How Digital Scheduling Platforms Effect Insurance-Based Disparities in Access to Specialist Outpatient Care: A Cross-Sectional Audit Study in Berlin, Germany

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Abstract

Background: Digital appointment scheduling platforms have the potential to be widely adopted but may interact with insurance-driven incentives to amplify access inequities. In Germany's dual insurance system, privately insured (PHI) patients may obtain earlier specialist appointments than statutory health insurance (SHI) patients.

Objective: To quantify differences in wait times to first-available specialist outpatient appointments for SHI versus PHI profiles on a large commercial online scheduling platform (Doctolib) in Berlin, and to assess whether providers offering equal appointment options for both insurance types are deprioritized by the platform.

Methods: We performed a cross-sectional internet-based audit between January 6 and February 26, 2025. Two standardized simulated patient profiles (SHI and PHI) were used to query 1,867 platform listings; providers with at least one bookable slot for both profiles were retained (n = 492). Primary outcome was wait time in days to the earliest available appointment. Paired t-tests compared within-provider wait times; subgroup analyses examined specialty-specific differences. Sensitivity analyses excluded the top 5% longest waits. Effect sizes (Hedges' g) were computed.

Results: Across 492 providers, mean wait times were 50.3 days (SD 52.2) for SHI and 22.6 days (SD 36.8) for PHI, yielding a mean difference of 27.7 days (95% CI 23.6–31.9; t(491) = 13.05; p < .001; Hedges' g = 0.59). After excluding the top 5% of wait times (n = 44), the difference remained significant (? = 23.1 days, 95% CI 20.0–26.2; t(447) = 14.77; p < .001). The largest specialty gaps were observed in urology (? = 45.8 days; p < .001), general surgery (? = 34.9 days; p = .012) and ENT (? = 31.6 days; p < .001). Providers that offered earlier PHI appointments showed substantially longer SHI waiting times (61.8 vs 37.5 days; p < .001) and substantially shorter PHI waits (12.0 vs 38.2 days; p < .001). Platform ranking was correlated with earlier PHI availability (r = 0.574; p = 0.001), suggesting algorithmic amplification of differential access.

Conclusions: On this commercial scheduling platform in Berlin, SHI patients experienced substantially longer waits for first-available specialist appointments than PHI patients across multiple specialties. Platform ranking and differential slot allocation appear to amplify pre-existing insurance-based access inequities. Algorithmic transparency and insurance-neutral ranking criteria should be considered to promote equitable access. Clinical Trial: no registration

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How Digital Scheduling Platforms Effect Insurance-Based Disparities in Access to Specialist Outpatient Care: A Cross-Sectional Audit Study in Berlin, Germany

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Introduction

Disparities in access to medical care—particularly in scheduling outpatient appointments—are well documented in health services research. [1–3]
In Germany, this issue is especially pronounced due to its dual insurance system, which separates statutory health insurance (SHI) and private health insurance (PHI). About 11% of the population are insured in PHI. [4]
Several field experiments have shown that SHI patients face significantly longer wait times than PHI patients when attempting to schedule specialist appointments by phone, with reported differences ranging from 7 to 15 days. [5–9] Earlier data found that, in 2006, average waiting times for specialist appointments ranged from 9.5 to 24.8 working days. [10] In contrast, waiting time disparities have not been observed to the same extent in the primary care sector in Germany. [11]
Recently, online scheduling platforms (OSP) have become increasingly common and may soon replace traditional phone-based scheduling in many settings. [12,13] Atherton et al. report a mixed-methods investigation of patient use and experience of online appointment booking in primary care, focusing on adoption, usability, and user perceptions rather than audit outcomes. [12] Studies that examine OSP, show lower no show rates and overall shorter waiting times but do not assess inequalities. [13,14]
While digital platforms offer convenience and the appearance of neutrality, emerging evidence suggests they may also perpetuate or even reinforce access inequities. An U.S.-based study of an online scheduling platform in primary care found systematic discrimination against Medicaid patients. [15] Kurtzman et al. conduct an audit of online primary care appointment availability in the United States and identify differences in availability by insurance status (Medicaid vs private insurance). Although over 4.000 Listings were analysed this study did not simulate real bookings and did not focus on specialists care. Our study adds a cross-specialty, Germany-based audit on a commercial scheduling platform, extending the online-audit literature from primary care settings in the US to specialist bookings in a European dual-insurance system.
Online scheduling platforms can implement algorithms and rules that can be discriminating by design, which can be inforced due to the application of machine learning.[16] This study adds field evidence that disparities by insurance status are present on a commercial online platform in practice.
The analysed platform Doctolib is the self reported biggest online scheduling platform in Europe, however we know little about its influence on discrimination and the algorithms in place.
Due to the active process of applying rules for the platform by which patients can access appointments and the fact that this special platform comes with a monthly fee for the physician, we assume that waiting disparities would be higher than in the analogue system in order to justify the investment.
This study aims to investigate whether SHI patients experience longer wait times than PHI patients when booking specialists appointments through an OSP. Specifically, we examine
(i) the magnitude of waiting time differences between SHI and PHI patients across multiple medical specialties on the platform; and
(ii) whether providers offering equal appointment options for both insurance types are deprioritized by platform algorithms.

Methods

Study Design

We conducted a cross-sectional internet-based audit study to evaluate differences in appointment availability for SHI versus PHI patients on Doctolib, in Berlin, Germany. The study follows the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional research and adopts “simulated patient” methodology to minimize measurement bias. The full checklist is provided in Table S1 in the supplements section. [17]

Setting and Data Source

Data were collected between January 6 and February 26, 2025. The platform aggregates publicly accessible listings for outpatient medical specialists in Berlin and allows users to filter by insurance status (SHI vs. PHI). To mitigate temporal variability, each specialty was assessed within one day for both the PHI and the SHI profile. Due to frequent platform updates results, the order of appearance changed throughout the assessment window. In order to ensure complete uptake of all available specialists, all search result pages were saved as static HTML snapshots at the moment of extraction and then double checked if all possible appointments where incorporated. For validation assessment-day was included as confounder?

Participants and Sample Selection

The specialties were derived from the EU Professional Qualifications Directive (2005/36/EC) of the European Parliament and of the Council of September 7, 2005 on the recognition of professional qualifications. We deleted the specialities dentistry and orthodontics which showed no observable insurance-based differences in a prior pre-study in Frankfurt and offer no option to select between SHI and PHI on doctolib. We screened 1,867 provider listings on the platform; inclusion criteria were (1) active online booking availability during the data collection window and (2) availability of appointments for both SHI and PHI. Providers offering only one insurance type or no online booking were excluded. A total of 492 providers met inclusion criteria and were analyzed. Figure 1 provides a detailed flow diagram documenting each stage of screening and exclusion.

Audit Simulation and Data Collection

Two standardized profiles were created: one representing a SHI patient and one representing a PHI patient (aged 30–40 years, no prior appointment history). For each eligible provider, we conducted two parallel searches—one under each profile—on the same day and, wherever possible, within the same browser session to control for diurnal fluctuations in availability. For multi-physician practices or multi-location listings, each distinguishable physician/location combination was treated as a unit. For each entity (Listing of a physician), we recorded the earliest available appointment date without completing a booking. No real appointments were made, ensuring that study activities did not impact provider schedules.

Variables

- Primary outcome: Appointment wait time, defined as the number of days between the search date and the earliest available appointment.
- Exposure: Insurance status (SHI vs. PHI).
- Covariates: Medical specialty

Bias Control

To reduce measurement bias and maintain consistency, the data collection was conducted in the order presented by the platform (first to last page and top to bottom), and static snapshots were archived. The use of identical simulated profiles—differing only by declared insurance status—minimized confounding due to patient characteristics.

Statistical Analysis

Descriptive statistics (mean, median, interquartile range) were computed for wait times by insurance

type. Paired t-tests assessed within-provider differences in wait times for SHI versus PHI. To explore heterogeneity, we conducted subgroup analyses stratified by specialty. All analyses were two-tailed with α = .05. Analyses were performed in SPSS (version 28).

Sensitivity Analysis

To evaluate the robustness of findings, we excluded the top 5% of providers with the longest wait times (outliers) and repeated the paired comparisons. This outlier exclusion did not materially alter the direction or significance of results.

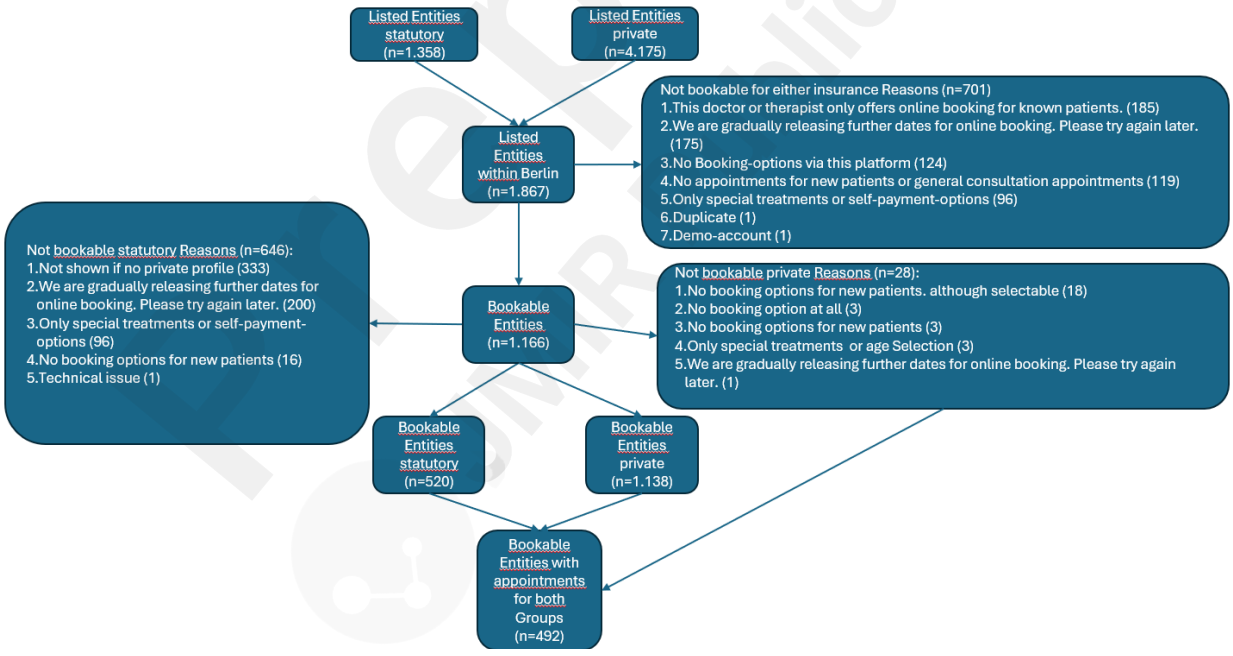
Ethical Considerations

As this study involved only publicly available booking information and no real patient data or appointment bookings, it was deemed exempt from formal ethics review under local regulations. Neither provider schedules were impacted nor are provider names reported.

Results

Participant Flow and Bookable Entities

We screened a total of 1 867 provider listings on the platform between January 6 and February 26, 2025. After applying our exclusion criteria (no online booking, availability for only one insurance type, or specialty outside the predefined list), 492 providers remained with at least one bookable appointment slot for both SHI and PHI patients (bookable entities with appointments for both groups [BE]). The detailed flow of inclusion and exclusion is presented in *Figure 1*.



In

Table 1 the bookable Entities are compared with available practices within Berlin based on the data of the Association of Statutory Health Insurance Physicians (Kassenärztliche Vereinigung [KV]) in order to estimate the local market share of the platform.

Note: The Berlin Kassenärztliche Vereinigung (KV) registry lists all outpatient specialists authorized to treat statutory-insured patients; however, platform listings did include multiple entries per physician and might omit some providers, so the KV comparison is approximate.

Provider Bookability by Specialty

Table 1. Estimated Market share in Berlin

KV Group	Registered in KV (n)	SHI Bookable (n)	PHI Bookable (n)	BE (n)	% SHI Bookable of KV	% Evaluable Cases
Surgery and Orthopedics*	689	189	287	175	27,4%	25,4%
Ophthalmology	349	20	57	20	5,7%	5,7%
Obstetrics and Gynecology	730	108	209	103	14,8%	14,1%
Dermatology and Venereology	228	18	172	18	7,9%	7,9%
ENT / Phoniatrics and Pedaudiology	281	82	116	75	29,2%	26,7%
Internal Medicine with Specialty Practice	587	15	87	14	2,6%	2,4%
Pediatrics	410	12	22	12	2,9%	2,9%
Neurology / Psychiatry	405	2	32	2	0,5%	0,5%
Radiology	261	38	53	38	14,6%	14,6%
Urology	183	36	103	35	19,7%	19,1%
Total	4123	520	1138	492	12,6%	11,9%

* Evaluable Cases = Bookable Entities for both groups
**This group combines the single specialities general surgery, vascular surgery and orthopedics.

Overall the physicians included on the plattform offering service to SHI Patients account for about 12.6% (492/4123) of the available practices in Berlin according to the KV. This match is not perfect as the lists do not correspond perfectly. The specialities do not match exactly the list of specialities chosen for this study. However it is a rough estimation of market share of Doctolib in Berlin.
The specialties with the highest SHI bookability rates were ENT, orthopedics, and obstetrics & Gynecology and urology. Neurology had the lowest SHI bookability (0.5 %), with only 2 out of 405 registered neurologists offering SHI appointments on this platform online.
Table 2 offers an overview over the distribution of cases among the specialities, the day of observation and the descriptive results on waiting times.

			Waiting time for Appointment					
Specialty	**n**	**Day of observation**	**PHI < SHI**	**No Diff.**	**SHI < PHI**	**%PHI < SHI**	**Mean SHI (SD)**	**Mean PHI (SD)**
General Surgery	13	Tuesday	7	5	1	53,8	51.9 (40.0)	17.0 (21.9)
Ophthalmology	20	Sunday	8	11	1	40,0	48.6 (58.3)	17.2 (35.0)
Obstetrics & Gynecology	103	Sunday	46	42	15	44,7	57.9 (54.7)	37.9 (48.6)

Vascular surgery	3	Sunday	0	2	1	0,0	39.7 (39.5)	51.7 (24.5)
Dermatology	18	Monday	6	11	1	33,3	63.0 (43.7)	47.4 (44.1)
ENT	75	Wednesday	45	27	3	60,0	50.6 (35.9)	19.9 (29.5)
Cardiology	14	Monday	11	2	1	78,6	174.8 (123.2)	44.1 (29.5)
Pediatrics	12	Sunday	0	12	0	0,0	13.5 (18.6)	13.5 (18.6)
Neurology	2	Monday	1	1	0	50,0	82.0 (5.7)	81.5 (6.4)
Orthopedics	159	Tuesday	121	29	9	76,1	36.2 (31.4)	11.2 (16.8)
Radiology	38	Sunday	15	21	2	39,5	19.6 (25.2)	8.9 (16.8)
Urology	35	Saturday*	23	10	2	65,7	80.7 (52.5)	30.6 (32.2)
All Specialties	492		283	173	36	57,5	50.3 (52.2)	22.55 (36.8)

*Due to the observation day is followed by Sunday allowing no bookings on this day, waiting times for both SHI and PHI were reduced by one systematically

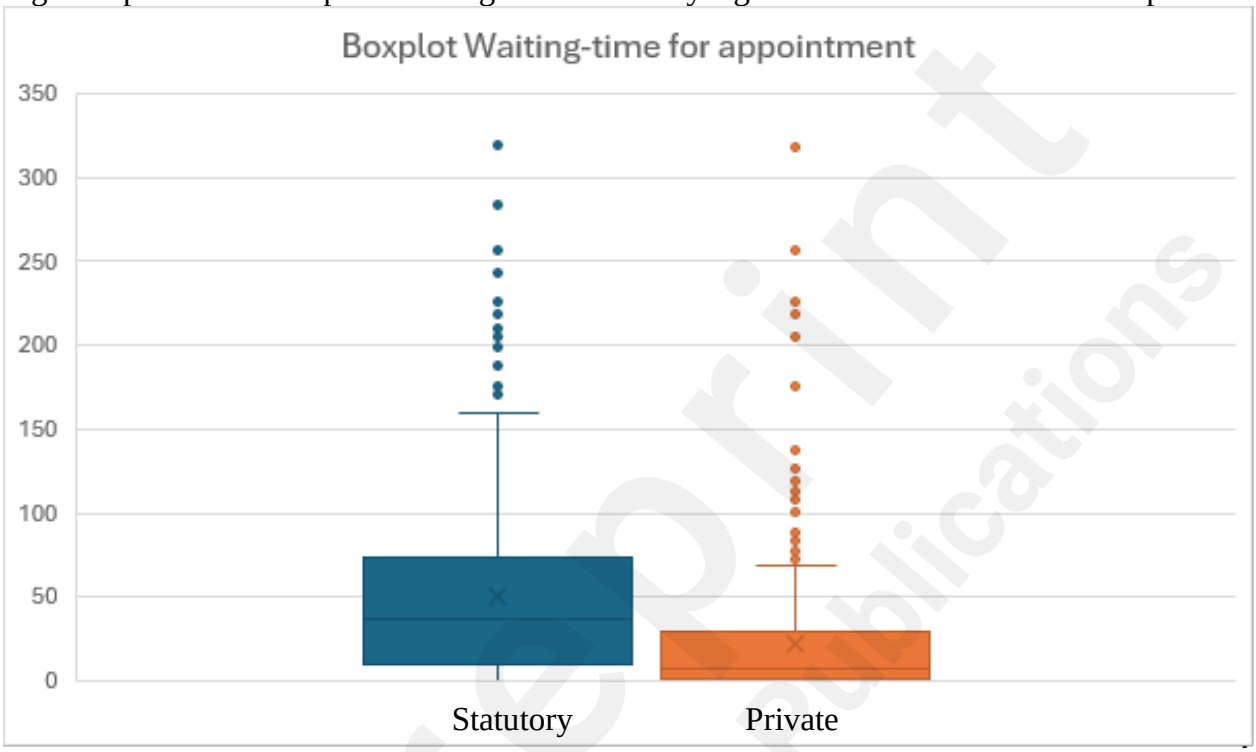
Paired t-tests were conducted across specialties to compare the first available appointment wait times for SHI versus PHI profiles. Specialties with fewer than three evaluable cases (vascular surgery, neurology) were excluded from hypothesis testing. Pediatrics did have no difference in the mean so hypothesis testing could not be performed. *Table 3* summarizes the results.

Table 3. Paired t-Test Results for First Available Appointment Wait Times (Days)

Specialty	**n**	**Mean Difference (SHI–PHI)**	**95 % CI**	**t (df = n–1)**	**p-Value**	**Hedges' g**
General Surgery	13	34.9	9.12 to 60.72	2.95	0.012	0.79
Ophthalmology	20	31.4	9.65 to 53.16	3.02	0.007	0.66
Obstetrics & Gynecology	103	20.1	11.51 to 28.61	4.65	< 0.001	0.46
Dermatology	18	15.6	–0.10 to 31.33	2.01	0.051	—
ENT	75	30.7	21.43 to 40.02	6.59	< 0.001	0.76
Cardiology	14	130.7	58.11 to 203.32	3.89	< 0.001	1.01
Pediatrics	12	0.0	—	—	—	—
Orthopedics	159	25.0	20.00 to 29.94	9.93	< 0.001	0.79
Radiology	38	10.7	3.28 to 18.09	2.92	0.006	0.47
Urology	35	50.1	30.62 to 69.55	5.23	< 0.001	0.87

All Specialties	492	27.7	23.58 to 31.93	13.05	< 0.001	0.59

Across all specialties (including those with small sample sizes), SHI patients waited on average 27.7 days longer than PHI patients (95 % CI 23.6–31.9; t = 13.05; p < .001; Hedges' g = 0.59). That corresponds to approximately four weeks.
The largest disparities occurred in Cardiology (mean difference = 130.7 days; p < .001; g = 1.01) and Urology (50.0 days; p < .001; g = 0.87).
Figure 2 provides a Boxplot showing the statistically significant difference across all specialties.



Comparison of Providers With and Without Faster PHI Appointments
Understanding that physicians offer different appointment slots for SHI and PHI, patients we sought to examine whether the offering a later slot for SHI patients corresponds with the possibility to offer an earlier slot for PHI patients. Therefore we examined how offering faster appointment slots to privately insured (PHI) patients was associated with wait times for both SHI and PHI profiles. Providers were classified into two groups:

- *Group 0 ("No"):* Providers whose earliest SHI and PHI appointments did *not* differ (n = 173).
- *Group 1 ("Yes"):* Providers whose PHI appointment was earlier than their SHI appointment (n = 283).
- 36 providers did offer an earlier appointment to SHI patients and where therefore excluded form this analysis.

An independent t-test provided:

Table 3. Descriptive Statistics by provider Group

Variable	Group	n	Mean (days)	SD (days)	SE of Mean (days)
Wait time (SHI)	0	173	37.5	44.9	3.4
	1	283	61.8	55.2	3.3

Wait time (PHI)	0	173	38.2	45,8	3.5
	1	283	12.0	25.2	1.5

Table 4. Independent-Samples t-Test and Effect Sizes

Variable	Levene's F (p)	t (df)	p (two-tailed)	Mean Diff (0–1)	95 % CI	Cohen's d	Hedges' g	Glass's Δ
Wait time (SHI)	4.349 (0.038)	−4.880 (454)	< .001	−24.3days	−34.05 to −14.50	−0.471	−0.470	−0.440
Wait time (PHI)	64.652(<.001)	6.921 (454)	< .001	26.2 days	18-75 to 33.68	0.761	0.759	1.039

Notes: Levene's test assessed equality of variances. *Mean Diff (0–1)*: Group 0 mean minus Group 1 mean (so negative for SHI indicates longer waits in Group 1). *Effect sizes*: Cohen's d and Hedges' g use pooled SD; Glass's Δ uses the SD of the control group (Group 0).

SHI wait times were significantly longer for providers who prioritized PHI patients (Group 1: 61.8 days) compared with those who did not (Group 0: 37.5 days), with a mean difference of −24.3 days (95 % CI −34.0 to −14.5; t(490) = −4.88, p < .001; Hedges' g = −0.470). SHI Patients wait 24.3 days shorter when they face non discriminating practices.

PHI wait times were significantly shorter in Group 1 (12.0 days) versus Group 0 (38.2 days), with a mean difference of 26.2 days (95 % CI 18.8 to 33.7; t(490) = 6.92, p < .001; Hedges' g = 0.76). This shows that the group of discriminating physicians can offer appointments to PHI patients 26.2 days earlier than those who do not differentiate between SHI and PHI patients.

These results indicate that practices offering faster slots to PHI patients not only reduced PHI wait times substantially but also correspondingly increased SHI wait times, with large effect sizes in both comparisons.

Due to the insights of the observation that the algorithm might favor the earliest appointment slot, this would lead to less visibility of non discriminating practices. For the specialities Obstetrics & Gynecology, Dermatology and ENT (n=801) we could reproduce ranking on doctolib exactly due to exact name and address notation in our dataset and the corresponding screenshots from the PHI Profile. With 493 Practice with available ranking and PHI-appointments we performed the following correlation analysis:

Rank on Doctolib and Waiting time for PHI have a highly significant (p=0.001) pearson correlation of 0.574 (CI 0.512-0.631). This indicates a moderately strong positive correlation.These findings demonstrate that the ranking order of entries on doctolib is correlated with appointment availability. Specifically, listings offering the earliest available appointments are positioned highest in the ranking..

Of the specialities with information on the rank, 176 also had appointments available for both PHI and SHI Patients. An unpaired t-test showed the results in table 5 and 6:

Table 5: Group Statistics on Rank

	Earlier appointment for PHI	N	Mean	SD	**SE of Mean**
Rank	on,00	80	144.5	73,3	8,198

Doctolib	1,00	96	84.4	63,1	6,438

Table 6: Results of unpaired t-test on ranks

Variable	Levene's F (p)	t (df)	p (two-tailed)	Mean Diff (0–1)	95 % CI	Cohen's d	Hedges' g	Glass's Δ
Wait time (SHI)	2.011 (0.158)	−5.846 (174)	< .001	60 ranks	39.85 to 80.4	0.885	0.881	0.953

The results show that non discriminating practices are on average 60 ranks behind compared to discriminating practices in the results for PHI patients. As the listings on Doctolib have 20 practices per page, non discriminating practices will on average be placed three pages behind discriminating practices on this platform.

Validation Analysis: Paired t-Test Without Top 5% Outliers

To confirm the robustness of our primary findings, we repeated the paired t-test after excluding the top 5% of longest wait times (n = 44), yielding a sample of 448 providers. *Table 5* presents the group statistics and inferential results for SHI versus PHI wait times in this reduced sample.

Table 5. Paired t-Test Results for Wait Times After Outlier Exclusion

Statistic	SHI	PHI	Difference (SHI–PHI)
n	448	448	—
Mean (days)	39.3	16.2	23.1
SD (days)	34.0	21.6	33.1
SE of Mean (days)	1.6	1.0	1.6
95% CI of Mean Difference			20.04 to 26.19
t (df = 447)			14.773
p-Value (two-tailed)			< .001

After removing extreme wait time outliers in both SHI and PHI patients, SHI patients continued to experience significantly longer waits than PHI patients, with an average difference of 23.11 days (95% CI 20.04–26.19; t(447) = 14.77; p < .001). This validation analysis confirms the primary finding of a substantial disparity in appointment wait times by insurance status.

Specialty-Specific Differences in Wait Times After Outlier Exclusion

We conducted paired t-tests stratified by specialty after excluding the top 5% of providers with the longest appointment wait times. The results are shown in *Table 6*. Specialties with insufficient sample sizes (e.g., vascular surgery, neurology) or identical values (pediatrics) are noted accordingly.

Table 6. Paired t-Test Results by Specialty After Excluding Top 5% Longest Wait Times

Specialty	n	SHI Mean (days)	PHI Mean (days)	Mean Difference	95 % CI of Difference	t	p-Value	Hedges' g
General	13	51.9	17.0	34.9	9.1 to	2.949	**0.012***	0.792

Surgery					60.7			
Ophthalmology	16	25.4	3.0	22.4	4.8 to 39.9	2.714	**0.016***	0.661
OB/GYN	89	43.2	25.8	17.4	10.6 to 24.2	5.075	**< .001 ****	0.536
Vascular Surgery	3	39.7	51.7	−12.0	−63.6 to 39.6	-1.000	0.423	—
Dermatology	13	40.9	25.7	15.2	−0.4 to 30.9	2.119	0.056	—
ENT	71	47.3	15.7	31.6	22.9 to 40.3	7.235	**< .001 ****	0.854
Cardiology	5	26.0	1.2	24.8	−17.4 to 67.0	1.630	0.178	—
Pediatrics	12	13.5	13.5	—	—	—	—	—
Neurology	1	78.0	77.0	—	—	—	—	—
Orthopedics	156	34.1	10.8	23.3	18.9 to 27.7	10.530	**< .001 ****	0.841
Radiology	38	19.6	8.9	10.7	3.3 to 18.1	2.924	**0.006** *	0.470
Urology	31	72.1	26.3	45.8	28.0 to 63.7	5.236	**< .001 ****	0.929
All Specialties	448	39.3	16.2	23.1	20.0 to 26.1	14.77	**< .001 ****	0.59

*significant , **highly significant

Statistically significant differences in SHI vs. PHI wait times were observed in *7 of the 12 specialties*, confirming the persistence of access disparities after excluding outliers.

The *largest disparities* were seen in:

Urology (mean difference = 45.8 days, Hedges' g = 0.929)

General Surgery (34.9 days, g = 0.792)

ENT (31.6 days, g = 0.854)

Specialties with *non-significant results* (p > .05) after outlier exclusion included: *Dermatology* (p = .056), *Cardiology* (p = .178)**,** *Vascular surgery* (p = .423). *Pediatrics* had no variance and *Neurology* was underpowered.

Discussion

In this cross-sectional internet–based audit of 492 outpatient specialists listed on a major European booking platform, we found that SHI patients in Germany faced substantially longer wait times for first-available appointments compared with PHI patients. Across all specialties, the mean wait-time difference was 27.7 days (95 % CI 23.6–31.9; p < .001), and this disparity remained significant after excluding the top 5 % of longest waits (Δ = 23.1 days; 95 % CI 20.0–26.2; p < .001). Specialty-specific analyses demonstrated large effect sizes (Hedges' g ≥ 0.59 overall), with the most pronounced gaps in urology (Δ = 45.8 days, g = 0.93), ENT (Δ = 31.6 days, g = 0.85), and orthopedics (Δ = 23.3 days, g = 0.84).

No previous study of comparable scale on appointment allocation via online platforms has been identified.This attributes specifically to specialists appointment in an dual System of PHI and SHI. Results show markedly longer waiting times than earlier telephone-based surveys in Germany, supporting the hypothesis that physicians subscribing to Doctolib's paid service have a higher share

of privately insured patients and may thereby recoup the platform's costs.
Our findings therefore extend prior "secret shopper" and audit-study research by demonstrating that digital booking platforms—despite offering an ostensibly neutral interface—perpetuate insurance-based access inequities in outpatient specialty care. The preferential ranking of earlier appointment slots advantages providers whose PHI slot precedes their SHI slot offer faster access to PHI patients (mean 12.1 vs. 36.9 days; $p < .001$). This algorithmic effect likely amplifies structural disparities intrinsic to Germany's dual-insurance system, in which PHI reimbursement rates exceed those of SHI.
Furthermore, although a subset of providers offered identical earliest appointment dates to both profiles ("fair-play" group), these physicians tend to appear lower in search results, suggesting that equal-access providers are penalized by ranking algorithms that prioritize earliest availability. That the algorithm of the platform prioritizes providers with earlier appointments for PHI was also proven in this study.
In our audit, a notable subset (96) of practices presented self-pay or privately billed service options exclusively to SHI profiles—often in the form of enhanced screening packages, extended consultation times, self-pay appointments or cosmetic procedures—while these offerings were absent or framed differently for PHI profiles. This practice suggests some providers actively promote add-on services at out-of-pocket rates to SHI patients as an alternative revenue stream.
Such differential presentation of self-pay options not only underscores an additional layer of access complexity—where SHI patients must navigate not just longer waits but also extra financial barriers—but may also reflect an implicit incentive for providers to prioritize higher-margin services over standard insured care. From a health-economics perspective, these behaviors could exacerbate inequities by shifting SHI patients toward more costly, non-covered services.

Limitations

This study offers a valuable contribution by systematically quantifying insurance-based disparities in access to specialist care through digital appointment platforms—a growing channel in health care delivery. Nevertheless, several limitations warrant consideration. First, our sampling frame comprised only providers listed on one online platform; approximately 12.6 % of KV-registered specialists offered SHI appointments on that platform, so our results is not generalize to all outpatient care pathways, including phone or in-person booking. Additionally the sample is not representative as the opt-in to the use of this platform is likely to induce a selection bias by itself. Platform listings can also include duplicate entries for the same physician or omit some providers, introducing potential misclassification and selection bias. Second, the platform's proprietary ranking algorithms are opaque; while we see an "earliest-appointment" prioritization, other factors may influence listing order as the found correlation was only moderate. Third, our audit design captures only first-available slots and cannot account for cancellations, patient no-shows, or subsequent appointment opportunities. Lastly, smaller subsamples—for example, vascular surgery ($n = 3$) and neurology ($n = 2$)—were underpowered for robust specialty-specific inference.

Although conducted in Berlin, our results likely reflect broader trends in digital health services where revenue-driven algorithms intersect with insurance-driven reimbursement structures. Other urban regions and international settings with comparable dual-insurance or tiered-reimbursement systems may exhibit similar patterns. Policymakers and platform operators should consider implementing safeguards—such as algorithmic audits or insurance-neutral ranking criteria—to promote equitable access. Moreover, transparency around platform ranking factors and reimbursement incentives should be implemented. During the research period time-outs were frequent so the researchers had to switch browsers several times. Transparency has also been reduced since the above mentioned prestudy. In the prestudy setting no profile was needed. During selection process for appointments the option to go back and change insurance status was offered. This

allowed a direct comparison of the available appointment slots. However it seems that by the time of this main study this option was removed by the platform.

Conclusion

Digital booking platforms, while improving convenience, appear to reaffirm offline inequities in specialist access: statutory-insured patients wait substantially longer than their privately insured counterparts. These disparities are consistent across multiple specialties and robust to validation analyses. Addressing algorithmic and structural drivers of unequal access should be a priority for healthcare stakeholders aiming to ensure fairness in an increasingly digital care delivery environment. However the inequality shown is a result of the dual system in Germany and just seems to be reinforced by the platform. If as indicated there is a significant shift towards making online appointments this systematic effects should be monitored on a broader scale.

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Conflicts of Interest (required)

Cordula Kreuzenbeck none declared.

Silvia Angerer none declared.

Data Availability

The whole original dataset is available from the corresponding author on reasonable request.

Authors' Contributions

Cordula C. J. Kreuzenbeck (corresponding author) and Silvia Angerer. CCJK conceived the study, designed the audit protocol, collected and validated the data, performed the analyses, and drafted and revised the manuscript. SA Revised the Manuscript, validated the statistical analyses.

Abbreviations

BE; Bookable entities — Bookable entities with appointments for both insurance groups (listings/physician-location units on the platform).
ENT; Ear, nose, and throat — Otolaryngology / ENT specialty.
KV; Kassenärztliche Vereinigung (Association of Statutory Health Insurance Physicians) — regional registry of outpatient specialists.
OSP; Online scheduling platform(s) — commercial web-based appointment booking platforms (e.g., Doctolib).
PHI; Private health insurance — privately insured patients/profile.
SHI; Statutory health insurance — statutory (public) insured patients/profile.

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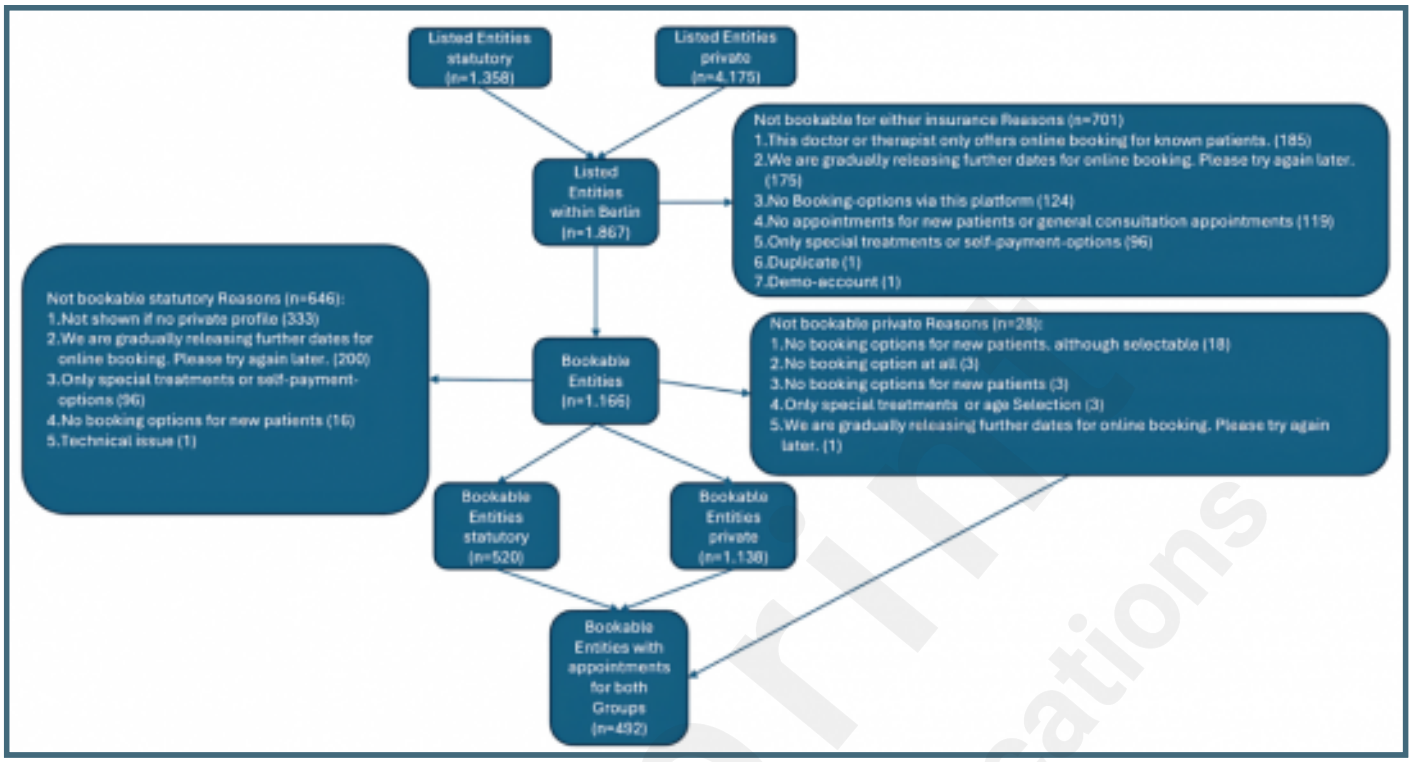
Supplementary Files

Figures

Extraction of comparable Data.



CONSORT (or other) checklists

Strobe Checklist on study and reporting.
URL: http://asset.jmir.pub/assets/60d3de82e9fe3e3a7ddcd04766ee0001.pdf