Age-specific Effects of Early Daycare on Children's Health

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Daycare Coverage in Germany

Over the past decades, many countries including Germany have pursued policies to meet the demand for early daycare slots

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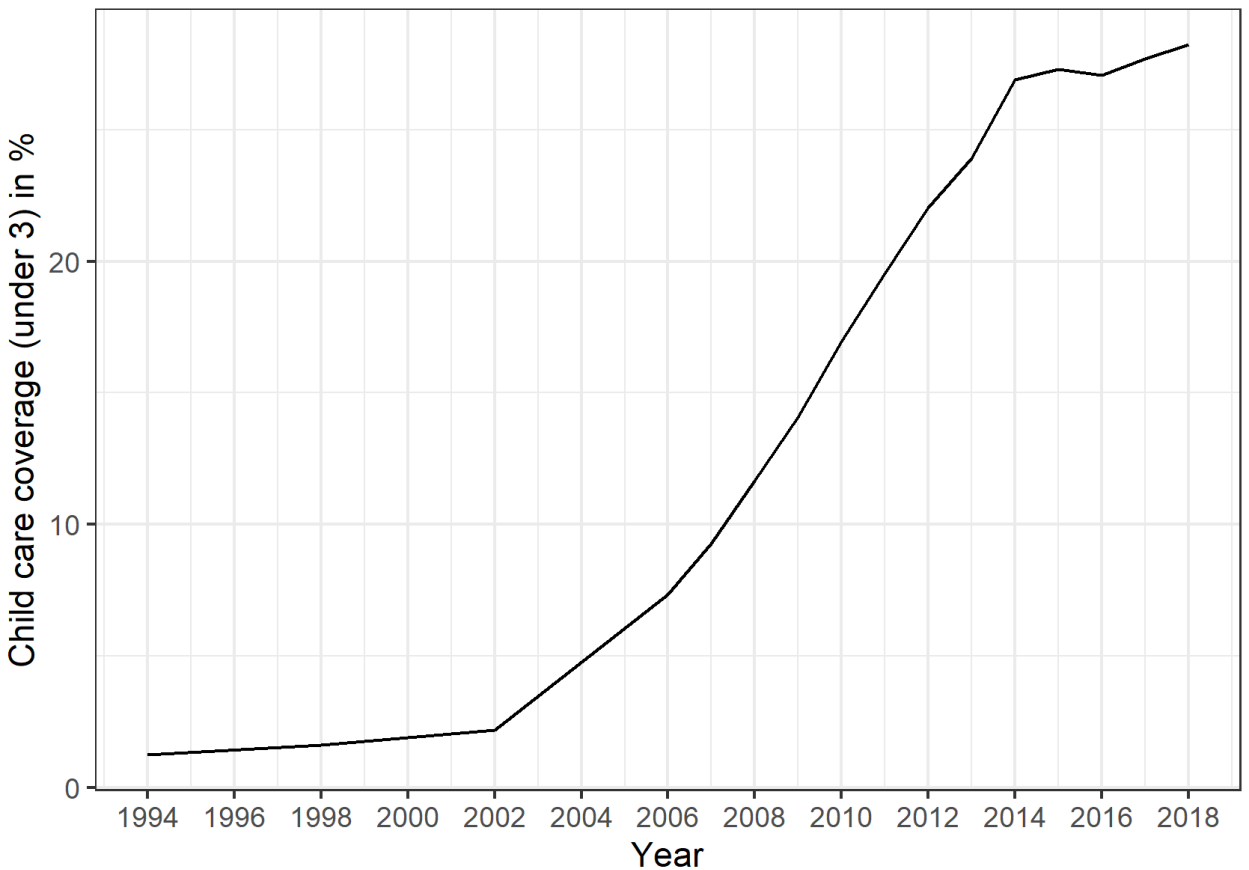
Figure 1: Daycare coverage U3 West-Germany



Source: Destatis 1994-2018, own calculations

Introduction

- Existing research focuses on the effects of daycare on (non-)cognitive abilities of children
- Daycare attendance may also affect physical and mental health $\Rightarrow$ Evidence that health is an important determinant of the formation of (non-)cognitive skills and for a positive association between health at school start and later-life cognitive outcomes (e.g. Currie, 2020)
- There is little evidence on the effects of (early) daycare attendance on health

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Research questions

What is the effect of a major daycare expansion for children below the age of 3 on physical and mental health?

- *What are the instantaneous effects (children at daycare age)?*
- *Do effects transmit to children at elementary school age? Are there mid-run effects?*

In a nutshell

Identification strategy

Differences-in-differences and **event-study** approaches exploiting temporal and spatial variation following a large daycare expansion for children below the age of three in Germany to estimate the effect of early daycare attendance on age-specific health outcomes

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Data

Administrative data containing health records (diagnoses) covering 90% of the German population

Results

My results suggest an increase of infections and respiratory diseases at early ages and a decrease at elementary school age

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Previous Literature

- Health effects of high quality daycare programs targeted on disadvantaged families
  - Perry Preschool Program (e.g. Heckman et al, 2010; Conti, Heckman & Pinto, 2016)
  - Abecedarian Project (e.g. Conti, Heckman & Pinto, 2016)
- Health effects of large scale public daycare expansions (based on **survey data**)
  - Low-cost daycare expansion in Quebec (e.g. Baker, Gruber & Milligan, 2008, 2019; Kottenlenberg & Lehrer, 2014)
  - Public daycare expansion for children 3+ in Germany (Cornelissen et al, 2018; Lauber, 2015)
- Health effects of large scale public daycare expansions (based on **administrative data**)
  - Daycare fee abolishment in Sweden (van den Berg & Siflinger, 2022)
  - Daycare expansion for children 3+ in Spain (Mercader, 2022)

Contribution to Literature

So far the literature focuses on the effects of daycare visits aged 3+ and mostly assesses either (non-)cognitive skills or subjective and broad health measures obtained in survey data. I add to the literature by:

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- assessing specific health outcomes (e.g. infectious diseases, mental health, obesity, etc.) using administrative health records
- evaluating short-run and mid-run effects
- exploiting parental care as the counterfactual

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Daycare expansion

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- Increase from 11.5% in 2008 to 28.2% in 2018
- Large regional variation here
- Highly subsidized and for free for low-income families
- The daycare expansion was already shown to increase female labor market participation (Müller & Wrohlich, 2020), to improve socio-emotional skills of children (Felfe & Lalive, 2018) and to reduce child maltreatment (Sandner & Thompsen, 2020)

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Data

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- Age-specific analysis: 1 – 2, 3 – 5, 6 – 8 and 9 – 10 year olds
- Data include among others: assured diagnosis as ICD-10 codes, birth year and month, sex, county of residence

Outcome variables

Table 1: Outcomes

	1-2 years	3-5 years	6-8 years	9-10 years
Infections (no.)	1.39 (1.59)	1 (1.29)	0.78 (1.11)	0.66 (1.04)
Ear diseases (no.)	0.58 (1.13)	0.84 (1.47)	0.45 (1.09)	0.28 (0.84)
Respiratory diseases (no.)	2.85 (2.67)	2.65 (2.75)	1.85 (2.35)	1.58 (2.22)
Mental disorders (ext.)	0.18 (0.38)	0.37 (0.48)	0.33 (0.47)	0.27 (0.45)
Obesity (ext.)	0.01 (0.12)	0.02 (0.15)	0.03 (0.18)	0.05 (0.22)
Injury (no.)	0.22 (0.56)	0.19 (0.54)	0.19 (0.57)	0.24 (0.65)
Vision problems (ext.)	0.34 (0.47)	0.38 (0.49)	0.34 (0.47)	0.32 (0.47)
Treatment cases	6.33 (3.84)	6.14 (4.04)	5.28 (7.46)	4.92 (8.91)
Healthcare costs	320 (313)	287 (320)	245 (393)	249 (450)
Observations	9,042,454	16,840,400	17,167,518	11,674,867

KBV 2009-2019, own calculations.

Mechanisms

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Hygiene-Hypothesis (Strachan, 1989)

+ Higher prevalence at time shortly after entering daycare
- Lower prevalence at older ages as exposure at young ages initiates immunization process $\Rightarrow$ important to study age-specific effects

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Other "expansion effects"

+ Daycare centers surveill children's health (e.g. traces of abuse) $\Rightarrow$ potentially more doctor visits $\Rightarrow$ more diagnoses
+ Employed parents need doctor's note to take sick leave when child is sick $\Rightarrow$ more doctor visits $\Rightarrow$ more diagnoses
- Employed parents have less time $\Rightarrow$ fewer doctor visits $\Rightarrow$ fewer diagnoses

Mechanisms

Ex-ante there is no clear prediction of the direction of the effects:

Income Effect

- The reform induced maternal labor market participation (Müller & Wrohlich, 2020) $\Rightarrow$ income effect?
- Generally, income and health are positively correlated $\Rightarrow$ lower prevalence of diseases due to income effect of the reform?

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Empirical Strategy: Generalized DiD

Using *temporal* and *spatial* variation in the expansion speed:

$$Y_{it} = \psi_t + \theta cc_{ct} + X_{it}\beta + \mu_c + \varepsilon_{it}$$

- cc_{ct}: Average child care coverage rate in county c at time $t \in age[1, 2]$
- μ_c: County fixed effects
- ψ_t: Birth cohort fixed effects
- X_{it}: Control variables (age, gender, swine flu incidence per county in 2009-2011) here

Empirical Strategy: Alternative approaches & Validity

DiD (age 3 – 10): Details

$$Y_{it} = \psi_t + \gamma_1 Treat_i + \gamma_2 (Treat_i \times Phasein_t) + \theta (Treat_i \times Post_t) + X_{it}\beta + \varepsilon_{it}$$

- $Post_t$: Dummy variable indicating whether child i was born within main expansion period (in year $t \in [2007, 2011]$)
- $Phasein_t$: Dummy variable indicating whether child i was born in year $t \in [2005, 2006]$
- $Treat_i$: Dummy variable indicating whether child i lives in a treatment county ($=$ counties whose expansion speed is above the 70th percentile within main expansion period)
- θ: Coefficient of interest (ITT)

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Event-Study approach:

$$Y_{it} = \psi_t + \theta (Treat_i \times Cohort_i) + X_{it}\beta + \varepsilon_{it}$$

- $Cohort_i$: Birth year of child i, reference birth year: 2005

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Generalized DiD

Table 2: Generalized DiD Results

	Age: 1-10	Age: 1-2	Age: 3-5	Age: 6-8	Age: 9-10
Infections	0.001	0.008***	0.001	−0.003**	−0.004***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
% change (10pp. increase)	1.1%	5.7%	1%	-3.9%	-6%
Ear diseases	0.002*	0.003***	−0.001	−0.00001	−0.001*
	(0.001)	(0.001)	(0.001)	(0.0004)	(0.0003)
% change (10pp. increase)	3.6%	5.1%	-1.2%	-0.02%	-3.5%
Respiratory diseases	-0.0002	0.016***	−0.001	−0.004*	−0.006***
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)
% change (10pp. increase)	-0.09%	5.6%	-0.4%	-2.2%	-3.8%
Mental disorders	-0.001*	0.001**	0.0001	−0.001**	−0.001**
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)
% change (10pp. increase)	-3.3%	5.6%	0.3%	-3%	-3.6%
Treatment cases	-0.006**	0.011**	−0.012***	−0.006*	−0.005+
	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)
% change (10pp. increase)	-1.1%	1.7%	-2%	-1.1%	-1%
Birth cohorts	2000-2014	2008-2014	2006-2014	2003-2011	2000-2009
Observations	54,152,617	8,522,318	14,117,164	13,979,548	10,605,770

Note: SE clustered on county-level, $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001

For obesity, injury, vision problems and healthcare costs I do not find significant and robust effects Age-specific

Other approaches & Robustness Checks

- DiD: Results are confirmed, but no robust effects for mental disorders DiD
- Event Studies: Show common trends pre-reform, confirm effects post-reform Event-Study
- Intensive/Extensive margin: Similar results here
- Placebo-Regression with Diabetes as outcome: No significant effects here
- Excluding control variables: Similar results here
- DiD: Different definitions of Treatment status: e.g. upper 50% = treatment group, lower 50% = control group: Similar results here
- DiD: Randomization inference (to do)

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Conclusion

My results provide evidence that the daycare expansion leads to

- a substitution of respiratory diseases and infections from the first years of elementary school to first years of daycare $\Rightarrow$ in line with hygiene hypothesis and van den Berg & Siflinger (2022)
  - For all communicable diseases: null-sum effect across all age groups
  - One additional year of education or age about twice as large effects

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  - For all communicable diseases: null-sum effect across all age groups
  - One additional year of education or age about twice as large effects
- an increase in health care consumption at age 1–2 years and a reduction at age 3–5 and 6–8 years
- results on mental health; and healthcare costs unclear – suggests null-sum effect
- null effects for all other diseases (obesity, injury, vision problems)

Policy implications

Is the substitution of illness spells good or bad?
$\Rightarrow$ Difficult to judge, but

- Healthcare costs: Zero-sum situation
- Other considerations
  - Benefit: fewer sickness days at school $\Rightarrow$ positive effect on education and labor market outcomes
  - Benefit: being sick at young ages increases the probability of not having younger siblings that catch the infection as well $\Rightarrow$ potentially positive effects for younger siblings (Daysal et al., 2022)
  - Drawback: more sick days in daycare $\Rightarrow$ could affect socio-emotional development negatively
  - Drawback: some diseases and antibiotic intake more harmful at younger ages
- Open questions: Illness duration different for different age groups? Opportunity costs for parents?

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Thanks for your attention!

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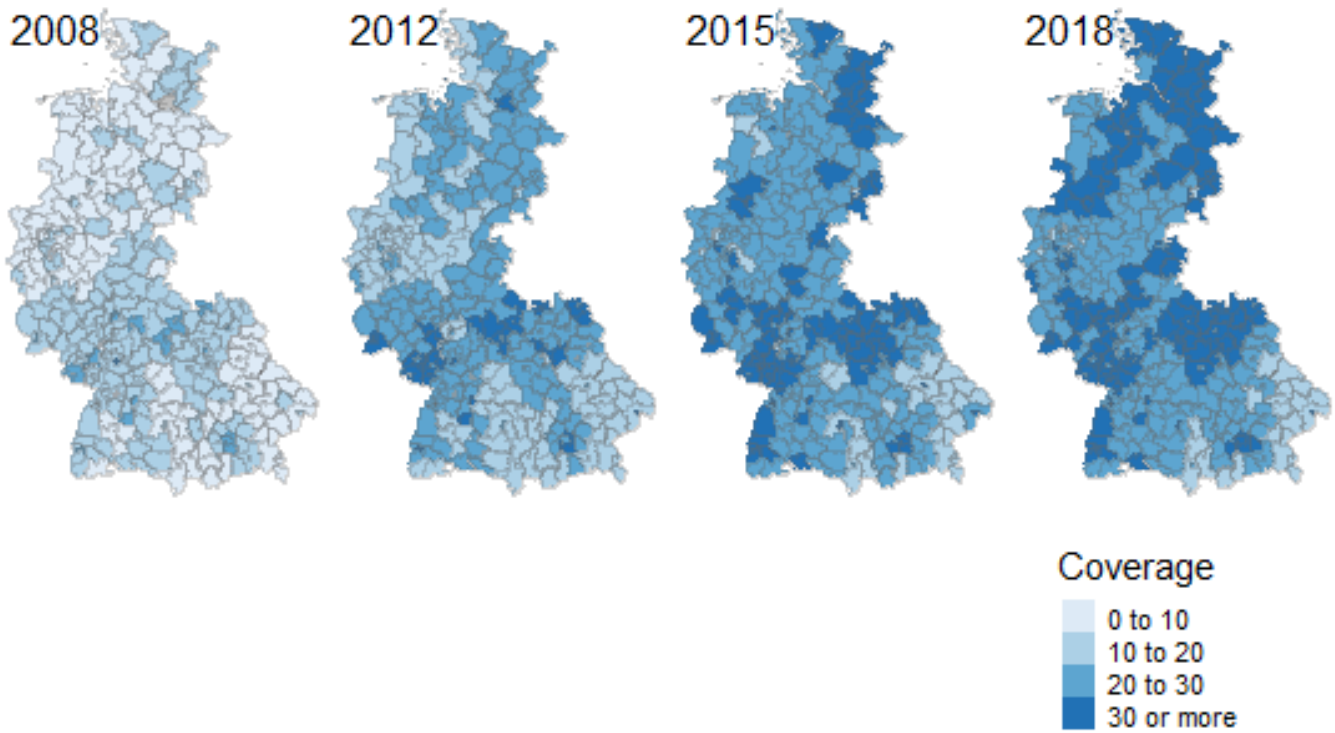
Regional daycare expansion

Figure 2: Daycare expansion during 2008 and 2018



Source: Destatis 2008-2018, own calculations

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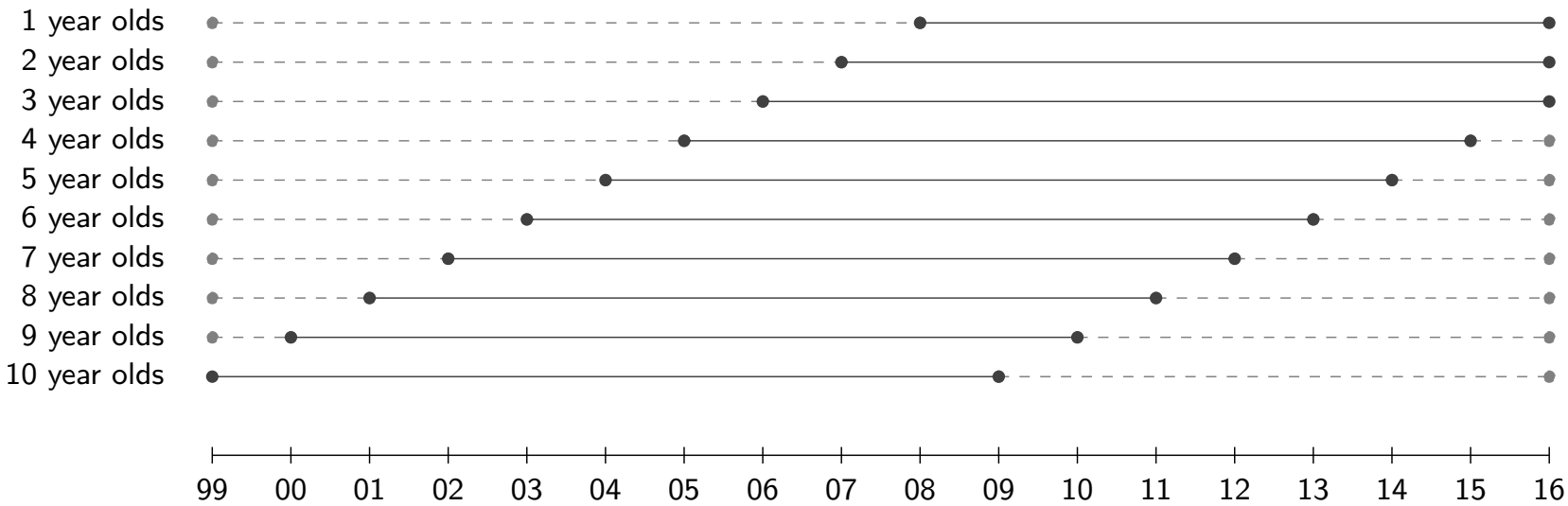
Observation period



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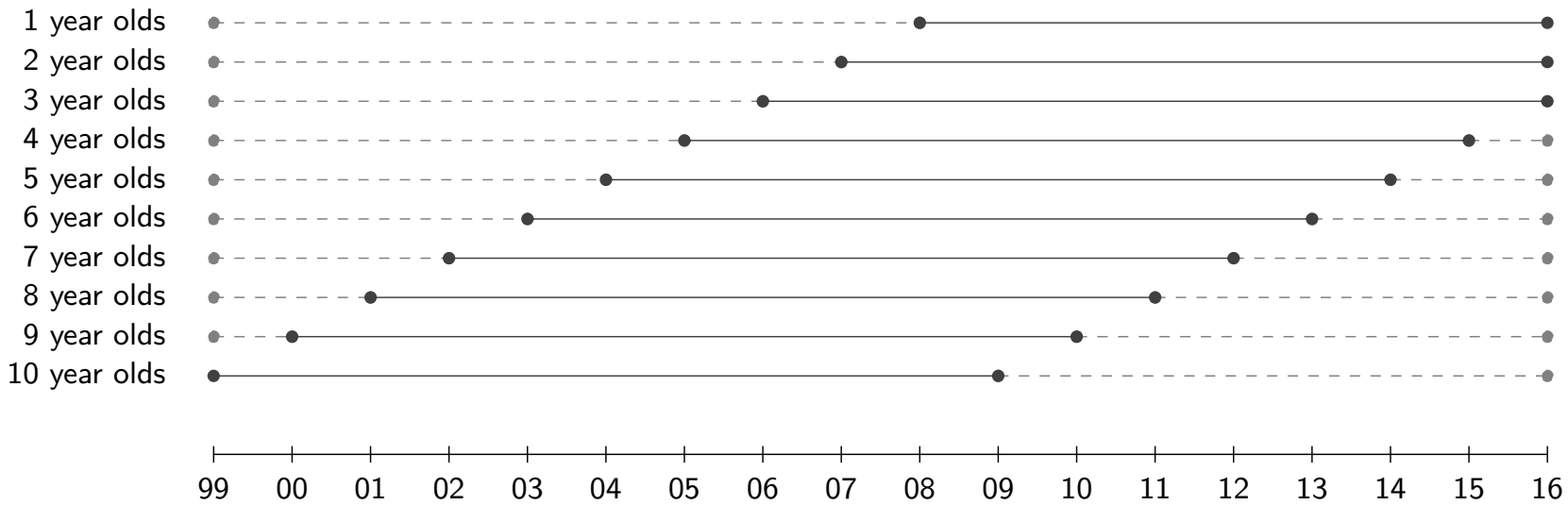

Observation periods:

- 1–2 year olds: observed cohorts 2008 – 2016
- 3–5 year olds: observed cohorts 2006 – 2014
- 6–8 year olds: observed cohorts 2003 – 2011
- 9–10 year olds: observed cohorts 2000 – 2009

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DiD

Two differences: Compare the health outcome of interest for 1 – 2 year olds **before and after** the reform from counties where **daycare expanded a lot** (treatment group) and counties with **little or no increase** in daycare coverage (control group) (following Havnes & Mogstad (2011))

- Main expansion period: 2008 – 2012
- Post-reform cohorts: 2007 – 2011
- Phase-in cohorts: 2005 – 2006
- Pre-reform cohorts: < 2005
- Definition of treatment and control group:
  - Order counties according to percentage point increase in daycare coverage rates from 2008 – 2012
  - Separate sample at the 30th percentile: upper 30 percent = treatment group, bottom 30 percent = control group

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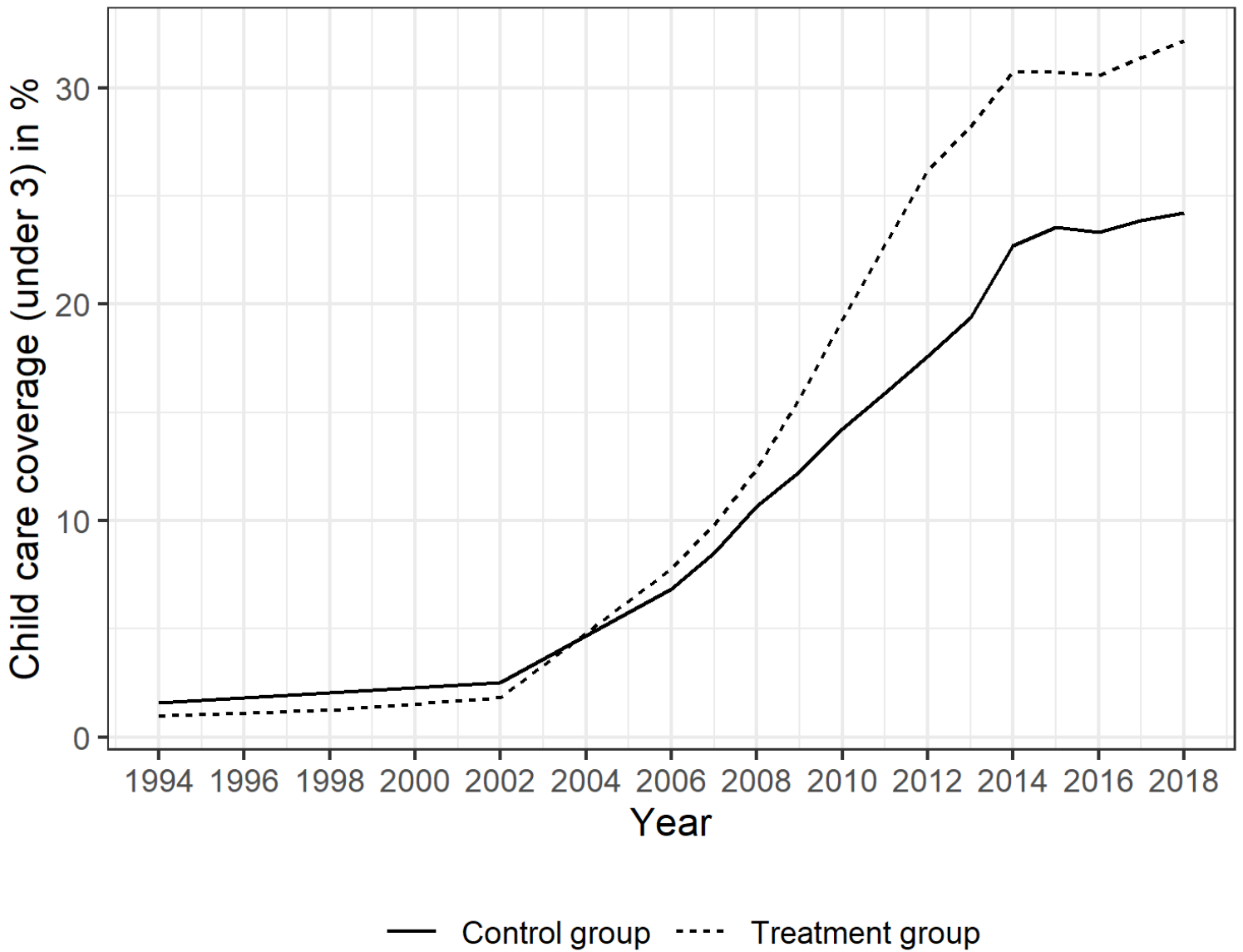
Daycare expansion in treatment and control counties

Figure 3: Daycare expansion during 1994 and 2018



Descriptive statistics for treatment and control counties

Table 3: Descriptive statistics treatment vs. control counties

	Control counties (N = 163)	Treatment counties (N = 160)
Daycare coverage rate		
mean (sd)	10.9853 ± 4.7558	12.3356 ± 4.5809
Unemployment rate		
mean (sd)	6.3000 ± 2.9573	5.8000 ± 2.2728
Share of population U3		
mean (sd)	2.5153 ± 0.2095	2.4356 ± 0.2250
Average age		
mean (sd)	42.4270 ± 1.1592	42.5744 ± 1.2664
Share of migrants		
mean (sd)	9.9798 ± 4.5270	6.7119 ± 3.0633
Fertility rate		
mean (sd)	1.4025 ± 0.1065	1.4144 ± 0.1051
Infant mortality		
mean (sd)	3.7123 ± 2.0819	3.4644 ± 1.9653
Life expectancy		
mean (sd)	80.2098 ± 1.0357	80.1806 ± 0.8335
Female employment rate		
mean (sd)	44.9859 ± 4.0261	45.8387 ± 3.3097
Household income		
mean (sd)	1,624.4294 ± 213.8849	1,593.3500 ± 172.5046
Population density		
mean (sd)	760.8405 ± 803.7271	357.5312 ± 463.3122
GDP per capita		
mean (sd)	33.2859 ± 12.5471	28.0613 ± 12.4159
Excess nitrogen		
mean (sd)	76.1969 ± 24.2337	71.0931 ± 26.4032

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DiD Results

Table 4: DiD Results

	Age: 3-10	Age: 3-5	Age: 6-8	Age: 9-10
Infections	−0.004	−0.013	−0.027**	−0.009
	(0.011)	(0.012)	(0.010)	(0.009)
Ear diseases	0.016+	0.005	−0.006	0.001
	(0.008)	(0.008)	(0.005)	(0.003)
Respiratory diseases	−0.031	−0.025	−0.050*	−0.024
	(0.021)	(0.020)	(0.020)	(0.016)
Mental disorders	0.031*	0.025*	0.029+	0.025
	(0.016)	(0.010)	(0.017)	(0.017)
Treatment cases	0.001	−0.062**	−0.062*	0.015
	(0.031)	(0.023)	(0.029)	(0.029)
Birth cohorts	2000-2011	2006-2011	2003-2011	2000-2009
Observations	21,215,410	5,235,062	7,903,346	5,990,518

Note: SE clustered on KKZ level, $^{+}p<0.1$; $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Results

Age-specific results

Table 5: Generalized DiD Results by age group

	Age: 1	Age: 2	Age: 3	Age: 4	Age: 5	Age: 6	Age: 7	Age: 8	Age: 9	Age: 10
Infections	0.009***	0.010***	0.003	−0.0003	−0.001	−0.002*	−0.003***	−0.003***	−0.004***	−0.005***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ear diseases	0.002*	0.005***	0.002*	−0.002*	−0.002*	−0.001	−0.0002	0.00002	−0.001+	−0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.0004)	(0.0003)	(0.0003)
Respiratory diseases	0.016***	0.020***	0.006*	−0.005+	−0.007**	−0.006***	−0.005**	−0.005**	−0.007***	−0.007***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Mental disorders	0.001	0.001***	0.001	−0.0002	−0.001+	−0.001**	−0.001*	−0.001**	−0.001***	−0.001***
	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Treatment cases	0.005	0.012**	−0.006	−0.018***	−0.018***	−0.014***	−0.007**	−0.005*	−0.005*	−0.006*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Birth cohorts	2008-2018	2007-2017	2006-2016	2005-2015	2004-2014	2003-2013	2002-2012	2001-2011	2000-2010	1999-2009
Observations	4,287,667	4,754,773	5,278,596	5,801,293	5,760,578	5,725,600	5,708,062	5,733,983	5,806,102	5,868,892

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001.

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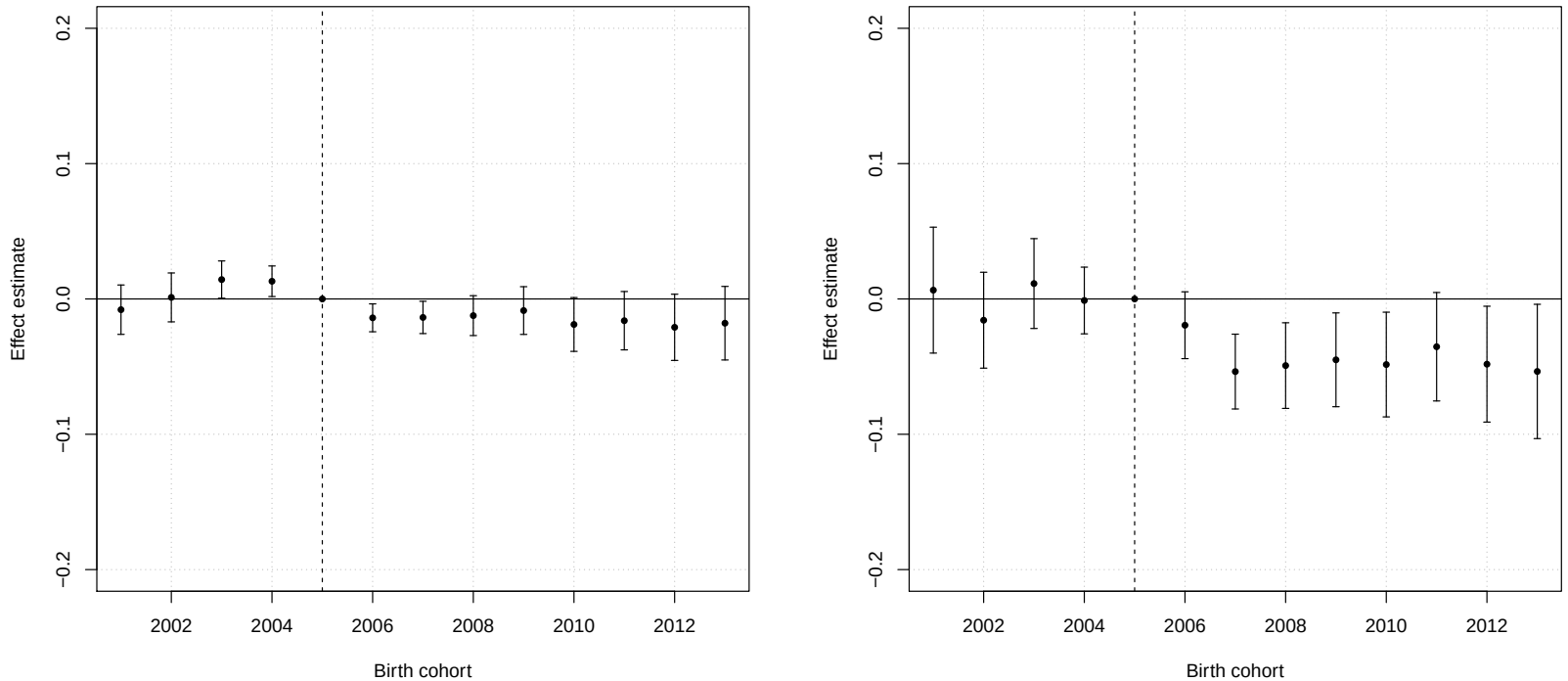
Graphical Evidence: Event Studies



(a) Infections: 6–8 years (b) Respiratory diseases: 6–8 years

Figure 4: Event study: Respiratory diseases

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DiD: Other treatment definitions: infections

Table 6: DiD Results Infections: Different treatment definitions

	Age: 3-5	Age: 6-8	Age: 9-10
upper 50 vs. lower 50%	−0.002	−0.011	−0.002
	(0.009)	(0.009)	(0.007)
Observations	9,241,248	13,979,422	10,605,626
upper 40 vs. lower 40%	−0.008	−0.021*	−0.008
	(0.010)	(0.009)	(0.008)
Observations	7,162,809	10,828,710	8,212,083
upper 35 vs. lower 35%	−0.010	−0.025**	−0.009
	(0.011)	(0.009)	(0.008)
Observations	6,107,240	9,224,953	6,992,512
upper 25 vs. lower 25%	−0.019	−0.030**	−0.011
	(0.014)	(0.011)	(0.010)
Observations	4,085,745	6,147,066	4,646,346
upper 20 vs. lower 20%	−0.018	−0.032**	−0.014
	(0.014)	(0.011)	(0.011)
Observations	3,406,869	5,105,933	3,849,284
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes
Birth cohorts	2006-2011	2003-2011	2000-2009

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other treatment definitions: ear diseases

Table 7: DiD Results ear diseases: Different treatment definitions

	Age: 3-5	Age: 6-8	Age: 9-10
upper 50 vs. lower 50%	0.006	−0.001	0.001
	(0.006)	(0.004)	(0.003)
Observations	9,241,241	13,979,415	10,605,625
upper 40 vs. lower 40%	0.007	−0.004	−0.002
	(0.007)	(0.005)	(0.003)
Observations	7,162,812	10,828,713	8,212,080
upper 35 vs. lower 35%	0.005	−0.006	−0.001
	(0.007)	(0.005)	(0.003)
Observations	6,107,238	9,224,951	6,992,508
upper 25 vs. lower 25%	0.006	−0.003	0.004
	(0.009)	(0.005)	(0.004)
Observations	4,085,741	6,147,065	4,646,343
upper 20 vs. lower 20%	0.002	−0.005	0.004
	(0.009)	(0.006)	(0.004)
Observations	3,406,865	5,105,931	3,849,280
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes
Birth cohorts	2006-2011	2003-2011	2000-2009

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other treatment definitions: respiratory diseases

Table 8: DiD Results respiratory diseases: Different treatment definitions

	Age: 3-5	Age: 6-8	Age: 9-10
upper 50 vs. lower 50%	−0.020	−0.034*	−0.018
	(0.014)	(0.015)	(0.013)
Observations	9,241,241	13,979,415	10,605,625
upper 40 vs. lower 40%	−0.015	−0.039*	−0.022
	(0.016)	(0.017)	(0.014)
Observations	7,162,802	10,828,708	8,212,081
upper 35 vs. lower 35%	−0.017	−0.046*	−0.024
	(0.018)	(0.019)	(0.015)
Observations	6,107,230	9,224,947	6,992,509
upper 25 vs. lower 25%	−0.033	−0.050*	−0.024
	(0.023)	(0.024)	(0.019)
Observations	4,085,736	6,147,064	4,646,344
upper 20 vs. lower 20%	−0.031	−0.054*	−0.029
	(0.025)	(0.026)	(0.020)
Observations	3,406,862	5,105,930	3,849,280
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes
Birth cohorts	2006-2011	2003-2011	2000-2009

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other treatment definitions: mental disorders

Table 9: DiD Results mental disorders: Different treatment definitions

	Age: 3-5	Age: 6-8	Age: 9-10
upper 50 vs. lower 50%	0.04^{+}	0.002	0.001
	(0.002)	(0.002)	(0.002)
Observations	9,241,246	13,979,423	10,605,626
upper 40 vs. lower 40%	0.004^{+}	0.001	−0.0001
	(0.002)	(0.003)	(0.003)
Observations	7,162,807	10,828,712	8,212,079
upper 35 vs. lower 35%	0.006^{**}	0.001	0.0003
	(0.003)	(0.003)	(0.003)
Observations	6,107,233	9,224,949	6,992,509
upper 25 vs. lower 25%	0.007^{+}	0.004	0.003
	(0.004)	(0.004)	(0.004)
Observations	4,085,740	6,147,065	4,646,343
upper 20 vs. lower 20%	0.007^{+}	0.004	0.003
	(0.004)	(0.004)	(0.004)
Observations	3,406,864	5,105,931	3,849,280
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes
Birth cohorts	2006-2011	2003-2011	2000-2009

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other treatment definitions: treatment cases

Table 10: DiD Results healthcare costs: Different treatment definitions

	Age: 3-5	Age: 6-8	Age: 9-10
upper 50 vs. lower 50%	0.586	0.764	3.878^{+}
	(1.040)	(1.595)	(2.229)
Observations	9,241,249	13,979,424	10,605,629
upper 40 vs. lower 40%	0.351	0.819	4.761^{+}
	(1.151)	(1.820)	(2.569)
Observations	7,162,807	10,828,712	8,212,082
upper 35 vs. lower 35%	−0.080	1.075	5.257^{+}
	(1.249)	(1.956)	(2.829)
Observations	6,107,235	9,224,949	6,992,509
upper 25 vs. lower 25%	−0.604	3.479	10.217**
	(1.404)	(2.430)	(3.239)
Observations	4,085,742	6,147,066	4,646,343
upper 20 vs. lower 20%	−0.361	2.433	7.578*
	(1.505)	(2.650)	(3.376)
Observations	3,406,865	5,105,932	3,849,280
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes
Birth cohorts	2006-2011	2003-2011	2000-2009

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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Generalized DiD results: Extensive margin

Table 11: Generalized DiD Results: Extensive/intensive margin

	Age: 1-2	Age: 3-5	Age: 6-8	Age: 9-10
Infections	0.002***	0.001	−0.001*	−0.002***
	(0.0003)	(0.0004)	(0.0003)	(0.0003)
Sample Mean	0.63	0.534	0.456	0.404
Ear diseases	0.001***	−0.0001	−0.00000	−0.0003*
	(0.0003)	(0.0003)	(0.0002)	(0.0001)
Sample Mean	0.327	0.394	0.239	0.164
Respiratory diseases	0.002***	−0.0003	−0.001*	−0.001***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Sample Mean	0.81	0.772	0.648	0.585
Mental disorders	0.001	−0.0005	−0.003	−0.006**
	(0.001)	(0.002)	(0.002)	(0.002)
Sample Mean	0.312	0.867	1.057	1.031
Birth cohorts	2008-2014	2006-2014	2003-2011	2000-2009
Observations	8,522,309	14,117,159	13,979,527	10,605,758

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. *Source:* KBV, own calculations.

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DiD: without controls

Table 12: Generalized DiD Results: Without controls

	Age: 1-2	Age: 3-5	Age: 6-8	Age: 9-10
Infections	0.001	-0.002^{+}	-0.001^{*}	-0.0004
	(0.001)	(0.001)	(0.0005)	(0.001)
Pre-Treatment Mean	1.394	1	0.777	0.665
Ear diseases	-0.001	-0.006^{***}	-0.003^{***}	-0.002^{***}
	(0.001)	(0.001)	(0.0003)	(0.0002)
Pre-Treatment Mean	0.583	0.84	0.454	0.284
Respiratory diseases	-0.015^{***}	-0.028^{***}	-0.016^{***}	-0.013^{***}
	(0.002)	(0.002)	(0.001)	(0.001)
Pre-Treatment Mean	2.854	2.653	1.852	1.583
Mental diseases	0.001^{***}	0.001^{**}	0.002^{***}	0.003^{***}
	(0.0004)	(0.0004)	(0.0002)	(0.0003)
Pre-Treatment Mean	0.177	0.37	0.329	0.275
Treatment cases	-0.006^{*}	-0.020^{***}	-0.015^{***}	-0.008^{***}
	(0.003)	(0.002)	(0.002)	(0.002)
Pre-Treatment Mean	6.331	6.135	5.282	4.915
Birth cohorts	2008-2014	2006-2014	2003-2011	2000-2009
Observations	8,522,325	14,117,126	13,979,465	10,605,676

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. *Source:* KBV, own calculations.

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DiD: Other expansion period definitions: infections

Table 13: DiD Results Infections: Different expansion period definitions

	Age: 3-5	Age: 6-8	Age: 9-10
Exp. period: 2008–2011	−0.012	−0.025**	−0.008
	(0.011)	(0.009)	(0.008)
Birth cohorts	2006-2010	2003-2010	2000-2009
Observations	4,296,474	6,914,050	5,882,942
Exp. period: 2009–2012	−0.013	−0.020*	−0.006
	(0.012)	(0.010)	(0.009)
Birth cohorts	2006-2011	2003-2011	2000-2009
Observations	5,181,917	7,811,109	5,913,604
Exp. period: 2009–2013	−0.011	−0.017+	−0.005
	(0.012)	(0.010)	(0.009)
Birth cohorts	2006-2012	2003-2011	2000-2009
Observations	6,154,171	7,924,942	5,996,757
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes

Note: +p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other expansion period definitions: ear diseases

Table 14: DiD Results Ear diseases: Different expansion period definitions

	Age: 3-5	Age: 6-8	Age: 9-10
Exp. period: 2008–2011	0.014^{+}	0.003	0.004
	(0.007)	(0.005)	(0.003)
Birth cohorts	2006-2010	2003-2010	2000-2009
Observations	4,296,469	6,914,046	5,882,937
Exp. period: 2009–2012	−0.007	−0.002	0.002
	(0.007)	(0.005)	(0.004)
Birth cohorts	2006-2011	2003-2011	2000-2009
Observations	5,181,916	7,811,105	5,913,600
Exp. period: 2009–2013	−0.001	0.001	0.005
	(0.008)	(0.004)	(0.004)
Birth cohorts	2006-2012	2003-2011	2000-2009
Observations	6,154,168	7,924,939	5,996,749
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other expansion period definitions: respiratory diseases

Table 15: DiD Results Respiratory diseases: Different expansion period definitions

	Age: 3-5	Age: 6-8	Age: 9-10
Exp. period: 2008–2011	−0.028	−0.051**	−0.023
	(0.019)	(0.019)	(0.017)
Birth cohorts	2006-2010	2003-2010	2000-2009
Observations	4,296,465	6,914,045	5,882,937
Exp. period: 2009–2012	−0.029	−0.039+	−0.008
	(0.019)	(0.020)	(0.016)
Birth cohorts	2006-2011	2003-2011	2000-2009
Observations	5,181,909	7,811,105	5,913,599
Exp. period: 2009–2013	−0.022	−0.037+	−0.0004
	(0.020)	(0.019)	(0.015)
Observations	6,154,155	7,924,936	5,996,750
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes

Note: +p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other expansion period definitions: mental disorders

Table 16: DiD Results Mental disorders: Different expansion period definitions

	Age: 3-5	Age: 6-8	Age: 9-10
Exp. period: 2008–2011	0.005^{+}	0.003	0.002
	(0.003)	(0.003)	(0.003)
Birth cohorts	2006-2010	2003-2010	2000-2009
Observations	4,296,474	6,914,045	5,882,936
Exp. period: 2009–2012	0.004	0.003	0.002
	(0.003)	(0.003)	(0.003)
Birth cohorts	2006-2011	2003-2011	2000-2009
Observations	5,181,915	7,811,106	5,913,600
Exp. period: 2009–2013	0.004	0.001	0.002
	(0.003)	(0.003)	(0.003)
Observations	6,154,172	7,924,942	5,996,744
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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DiD: Other expansion period definitions: treatment cases

Table 17: DiD Results healthcare costs: Different expansion period definitions

	Age: 3-5	Age: 6-8	Age: 9-10
Exp. period: 2008–2011	−1.267	0.314	6.901*
	(1.340)	(2.189)	(3.055)
Birth cohorts	2006-2010	2003-2010	2000-2009
Observations	4,296,470	6,914,049	5,882,939
Exp. period: 2009–2012	−1.009	−0.337	3.290
	(1.475)	(2.009)	(2.738)
Birth cohorts	2006-2011	2003-2011	2000-2009
Observations	5,181,913	7,811,105	5,913,602
Exp. period: 2009–2013	−1.597	0.066	4.715
	(1.444)	(2.198)	(3.051)
Birth cohorts	2006-2012	2003-2011	2000-2009
Observations	6,154,169	7,924,938	5,996,753
Control for age + gender	yes	yes	yes
Control for swine flu incidence	yes	yes	yes
Control for KKZ + Year FE	yes	yes	yes

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Robust standard errors clustered on county-level are in parentheses. *Source:* KBV, own calculations.

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Generalized DiD: Diabetes

Table 18: Placebo Regression (generalized DiD): Diabetes

	Age: 1-10	Age: 1-2	Age: 3-5	Age: 6-8	Age: 9-10
Infections	−0.00002	0.00003	−0.00001	−0.00005	−0.0001
	(0.00002)	(0.00003)	(0.00003)	(0.00004)	(0.00004)
Pre-Treatment Mean	0.002	0.001	0.001	0.002	0.003
Birth cohorts	2000-2014	2008-2014	2006-2014	2003-2011	2000-2009
Observations	54,152,607	8,522,318	14,117,165	13,979,538	10,605,769

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. *Source:* KBV, own calculations.

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