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Designing a Healthcare Utilization Index to Enable Worldwide Patient Comparisons: A Cross-Sectional Study

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Abstract

Currently, there is no straightforward measure that combines the extent to which a patient uses different healthcare services into a comprehensive score. This study aimed to develop such a tool and investigate its relationship to overall health outcomes, including mortality and life expectancy. We developed the Healthcare Utilisation (HUTIL) index by assigning weights to different healthcare services based on their typical costs compared to a primary care physician (PCP) visit. These cost ratios were sourced from global data found in literature and online databases. Using these weights, we calculated an annual average HUTIL score per person across European countries using official statistics and EU data. Countries were then grouped according to whether their scores were above or below the European median and compared in terms of mortality rates and life expectancy. Analysis of data from 63 countries showed that, compared with PCP consultation, specialist visits cost about twice as much (median ratio 2), emergency department visits four times as much (median ratio 4), nursing home visits half as much (median ratio 0.5), and each hospital day about eight times as much (median ratio 8). Using these ratios, the HUTIL index was calculated for 26 European countries. Countries with scores above the median tended to have higher death rates (1047 vs. 889 per 100,000 people; statistically significant) and shorter life expectancy (78.2 vs. 82.0 years) compared with countries below the median. The cost ratio between healthcare services and primary care visits is surprisingly stable worldwide. The HUTIL index, based on these ratios, has the potential to serve as a global tool for assessing the utilization of healthcare services and supporting comparative health research.

Keywords: Health, Healthcare services, Healthcare Utilisation (HUTIL) index, Health research

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Introduction

Healthcare services utilisation refers to the measurement or description of how often individuals use healthcare services aimed at preventing or treating health issues, promoting health maintenance and well-being, or

acquiring information about their health status and prognosis [1].

Research on healthcare utilisation typically depends on indicators such as the cost and the volume of services consumed [1–5], yet both of these have inherent drawbacks. The costs of medical procedures and consultations vary significantly across countries and over time [6, 7], rendering costs alone an unreliable proxy for utilization levels. For instance, in the United States, healthcare spending increased substantially between 1977 and 2017, while the actual volume of services used grew at a slower pace [8]. This disconnect reduces the usefulness of costs as a sole measure for comparing healthcare utilisation across diverse healthcare systems or historical periods. Meanwhile, although more than 30 different indicators exist for measuring healthcare utilisation, most focus on the volume of a single type of healthcare service [2]. Tracking volumes of individual services, such as hospital stays, primary care visits, specialist consultations, home nursing visits, or emergency department (ED) visits, fails to capture the full scope of healthcare utilization [1, 3–5] and complicates statistical analysis [9]. To our knowledge, no straightforward tool currently exists to combine the total volume of various healthcare services into a single, meaningful metric. An ideal measure would integrate multiple healthcare service types, be applicable worldwide, remain robust to regional and temporal differences in healthcare prices, and correlate with key health outcomes.

The number of healthcare services a patient uses, especially the need for more specialized or intensive interventions, can serve as indirect markers of disease severity. Prior cohort studies have linked specialist visits [10], ED visits [10], and hospital admissions [11, 12] with mortality risk. Furthermore, specialist consultations, ED visits, and hospitalizations generally incur higher costs than primary care visits across many countries [6, 7, 13–16]. We hypothesized that the cost multipliers comparing other healthcare services to a primary care physician (PCP) visit remain relatively stable globally. These multipliers could therefore be used to weight and aggregate different types of healthcare services into a single utilisation index. Additionally, given their association with disease severity, such a weighted index should also correlate with mortality.

This proof-of-concept study aimed to create a Healthcare Utilisation (HUTIL) index based on the relative costs of different healthcare services. As a secondary objective, it sought to examine the relationship between average annual HUTIL scores and mortality rates across European countries.

Materials and Methods

Utilisation of healthcare services, mortality, and life expectancy in Europe

Data on annual national healthcare utilisation across Europe from 2014 to 2019 were collected from various sources, including Eurostat (the European Union's statistics portal) [17–19], the European Society for Emergency Medicine [20], and national statistical offices of individual countries.

The EU's healthcare utilisation statistics are primarily sourced from two datasets: the Joint Questionnaire on Non-Monetary Health Care Statistics, which is completed annually by EU member states [21], and the European Health Interview Survey (EHIS) [22]. The Joint Questionnaire primarily relies on administrative data, which varies by country and variable. In contrast, the EHIS is a population-based survey of individuals aged 15 years and older residing in private households. These datasets provide annual statistics on inpatient discharges, average hospital stays [23], consultations with healthcare professionals [17], and inpatient medical procedures. The figures are reported in absolute numbers, percentages, and population-adjusted rates (per 100,000 people), using System of Health Accounts (SHA) standards where relevant [24].

The EHIS aims to offer comparable data on health status, risk factors, and self-reported healthcare use. It includes information on GP and specialist consultations within the past four weeks (categorized as none, one, two, or three or more visits) [18], as well as the use of home care services in the past year, including visits by nurses [19]. Data were drawn from the second wave of the EHIS (2013–2015) and the third wave (2019), both of which covered all EU countries, as well as Iceland, Norway, and Turkey.

Emergency department (ED) visit data were obtained from the official statistics of several countries (Cyprus, Bulgaria, Denmark, Estonia, Finland, Poland, Portugal, Slovakia, Slovenia, and Sweden), as well as from the European Society for Emergency Medicine [20]. Data on national mortality rates (per 100,000 population) and life expectancy at birth were retrieved from Eurostat [25, 26].

Patient and public involvement

Patients did not participate in the design or implementation of the study.

Statistical methods

In the first stage of the research, the Healthcare Utilisation (HUTIL) index was created by summing the weighted volumes of various healthcare services. Weights were based on the median global cost ratios between each service and a primary care provider (PCP) consultation. These national cost ratios were calculated by dividing the cost of each service (e.g., a specialist consultation, ED visit, nurse home visit, or hospital day) by the cost of a PCP consultation in that country. When direct cost comparisons were available from the same source, ratios were computed directly. In cases where data sources differed, the average PCP consultation cost in that country was used for estimation. If multiple values existed for one country, the average ratio was used. Median global ratios were reported with interquartile ranges (25–75%).

In the second stage, an annual unweighted healthcare utilisation (UHU) per capita figure was calculated by summing per capita counts of PCP consultations, specialist visits, ED consultations, hospital days, and nurse home visits. The number of annual PCP and specialist visits was derived from the total number of medical consultations [17] and the proportion of each consultation type in 2014 and 2019 [18]. Hospital days were estimated by multiplying the average length of stay by the total number of annual discharges [23]. The annual number of nurse home visits per capita was calculated using the proportion of the population receiving such care [19] and the average number of visits per patient annually [27]. If data were missing, a standard assumption of three weekly visits over three months was applied.

The HUTIL index was then calculated by summing the weighted service counts. Annual averages for UHU, the HUTIL index, mortality, and life expectancy were computed for each country from 2014 to 2019.

Countries were grouped into two categories based on whether their HUTIL index scores were above or below the European median. Life expectancy and mortality were compared between these groups using the Wilcoxon test. A similar analysis was performed using UHU scores. Four sensitivity analyses were performed to evaluate assumptions used in the HUTIL index:

1. Assuming all medical consultations were with PCPs.
2. Assuming all were with specialists.
3. Excluding nurse home visits from the index.
4. Limiting the analysis to data from 2014 and 2019, which aligned with EHIS waves.

All statistical tests used a 5% significance threshold, and analyses were carried out in STATA version 18.0 (StataCorp LP, College Station, TX, USA).

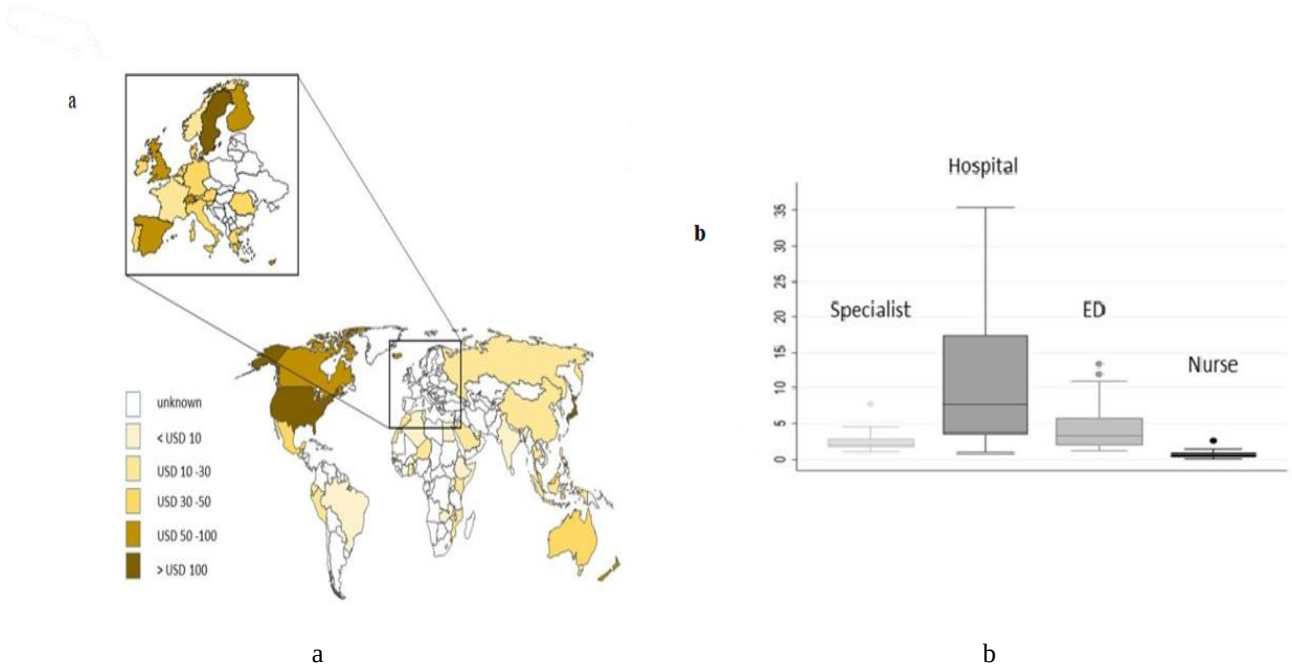
Results and Discussion

Stage one: global healthcare service costs used to construct the HUTIL index

Healthcare service cost data were collected for 63 countries, covering 24 from Europe, 7 from the Americas, 16 from Asia, 2 from Oceania, and 14 from Africa **(Figure 1)**. These data were sourced from 105 references, including 30 peer-reviewed publications, 39 official documents or websites (such as those from governments, health insurance providers, and hospitals), and 36 informal sources (mainly websites targeted at expatriates).

The average cost for a primary care physician (PCP) consultation varied significantly, from as low as USD 2.6 in Somalia to as high as USD 232 in Israel **(Figure 1)**. Globally, the median cost ratios relative to a PCP consultation were: 2.0 (IQR 1.6–2.9) for a specialist consultation, 3.6 (IQR 1.9–5.8) for an emergency department (ED) visit, 7.6 (IQR 3.5–17.4) for a hospital day, and 0.5 (IQR 0.4–0.8) for a nurse's home visit.

The HUTIL index, reflecting the considered period, was constructed using rounded median cost ratios as follows: 1 × number of PCP consultations + 2 × number of specialist consultations + 4 × number of ED visits + 8 × number of hospital days + 0.5 × number of nurse home visits.



a b

Figure 1. Cost of a consultation with a primary care physician (PCP) and other healthcare services to PCP cost ratios. The map shows the mean cost (in USD) of a consultation with a PCP by country (A). The box and whisker plots show the worldwide healthcare services to PCP consultation cost ratios (B), with the central horizontal lines representing medians.

Table 1. Annual mean number of healthcare services used per inhabitant and HUTIL index scores by country

Country (official two-letter code)	Number of times healthcare services were used (UHU)	HUTIL index score
Belgium (BE)	12.3 (11.9–12.8)	22.2 (22.0–22.3)
Bulgaria (BG)	9.0 (8.8–9.2)	23.2 (22.7–23.7)
Cyprus (CY)	3.5 (3.3–3.7)	9.1 (8.4–9.8)
Czechia (CZ)	10.4 (10.3–10.5)	27.0 (26.8–27.2)
Denmark (DK)	6.9 (6.9–7.0)	13.5 (13.2–13.8)
Estonia (EE)	8.1 (7.6–8.5)	20.4 (19.7–21.3)
Finland (FI)	7.5 (7.2–7.8)	19.8 (18.0–21.6)
France (FR)	11.0 (10.5–11.4)	23.1 (22.5–23.7)
Germany (GE)	13.7 (13.3–14.0)	33.5 (33.2–33.8)
Hungary (HU)	14.0 (13.7–14.2)	31.8 (31.2–32.4)
Iceland (IS)	9.3 (NA)	16.9 (NA)
Ireland (IE)	7.7 (7.3–8.1)	15.2 (14.8–15.7)
Italy (IT)	12.5 (12.2–12.8)	22.6 (22.3–22.9)
Latvia (LV)	8.4 (8.3–8.6)	21.8 (21.6–22.0)
Lithuania (LT)	12.2 (11.7–12.6)	28.4 (28.1–28.7)
Netherlands (NL)	11.7 (11.3–12.1)	17.6 (17.1–18.1)
Norway (NO)	8.9 (NA)	16.2 (NA)
Poland (PL)	9.8 (9.5–10.0)	21.4 (20.9–21.9)
Portugal (PT)	6.4 (6.2–6.7)	16.8 (16.3–17.3)
Romania (RO)	7.4 (7.2–7.6)	19.7 (19.4–20.1)
Slovakia (SK)	13.1 (12.9–13.4)	28.0 (27.3–28.7)
Slovenia (SI)	9.2 (9.1–9.3)	21.0 (20.8–21.3)
Spain (ES)	9.7 (8.7–10.6)	18.0 (16.9–19.2)

Sweden (SE)	4.6 (4.4–4.8)	11.9 (11.3–12.5)
Switzerland (CH)	8.3 (2.4–14.1)	19.1 (15.1–23.2)
United Kingdom (UK)	7.7 (NA)	15.5 (NA)

Values are means (95% CI); HUTIL = healthcare utilization index, and NA = not available.

Stage two: utilisation of healthcare services and HUTIL index across Europe

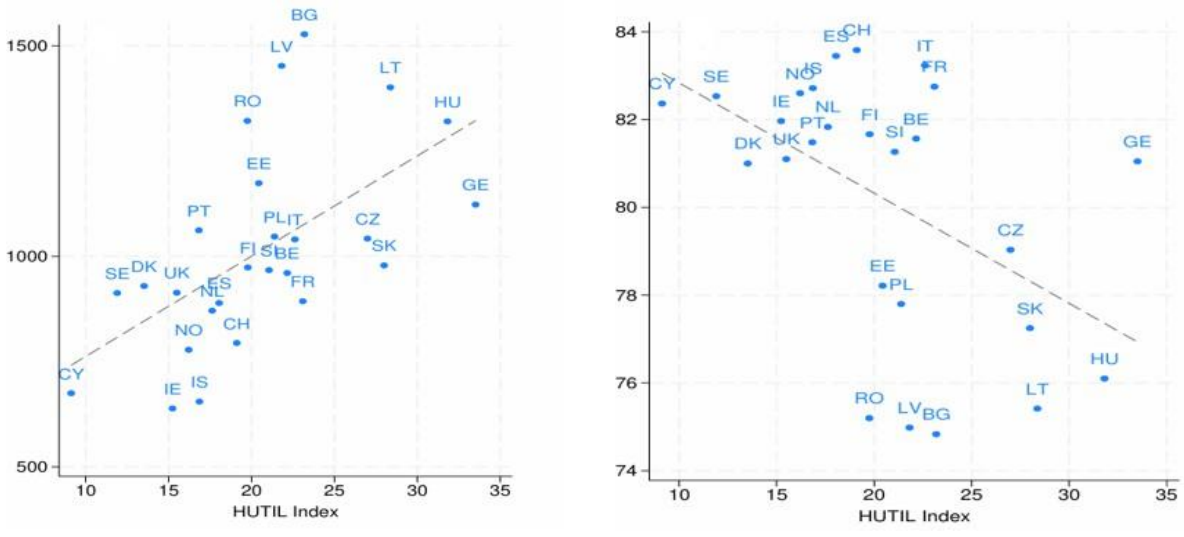
Healthcare usage data were gathered for 33 European countries, including annual figures on visits to primary care providers (PCPs), specialists, and hospital stays. For 26 of these countries, data were also available on emergency department (ED) visits and nurse home visits **(Table 1)**.

Based on this information, average per capita scores for both healthcare service use (UHU) and the HUTIL index were computed for the 26 countries **(Table 1)**. Among the components of the HUTIL index, the most significant contribution came from hospital stays, accounting for 48.4% (95% CI = 22.0–62.7%). Consultations with PCPs and specialists contributed 20.3% (95% CI = 11.4–29.6%) and 21.4% (95% CI = 8.3–38.1%), respectively. ED visits (6.3%; 95% CI, 1.1–17.6%) and home nurse visits (3.7%; 95% CI, 0.8–10.1%) played a more minor role.

Relationship between healthcare utilisation, HUTIL index, and mortality

Countries with higher-than-average healthcare service use (UHU > 9.1) showed no significant differences in mortality rates or life expectancy compared to countries with average or below-average usage. Specifically, the high-usage group had a mean mortality rate of 979 deaths per 100,000 people (IQR: 893–1047) and an average life expectancy of 81.3 years (IQR: 77.8–82.7). In contrast, the comparison group had 930 deaths per 100,000 (IQR: 794–1174) and a life expectancy of 81.5 years (IQR: 78.2–82.4), with both comparisons showing no statistical significance (P = 0.82 and P = 0.78, respectively).

However, countries with an HUTIL index above the median value (greater than 20.1) demonstrated a different pattern. These nations had significantly higher mortality rates (1047 per 100,000; IQR: 979–1321) and lower life expectancy (78.2 years; IQR: 76.1–81.3) than those with median or lower HUTIL scores (889 per 100,000; IQR: 778–930 and 82.0 years; IQR: 81.5–82.6, respectively), with both comparisons reaching statistical significance (P < 0.01 and P = 0.01). This pattern was consistently observed across four separate sensitivity analyses **(Figure 2)**.



a) b)

Figure 2. Scatter plots of national mean HUTIL index scores against mortality rates (a) and life expectancy (b). Mortality rates are expressed in deaths per 100,000 inhabitants. Life expectancy at birth is expressed in years. Countries are designated by their official two-letter code. All values are mean data from Eurostat for 2014–2019 [25, 26]. HUTIL index: healthcare utilisation index.

This study revealed significant global differences in the absolute costs of healthcare services, ranging from as low as 1% of the highest observed cost. However, a notable finding was the relative consistency in the cost ratios between various services and a primary care consultation (PCP), which allowed for the creation of a globally standardized HUTIL index. This index assigns weights to healthcare services based on their cost relative to PCP visits, offering a novel way to assess healthcare utilisation alongside its financial impact. The HUTIL index may also serve as a meaningful indicator of mortality outcomes.

Traditional metrics—such as the frequency of a single service or the total expenditure on healthcare—fall short in reflecting the overall utilization of healthcare resources. Similarly, adding up service counts without considering their cost or clinical significance can misrepresent their actual impact (e.g., a PCP visit is not equivalent to a hospital stay). The HUTIL index addresses this by incorporating both service volume and associated costs, offering a more comprehensive picture. For instance, a shift toward shorter hospital stays with increased outpatient follow-up may not change the total number of services used. Still, the HUTIL index would reflect a reduced burden due to lower-weighted services. Likewise, choosing an ED over a PCP for similar concerns would yield a higher index score, highlighting a greater strain on healthcare resources. These examples demonstrate the index's utility in capturing nuances that simple service counts or raw expenditure figures miss.

Interestingly, the unweighted average number of healthcare services used per person across European nations showed no clear relationship with mortality or life expectancy. In contrast, the HUTIL index, which accounts for the weighted contribution of each service, did show a correlation, suggesting it may be a more effective tool for evaluating the impact of the health system.

Previous research has linked increased use of specialist care, emergency services, and hospital admissions with elevated mortality risk [10–12], which aligns with the heavier weights assigned to these services in the HUTIL index. However, caution is needed when interpreting the observed association between national HUTIL scores and mortality. The index does not account for how services are distributed within populations, particularly whether high utilisation is concentrated among those with elevated mortality risk.

Further investigation is required to explore how the HUTIL index can be applied across different countries, health systems, time periods, or population groups, and whether it might be used to identify individuals at greater risk or with higher healthcare needs.

Limitations and considerations

A major constraint of this study was the relatively small sample size, as data were only available for a limited number of European countries, which restricted the ability to perform statistically adjusted analyses. To better explore the relationship between HUTIL index scores and mortality, future research should use individual-level patient data.

While it was technically feasible to estimate healthcare usage and HUTIL index values for most European countries, several caveats warrant caution when interpreting these results. Healthcare utilisation is influenced by numerous interrelated factors, including population health status, cultural norms, individual care-seeking behaviour, service accessibility, logistical and financial barriers (e.g., travel distance or language), and the resources available within the system to deliver and fund care [3, 28, 29]. Consequently, identical medical conditions may result in different patterns of care use depending on the country.

Moreover, the healthcare utilisation data used—sourced primarily from national administrative datasets via Eurostat—reflect each country's unique system design. As a result, these figures may not be entirely comparable across countries. Additionally, since our calculations relied on average values (or estimated means), they assumed that the data within national populations was normally distributed. This assumption is unlikely to hold and introduces a level of uncertainty. Therefore, observed differences between countries in HUTIL index scores and healthcare usage may partly reflect structural and systemic differences rather than true disparities in health needs. Accurately estimating these indicators would require representative, individual-level data from each country.

Further limitations

Inconsistent and heterogeneous reporting of healthcare costs across countries posed another limitation. The cost data were collected through an informal review of diverse sources of varying reliability, spanning different periods. This non-systematic approach introduces potential

biases. Cost figures included a mix of patient out-of-pocket expenses, billed charges, and actual costs, depending on the source of the information. Additionally, reported costs often varied based on patient diagnosis, comorbidity profiles, or procedures performed—factors that significantly influence consultation expenses.

Nonetheless, even though the absolute cost values differed widely, the relative cost relationships between service types remained relatively stable. Whenever possible, costs were taken from the same sources to preserve internal consistency. It is important to note that the HUTIL index is not intended to capture exact national healthcare costs; rather, it serves as an indicative tool that reflects the relative financial burden of different healthcare services. To enhance usability, cost ratios were rounded, and the same weights were applied across countries, reinforcing the index's function as a generalized comparative tool rather than a precision instrument.

Some service utilisation figures—such as the number of annual nurse home visits or consultations with PCPs and specialists—were estimated, introducing a degree of inaccuracy to the UHU and HUTIL scores. However, the results from sensitivity analyses were consistent with the primary findings, suggesting robustness.

Finally, the HUTIL index does not encompass every healthcare service or provider. It was deliberately limited to the most commonly used and most expensive services—those likely to be tracked in national health statistics. While some services were excluded, their contribution to the total index is expected to be minimal.

Conclusion

Despite these limitations, the study found that cost ratios between various healthcare services remain relatively stable across countries. Based on this consistency, the HUTIL index shows promise as a globally applicable metric to support future research into healthcare utilisation patterns.

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