'ipertensione sostenuta. Inoltre, tre quarti dei soggetti diagnosticati con ipertensione in ambulatorio presentavano un'ipertensio-

ne di Grado 1, sottolineando la necessità di un intervento precoce attraverso modifiche dello stile di vita e trattamenti farmacologici, se necessario.

Preoccupante è la quota significativa di individui ipertesi che non ricevevano un trattamento adeguato. Tra i pazienti ipertesi, il 74% non era trattato e, tra coloro in terapia, l'80% non raggiungeva i livelli target di pressione arteriosa. Lo studio ha rilevato che l'85% dei pazienti in monoterapia rimaneva iperteso, indicando la possibile necessità di una terapia combinata e di un'ottimizzazione del trattamento.

Questi risultati evidenziano il ruolo essenziale dei medici di base nella diagnosi e nella gestione efficace dell'ipertensione. È infatti loro il compito di garantire una valutazione accurata della pressione arteriosa, promuovere cambiamenti dello stile di vita e adattare le terapie farmacologiche alle esigenze individuali. Un approccio globale e multifattoriale, che includa l'educazione del paziente, il monitoraggio regolare e strategie terapeutiche basate sull'evidenza, è cruciale per migliorare il controllo dell'ipertensione e ridurre i rischi cardiovascolari associati. Questo studio sottolinea l'urgente necessità di strategie di salute pubblica più efficaci per affrontare l'ipertensione e le sue conseguenze a lungo termine.

Introduction

Hypertension is a widespread condition with profound implications for global health. Often asymptomatic, it is referred to as the "silent killer," affecting 1.3 billion adults worldwide [1, 2]. Characterized by persistently elevated blood pressure ($\geq 140/90$ mmHg) [1, 2], hypertension is a leading cause of severe health complications such as heart disease, stroke, and kidney failure [3]. Despite its substantial health burden, hypertension frequently

goes undiagnosed and inadequately managed, with only 21% of affected individuals achieving effective blood pressure control [1-3].

The economic impact of hypertension is equally significant. Uncontrolled blood pressure imposes substantial costs on healthcare infrastructures, particularly in treating complications such as heart diseases and strokes [3]. Individuals and families, particularly in low- and middle-income countries (LMICs), disproportionately bear these costs due to limited access to healthcare and essential medications [4].

Even in high-income countries, hypertension remains a pressing healthcare challenge due to its subtle onset and chronic progression, which demands consistent management and monitoring. In Switzerland, approximately 1.5 million adults aged 30–79 years are living with hypertension, which accounts for nearly one in three adults in this age group [5]. Addressing this issue is crucial, as achieving a 50% blood pressure control rate in Switzerland would require effective treatment for an additional 180,000 individuals, potentially preventing 18,000 deaths by 2040 [5].

National health studies, such as the May Measurement Month campaigns [6], have identified significant gaps in hypertension awareness and management in Switzerland. On one hand the survey confirmed that about one-third of the Swiss population has blood pressure values in the hypertensive domain, and on the other that only half of those diagnosed with hypertension had their blood pressure under control [7]. This also aligns with findings from the Swiss Health Survey [11], which reported that 19.5% of the population aged 15+ had high blood pressure in 2022, up from 14.7% in 2002. These trends underscore the growing prevalence of hypertension and highlight the impor-

tance of early interventions and long-term strategies to address risk factors and prevent complications [6-8].

A specific management challenge is white coat hypertension (WCH), defined as elevated blood pressure readings ($\geq 140/90$ mmHg) observed only in clinical settings, with normal home or ambulatory measurements. Previously considered benign, WCH is now recognized as predictive of sustained hypertension and increased cardiovascular risk [9]. Additionally, natural fluctuations in blood pressure, such as a typical 10–20% nocturnal "dip," are important prognostic factors. The absence of this dipping pattern is associated with increased cardiovascular risk, including heart attacks, strokes, and kidney disease [10].

Current ESC and ESH guidelines recommend a multifaceted approach, combining lifestyle interventions—including dietary modifications, increased physical activity, and smoking cessation—with pharmacological therapies. Standard pharmacological interventions typically involve ACE inhibitors, angiotensin II receptor blockers, dihydropyridine calcium channel blockers, diuretics (thiazides and thiazide-like diuretics such as hydrochlorothiazide, chlorthalidone, and indapamide), and beta-blockers.

A recent Swiss study examining trends in potentially avoidable hospitalizations (PAH) due to hypertension (1998–2018) found that hypertension-related PAH patients were more likely younger, female, non-Swiss nationals, and admitted as emergencies, resulting in healthcare expenditures of approximately CHF 16.5 million in 2018 alone. This highlights the substantial economic impact of uncontrolled hypertension and underscores the need for enhanced prevention and management strategies [11].

Lifestyle factors significantly influ-

ence hypertension prevalence in Switzerland. The SAPALDIA cohort study identified obesity and physical inactivity as major contributors [12]. Furthermore, regional differences in hypertension awareness, treatment, and control exist, with urban areas generally performing better than rural regions. Linguistic disparities also affect management; Italian- and French-speaking regions exhibit lower awareness and treatment rates compared to the German-speaking region, influenced by factors such as healthcare access and cultural perceptions [13].

Unfortunately, data specific to hypertension in the Italian-speaking region of Switzerland remain limited. To address this gap, our study aims to characterize hypertension prevalence, management, and treatment outcomes in this region, providing valuable insights into locally relevant factors.

Methods

This study is based on the Ticino Epidemiological Stiffness Study (TEST study), a cross-sectional population study conducted in the Canton of Ticino (Southern Switzerland) between 2017 and 2018. It involved residents aged 18 years and older which were recruited through random sampling from a mailing list provided by the Swiss Federal Statistical Department [18]. The TEST study adhered to the principles of the Helsinki Declaration of 1964 and was approved by the local Swiss ethics committee (CE 3115-2016-01718). All participants provided informed consent to take part in the study.

The study included a total of 1,202 participants. Each participant completed a standardized questionnaire designed to assess health status, medical history, dietary habits, and physical activity. Each subject was asked if he or she was aware of his/her values of blood pressure and

whether he or she was taking anti-hypertensive drugs and in that case which ones. Blood samples were collected to analyze serum glucose, HbA1c, creatinine, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides, total cholesterol, and cystatin. Additionally, a 24-hour urine collection was conducted, divided into "daytime" and "nighttime" periods based on the participants' self-reported sleep and wake times.

Regarding blood pressure, it was measured two times during the clinical visit and then each participant was equipped with an Ambulatory Blood Pressure Monitor (ABPM) for continuous 24-hour monitoring. The device recorded measurements every 30 minutes during the day and once per hour at night. Blood pressure monitoring was conducted on working days, and participants were instructed to follow their usual daily routine [15].

For the purposes of this study, in order to identify subjects with hypertension, we used the 2024 ESC and 2023 ESH guideline definitions: an office systolic blood pressure (BP) of ≥ 140 mmHg and/or diastolic BP of ≥ 90 mmHg or a systolic daytime ABPM ≥ 135 mmHg and/or nighttime ABPM ≥ 120 mmHg or a systolic 24h ABPM ≥ 130 mmHg and/or diastolic ≥ 80 mmHg. Stress-induced hypertension (also known as white-coat HT), was defined as elevated office blood pressure with normal ABPM measurements, while masked hypertension was defined as BP below the HT diagnostic threshold in office but above the HT diagnostic threshold in ABPM measurements. Blood pressure dipping was considered normal if the difference between daytime and nighttime systolic pressure was $\geq 10\%$.

Results

A total of 1,202 subjects were in-

	Total hypertensive subjects	Systolic blood pressure in office ≥ 140 mmHg	Diastolic blood pressure in office ≥ 90 mmHg	24-hour systolic blood pressure ≥ 130 mmHg	24-hour diastolic blood pressure ≥ 80 mmHg	Daytime systolic blood pressure ≥ 135 mmHg	Nighttime systolic blood pressure ≥ 120 mmHg
Number of subjects	556	251	239	197	298	170	261
% of the total	46%	21%	20%	16%	25%	14%	22%

Tab. 1: Main findings in the population.

cluded in the study, of whom 556 (46%) were classified as hypertensive based on their levels of BP in office or at ABPM, or the presence of ongoing antihypertensive treatment.

Office blood pressure measurements indicated that 251 participants (21%) had systolic hypertension (≥ 140 mmHg), while 239 (20%) had diastolic hypertension (≥ 90 mmHg). Ambulatory blood pressure monitoring (ABPM) revealed that 197 individuals (16%) had 24-hour systolic hypertension (≥ 130 mmHg), whereas 298 (25%) presented with 24-hour diastolic hypertension (≥ 80 mmHg). Daytime systolic hypertension (≥ 135 mmHg) was detected in 170 subjects (14%), while nighttime systolic hypertension (≥ 120 mmHg) was observed in 261 subjects (22%). Among all subjects, 145 (26%) were undergoing antihypertensive therapy (Table 1).

Regarding office hypertension, 334 individuals exhibited elevated blood pressure in the clinical setting. Stress-induced hypertension (also known as white-coat HT), defined as elevated office blood pressure with normal ABPM measurements, was identified in 88 subjects, representing 26% of those with office hypertension. Among the individuals with normal office blood pressure, 23% were diagnosed with masked hypertension, defined as BP below the HT diagnostic threshold in office but above the HT diagnostic threshold in ABPM measurements. The prevalence of non-dippers (difference be-

tween systolic daytime pressure and systolic nighttime pressure $< 10\%$) was 55%.

Office blood pressure severity classification indicated that 242 participants (72% of those with office hypertension) had Grade 1 hypertension (systolic 140–159 mmHg and/or diastolic 90–99 mmHg). Grade 2 hypertension was observed in 77 subjects (23%) with values of systolic BP between 160 and 179 mmHg and/or diastolic between 100 and 109 mmHg, while Grade 3 hypertension ($\geq 180/110$ mmHg) was identified in 15 subjects (5%).

As far as the prevalence and treatment rates across different age groups, among younger individuals (18-40 years), 26% had HT, but only 1.4% of them were receiving treat-

ment. In contrast, HT prevalence rises with age (47% in 41-65 years and 74% in >65 years), with a higher proportion of treated individuals in older groups, respectively 9.8% and 36% (Fig. 1).

Among hypertensive patients, 411 (74%) were not receiving any pharmacological treatment. Among the 145 treated individuals, 116 (80%) did not achieve target blood pressure levels. Specifically, among those on monotherapy ($n=74$), 63 remained hypertensive, representing 85% of this subgroup. Their mean office blood pressure was 139/88 mmHg, with a 24-hour average of 128/78 mmHg, daytime systolic blood pressure of 131 mmHg, and nighttime systolic blood pressure of 119 mmHg. Among patients on dual therapy ($n=52$), 39 remained hypertensive (75%), with an office blood pressure of 141/85 mmHg, 24-hour average of 127/78 mmHg, daytime systolic blood pressure of 130 mmHg, and nighttime systolic blood pressure of 119 mmHg. Lastly, among those on three or more medications ($n=19$), 14 remained hypertensive (73%). Their mean office blood pressure was 137/84 mmHg, with a 24-hour average of

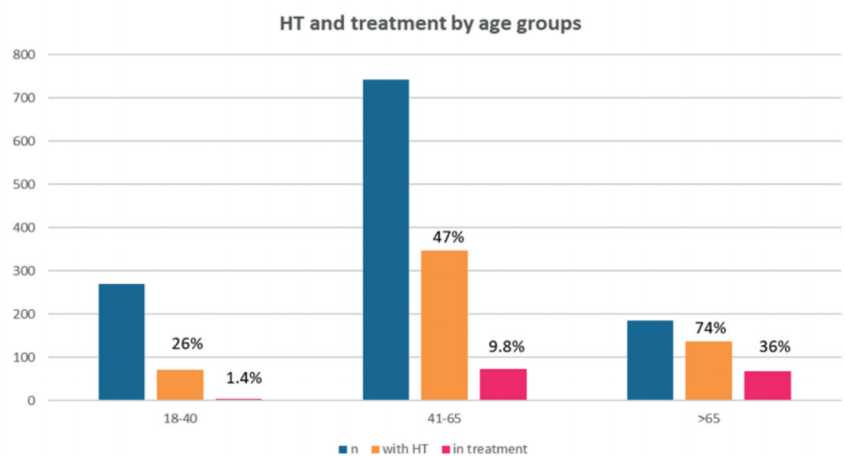


Fig. 1: Percentage of subjects with hypertension (orange) and treated with antihypertensive medications (pink) compared with total subjects (blue).

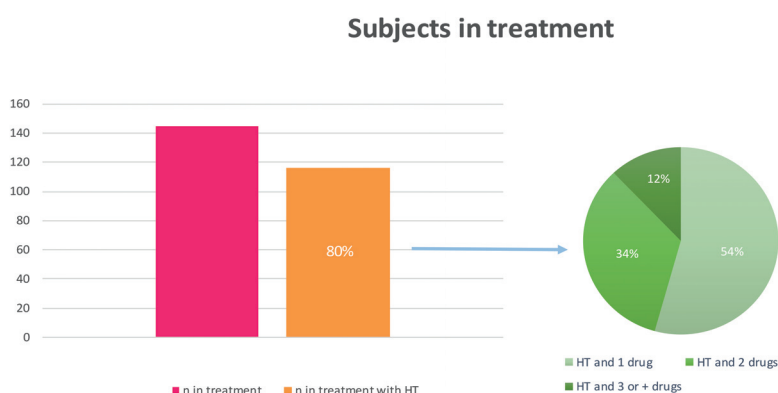


Fig. 2: Percentage of subjects in treatment not reaching target blood pressure values (orange) broken down by number of medications taken (pie chart).

of patients on dual therapy and 73% on three or more medications do not achieve adequate blood pressure control. These findings, although referring to the diagnosis and not to the severity of hypertension, suggest that hypertension management requires a more personalized approach, with close monitoring and, potentially, optimization of medication regimens. The role of the primary care physician is essential in the early detection, assessment, and management of hypertension. Physicians should be equipped to evaluate the reliability of office blood pressure measurements and determine the necessity for additional diagnostic tools such as ABPM. Moreover, they play a pivotal role in guiding patients toward lifestyle modifications and implementing pharmacological interventions when necessary. Regular follow-ups and treatment adjustments based on individual patient responses are crucial for optimizing blood pressure control and minimizing the risk of long-term complications.

In conclusion, this study highlights the high prevalence of hypertension, the challenges in accurate diagnosis, and the substantial proportion of treated individuals who fail to reach target blood pressure levels. A multifaceted approach, incorporating lifestyle interventions, patient education, and tailored pharmacological strategies, is essential for improving hypertension management and reducing its impact on public health.

122/78 mmHg, daytime systolic blood pressure of 124 mmHg, and nighttime systolic blood pressure of 116 mmHg (**Fig 2**). We considered a subject hypertensive whether there were one or more of the following criteria: an office systolic blood pressure (BP) of ≥ 140 mmHg and/or diastolic BP of ≥ 90 mmHg or a systolic daytime ABPM ≥ 135 mmHg and/or nighttime ABPM ≥ 120 mmHg or a systolic 24h ABPM ≥ 130 mmHg and/or diastolic ≥ 80 mmHg.

Discussion

The present study provides critical insights into the prevalence and management of hypertension in the examined population. According to the 2024 ESC and 2023 ESH guidelines more than 40% of the subjects exhibited hypertensive blood pressure levels, emphasizing the widespread nature of this condition and the potential public health implications.

One of the key findings of this study is that one in four individuals with office hypertension presents stress-induced hypertension, characterized by elevated blood pressure in the clinical setting but normal readings

in ambulatory monitoring. This underscores the need for accurate diagnostic methods, including ABPM, to differentiate between true hypertension and transient office-induced elevations. Failure to recognize this phenomenon may lead to unnecessary treatment, exposing patients to potential adverse effects without clinical benefit.

Additionally, the study reveals that almost three-quarters of individuals with office hypertension have Grade 1 hypertension. This finding highlights an important opportunity for early intervention, which could significantly impact long-term cardiovascular outcomes. Lifestyle modifications, including dietary adjustments, increased physical activity, and weight management, should be prioritized to prevent progression to more severe hypertension.

A particularly concerning aspect of the study is the high percentage of treated hypertensive individuals who fail to reach target blood pressure levels. Among those receiving monotherapy, 85% remain formally hypertensive, indicating a need for more effective therapeutic strategies, including dose adjustments, or combination therapy. Similarly, 75%

Hypertension - prevalence and management efficacy in Southern Switzerland

Abstract

Hypertension is a major public health concern worldwide, significantly contributing to cardiovascular morbidity and mortality. This study investigates the prevalence, management, and treatment outcomes of hypertension in the Italian-speaking region of Switzerland. A total of 1,202 individuals participated in the study, undergoing office blood pressure measurements and 24-hour ambulatory blood pressure monitoring.

Results indicate that over 40% of the examined population exhibited hypertensive blood pressure levels according to the 2024 ESC and 2023 ESH guidelines. A key finding is that one in four individuals with office hypertension experienced stress-induced hypertension, highlighting the importance of ambulatory blood pressure monitoring in distinguishing context related elevations from sustained hypertension. Additionally, three-quarters of those diagnosed with office hypertension presented with Grade 1 hypertension, underscoring the need for early intervention through lifestyle modifications and pharmacological treatment when necessary.

Alarming, a significant proportion of hypertensive individuals did not receive adequate treatment. Among hypertensive patients, 74% were untreated, and among those undergoing treatment, 80% failed to reach target blood pressure levels. The study found that 85% of patients on monotherapy remained hypertensive, indicating the potential need for combination therapy and treatment optimization.

These findings emphasize the essential role of primary care physicians in diagnosing and managing hypertension effectively. Physicians must en-

sure accurate blood pressure assessment, promote lifestyle changes, and tailor pharmacological interventions to individual needs. A comprehensive, multifaceted approach incorporating patient education, regular monitoring, and evidence-based treatment strategies is crucial to improving hypertension control and reducing the associated cardiovascular risks. This study highlights the urgent need for enhanced public health strategies to address hypertension and its long-term consequences effectively.

Keywords: Hypertension, Prevalence, Management, Treatment efficacy, Switzerland

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Declarations

- Authors' role in the preparation of the manuscript: conceptualization, L.G., M.Z., and F.C.; investigation, R.D.G. and L.G.; data curation, M.Z. and R.D.G.; writing—original draft preparation, M.Z., L.G. S.S. and F.C.; writing—review and editing, L.G. and F.M. All authors have read and agreed to the published version of the manuscript.
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- Access to raw data: the authors are ready to provide the raw data upon reasonable request.