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Regional Features in the Treatment of Parkinson's Disease in the Baltic States Compared to Germany

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Abstract

Parkinson's Disease (PD) is a progressive neurodegenerative disorder characterized by motor symptoms, alongside non-motor manifestations. In advanced stages, people with PD (PwP) require extensive support to maintain mobility and quality of life, creating substantial demand on healthcare and reimbursement systems. Reported prevalence varies across Europe, with Germany at 350 per 100,000, Estonia at 314 per 100,000, Lithuania at 265 per 100,000, and Latvia at 217 per 100,000.

This study applies a structured, qualitative comparative policy mapping approach (a subtype of comparative policy analysis) to describe and compare how national reimbursement and service-delivery rules shape access to PD treatments in Latvia, Lithuania, and Estonia, using Germany as a high-resource comparator. Key constructs, including availability, accessibility, affordability, and reimbursement, were defined a priori and operationalized into extractable indicators (e.g., formulary inclusion, reimbursement rate, cost-sharing, authorization requirements, and service-capacity proxies). Data sources included reimbursement agency databases, national formularies, policy documents, and expert input. Analysis was structured across three domains: pharmacological therapy, device-assisted therapies (DATs), and rehabilitation and supportive therapies.

Findings show that Germany ensures broad access to all treatment domains, including newer pharmacological options, reimbursed DATs, and structured multidisciplinary rehabilitation. Estonia and Lithuania provide full reimbursement for standard medications but limited access to

DATs and variable rehabilitation services. Latvia remains most constrained, with partial reimbursement for medications, no reimbursed DATs, and underdeveloped supportive therapies.

Differences in reimbursement design (including cost-sharing and eligibility rules) and service capacity co-occur with broader system financing differences (total health expenditure: 12.6% of GDP in Germany vs. 7.6% in Latvia, 7.2% in Lithuania, and 7.0% in Estonia; government-funded expenditure: 10.1%, 4.9%, 4.7%, and 5.2%, respectively). These findings are descriptive and intended to clarify where policy design and implementation may plausibly contribute to cross-country variation in access.

Introduction

Parkinson's Disease (PD) is a progressive neurodegenerative disorder characterized by motor symptoms such as bradykinesia, tremor, and rigidity, as well as non-motor symptoms including declining cognitive abilities, autonomic dysfunction, and psychiatric disturbances. Together, these contribute to disability, reduced quality of life, and increasing demand on healthcare systems [1,2]. In Germany, the prevalence for PD in 2022 was 350 per 100,000, and highest among individuals over 60 years [3]. Estonia has reported an age-adjusted incidence of 28.0 per 100,000 person-years [4] and a prevalence of 314 per 100,000 [5]. Lithuania has reported a prevalence of 265 per 100,000 [6], while Latvia has reported 217 per 100,000 for idiopathic PD. This lower recorded prevalence should be interpreted cautiously, as differences in case ascertainment, diagnosis, registration practices, and access to specialist care may also influence national estimates.

Treatment strategies for PD are guided by international and national recommendations. The German S2k guideline [7] and European consensus statements [8] emphasize a multidimensional approach that integrates pharmacological therapy (e.g., levodopa, catechol-O-methyltransferase (COMT) inhibitors, and other dopaminergic medications [9]), device-assisted therapies (DATs) (e.g., deep brain stimulation (DBS) and infusion treatments for advanced disease stages [10]), and supportive therapies including physiotherapy, occupational therapy, speech therapy, and palliative care [11]. Latvia issued its own clinical guidelines in 2018, developed by the Latvian Neurodegenerative Disease Association, which align with international standards for

both PD and Parkinson's-plus syndromes [12]. Lithuania also issued its own clinical guidelines in 2023, which align with international standards for PD [13]. By contrast, Estonia lacks up-to-date guidelines, and clinical practice is largely based on European recommendations. Across recommendations, care is consistently described as patient-centered and individualized to the needs of PwP [14].

Despite shared standards, access to comprehensive PD care differs considerably within Europe. Germany's well-resourced healthcare system ensures broad availability of pharmacological treatments, advanced DATs, and multidisciplinary rehabilitation [15]. In contrast, the Baltic states face systemic challenges, including constrained healthcare budgets, restrictive reimbursement policies, shortages of movement disorder specialists, and limited numbers of specialized centers [16,17]. More generally, disparities in the adoption of new pharmacological treatments, DATs, and structured rehabilitation programs contribute to variation in treatment outcomes across Europe [18-21].

The objective of this study is to describe and compare how national policy instruments relevant to PD care (formularies, reimbursement rates and cost-sharing, authorization rules, and service-coverage provisions) map onto three care domains (medications, DATs, and rehabilitation/supportive therapies) in Latvia, Lithuania, and Estonia, and to contrast these patterns with Germany as a high-resource benchmark case. Germany was selected as a comparator because (i) it has near-universal mandatory coverage and mature reimbursement institutions, (ii) it typically has broader and earlier adoption of PD-related innovations within Europe, and (iii) it provides a policy "upper bound" reference against which constraints in smaller health systems can be more transparently characterized. This is a most-different systems comparison with respect to financing and service capacity, used here for structured description rather than causal attribution. This study focuses on PD as defined by ICD-10 code G20 (idiopathic, primary, or unspecified PD). Other Parkinsonian syndromes (G21-G23) were excluded to ensure comparability of prevalence and treatment data across countries [7]. By operationalizing "access" constructs and extracting policy indicators from the same categories of public sources across countries, the study aims to improve analytical clarity regarding where and how policy design may coincide with gaps in treatment access.

Methodology

Study Design

This study employed a qualitative comparative policy analysis using a structured policy mapping design. Policy mapping is a descriptive subtype of comparative policy analysis that (1) defines key constructs a priori, (2) translates them into extractable indicators, and (3) compares policy instruments and implementation features across jurisdictions in a transparent, reproducible way. The unit of analysis was the country-level policy and coverage environment for PD care (not individual PwP or providers).

Country Selection and Comparator Logic

Countries were selected to represent (a) three Baltic health systems with shared regional context but differing reimbursement and service configurations (Latvia, Lithuania, Estonia), and (b) one high-resource European comparator (Germany). The analytical purpose was to contrast policy design and coverage patterns under different financing and capacity constraints, not to test a causal model.

Definitions and Operationalization

Key constructs were defined and operationalized before extraction to address analytical clarity:

- Availability: Whether a therapy/service is present within the country's publicly relevant treatment landscape. Operational indicators: (i) national formulary/listing or registration status for medicines; (ii) presence of reimbursed procedure codes or national coverage rules for DATs; (iii) stated coverage of rehabilitation/supportive therapies in national benefit rules; and (iv) existence of designated centers/programs (where publicly documented).
- Accessibility: The extent to which eligible PwP can practically obtain the therapy/service within the system. Operational indicators: (i) requirement for prior authorization or exceptional-approval pathways; (ii) provider restrictions (e.g., neurologist-only initiation);

(iii) documented service-capacity constraints (e.g., number of centers, known workforce limitations reported in official or reputable sources); and (iv) reported waiting times when publicly documented.

- Affordability: The patient-facing financial burden conditional on receipt. Operational indicators: (i) reimbursement rate; (ii) cost-sharing/co-payment/coinsurance where specified; and (iii) whether the therapy is effectively private-pay if not reimbursed.
- Reimbursement (coverage design): The rules determining public payment for therapies/services, including eligibility conditions, benefit inclusion, and patient cost-sharing.

In this manuscript, "full reimbursement" is used strictly to mean: (1) the item is included in the publicly covered benefit package and (2) the patient cost-sharing for that item is 0% (or is waived under the standard PD indication), based on published reimbursement rules. This is analytically distinct from mere "benefit inclusion" (covered but with co-payment/coinsurance) and from "registered/available but not covered" (private-pay). Where a country's policy implies nonzero cost-sharing (e.g., Latvia 75% reimbursement), it is reported as partial reimbursement rather than full reimbursement.

Data Sources

Data were drawn from government and insurance publications, reimbursement agency databases, and national formularies: Germany's Federal Joint Committee (G-BA) [22] and Rote Liste [23]; Estonia's Health Insurance Fund (Tervisekassa) [24]; Lithuania's National Health Insurance Fund (VLK) [25]; and Latvia's National Health Service (NVD) [26].

Secondary sources included peer-reviewed literature, policy reports, and documents from neurological societies. International standards (European Academy of Neurology (EAN) [27] and the Movement Disorder Society-European Section (MDS-ES) [9]) provided the reference framework, supplemented by national guidelines [7,13,28]. Expert input was used as contextual triangulation to interpret how written policies are implemented in practice, particularly for capacity constraints and exception pathways.

Data Extraction and Reproducibility

To strengthen transparency and reproducibility, data extraction followed a structured template. For each country and each therapy/service, we extracted: (i) policy listing/inclusion status; (ii) reimbursement rate and stated cost-sharing; (iii) authorization/eligibility requirements; (iv) provider restrictions; and (v) service-capacity descriptors (e.g., number of centers where publicly documented). Extraction was performed by the corresponding author using publicly available sources and cross-checked against at least one secondary source or expert contextual input when policy implementation was ambiguous.

A summary extraction matrix is reflected in Tables 1a and 1b, and the operational definitions used for coding are stated above.

Analytical Framework

The analysis was structured around three domains of PD care: medication reimbursement and availability, access to DATs, and rehabilitation/supportive therapies. For medications, reimbursement of standard treatments such as levodopa, dopamine agonists, monoamine oxidase-B (MAO-B) inhibitors, and COMT inhibitors was assessed, along with the inclusion of newer options like opicapone, extended-release levodopa-carbidopa, and inhaled levodopa. Access to DATs was evaluated through reimbursement policies, the distribution of specialized centers, availability of neurosurgical expertise, and administrative requirements such as authorization processes. Finally, rehabilitation and supportive therapies were examined with attention to the provision of physiotherapy, occupational therapy, speech therapy, multidisciplinary programs, dedicated movement disorder centers, and palliative or home-based care for advanced disease stages.

Reimbursement design was interpreted as a policy instrument that can support (or constrain) commonly stated health-system goals such as equity of access, financial risk protection, and timely uptake of effective therapies. In this study, that link was operationalized descriptively: we examined whether higher levels of coverage (benefit inclusion with low or zero cost-sharing) and fewer authorization barriers co-occurred with broader service availability

across PD care domains. We do not claim causality; rather, we use this framing to explain why reimbursement rules are analytically central in a cross-country access comparison.

Data Interpretation

Findings were contextualized within European healthcare policy, comparing high-resource (Germany) and resource-limited (Baltic) systems. Three dimensions guided interpretation: financial (reimbursement and out-of-pocket payments), structural (specialized services), and policy (eligibility restrictions, delays in adopting innovations). Interpretations are presented as descriptive inferences grounded in extracted policy indicators and triangulated contextual information, without asserting that any single policy component alone explains observed access differences.

Ethical Considerations

As only publicly available data, guidelines, and secondary literature were used, no ethical approval was required. Expert input was limited to non-identifiable, system-level contextual clarification and did not involve patient-level data or private records.

Results

This section reports descriptive findings based on the operational indicators defined above (availability, accessibility, affordability, and reimbursement). Tables 1a and 1b summarize policy inclusion and coverage design by domain. Where “access” is discussed, it refers to policy- and system-level features (e.g., authorization rules, service capacity) rather than measured PwP utilization.

This comparative healthcare policy analysis revealed substantial disparities in the availability, reimbursement, and accessibility of PD treatments across Germany and the Baltic states (Tables 1a and 1b). The findings are presented under three key domains: medication reimbursement and availability, access to DATs, and rehabilitation/supportive therapies. Each country’s healthcare system was assessed to determine the extent of public reimbursement for PD treatments and the impact of national healthcare policies on PwP access. The number of active neurologists, number of PwP, and the population of each country was compared (Table 2).

Medications

Pharmacological treatment is the foundation of Parkinson's disease management, as medications are essential for controlling motor symptoms, reducing motor fluctuations, and supporting functional independence [2]. Core therapies include levodopa, dopamine agonists, MAO-B inhibitors, and COMT inhibitors, while newer options such as inhaled or extended-release formulations can further optimize motor control. The extent to which these medications are reimbursed and available differs across countries, directly influencing treatment equity and PwP access. The market reference prices per country in September 2025 are reported in Figure 1.

Germany

Germany has one of the most comprehensive reimbursement systems in Europe. Under statutory health insurance (Gesetzliche Krankenversicherung, GKV), PwP receive full reimbursement for levodopa, dopamine agonists, MAO-B inhibitors, and COMT inhibitors [23]. Newer treatments, including inhaled levodopa and extended-release levodopa-carbidopa, are also included in the national formulary [23]. These options allow for management of motor fluctuations through both rapid-acting and extended-release formulations. Neurologists can prescribe flexibly, adjusting dosages and switching medications without prior insurer approval [29], which supports timely treatment adjustments. Germany's well-distributed pharmacy network and specialized movement disorder centers ensure that PD medications are accessible nationwide, reducing the risk of regional shortages [30]. Access to some medications, such as opicapone or safinamide, may require individual approval through statutory insurance. In practice, not all neurologists pursue this process, limiting uptake in the public system. As a result, access to these newer and costlier therapies can be more straightforward for PwP with private health insurance.

Estonia

Estonia provides 100% reimbursement for all standard PD medications through the Health Insurance Fund [24]. PwP face no out-of-pocket costs for levodopa-carbidopa or levodopa-benserazide, dopamine agonists, MAO-B inhibitors, or COMT inhibitors. Sustained-release formulations, such as extended-release levodopa-benserazide and levodopa-carbidopa-

entacapone, are also reimbursed, offering treatment options for PwP with motor fluctuations. Although inhaled levodopa and newer extended-release levodopa-carbidopa formulations are not yet included in the formulary, Estonia has succeeded in creating broad and equitable access to essential therapies for its population. Medications are usually initiated by neurologists in outpatient clinics and continued by family doctors, supporting continuity of care across the system. Pharmacies throughout the country can order medications within short timeframes, minimizing regional disparities. The combination of universal reimbursement and reliable distribution makes Estonia comparable to Germany in standard medication access, despite having a smaller healthcare budget.

Lithuania

Lithuania also provides full reimbursement for standard PD medications [25]. As in Estonia, levodopa and adjunct medications are universally reimbursed, protecting PwP from the financial burden of chronic treatment. Neurological care in Lithuania has adapted over the years to align with European standards, supported by workforce development and broader healthcare reforms [31]. Public healthcare availability is relatively good, with a neurologist-to-population ratio of 1:6091 and most outpatients seen within one to three months (70% within 30 days). Tertiary care appointments, however, may take several months [31]. PwP are free to choose providers nationwide, which helps balance regional disparities. Like Estonia, Lithuania has not yet incorporated newer options such as inhaled levodopa or the latest extended-release levodopa-carbidopa formulations into the formulary, limiting therapeutic flexibility for PwP with advanced disease compared to Germany.

Latvia

Latvia remains the most constrained in this domain. Although all basic oral PD medications are available, the choice of levodopa formulations is more limited than in Germany but similar to those in Estonia and Lithuania. PwP receive 75% reimbursement for standard PD medications, leaving 25% of costs to be paid out-of-pocket [26]. Access to dopamine agonists is likely to be particularly constrained in practice because these agents are generally more expensive than standard levodopa formulations, making the remaining 25% patient share more difficult to absorb over time. For PwP in later disease stages who require multiple medications or

higher dosages, this creates a considerable financial burden. The difference compared to Estonia and Lithuania, which offer full reimbursement, highlights substantial regional inequities. Sometimes PwP in Latvia reduce or delay refills due to costs, which can affect adherence, symptom control, and disease outcomes. Although there have been occasional supply disruptions of levodopa-benserazide, national efforts are ongoing to reduce administrative barriers in medication supply and improve availability [32]. PD treatment is managed exclusively by neurologists; however, special state-reimbursed prescriptions for recommended medications may be issued either by family doctors or by neurologists. Waiting times for state-funded consultation of neurologists are different (one to three months) and are considerably longer on the tertiary level (three to five months). Some neurologists are not fully trained in advanced PD management, and expertise is concentrated in Riga [33]. As a result, Latvian PwP face both financial and structural barriers to optimized therapy, with access often determined by geography and personal resources.

Device-Assisted Therapies

DATs are indicated for PwP with advanced PD whose symptoms are insufficiently controlled with oral medications. These include deep brain stimulation (DBS), levodopa-carbidopa intestinal gel, levodopa-carbidopa-entacapone intestinal gel, foslevodopa-foscarbidopa subcutaneous infusion, and apomorphine infusion therapy. DATs can improve motor outcomes, reduce off time and treatment-related complications, and decrease long-term healthcare utilization, but their reimbursement and practical availability vary considerably across Europe [34].

Germany

Germany provides universal access to all major DATs through statutory health insurance [23]. More than 50 movement disorder centers offer DBS surgery, infusion therapies, and magnetic resonance (MR)-guided focused ultrasound, with a Delphi-panel approach used to ensure equitable PwP selection [7,35]. PwP who meet criteria can be referred for surgical or infusion interventions without financial barriers, and follow-up care is supported by specialist nurses and home-based services [36,37]. Access to certain high-cost infusion therapies, such as

foslevodopa-foscarbidopa subcutaneous infusion (exceeding 6000 EUR/month), may still require individual approval under statutory insurance. In these cases, uptake may be lower in the public system, while PwP with private insurance often have straightforward access.

Estonia

Estonia reimburses DBS, levodopa-carbidopa intestinal gel, and apomorphine therapy through the Health Insurance Fund [24]. Access, however, is limited by capacity. The country has two neurosurgical centers, with only one specializing in DBS, which results in long waiting times and limited case numbers [38]. Levodopa-carbidopa intestinal gel and apomorphine pens are available but subject to hospital budget limits and administrative approval, contributing to treatment delays. Thus, reimbursement exists at the policy level, but practical access is constrained by resources and administrative processes.

Lithuania

Lithuania reimburses DBS and destructive procedures (stereotactic and gamma-knife surgery), with typical waiting times for DBS not exceeding six to nine months, and destructive procedures available without delay. Levodopa-carbidopa intestinal gel, foslevodopa-foscarbidopa subcutaneous infusion, and apomorphine pens and pumps are registered but not reimbursed, limiting access primarily due to high costs. Levodopa-carbidopa-entacapone intestinal gel and apomorphine pumps remain unavailable [25]. For PwP not eligible for DBS, financial and structural barriers restrict access to advanced therapies, leaving oral medications as the only reimbursed option.

Latvia

Latvia discontinued reimbursement for DBS after six procedures performed between 2005 and 2009 at Pauls Stradins Clinical University Hospital. Currently, only battery replacement for earlier cases is covered. Legislation prevents PwP from seeking state-funded DBS abroad under EU S2 provisions, even with neurologist consilia recommendations. Other DATs, including levodopa-carbidopa intestinal gel, foslevodopa-foscarbidopa subcutaneous infusion, levodopa-carbidopa-entacapone intestinal gel, and apomorphine infusion, are not reimbursed [26]. Because these therapies are high-cost interventions, non-reimbursement makes them

functionally unattainable for almost all PwP outside rare self-funded cases. Attempts by neurologists to secure reimbursement through individual exceptions have been rejected, with policymakers citing financial constraints and competing health priorities. As a result, Latvian PwP with advanced PD rely on oral medications alone unless they are able to fund private treatment abroad.

Supportive Therapies

Rehabilitation and supportive therapies are a key component of PD management, addressing functional decline that persists despite pharmacological or device-assisted treatment. Core services include physiotherapy, occupational therapy, and speech therapy, complemented in some settings by inpatient or outpatient neurorehabilitation programs and palliative care. The extent to which these services are reimbursed, available, and supported by trained specialists varies considerably between countries, influencing continuity of care across disease stages [39]. Across the Baltic states, rehabilitation services are generally reimbursed and do not require patient co-payments when accessed through state-funded or specialist referral pathways; however, practical access remains constrained by workforce shortages, regional disparities, and limited service capacity. In Germany, by contrast, service availability is broader, but standard co-payments usually apply unless patients are exempt.

Germany

In Germany, physiotherapy, occupational therapy, and speech therapy are reimbursed under statutory health insurance through the Heilmittel-Richtlinie (HeilM-RL) of the G-BA, although adults generally make a standard co-payment unless exempt [40,41]. These services are delivered in both inpatient and outpatient settings and coordinated through multidisciplinary centers. The directive defines specific therapeutic modalities, including physiotherapy, occupational therapy, and speech therapy for voice, speech, language, and swallowing disorders, as well as psychotherapeutic and nutritional therapy. The regulation distinguishes between short-term prescriptions and long-term needs: an unlimited, unbureaucratic prescription of therapies is only possible for PwP in Hoehn and Yahr (HY) stage 5, while earlier stages (HY 1-4) require time-limited prescriptions with defined maximum treatment units per case. In these

earlier stages, further prescriptions can be issued but must be justified and may require approval by the statutory health insurance provider. Private health insurance policies are not subject to these restrictions. In practice, PwP in earlier stages of the disease have structured access to rehabilitation, but within limits of approved therapy units and subject to administrative oversight. Germany also offers inpatient neurorehabilitation programs, home-based physiotherapy, and integrated palliative care, with specialized units and home-based nursing teams supporting advanced PwP [42].

Estonia

In Estonia, rehabilitation services, including physiotherapy, occupational therapy, and speech therapy, are reimbursed through public insurance when accessed with a specialist referral. However, service capacity is constrained by workforce shortages and regional disparities [24]. Speech therapy remains inconsistently available in practice, and only a limited number of therapists are trained in PD-related dysphagia. General palliative care services are established, including home-based support and hospice care [43]. Interdisciplinary teams in regional and central hospitals provide additional support for PD management.

Lithuania

Lithuania has a stronger framework, with specialized rehabilitation centers in Vilnius, Kaunas, and Abromiskes offering PD programs, supplemented by both public and private facilities for movement disorder care. Rehabilitation services, including physiotherapy, occupational therapy, and speech therapy, are reimbursed. PwP do not incur co-payments when these services are accessed with a specialist referral. Workforce challenges remain, particularly in nursing, general practice, and rehabilitation specialties, alongside regional disparities [44]. National-level initiatives have aimed to improve workforce planning and retention. In 2023, specialized regulatory documents were introduced to strengthen the awareness of PD rehabilitation, outlining principles, techniques, and the legal basis of care [13]. Palliative care availability has expanded, with home-based nursing services offered, although demand still exceeds capacity. Dedicated PD palliative units have not yet been established, though general and dementia-focused units exist. Home-based palliative services are provided when Barthel's index score is

≤40 [45]. Access to art therapy has grown, supported by university-level training programs for certified art therapists.

Latvia

Latvia offers a state-funded neurodegenerative disease rehabilitation program at Riga East University Hospital (RAKUS), where PwP undergo multidisciplinary assessment by a rehabilitation physician, physiotherapist, occupational therapist, and speech therapist. Outpatient implementation is limited by long waiting times (up to one year). In Riga, a small number of physiotherapists trained in PD care are available, with up to ten state-funded sessions per year, or through private payment, which is accessible more quickly, although physiotherapists with specialization in movement disorders remain rare. This provision remains insufficient for long-term rehabilitation needs. Physiotherapy and speech therapy do not require co-payment when provided as state-funded services; however, access is limited by long waiting times and restricted service capacity. In practice, speech therapy for PD-related communication and swallowing problems remains very limited [26]. Palliative care services are limited. A mobile hospice team operated by Hospiss.lv is available for PwP with life expectancy under six months, but eligibility requires a multidisciplinary hospital board decision. Services are not PD-specific and are restricted by financial and workforce limitations. Although minimal home-based assistance by social workers is available, there is no provision for home nursing care. As a result, family members provide most caregiving, often without training or structured support.

Comparative Summary

Across all domains, Germany demonstrates comprehensive access to PD treatments, with universal reimbursement, established DAT services, and extensive rehabilitation and palliative care. Estonia and Lithuania provide strong medication coverage but show limitations in the availability of DATs and rehabilitation, reflecting structural capacity constraints. Latvia provides partial reimbursement for medications, has no reimbursed DATs, and limited rehabilitation and palliative services, resulting in comparatively lower overall access.

Discussion

This comparative policy mapping indicates that the Baltic states and Germany differ in multiple policy instruments relevant to PD care, including cost-sharing rules, coverage of DATs, and the scope and capacity of rehabilitative services. The findings support a descriptive conclusion that national policy design and system capacity may plausibly contribute to cross-country differences in access; however, patient-level outcomes and utilization were not measured in this study.

In 2022, Germany's healthcare spending amounted to 12.6% of the country's gross domestic product (GDP), of which approximately 10.1% was government funded [46]. In contrast, the Baltic states allocated a smaller share of their economic output to health, with 7.6% of GDP in Latvia, 7.2% in Lithuania, and 7.0% in Estonia [46], with government contributions covering only 4.9%, 4.7%, and 5.2% of GDP, respectively [47]. (Note: The expenditures reflect the year 2022 and may be higher due to the COVID-19 pandemic). This means that individuals in the Baltic region bear a higher burden of out-of-pocket healthcare costs compared to PwP in Germany. In 2022 and 2023, out-of-pocket expenditure accounted for approximately 30.7% of current health expenditure in Latvia, 31.8% in Lithuania, 23.2% in Estonia, whereas in Germany it was only 11.3% [48]. Such financial disparities have far-reaching implications for disease management, treatment adherence, and long-term outcomes in chronic neurological conditions such as PD, emphasizing the need for more equitable healthcare funding and access across Europe.

Medication Reimbursement and Innovation

Medication reimbursement is fundamental to consistent treatment. Latvia's 75% reimbursement, versus 100% in Germany, Estonia, and Lithuania, imposes a disproportionate financial burden on PwP, contributing to reduced adherence. Most reimbursed PD medications in Latvia are priced lower than in the neighboring Baltic states due to generic competition and regional price harmonization, yet substantial price gaps with Germany persist (Figure 1). Consequently, Latvia spends the least public funds on PD medicines among the four countries. Out-of-pocket costs are associated with non-adherence, higher hospitalization, and mortality [49,50], and similar patterns are seen in the United States, where affordability strongly predicts

treatment continuity [51]. Notably, Latvia reports some of the highest PwP out-of-pocket costs in Europe, exacerbating inequities in treatment access.

Importantly, cross-country differences are not limited to whether a medicine is "present" in the market; they also reflect benefit inclusion, cost-sharing, and administrative pathways for coverage. In this analysis, "full reimbursement" requires both benefit inclusion and zero standard PwP cost-sharing, whereas partial reimbursement (e.g., 75%) implies a persistent affordability barrier even when a medicine is covered.

Non-reimbursement of newer options, such as inhaled levodopa, extended-release levodopa, and opicapone, reflects both restrictive reimbursement policies and limited market entry/registration by manufacturers. This mirrors a broader European pattern of delayed drug adoption, with Germany and Scandinavian countries integrating innovations faster while smaller markets remain behind. In Germany, access to some agents (e.g., opicapone, safinamide) may require prior approval under statutory insurance, though they are generally available. Early adoption of advanced medications can delay motor complications and reduce later reliance on invasive therapies [52]. However, the present study does not quantify the downstream clinical or economic effects of delayed adoption; it only documents differences in coverage design and availability.

Device-Assisted Therapies

DATs, including DBS and infusion therapies, remain inequitably distributed. Germany reimburses all major DATs, enabling timely access for people with advanced PD [7,23]. Latvia reimburses none: DBS funding stopped after 2009 (only battery replacements are covered), and access abroad under EU S2 is generally prevented except for rare, individually approved cases. Infusion options, such as levodopa-carbidopa intestinal gel, foslevodopa-foscarbidopa subcutaneous infusion, and levodopa-carbidopa-entacapone intestinal gel, as well as apomorphine infusion are likewise excluded, leaving eligible PwP reliant on oral medications.

From a policy-instrument perspective, DAT coverage rules operationalize how systems allocate high-cost therapies under goals such as equity and cost containment. Germany's model combines broad benefit inclusion with structured eligibility and follow-up, whereas Latvia's

exclusion of DATs represents a different allocation decision under budget constraints [53-56]. The study documents these differences without asserting which choice is optimal, as cost-effectiveness assessments and outcome data were not performed here.

Rehabilitation and Supportive Therapies

Rehabilitation and palliative care are central to comprehensive PD management yet remain underdeveloped in the Baltics. Germany, the Netherlands, and Sweden integrate multidisciplinary rehabilitation, such as physiotherapy, occupational therapy, speech therapy, and palliative support, into routine care [40,57,58], and these programs are associated with slower functional decline and reduced caregiver burden. By contrast, the Baltic states face constrained access due to workforce shortages and regional disparities [24,25] and lack structured palliative nursing support [26]. While general palliative services exist in Estonia and Lithuania, PD-specific nursing or home-based programs are largely absent across the region, leaving families to provide most care with resulting caregiver burden and poorer end-of-life outcomes.

These findings suggest potential implementation opportunities (e.g., tele-rehabilitation, nurse-led models) [59-62] that could be explored or evaluated in the Baltic context, but the present study does not test interventions.

Policy Implications

Rather than prescriptive recommendations, the findings point to three policy “pressure points” where Baltic systems differ most from the German comparator: (1) cost-sharing for essential medicines (Latvia), (2) benefit inclusion and eligibility pathways for DATs (especially Latvia and partly Lithuania), and (3) covered scope and capacity for rehabilitation/supportive therapies (all Baltic states, with the greatest constraints in Latvia). These are plausible targets for future national evaluations (e.g., budget impact analyses, cost-effectiveness work, and implementation pilots).

Study Limitations

Limitations reflect the descriptive design. Limitations include reliance on publicly available documents, reimbursement databases, and expert input, potentially missing informal practices or recent changes, as well as cross-country differences in transparency and reporting that may introduce inconsistencies despite triangulation. The analysis focuses on policy rather than PwP outcomes (adherence, quality of life, survival not assessed). Finally, comparing one high-resource country (Germany) with three smaller Baltic states highlights disparities but may limit generalizability to other European contexts. Additionally, some "accessibility" elements (e.g., waiting times, uptake, regional shortages) were not consistently available in comparable formats across all countries, so proxies and contextual expert input were used rather than harmonized utilization measures.

Future Directions

Future research should link policy analysis with patient-level outcomes (adherence, hospitalizations, quality of life) to show how policy translates into care, and extend comparisons to additional European countries to situate the Baltics. A next step consistent with the present policy mapping would be an evaluative policy analysis (e.g., budget impact + equity impact) focused on one or two specific policy changes (such as Latvia's medication cost-sharing or DAT inclusion pathways), with clearly defined counterfactual scenarios. Future evaluations of reimbursement reforms should also consider a societal perspective, as the benefits of improved access may extend beyond healthcare use to include preserved productivity and reduced informal caregiver burden. Service-delivery innovations, such as tele-rehabilitation and PD nurse-led models, offer cost-effective ways to bridge workforce and regional gaps.

Conclusion

This structured comparative policy mapping demonstrates that Latvia, Lithuania, and Estonia differ from Germany in multiple policy instruments relevant to PD care, including cost-sharing design, benefit inclusion of DATs, and the covered scope and capacity of rehabilitation/supportive therapies. Germany offers broad access across medications, DATs, and rehabilitation; Estonia and Lithuania reimburse medications but face DAT and rehabilitation barriers; Latvia is most constrained, with partial reimbursement, no reimbursed DATs, and weak

supportive therapies. These findings do not establish causality, but they clarify where policy design and implementation features align with potential access barriers and where more evaluative work may be most informative.

Declarations

Abbreviations

COMT: Catechol-O-methyltransferase

DATs: Device-assisted therapies

DBS: Deep brain stimulation

EAN: European Academy of Neurology

G-BA: Federal Joint Committee

GDP: Gross domestic product

GKV: Statutory Health Insurance

HY: Hoehn and Yahr

ICD-10: International Classification of Diseases, 10th Revision

MAO-B: Monoamine oxidase-B

MDS-ES: Movement Disorder Society-European Section

MR: Magnetic resonance

NVD: National Health Service

PD: Parkinson's Disease

PwP: People with Parkinson's Disease

RAKUS: Riga East University Hospital

VLK: National Health Insurance Fund

Ethics approval and consent to participate

This study used only publicly available policy documents, reimbursement databases, formularies, clinical guidelines, and secondary literature. No patient-level data, human participants, biological samples, or private records were involved. Expert input was limited to

non-identifiable, system-level contextual clarification. Therefore, formal ethics approval and informed consent to participate were not required.

Consent for publication

Not applicable.

Availability of data and materials

All data used in this study were obtained from publicly available sources, including national reimbursement agency databases, formularies, policy documents, clinical guidelines, and published literature. The sources are cited in the reference list. Additional extracted comparative data may be made available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' contributions

PA conceived and designed the study, conducted the policy mapping and comparative analysis, interpreted the findings, and drafted the manuscript.

LS, RL, GS, KR, KS, and PT contributed to the study design, provided country-specific and clinical expertise, and critically revised the manuscript for important intellectual content.

LS, RL, KR, and PT also contributed to data interpretation and contextual validation of national treatment and reimbursement information.

All authors read and approved the final manuscript.

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Data availability

This study did not generate or analyze a proprietary dataset. All information used in this study was obtained from publicly available sources, including national reimbursement databases, formularies, policy documents, clinical guidelines, and published literature, all of which are cited in the reference list. Additional extracted comparative material may be made available from the corresponding author upon reasonable request.

Table 1a: Availability and reimbursement of pharmacological therapies for Parkinson's Disease

Table 1b: Availability and reimbursement of device-based and surgical therapies for Parkinson's Disease

Table 2: Comparison of the number of active neurologists, people with Parkinson's Disease, and population for the Baltic states and Germany

Figure 1: Reference price per package for selected PD medications (EUR), September 2025. Prices reflect national reference price lists (not PwP co-pay). Medication doses shown on x-axis.

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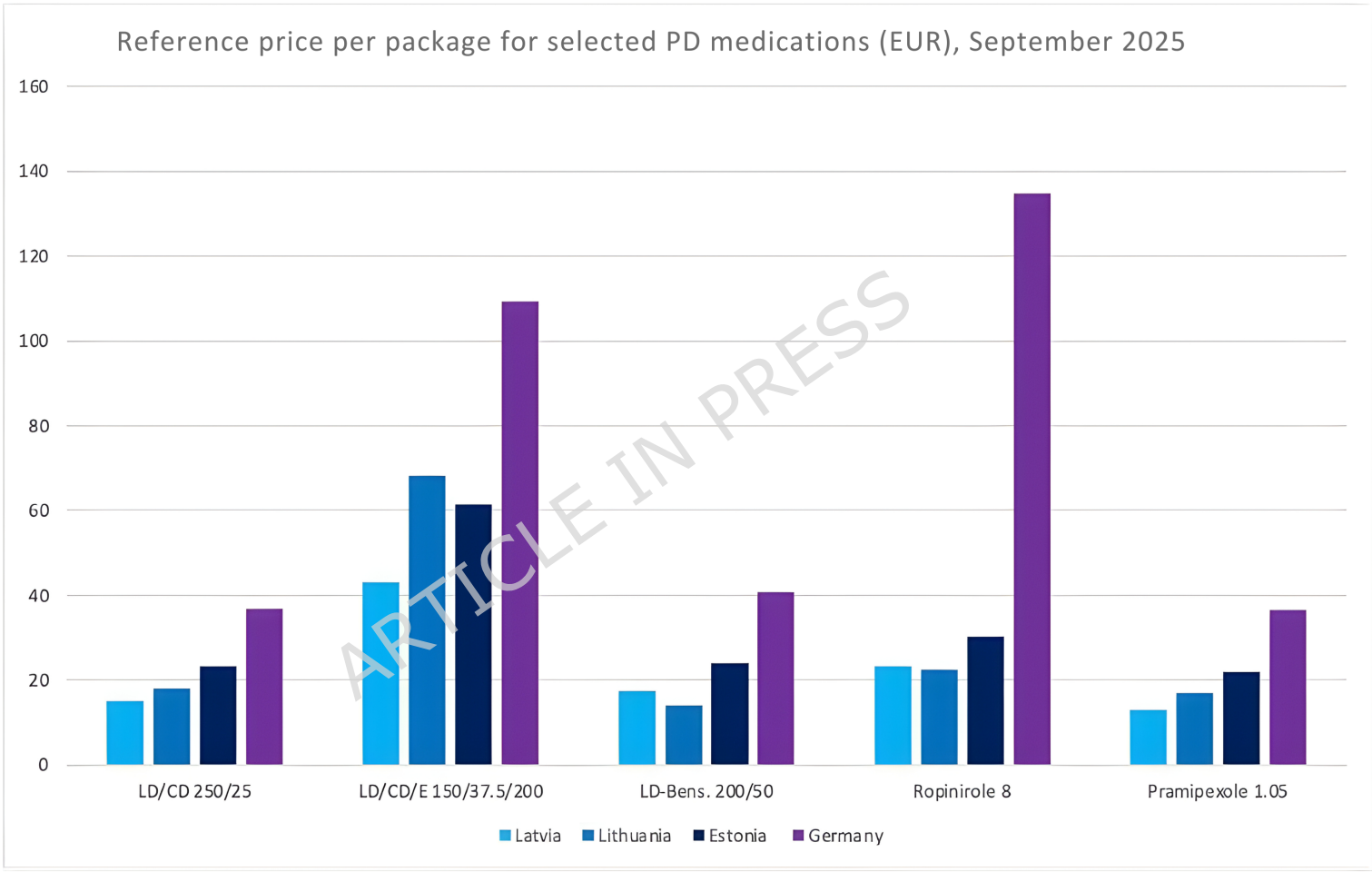

Table 1b: Availability and reimbursement of device-based and surgical therapies for Parkinson's Disease

Therapy / intervention	Country	Benefit inclusion (reimbursed)?	Patient cost-sharing	Authorization / eligibility	Service capacity / notes
Levodopa/carbidopa intestinal gel (Duodopa)	Germany	Yes	0%	Standard specialist pathway	Available, reimbursed
	Estonia	Yes	0%	Administrative/hospital budget constraints	Available, reimbursed
	Lithuania	No	Private-pay	—	Registered, not reimbursed
	Latvia	No	Private-pay	—	Registered, not reimbursed
Foslevodopa/foscarbidopa (Produodopa)	Germany	Yes	0%	May require individual approval for high-cost cases	Available, reimbursed
	Estonia	Yes	0%	Administrative/hospital approval	Available, reimbursed
	Lithuania	No	Private-pay	—	Registered, not reimbursed
	Latvia	No	Private-pay / not available	—	Not registered / not available
Levodopa/entacapone/carbidopa gel (Lecigon)	Germany	Yes	0%	Specialist pathway	Available, reimbursed
	Estonia	No	—	—	Not available
	Lithuania	No	—	—	Not available
	Latvia	No	—	—	Not available
Levodopa microgranules (Sensidose)	Germany	Yes	0%	—	Available, reimbursed
	Estonia	No	—	—	Not available
	Lithuania	No	—	—	Not available
	Latvia	No	—	—	Not available
Apomorphine (pen/pump)	Germany	Yes	0%	Specialist pathway	Available, reimbursed
	Estonia	Yes	0%	Consilium / approval pathway	Available, reimbursed
	Lithuania	No	Private-pay	—	Pen only, not reimbursed; pump unavailable
	Latvia	No	Private-pay	—	Pen only, not reimbursed; pump unavailable
Deep brain stimulation (DBS)	Germany	Yes	0%	Standard eligibility criteria	~50 centers, reimbursed
	Estonia	Yes	0%	Referral + capacity constraints	1 center (Tartu)
	Lithuania	Yes	0%	Referral + waiting time	2 centers (Vilnius, Kaunas)

	Latvia	No	Private-pay	Cross-border S2 generally not available	Previously performed 2005-2009 at Stradins; reimbursement discontinued for new cases; battery replacement for legacy cases covered
MR-guided focused ultrasound (MRgFUS)	Germany	Yes (select centers)	0%/case-based	Center-specific pathway	Kiel, Freiburg, Kassel, Bonn
	Estonia	No	—	—	Not available
	Lithuania	No	—	—	Not available
	Latvia	No	—	—	Not available
Gamma knife / stereotactic surgery	Germany	Yes	0%	Standard	Available, reimbursed
	Estonia	No	—	—	Not available
	Lithuania	Yes	0%	Standard	Available, reimbursed
	Latvia	Gamma knife: No	Private-pay	—	Gamma knife available, not reimbursed

Note: “Reimbursed” indicates benefit inclusion in the public package; “registered/available but not reimbursed” indicates private-pay. “Service capacity” is included as an accessibility proxy (implementation constraint).

Table 2: Comparison of the number of active neurologists, people with Parkinson's Disease (PwP), and population for the Baltic states and Germany

Country	Population (millions)	Number of PwP (ICD-10 G20)	PD per 100,000 population	Number of active neurologists	Neurologists per 100,000 population	PwP per neurologist
Latvia	1.857	4,026	216.8	280	15.1	14.4
Lithuania	2.830	8,085	285.7	464	16.4	17.4
Estonia	1.370	4,300	313.9	110	8.0	39.1
Germany	83.500	295,000	353.3	10,070	12.1	29.3

Note: PD prevalence per 100,000 and neurologists per 100,000 were calculated as: (count ÷ population) × 100,000. PD cases refer to idiopathic Parkinson's Disease (ICD-10 G20) to maintain cross-country comparability.

Table 1a: Availability and reimbursement of pharmacological therapies for Parkinson's Disease

Therapy	Country	Benefit inclusion in public package?	Reimbursement rate	Patient cost-sharing	Authorization / access notes
System rule (PD medicines)	Germany	Yes	100%	0%	Standard GKV coverage for listed PD meds
	Estonia	Yes	100%	0%	Standard coverage
	Lithuania	Yes	100%	0%	Standard coverage
	Latvia	Yes	75%	25% coinsurance	Standard coverage for listed PD meds
Oral levodopa formulations	Germany	Yes	100%	0%	No prior approval (standard prescribing)
	Estonia	Yes	100%	0%	Standard coverage
	Lithuania	Yes	100%	0%	Standard coverage
	Latvia	Yes	75%	25% coinsurance	Standard coverage
Inhaled levodopa	Germany	Yes	100%	0%	Listed/available
	Estonia	No	—	Not available	Not available
	Lithuania	No	—	Not available	Not available
	Latvia	No	—	Not available	Not available
COMT inhibitors: entacapone	Germany	Yes	100%	0%	Standard
	Estonia	Yes	100%	0%	Standard
	Lithuania	Yes	100%	0%	Standard
	Latvia	Yes (combo with L-dopa/CD)	75%	25% coinsurance	Reimbursed only in specified combinations
COMT inhibitors: opicapone	Germany	Yes	100%	0%	May require exception/prior approval under statutory insurance
	Estonia	Yes (conditional)	100%	0%	Conditional/approval pathway
	Lithuania	Yes (conditional)	100%	0%	Conditional/approval pathway
	Latvia	No	—	Private-pay	Out-of-pocket
Dopamine agonists (oral): pramipexole, ropinirole	Germany	Yes	100%	0%	Standard
	Estonia	Yes	100%	0%	Standard
	Lithuania	Yes	100%	0%	Standard
	Latvia	Yes	75%	25% coinsurance	Standard coverage
Dopamine agonists: rotigotine patch	Germany	Yes	100%	0%	Standard
	Estonia	No	—	Not available	Not available
	Lithuania	No	—	Not available	Not available
	Latvia	No	—	Not available	Not registered
MAO-B inhibitors: selegiline, rasagiline	Germany	Yes	100%	0%	Standard
	Estonia	Yes	100%	0%	Standard
	Lithuania	Yes	100%	0%	Standard
	Latvia	Yes	75%	25% coinsurance	Selegiline + rasagiline reimbursed (75%)
MAO-B inhibitors: safinamide	Germany	Yes	100%	0%	Standard (per your table)
	Estonia	No	—	—	Available but not reimbursed

	Lithuania	No	—	Private-pay	Available but not reimbursed
	Latvia	No	—	Not available	Not registered
Amantadine	Germany	Yes	100%	0%	Oral + IV reimbursed
	Estonia	Yes	100%	0%	Oral + IV reimbursed
	Lithuania	Yes	100%	0%	Oral + IV reimbursed
	Latvia	Oral: Yes	75%	25% coinsurance	IV hospital-use only
Trihexyphenidyl	Germany	Yes	100%	0%	Available
	Estonia	Yes	100%	0%	Available, reimbursed
	Lithuania	Limited availability	—	—	Limited availability
	Latvia	Yes	75%	25% coinsurance	Available, reimbursed (75%)

Note: Full reimbursement = benefit inclusion + 0% patient cost-sharing. Partial reimbursement = benefit inclusion + nonzero cost-sharing (e.g., Latvia 75% reimbursement → 25% coinsurance). “Registered/available but not reimbursed” = private-pay. “Authorization” captures prior approval/consilium/exception pathways (accessibility).