Quantifying the Future Health, Economic and Societal Impact of Optimised Guideline-Directed Medical Therapy on Potentially Avoidable Hospitalisations (PAH) Across Multiple Countries: The Global PAH Programme

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Why did we perform this research?

- Asthma, COPD, heart failure, hypertension and type 2 diabetes are major contributors to non-communicable disease burden, placing sustained pressure on hospital capacity, costs and workforce.[1]
- The OECD defines potentially avoidable hospitalisations (PAHs) in these conditions as inpatient admissions that could be avoided through effective primary care and as a standardised indicator of how well chronic conditions are managed through timely primary and community care.[2]
- Uptake of optimised guideline-directed medical therapy is an evidence-based way to improve patient outcomes and reduce hospitalisations; however, its impact on health system capacity is not well quantified.

How did we perform this research?

- Global PAH is a flexible, individual-level microsimulation model that projects future potentially avoidable hospitalisations[3] and their related clinical, health system, economic, societal, and environmental impacts.
- Nationally representative synthetic populations of each country (>50M individuals per country) were projected in annual cycles over 2026-2035 using Monte Carlo methods and dynamic risk equations reflecting demographic and behavioural risk factors (i.e., population change, including ageing; obesity, smoking). Individuals may develop disease, progress, or die; outcomes were aggregated to country level.
- Country-specific model inputs were extracted through targeted literature reviews and database reviews. Where suitable national estimates were unavailable, proxy-country data were identified and assessed for suitability prior to inclusion.
- Disease-specific primary-cause inpatient hospitalisations are projected, and GDMT is applied to assess the reduction in PAHs from five conditions.
- A global Steering Committee reviewed model assumptions and results; validation and sensitivity analyses are embedded throughout.

Objective

Project disease-specific primary-cause hospitalisations and related healthcare resource use and economic impact across five chronic conditions in six countries and quantify the impact of complete 100% GDMT uptake

Scenarios	**Current GDMT:** existing uptake	vs	**Complete GDMT:** 100% treatment uptake	+	Uptake **sensitivity analyses**	
Countries	**France**	**Italy**	**Netherlands**	**Spain**	**United States**	**Japan**
Diseases	**Asthma**	**COPD**	**Heart Failure**	**Hypertension**	**Type 2 Diabetes**	
Outcomes	**Clinical**	**Health System**	**Economic**	**Societal**		

What did we find?

MODEL RESULTS

1 Patients with chronic disease are not receiving optimal treatments in accordance with clinical guidelines

Currently, GDMT reaches less than half of patients with chronic disease. See supplement QR code for clinical guidelines.

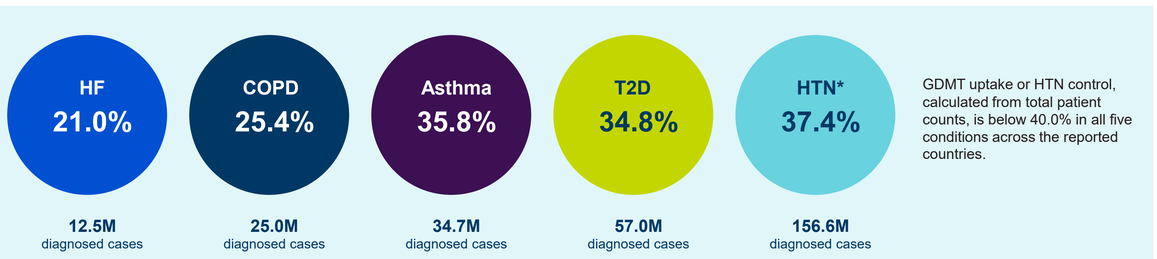


Figure 1. GDMT uptake across six countries, calculated as total GDMT counts divided by total diagnosed prevalence under current practice in 2026. *HTN defined as control status. Note: Cases are condition-specific and not mutually exclusive; HTN gap reflects control, including patients requiring titration.

2 100% uptake of GDMT offsets over two decades of hospital capacity demand growth for primary-cause hospitalisations

Ageing and population growth add 0.67M annual primary-cause admissions from the five included conditions by 2035. Complete GDMT avoids 1.49M primary-cause hospitalisations†, keeping demand below the 2026 level for approximately 22 years based on modelled results to 2035 and extrapolation thereafter.

†Assumes complete GDMT uptake; see panel 8 for alternative scenarios.

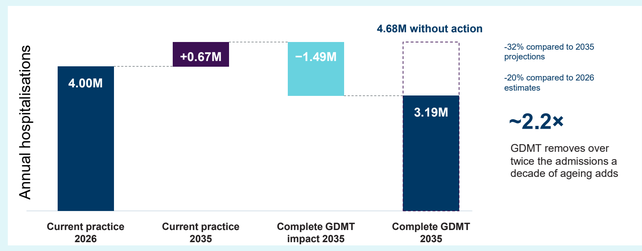


Figure 2. Annual primary-cause hospitalisations associated with the five included conditions across the six reported countries: 2026 baseline, projected growth to 2035 under current practice, and the effect of complete GDMT uptake.

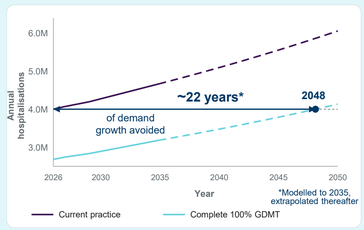


Figure 3. Projected annual primary-cause hospitalisations with current GDMT uptake vs complete (100%) GDMT uptake, to the year demand under complete GDMT returns to today's level. Values for 2026–2035 are modelled; later years are extrapolated after the 2026–2035 current-practice growth rate, assuming continued demand growth and sustained proportional GDMT benefit. Under these assumptions, demand returns to the 2026 level after approximately 22 years.

~22 years*
before demand under complete GDMT returns to today's level
*Modelled to 2035. Extrapolated thereafter.

Solutions to address workforce demand are needed today

Most EU countries already report doctor or nurse shortages, and Europe's shortfall is projected to widen by 2030 as both populations and the workforce age.[4,5] In the US, physician and nurse supply falls short of demand into the late 2030s.[6,7]

3 Closing the GDMT gap would prevent millions of hospitalisations

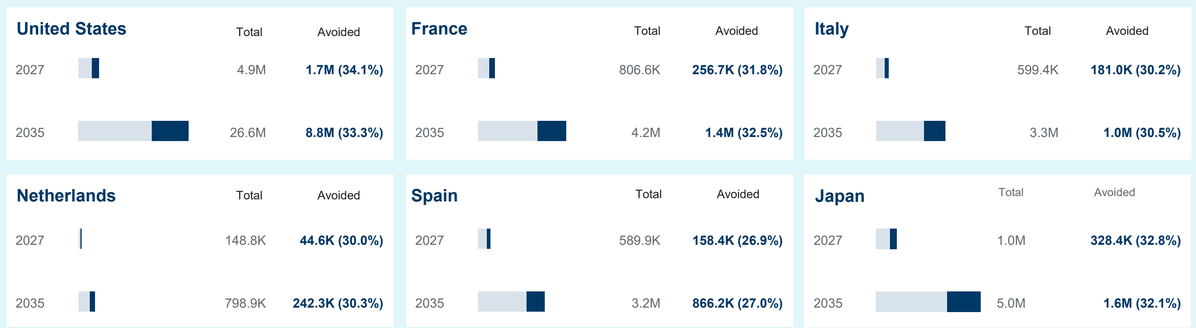
Complete (100%) GDMT uptake delivers substantial reductions in primary-cause hospitalisations within two years, with benefits sustained over 10 years. Some of the largest gains could be achieved in the three leading contributors to hospitalisations: heart failure, COPD, and type 2 diabetes

32.3%
Almost **1/3** of primary-cause hospitalisations could be avoided each year

14.0M hospitalisations potentially avoided by 2035

2.6M Hospitalisations already potentially avoided within two years

114.8M hospital bed days are released for other patients



Full grey bar = current practice; dark blue bar = potentially avoided hospitalisations. US scale: 0-30M; other countries: 0-6M.

Figure 4. Average annual percentage reduction in primary-cause hospitalisations over 2026–2035 (left), and cumulative hospitalisations under current practice and potentially avoided with complete GDMT uptake by 2027 and 2035 (right).

Country	Condition	Projected to 2035	% avoided (GDMT)	Condition	Projected to 2035	% avoided (GDMT)	Top two as % of all
	Leading			Second			
United States	**HF**	**13.8M**	44.8%	**T2D**	**8.1M**	15.8%	**82.2%**
France	**HF**	**2.0M**	35.0%	**COPD**	**1.0M**	18.3%	**71.8%**
Italy	**HF**	**1.9M**	37.6%	**COPD**	**0.91M**	18.6%	**85.3%**
Netherlands	**HF**	**0.39M**	35.0%	**COPD**	**0.29M**	17.9%	**85.7%**
Spain	**HF**	**1.6M**	33.8%	**COPD**	**1.2M**	17.2%	**84.7%**
Japan	**HF**	**3.1M**	31.8%	**T2D**	**1.0M**	18.4%	**81.3%**

Table 1. Percentage of cumulative leading and second leading primary-cause hospitalisations to 2035, and percentage potentially avoided under the complete GDMT scenario.

4 Hospitalisations: capacity released and costs averted

Reduced inpatient hospitalisations frees ward capacity, releases nursing time, averts costs, and improves productivity

Country	Bed days avoided	Nursing days released	Inpatient care costs averted	Productivity protected
US / USD	0.0-150.0M	0.0-75.0M	0.0-400.0B	0.0-100.0B
United States	**2035: 44.2M (32.9%)** 2027: 8.4M (33.9%)	**2035: 22.5M (32.9%)** 2027: 4.3M (33.9%)	**2035: US$139.6B (37.6%)** 2027: US$26.9B (38.8%)	**2035: US$34.6B (43.7%)** 2027: US$7.5B (44.1%)
EU / USD	0.0-50.0M	0.0-25.0M	0.0-30.0B	0.0-2.0B
France	**2035: 12.7M (31.6%)** 2027: 2.4M (31.1%)	**2035: 7.3M (31.6%)** 2027: 1.4M (31.1%)	**2035: US$8.2B (34.2%)** 2027: US$1.5B (33.7%)	**2035: US$491.1M (34.9%)** 2027: US$88.5M (31.1%)
Italy	**2035: 10.7M (30.1%)** 2027: 1.9M (29.8%)	**2035: 6.1M (30.1%)** 2027: 1.1M (29.8%)	**2035: US$5.2B (30.9%)** 2027: US$917.8M (30.5%)	**2035: US$236.9M (28.9%)** 2027: US$52.9M (28.0%)
Netherlands	**2035: 1.6M (29.6%)** 2027: 287.0K (29.5%)	**2035: 1.0M (29.6%)** 2027: 185.1K (29.5%)	**2035: US$1.2B (29.6%)** 2027: US$217.6M (29.5%)	**2035: US$180.7M (31.2%)** 2027: US$34.9M (29.0%)
Spain	**2035: 7.1M (26.6%)** 2027: 1.3M (26.6%)	**2035: 4.0M (26.6%)** 2027: 727.7K (26.6%)	**2035: US$5.5B (27.3%)** 2027: US$1.0B (27.6%)	**2035: US$208.6M (29.9%)** 2027: US$38.7M (27.0%)
JP / USD	0.0-150.0M	0.0-50.0M	0.0-30.0B	0.0-2.0B
Japan	**2035: 38.4M (31.5%)** 2027: 7.8M (32.0%)	**2035: 11.4M (31.5%)** 2027: 2.3M (32.0%)	**2035: US$11.3B (44.9%)** 2027: US$2.3B (45.0%)	**2035: US$464.0M (28.5%)** 2027: US$94.3M (28.0%)
Cumulative total	**2035: 114.8M (31.5%)** **2027: 22.1M (31.9%)**	**2035: 52.3M (31.4%)** **2027: 10.0M (31.8%)**	**2035: US$171.1B (37.0%)** **2027: US$32.8B (38.1%)**	**2035: US$36.2B (42.9%)** **2027: US$7.8B (43.2%)**

Full bars = cumulative current practice; colour portions = avoided. Thick: 2035; thin: 2027. All costs in USD; totals cover six countries. 2025 ECB/Bundesbank annual averages: EUR 1 = US$1.1300; JPY 1 = US$0.00668481 (1.1300/169.04); fixed for all years; 2026 price year; costs are undiscounted and constant. Nurse days are attributable to inpatient hospital stays; inpatient costs avoided may include nurse costs depending on the definition in the source reference.

Table 2. Bed days avoided, nursing days released, inpatient costs averted, and productivity gained cumulatively, by 2027 and 2035

5 Improved GDMT also eases ICU demand and ED capacity

Complete (100%) GDMT uptake is projected to improve capacity in the most resource-intensive care settings

Country	ED visits avoided	ED costs averted	ICU stays avoided	ICU bed days avoided	ICU costs averted
US / USD	0.0-350.0M	0.0-800.0B	0.0-5.0M	0.0-25.0M	0.0-50.0B
United States	**2035: 121.1M (37.6%)** 2027: 22.2M (36.0%)	**2035: US$244.6B (36.5%)** 2027: US$45.3B (35.5%)	**2035: 1.2M (34.6%)** 2027: 216.6K (34.6%)	**2035: 8.6M (36.6%)** 2027: 1.6M (37.6%)	**2035: US$15.5B (35.8%)** 2027: US$3.0B (36.6%)
EU / USD	0.0-20.0M	0.0-8.0B	0.0-1.0M	0.0-2.5M	0.0-6.0B
France	**2035: 7.0M (38.2%)** 2027: 1.3M (37.0%)	**2035: US$2.8B (41.9%)** 2027: US$512.8M (41.4%)	**2035: 153.4K (33.5%)** 2027: 29.6K (33.7%)	**2035: 604.7K (33.4%)** 2027: 116.4K (33.4%)	**2035: US$1.6B (34.9%)** 2027: US$310.2M (35.0%)
Italy	**2035: 5.8M (35.4%)** 2027: 1.1M (35.3%)	**2035: US$1.9B (40.9%)** 2027: US$354.4M (40.7%)	**2035: 221.0K (36.3%)** 2027: 39.0K (36.8%)	**2035: 747.8K (36.0%)** 2027: 135.0K (36.1%)	**2035: US$1.9B (36.6%)** 2027: US$338.3M (36.8%)
Netherlands	**2035: 510.2K (33.3%)** 2027: 96.0K (33.2%)	**2035: US$155.0M (33.3%)** 2027: US$29.2M (33.2%)	**2035: 10.6K (31.1%)** 2027: 1.9K (30.5%)	**2035: 16.9K (31.1%)** 2027: 3.1K (30.5%)	**2035: US$54.3M (31.1%)** 2027: US$10.0M (30.5%)
Spain	**2035: 5.6M (39.6%)** 2027: 1.0M (38.7%)	**2035: US$1.8B (41.5%)** 2027: US$335.4M (41.4%)	**2035: 31.1K (28.0%)** 2027: 5.5K (27.1%)	**2035: 154.9K (27.7%)** 2027: 27.4K (26.2%)	**2035: US$382.9M (27.5%)** 2027: US$67.7M (26.2%)
JP / USD	0.0-50.0M	0.0-10.0B	0.0-2.0M	0.0-5.0M	0.0-6.0B
Japan	**2035: 11.1M (24.4%)** 2027: 2.3M (25.1%)	**2035: US$2.2B (25.5%)** 2027: US$450.7M (26.2%)	**2035: 222.4K (29.7%)** 2027: 45.8K (30.9%)	**2035: 1.1M (30.5%)** 2027: 217.3K (31.8%)	**2035: US$567.4M (32.3%)** 2027: US$117.6M (33.7%)
Cumulative total	**2035: 151.2M (36.2%)** **2027: 28.0M (34.9%)**	**2035: US$253.4B (36.5%)** **2027: US$47.0B (35.5%)**	**2035: 1.8M (33.8%)** **2027: 338.4K (34.0%)**	**2035: 11.2M (35.5%)** **2027: 2.1M (36.4%)**	**2035: US$19.9B (35.4%)** **2027: US$3.8B (36.1%)**

Full bars = cumulative current practice; colour = avoided. Thick: 2035; thin: 2027. All costs in USD; totals cover six countries. 2025 ECB/Bundesbank annual averages: EUR 1 = US$1.1300; JPY 1 = US$0.00668481; fixed for all years; costs are undiscounted and constant. *Sum of ICU bed days avoided and ED visits avoided.

Table 3. Reductions in ICU stays and ED visits, and associated costs averted, cumulatively, by 2027 and 2035

6 Improved GDMT avoids hospitalisations across every condition

The largest absolute reductions in primary-cause hospitalisations are projected in heart failure, type 2 diabetes, and COPD

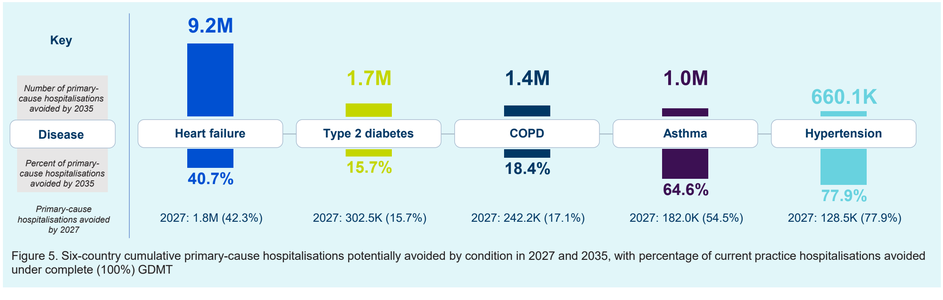


Figure 5. Six-country cumulative primary-cause hospitalisations potentially avoided by condition in 2027 and 2035, with percentage of current practice hospitalisations avoided under complete (100%) GDMT

7 Total monetary impact by country

Ward, productivity, ED and ICU costs averted cumulatively

Country	2027	2035
United States	US$82.6B (37.2%)	**US$434.3B (37.3%)**
France	US$2.4B (35.1%)	**US$13.1B (35.7%)**
Italy	US$1.7B (33.3%)	**US$9.2B (33.6%)**
Netherlands	US$291.7M (29.8%)	**US$1.6B (30.2%)**
Spain	US$1.5B (29.8%)	**US$7.9B (29.7%)**
Japan	US$2.9B (39.3%)	**US$14.6B (39.1%)**
Total (six countries)	**US$91.4B (37.0%)**	**US$480.6B (37.1%)**

Table 4. Total cumulative costs avoided by 2027 and 2035. Percentages show the proportion of projected current-practice costs avoided through complete GDMT. All costs are gross and presented in USD; totals cover six countries. 2025 ECB/Bundesbank annual averages: EUR 1 = US$1.1300; JPY 1 = US$0.00668481 (1.1300/169.04); fixed for all years; 2026 price year; costs are undiscounted.

8 Sensitivity analyses

Health system benefits remain meaningful when a more realistic GDMT uptake level is reached

Outcome avoided	Year	100% GDMT	80% GDMT	10-percentage-point absolute increase on current practice GDMT
Hospitalisations	2027	2.6M	1.9M	345.9K
	2035	14.0M	10.2M	1.8M
ED visits	2027	28.0M	19.6M	3.0M
	2035	151.2M	106.5M	16.1M
ICU stays	2027	338.4K	249.8K	43.6K
	2035	1.8M	1.3M	229.8K
Total costs	2027	US$91.4B	US$66.4B	US$9.9B
	2035	US$480.6B	US$349.5B	US$51.3B

Table 5. Cumulative hospitalisations, ED visits, ICU stays and costs avoided for France, Italy, the Netherlands, Spain, the US and Japan combined with 80% GDMT uptake or a 10-percentage-point absolute increase on current practice GDMT levels.

All costs are in USD; EUR 1 = US$1.1300; JPY 1 = US$0.00668481 (1.1300/169.04). 2025 ECB/Bundesbank annual averages, fixed for all years; 2026 price year; costs are gross, undiscounted and include healthcare and productivity costs. All scenarios include the same six countries. The 10-percentage-point absolute increase on current practice GDMT levels is applied to 2026 uptake and remain static through to 2035 (not compounding).

How might this impact current clinical practice and health policy reform?

GDMT is evidence-based and can be implemented now

Suboptimal uptake is a major, modifiable driver of potentially avoidable hospitalisations across six countries and five conditions - an implementation gap, not a shortage of effective therapies.

Existing therapies are an untapped capacity lever

Strengthening implementation relieves pressure on hospital capacity, frees workforce time and builds health-system resilience, using medicines that are already on formulary in many countries.

Limitations

Data limitations mean that proxy-country data are used across geographies, with selections driven through a pre-determined algorithm. The study focuses on only the diagnosed population living with disease and only considers primary-cause hospitalisations rather than downstream complications associated with some diseases (e.g., myocardial infarction, diabetic retinopathy, stroke) and thus underestimates the burden and potential impact of GDMT, especially in HTN and T2D. Partial regimens, discontinuation and re-initiation of GDMT were not explicitly modelled. Costs are gross and do not account for treatment and implementation costs. Probabilistic sensitivity analysis was not undertaken due to computation; uncertainty was assessed through deterministic sensitivity and scenario analysis. 100% GDMT uptake is a theoretical ceiling.

Reviewed by the Global PAH Steering Committee

Policy call to action:

1 Coordinated care pathways
Delivery leaders · Clinical societies

- Diagnose early and initiate GDMT; then optimise dose
- Mandate annual medication reviews to intensify or de-prescribe
- Standardise high-risk discharge protocols with specialist review
- Proactively identify high-risk patients and patients with comorbidities
- Ensure multidisciplinary care where clinically appropriate, with one accountable coordinator

2 Incentives for GDMT uptake
Policymakers · Payers · Delivery leaders · Patient organisations

- Embed GDMT prescribing metrics in quality and payment frameworks
- Add patient-facing incentives to disease management plans

3 Equitable access through reform
Policymakers · Delivery leaders · Payers · HTA leaders

- Let pharmacists and nurses initiate, optimise and monitor where regulations permit
- Use stratified population data to target the highest avoidable burden
- Fund education and digital tools for underserved populations
- Reform formularies to remove cost and coverage barriers

4 Budgets aligned to long-term value
Finance and health policymakers · Payers · HTA leaders

- Require 10-year hospitalisation and downstream cost projections
- Track GDMT uptake and patient-reported outcomes in national registries
- Pool funding across settings for shared accountability
- Adopt multi-year budgeting matched to when returns land

Supplement

References 1. World Health Organization. Noncommunicable diseases. Geneva: WHO, 2025. 2. OECD. Avoidable hospital admissions: Health at a Glance 2025: OECD indicators. Paris: OECD. DOI:10.1787/8f9e3f98. 3. OECD. Health Care Quality Indicators: Definitions for Avoidable Hospital Admissions (Primary Care Indicators). OECD Healthcare Quality and Outcomes (HCQO) Indicators: 2022-23 Definitions. Paris: OECD [model based on these definitions]. 4. OECD, European Commission. Health at a Glance: Europe 2024: State of Health in the EU Cycle. Paris: OECD. DOI: 10.1787/b3704e14-en. 5. WHO Regional Office for Europe. Health workforce migration in the WHO European Region: country case studies from Albania, Armenia, Georgia, Ireland, Malta, Norway, Republic of Moldova, Romania and Tajikistan. WHO: 2025. 6. Health Resources and Services Administration, National Center for Health Workforce Analysis. Physician Workforce: Projections, 2023–2038. Rockville (MD), 2025. 7. Health Resources and Services Administration, National Center for Health Workforce Analysis. Health Workforce Projections. Rockville (MD).

Note that overall and summed estimates may not exactly match individual outcomes due to numerical rounding

Abbreviations COPD, chronic obstructive pulmonary disease; GDMT, guideline-directed medical therapy; HCRU, healthcare resource use; HF, heart failure; HTN, hypertension; OECD, The Organisation for Economic Co-operation and Development; PAH, potentially avoidable hospitalisation; T2D, type 2 diabetes. *HTN GDMT defined by control status. Countries: ES, Spain; FR, France; IT, Italy; JP, Japan; NL, Netherlands; US, United States.

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