



Frankfurt School

Economic Evaluation of Cardiovascular Interventions

Afschin Gandjour, MD, PhD

Goal

- Determine the risk threshold for statin prescriptions in Germany based on predicted cost savings for sickness funds.

Introduction

Top 10 causes of death in Azerbaijan for both sexes aged all ages (2019)

[Hide filters](#) | [Top-10 deaths](#) | [Top-10 DALYs](#) | [Underlying data](#) | [Download with OData API](#)

Filters

Country

Azerbaijan

Year

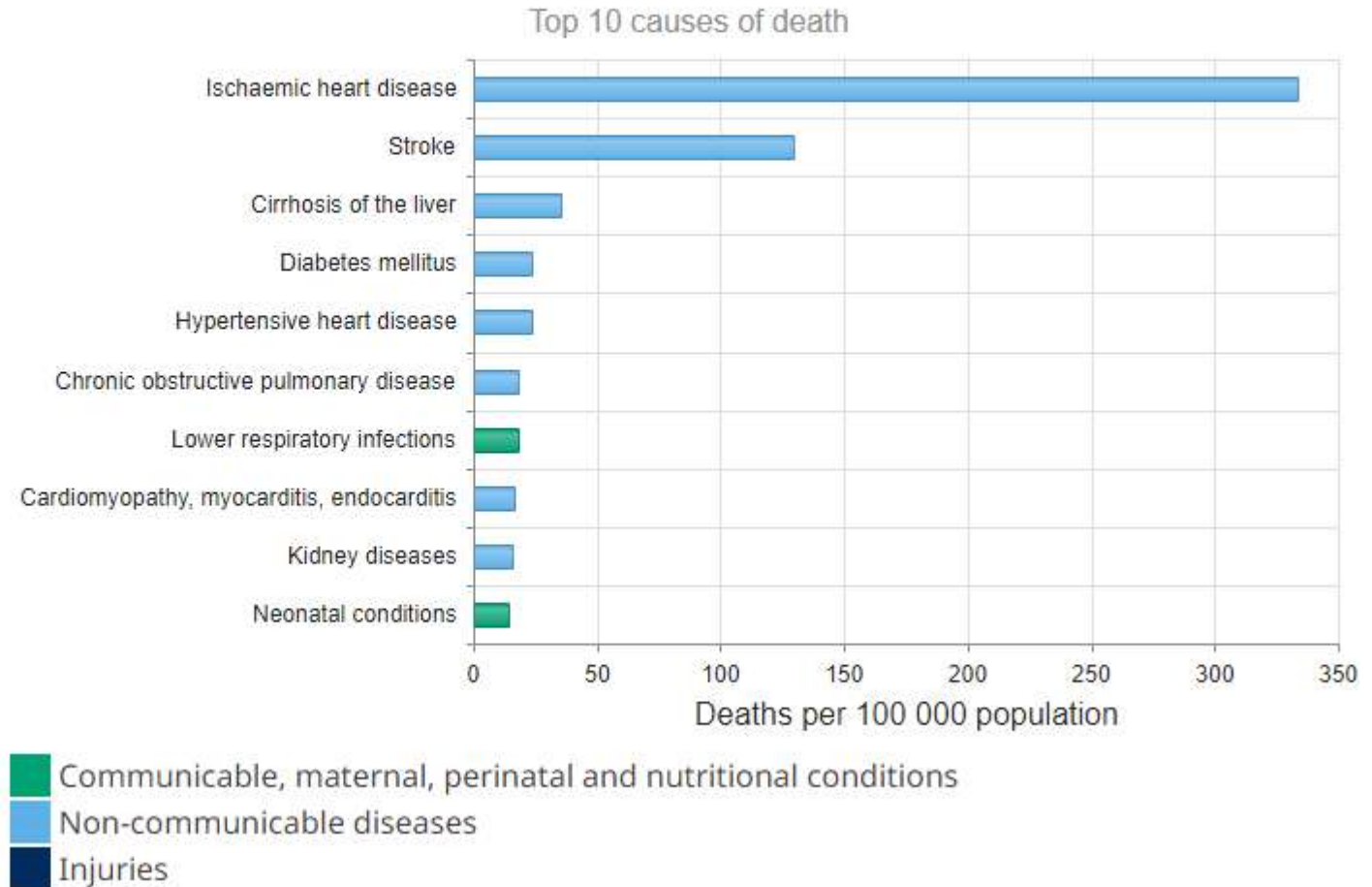
2019

Sex

Both sexes

Age group

All ages

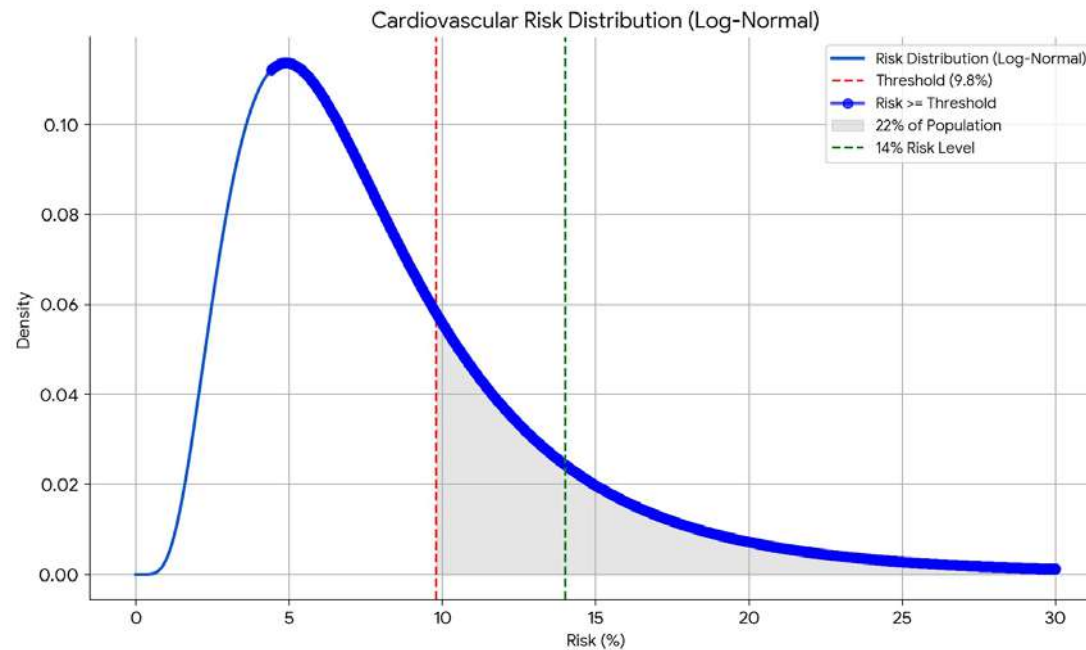


NNT to Achieve Savings in Germany for Statin Therapy

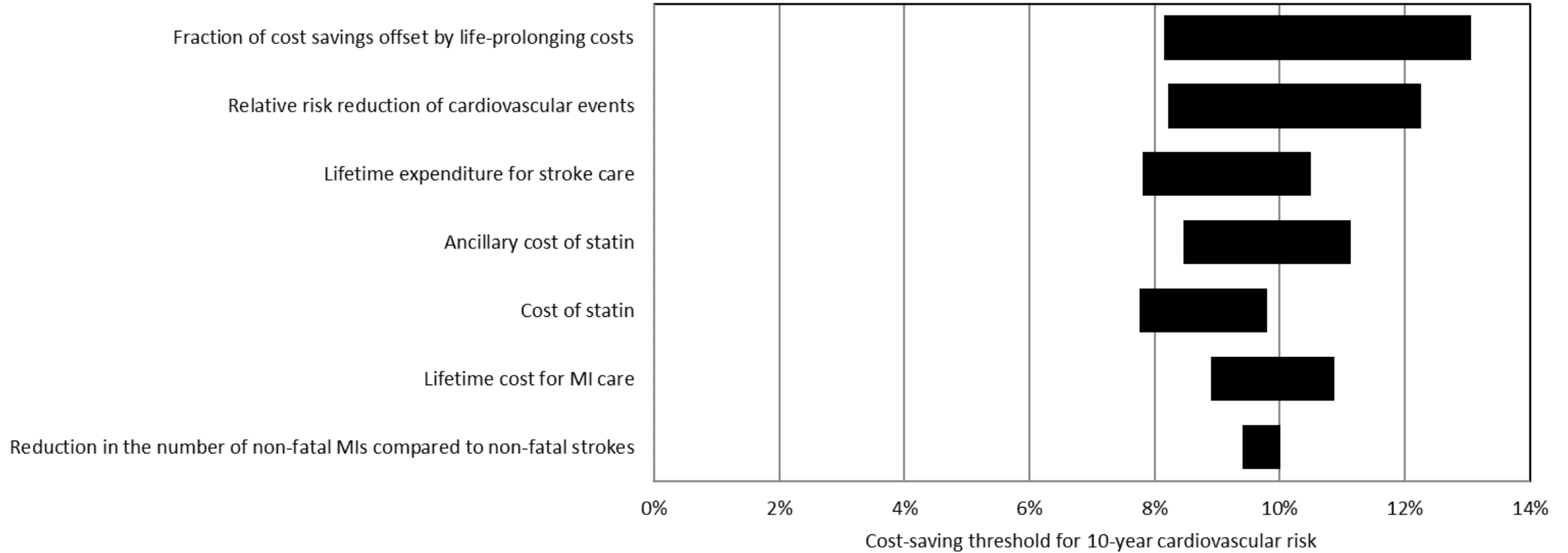
- Lifetime cost for stroke care: ≈ **€90.000**
- Fraction of cost savings offset by life-prolonging costs: 0.33
- Cost of a statin per day: **€0.19**
- Ancillary costs per year: **€47** (e.g., doctor visits, laboratory tests)
- Total cost per patient per year: **€115.62**
- Treatment cost over 10 years: **€1156**
- To break-even, need to prevent one CV event in 40 patients treated with statins
 - Maximum NNT (number need to treat) to achieve savings: **40**

10-year Cardiovascular Risk Threshold for Statin Therapy

- NNT: 40
- Absolute risk reduction: $1/\text{NNT} = 1/40 = 2.5\%$
- Relative risk reduction: 25%
- 10-year CVD risk: $\approx 10\%$
- Average 10-year CVD risk for individuals with 10-year CVD risk $\geq 10\%$: $\approx 14\%$



Sensitivity Analysis on Cost-Saving Threshold for 10-Year Cardiovascular Risk



Avoided Cardiovascular Events over 10 Years for Statin Therapy

- Prevalence of 10-year risk for CVD in Germany $\geq 10\%$: $\approx 22\%$
- Population size in Germany with a 10-year CVD risk $\geq 10\%$:
 - $60.5 \text{ million} \times 22\% = 13.3 \text{ million}$

Scenario	Best case	Low estimate	High estimate
Population size (10-year CVD risk $\geq 9.8\%$)	13,309,758	12,099,780	15,124,725
Initial expected CV events (14%)	1,867,359	1,508,843	2,324,670
Expected CV events (25% risk reduction)	1,391,732	1,201,793	1,619,133
Avoided CV events	475,627	307,049	705,537

Population and Individual Savings from Statin Use Above the Risk Threshold

	Best case	Low estimate	High estimate
Intervention cost	15,389,208,041	13,990,189,128	17,487,736,410
Savings	33,075,950,148	21,352,752,421	49,064,296,193
Net population saving	17,686,742,107	7,362,563,293	31,576,559,783
Net individual saving	1,328.86	608.49	2,087.74

Summary and Conclusions

- Significant portion of the population could benefit from statin therapy under the new threshold.
- Additional CV events avoided per year: $\approx 32,000$
- Maximum annual savings: $\approx \text{€}1.2$ billion
- Annual savings per individual: $\approx \text{€}130$ (which can be considered as an annual reward)

**THANKS
FOR YOUR
ATTENTION**

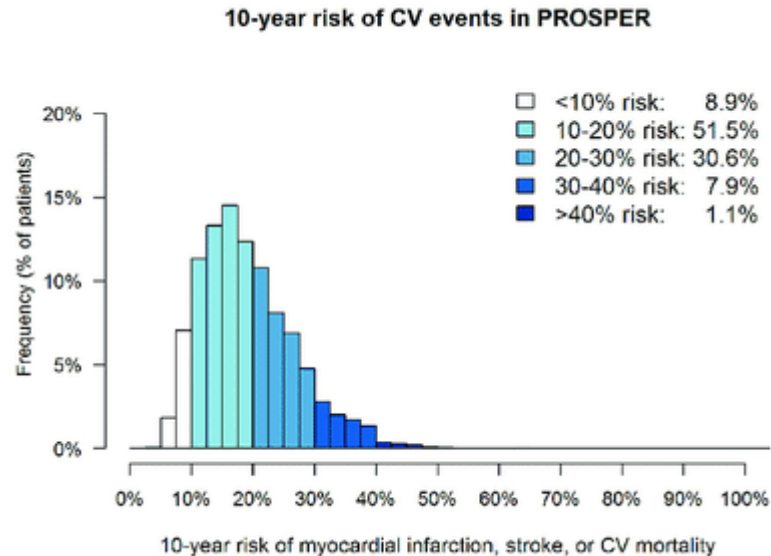


Limitations

- Assumptions around proportion of CV events that is fatal and mean risk above the 15% risk threshold.

Effectiveness of Statine Therapy at Population Level

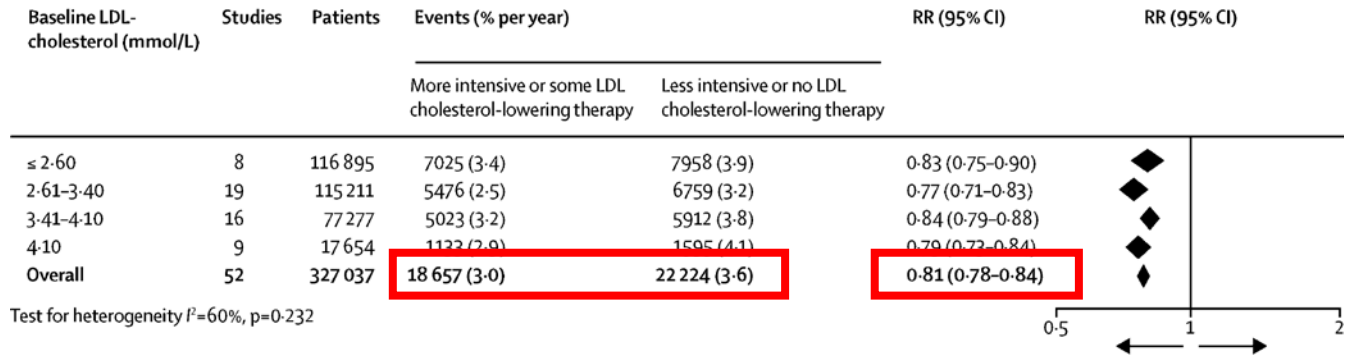
- Population size with NNT ≤ 40 in Germany:
- Population size with 10-year CVD risk of 15% in Germany for 20% RRR
 - Estimated Adult Population: 66.4 million
 - Prevalence of 10-year risk for fatal CVD $\geq 5\%$: 2.6% (95% CI 2.0–3.3)
 - Prevalence of 10-year for non-fatal CVD risk $\geq 15\%$: 2.6% (95% CI 2.0–3.3)



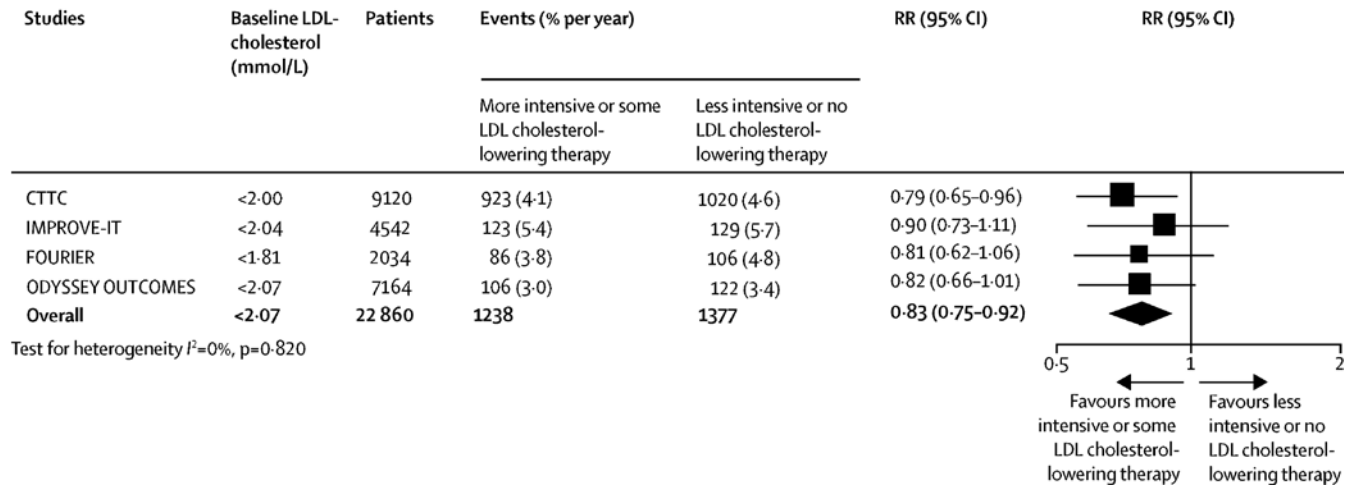
Rücker V, et al. Predicting 10-Year Risk of Fatal Cardiovascular Disease in Germany: An Update Based on the SCORE-Deutschland Risk Charts. PLoS One. 2016 Sep 9;11(9):e0162188.

SCORE2-OP working group and ESC Cardiovascular risk collaboration. SCORE2-OP risk prediction algorithms: estimating incident cardiovascular event risk in older persons in four geographical risk regions. Eur Heart J. 2021 Jul 1;42(25):2455-2467.

A



B

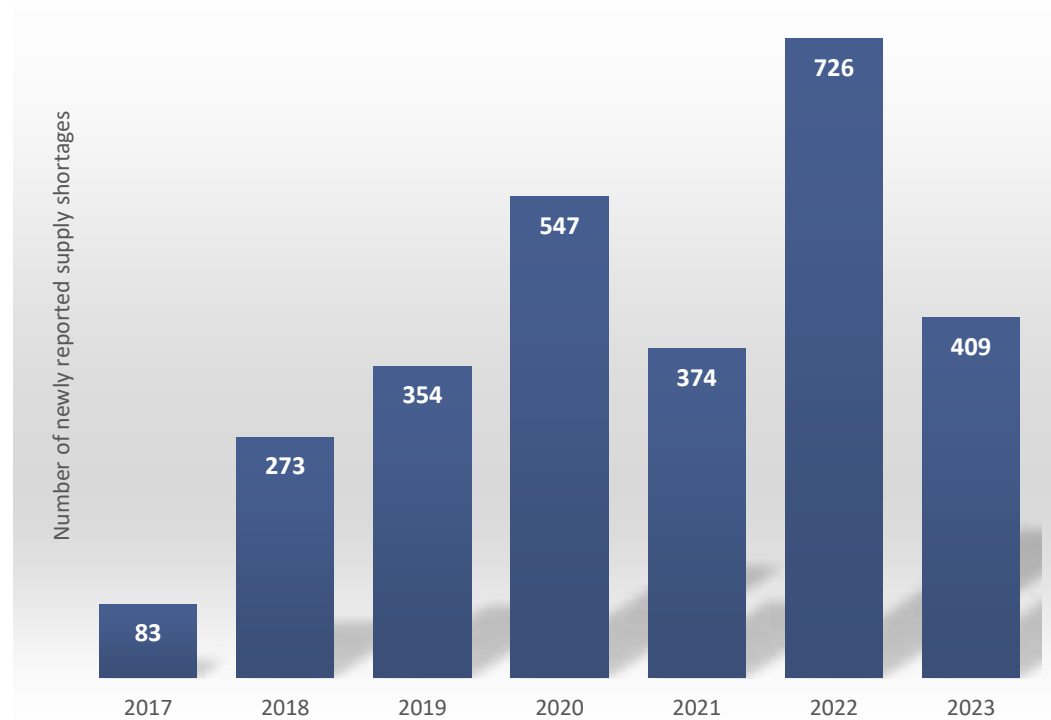


Effectiveness of Statine Therapy

- 0.6% reduction in CV events per year
 - ⇒ 6% reduction in CV events over 10 years
 - ⇒ NNT over 10 years: $1/0.06 = 16.66$
 - ⇒ NNT does not break-even!
- NNT = 10 requires 10-year CVD risk of 50% for 20% RRR ($50\% \times 20\% = 10\%$)

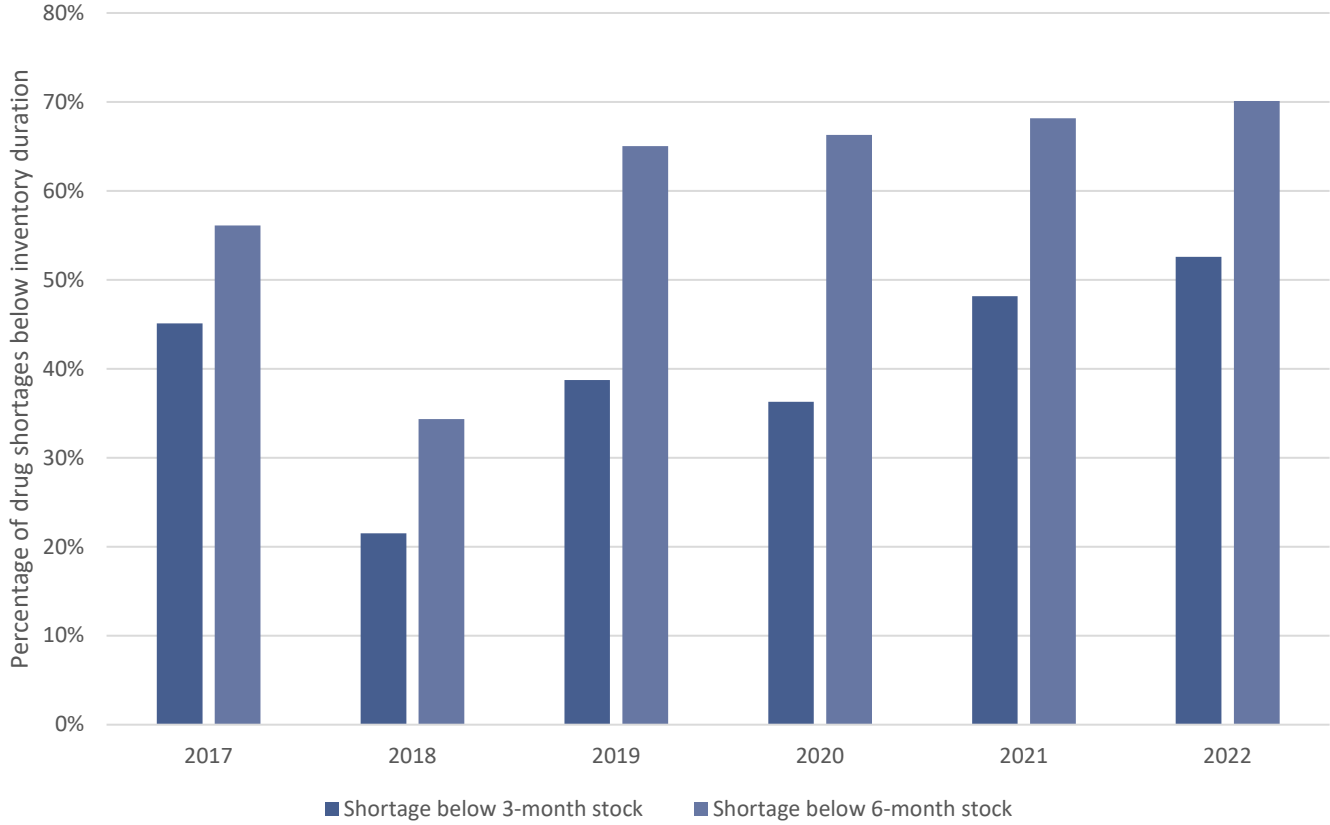
Analysis of Drug Shortages

- Median duration of shortages: 90 days.
- Mean duration of shortages: 195 days.



Source: BfArM (Veröffentlichte Lieferengpassmeldungen)

Impact of Stockpiling



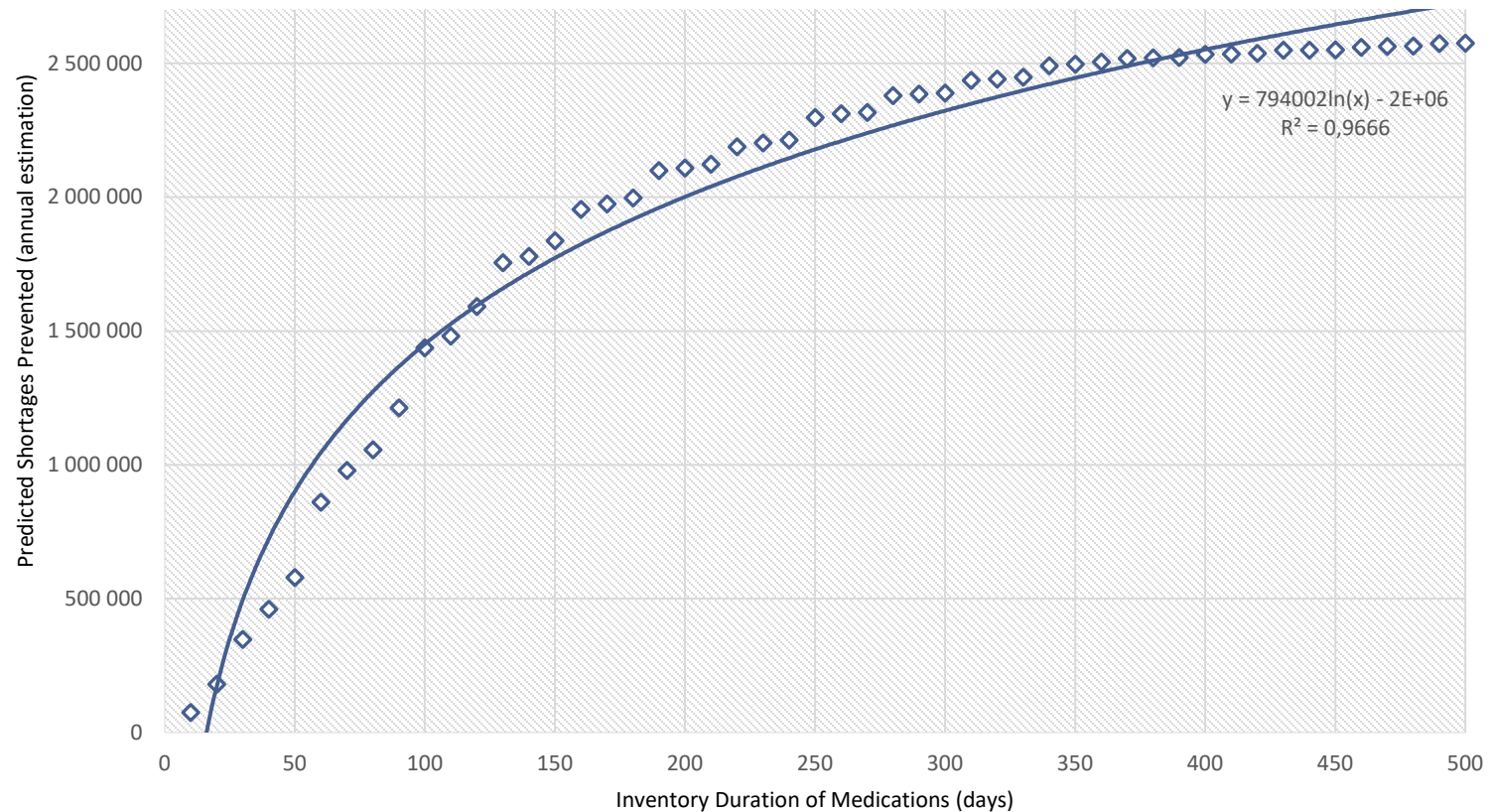
Cost Analysis

- Storage costs: Including temperature control, security, and compliance.
- Capital costs: Average WACC for generics manufacturers (8-12%).
- Loss of durability: Estimated based on typical expiration dates.

Cost Item	Amount (€)
Costs for warehouse expansion (annuity)	10,628,250
Storage costs	344,700,000
Capital costs	107,500,000
Costs for expired durability	428,821,918
Total storage costs (6 months)	891,650,168

Predicted Annual Drug Shortages Prevented by Inventory Duration

- Logarithmic relationship between inventory duration and prevented shortages.



Maximum Cost-effective Stockpiling Period

$$x = \frac{a\lambda}{b\Delta c}$$

- a is a coefficient
- λ is cost-per-QALY threshold
- b is the conversion rate (equal to 1 divided by the QALY gain per package)
- Δc is the stockpiling cost

QALY gain per DDD based on MCID: 0.085

Maximum cost-effective stockpiling period: 177 days.

QALY: quality-adjusted life year

MCID: minimum clinically important difference

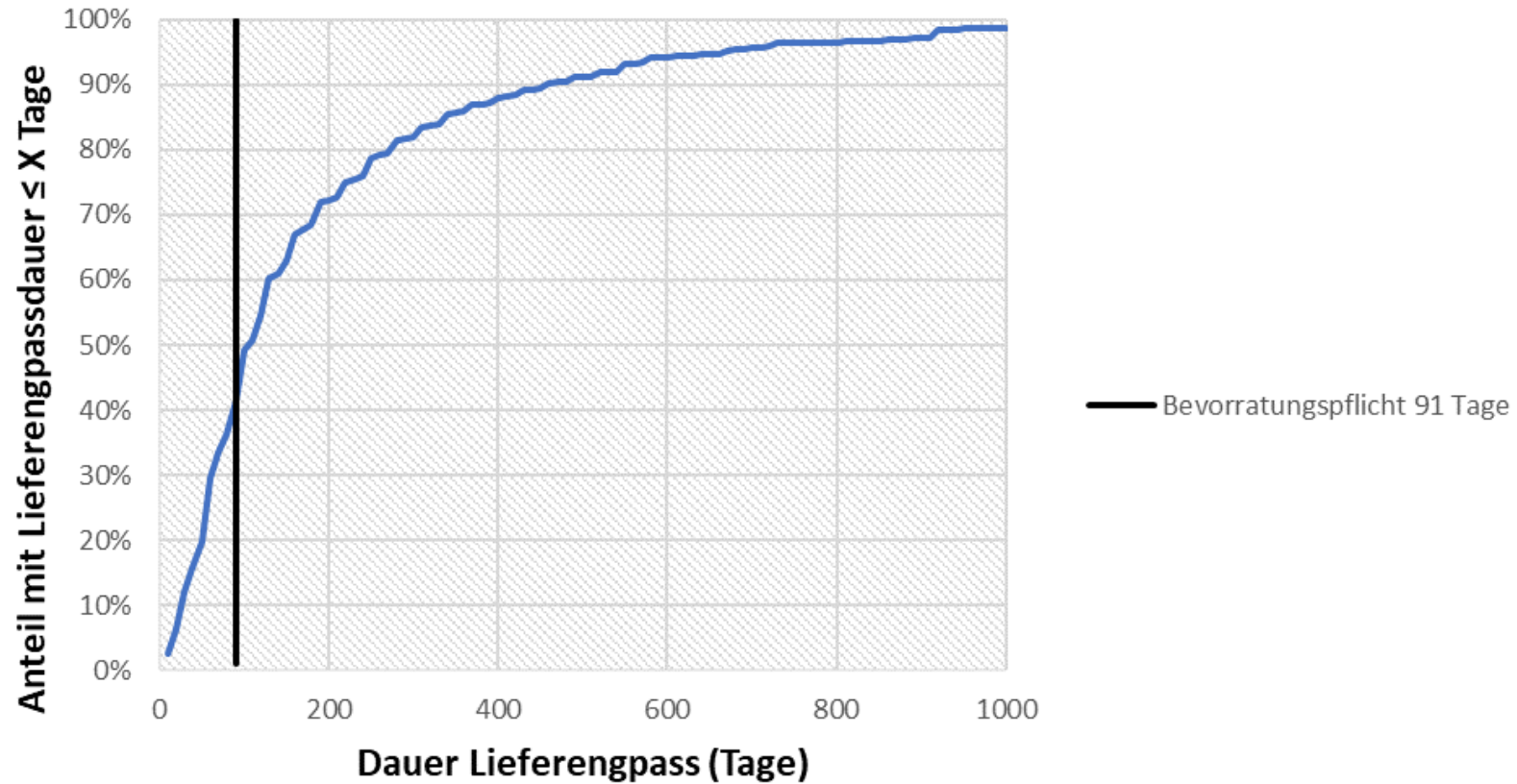
DDD: defined daily dose

Conclusions

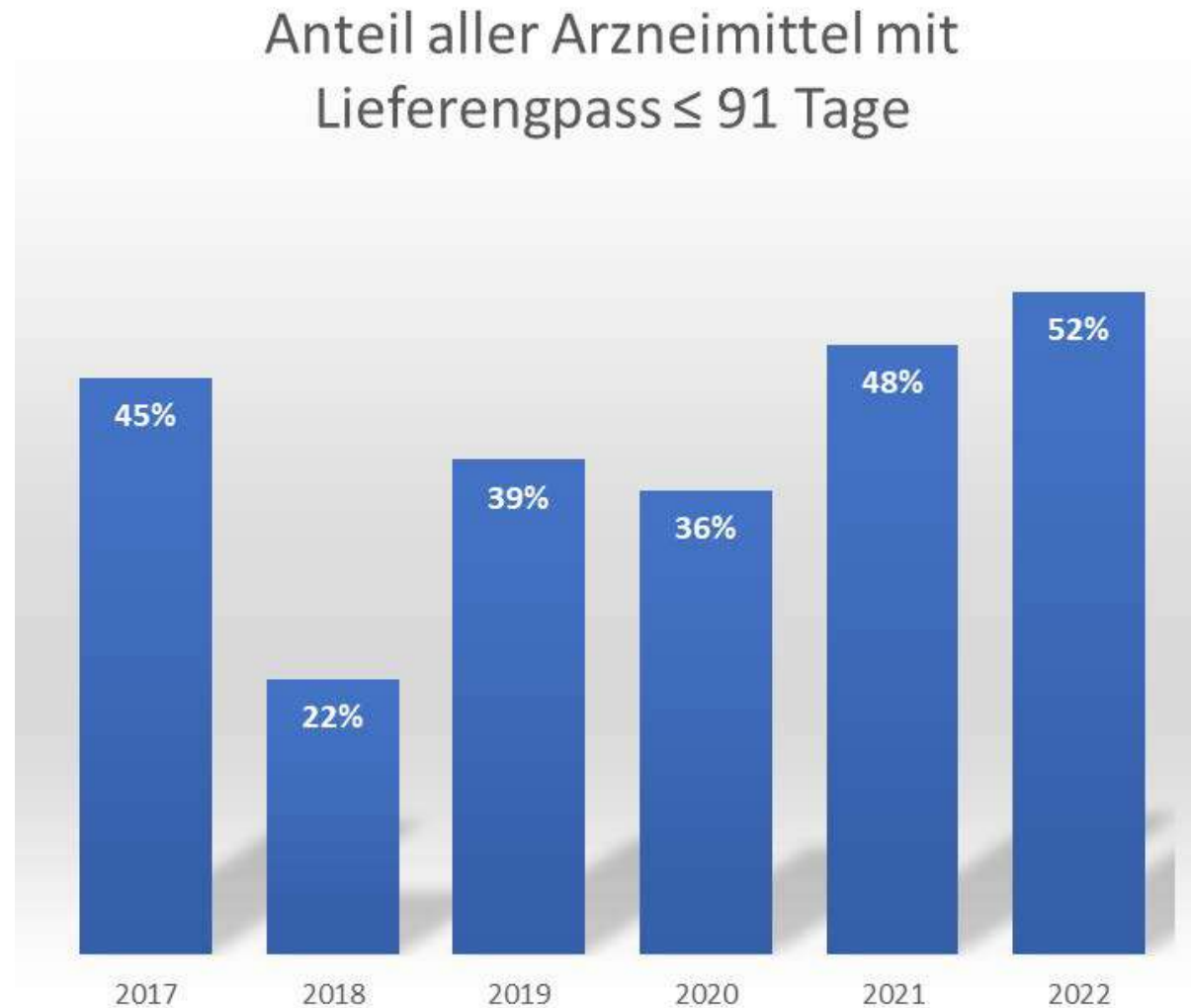
- Stockpiling law can significantly reduce shortages.
- Three-month and six-month stockpiling have different impacts.
- Cost-effectiveness analysis supports current policy directions.

Nur 48% aller Arzneimittel hatten einen Lieferengpass ≤ 91 Tage (41% ≤ 90 Tage).

Alle Arzneimittel mit beendetem Lieferengpass



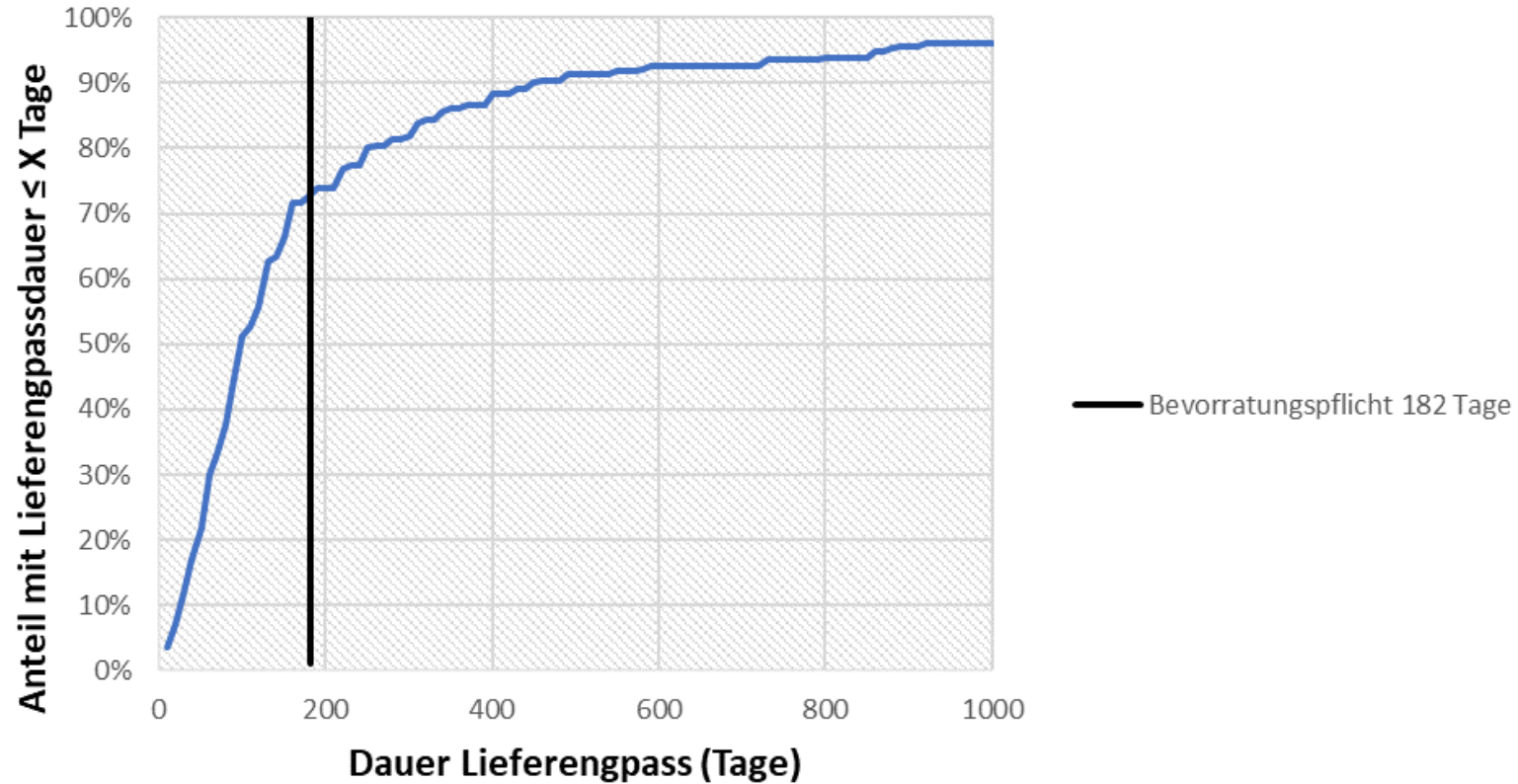
Lieferengpässe sind zwar etwas kürzer geworden, liegen jedoch in 2022 kaum niedriger als im Gesamtzeitraum.



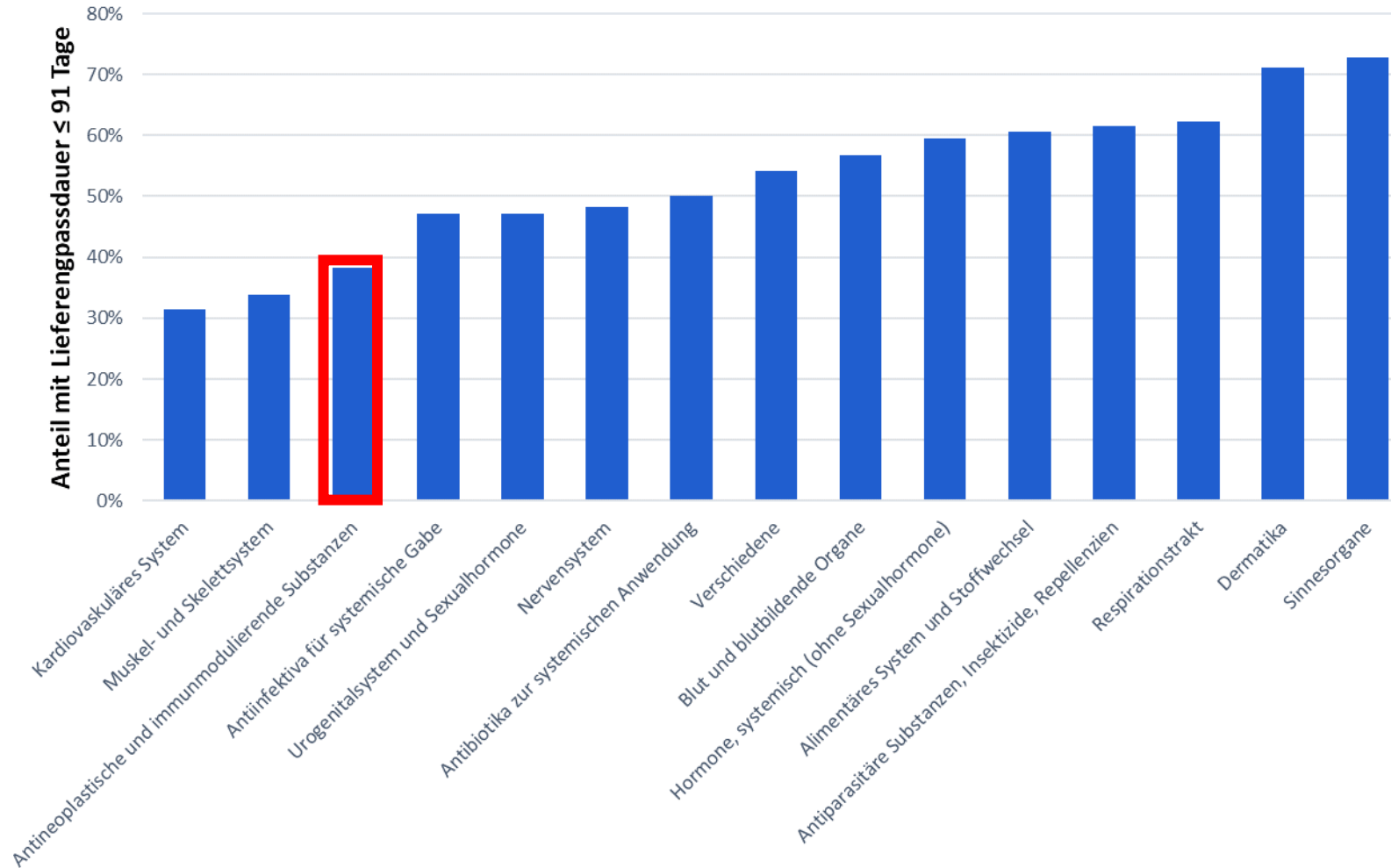
Datenquelle: BfArM (Veröffentlichte Lieferengpassmeldungen 2017 bis 2023)

77% aller Antibiotika hatten einen Lieferengpass ≤ 182 Tage.

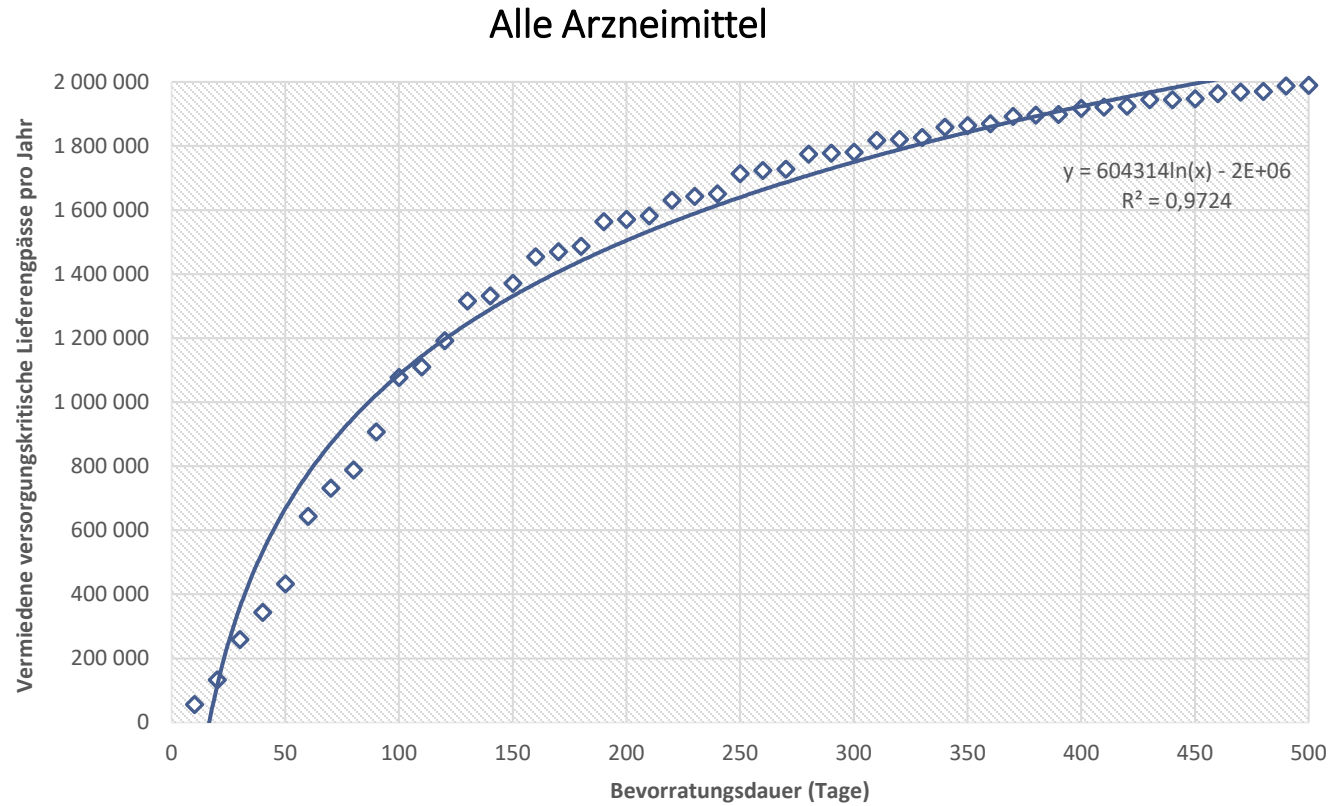
Antibiotika mit beendetem Lieferengpass



Nur 38% der Krebsarzneimittel hatten einen Lieferengpass ≤ 91 Tage (29% ≤ 90 Tage).



Abnehmender Grenznutzen einer Verlängerung der Bevorratungsdauer



Kosten der Bevorratung vs. Lockerung der Preisobergrenzen (alle rabattierten Generika)

Lagerkosten (3 Monate)

Lagerhaltung	€144,675,000
Kapitalkosten	€53,750,000
Abgelaufene Haltbarkeit	€214,410,959
Summe	€412,835,959

50% Preisaufschlag

€1,075,000,000

Cave: Einmalige Kosten für eine Lagererweiterung sind nicht eingeschlossen.

Maximale Bevorratungsdauer in Abhängigkeit von der Zahlungsbereitschaft zur Vermeidung eines versorgungskritischen Lieferengpases

$$x = \frac{a\lambda}{b\Delta c}$$

$$a = 604.314$$

$$\lambda = 88.000 \text{ (Zahlungsbereitschaft als Kosten pro QALY)}$$

$$b = 0,01$$

$$\Delta c = 3.809.420$$

⇒ Optimale Bevorratungsdauer von 135 Tagen

⇒ €100 Mio. Zusatzausgaben (135 vs. 90 Tage)

Zusammenfassung

- Eine Bevorratung von 3 Monaten verhindert ca. 40% bis 50% der Lieferengpässe (Base Case Szenario).
- Eine Bevorratung von 3 Monaten reduziert die Zahl der Lieferengpässe etwa auf das Niveau von 2019.
- Eine Verlängerung der Bevorratungsdauer um einen Monat könnte noch kosteneffektiv sein und zusätzlich ca. 10% bis 20% der Lieferengpässe verhindern.
- Bei Krebsarzneimitteln verhindert eine Bevorratung von 3 Monaten jedoch nur ca. 30% bis 40% der Lieferengpässe.
- Eine Bevorratung von 6 Monaten bei Krebsarzneimitteln würde ca. 61% der Lieferengpässe bei Krebsarzneimitteln verhindern.
- Eine Bevorratung von 6 Monaten bei Antibiotika kann 23% der Lieferengpässe nicht verhindern.
- Die Bevorratungskosten liegen bei ca. €100 - €150 Mio. pro Monat.

Offene Fragen

- Ist es ausreichend, die Zahl der Lieferengpässe auf das Niveau von 2019 zu reduzieren?
- Sollte die Bevorratung nicht auf 4 Monate erweitert werden?
- Sollte die Bevorratung bei Krebsarzneimitteln nicht auf 6 Monaten erweitert werden?

Frankfurt School of Finance and Management gGmbH

Adickesallee 32-34

60322 Frankfurt am Main

Vorname Nachname

Position

Telefon: +49 69 154008-0

Fax: +49 69 154008-650

E-Mail: info@fs.de

www.frankfurt-school.de



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