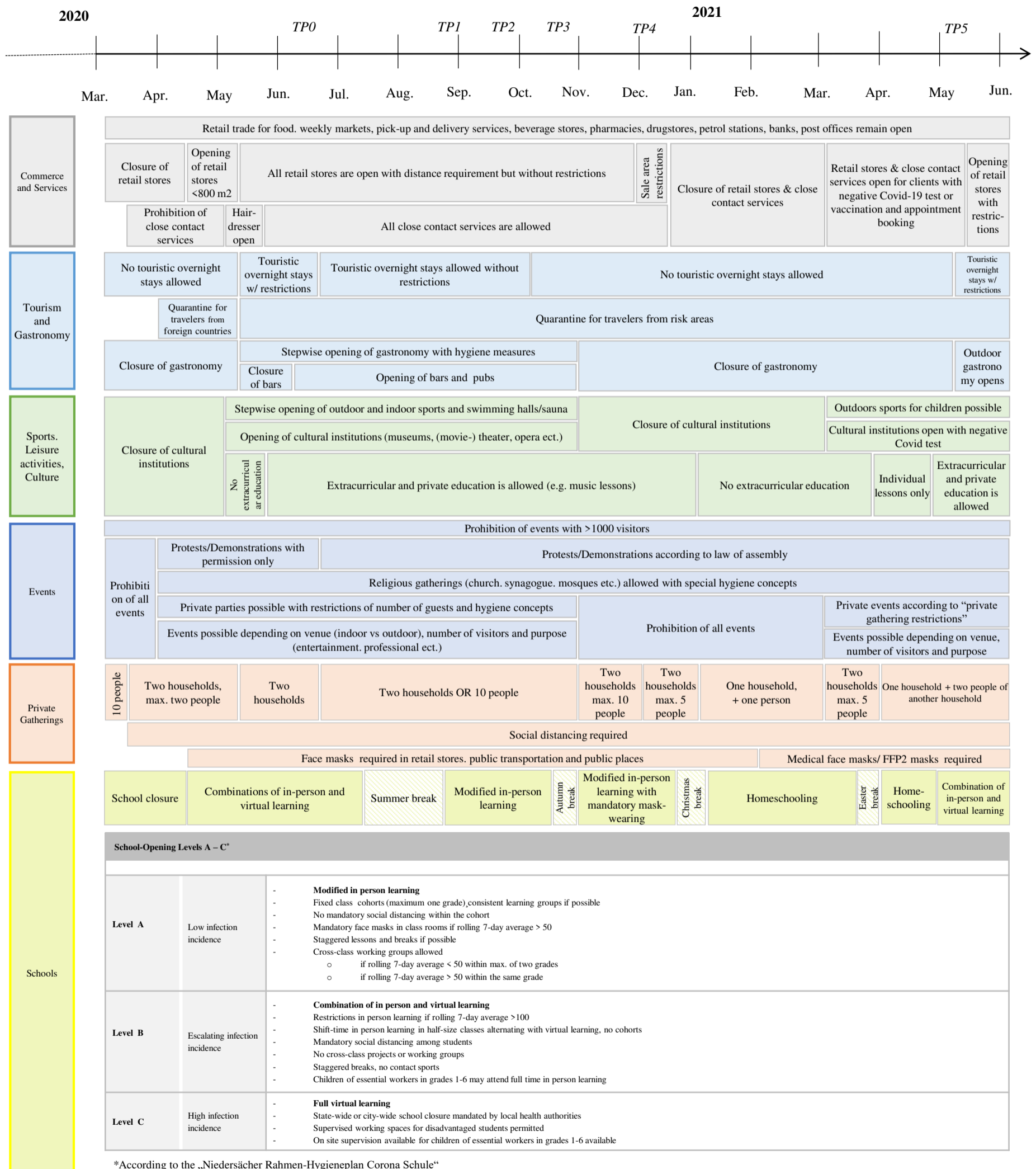## Supplemental Figure 1 COVID-19 restrictions and in-person vs. virtual learning

State-mandated contact restrictions in response to the pandemic changed multiple times during the study period. Restrictions in place in March and April 2020 were deescalated during May and June 2020, and reinstated in November. The following figure summarizes the mayor regulations prescribed by the Lower Saxony state government. Schools were open during the study period, with varying levels of in-person and virtual learning. Time point (TP) 1 occurred when school resumed after the summer break. TP2 occurred while school was in session and COVID-19 incidence was rising in the region, but before significant restrictions were implemented. TP3 occurred directly after the autumn break, with a first layer of restrictions in public life while school continued with in-person learning. TP4 occurred when a more restrictive lock-down took effect. TP5 occurred after a 4-month period of lock-down and home schooling.

For further details see https://www.niedersachsen.de/Coronavirus/vorschriften/vorschriften-der-landesregierung-201461.html.

2020 … TP0 … TP1 … TP2 … TP3 … TP4 … **2021** … TP5

Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May Jun.

Commerce and Services

Retail trade for food. weekly markets, pick-up and delivery services, beverage stores, pharmacies, drugstores, petrol stations, banks, post offices remain open

Closure of retail stores | Opening of retail stores <800 m2 | All retail stores are open with distance requirement but without restrictions | Sale area restrictions | Closure of retail stores & close contact services | Retail stores & close contact services open for clients with negative Covid-19 test or vaccination and appointment booking | Opening of retail stores with restrictions

Prohibition of close contact services | Hair-dresser open | All close contact services are allowed

Tourism and Gastronomy

No touristic overnight stays allowed | Touristic overnight stays w/ restrictions | Touristic overnight stays allowed without restrictions | No touristic overnight stays allowed | Touristic overnight stays w/ restrictions

Quarantine for travelers from foreign countries | Quarantine for travelers from risk areas

Closure of gastronomy | Stepwise opening of gastronomy with hygiene measures | Closure of gastronomy | Outdoor gastronomy opens

Closure of bars | Opening of bars and pubs

Sports. Leisure activities, Culture

Closure of cultural institutions | Stepwise opening of outdoor and indoor sports and swimming halls/sauna | Closure of cultural institutions | Outdoors sports for children possible

Opening of cultural institutions (museums, (movie-) theater, opera ect.) | Cultural institutions open with negative Covid test

No extracurricular education | Extracurricular and private education is allowed (e.g. music lessons) | No extracurricular education | Individual lessons only | Extracurricular and private education is allowed

Events

Prohibition of all events | Prohibition of events with >1000 visitors

Protests/Demonstrations with permission only | Protests/Demonstrations according to law of assembly

Religious gatherings (church. synagogue. mosques etc.) allowed with special hygiene concepts

Private parties possible with restrictions of number of guests and hygiene concepts | Prohibition of all events | Private events according to "private gathering restrictions"

Events possible depending on venue (indoor vs outdoor), number of visitors and purpose (entertainment. professional ect.) | Events possible depending on venue, number of visitors and purpose

Private Gatherings

10 people | Two households, max. two people | Two households | Two households OR 10 people | Two households max. 10 people | Two households max. 5 people | One household, + one person | Two households max. 5 people | One household + two people of another household

Social distancing required

Face masks required in retail stores. public transportation and public places | Medical face masks/ FFP2 masks required

Schools

School closure | Combinations of in-person and virtual learning | Summer break | Modified in-person learning | Autumn break | Modified in-person learning with mandatory mask-wearing | Christmas break | Homeschooling | Easter break | Home-schooling | Combination of in-person and virtual learning

School-Opening Levels A – C*

Level A	Low infection incidence	**Modified in person learning**
		- Fixed class cohorts (maximum one grade) consistent learning groups if possible
		- No mandatory social distancing within the cohort
		- Mandatory face masks in class rooms if rolling 7-day average > 50
		- Staggered lessons and breaks if possible
		- Cross-class working groups allowed
		  o if rolling 7-day average < 50 within max. of two grades
		  o if rolling 7-day average > 50 within the same grade

Level B	Escalating infection incidence	**Combination of in person and virtual learning** - Restrictions in person learning if rolling 7-day average >100 - Shift-time in person learning in half-size classes alternating with virtual learning, no cohorts - Mandatory social distancing among students - No cross-class projects or working groups - Staggered breaks, no contact sports - Children of essential workers in grades 1-6 may attend full time in person learning
Level C	High infection incidence	**Full virtual learning** - State-wide or city-wide school closure mandated by local health authorities - Supervised working spaces for disadvantaged students permitted - On site supervision available for children of essential workers in grades 1-6 available

*According to the „Niedersächer Rahmen-Hygieneplan Corona Schule"

TABLE A1   Students study participation and test results by time point

| | Time point of testing | | | | | | No. of participants* | No. of tests** |
	TP0	TP1	TP2	TP3	TP4	TP5	Total	Total
Participants	646	637	625	662	544	469	779	
New participants per time point	-	80	18	29	7	-	132	
Pharyngeal swap PCR tests *(Positive tests in parentheses)*	642	634	624	657 (1)	542	465	777 (1)	3564 (1)
Serum sample Antibody tests *(Positive tests in parentheses)*	570 (6)	501 (4)	-	494 (5)	-	370 (8)	667 (13)	1935 (23)

* No. of individuals participating in at least one testing time point

** No. of accomplished tests of all individuals and time points

TABLE A2   Demographics of study participants

Study participation per grade	Age (years)	Female sex	Hight (cm)	Weight (kg)	BMI	Chronic disease	Medication	Smoking	Household size	No. of children in household
	N (%)	Mean (SD)	N (%)	Mean (SD)	Mean (SD)	Mean (SD)	N (%)	N (%)	N (%)	Mean (SD)	Mean (SD)
Grade 5	84 (67.7%)	10.6 (0.4)	40 (47.6%)	146.3 (5.9)	37.5 (7.9)	17.3 (2.8)	8 (9.6%)	4 (4.8%)	0 (0%)	4.0 (0.9)	2.1 (0.9)
Grade 6	79 (65.3%)	11.7 (0.4)	33 (41.8%)	150.3 (6.5)	39.7 (8.0)	17.5 (2.6)	8 (10.4%)	8 (10.4%)	0 (0%)	4.2 (1.0)	2.2 (0.9)
Grade 7	101 (67.8%)	12.6 (0.4)	41 (40.6%)	156.8 (9.1)	44.6 (9.6)	17.9 (2.5)	9 (9.1%)	8 (8.1%)	0 (0%)	4.2 (1.1)	2.2 (0.9)
Grade 8	94 (76.4%)	13.7 (0.6)	45 (47.9%)	163.4 (7.9)	49.7 (8.6)	18.6 (2.5)	10 (10.8%)	8 (8.7%)	0 (0%)	4.2 (1.0)	2.2 (1.0)
Grade 9	98 (86.7%)	14.7 (0.5)	46 (46.9%)	167.6 (7.6)	54.9 (9.3)	19.5 (2.8)	14 (14.3%)	9 (9.2%)	2 (2.3%)	4.1 (1.1)	2.1 (0.9)
Grade 10	85 (72.0%)	15.7 (0.4)	40 (47.1%)	172.6 (8.9)	58.1 (9.0)	19.5 (2.3)	10 (11.9%)	13 (15.2%)	1 (1.3%)	4.2 (1.2)	2.1 (0.9)
Grade 11	83 (69.7%)	16.7 (0.5)	33 (39.8%)	175.3 (10.4)	63.6 (9.8)	20.6 (2.5)	10 (12.0%)	13 (15.7%)	11 (14.1%)	3.9 (1.1)	1.9 (0.9)
Grade 12	76 (78.4%)	17.5 (0.5)	39 (51.3%)	176.6 (8.5)	67.2 (11.1)	21.5 (2.5)	10 (13.5%)	27 (37.0%)	15 (21.4%)	3.7 (1.1)	1.6 (0.8)
Grade 13	77 (70.0%)	18.7 (0.5)	44 (57.1%)	175.5 (9.6)	68.1 (11.4)	22.0 (2.7)	7 (9.3%)	25 (33.8%)	31 (43.1%)	3.8 (1.0)	1.8 (0.9)
All students	777 (72.3%)	14.6 (2.6)	361 (46.5%)	164.8 (13.4)	53.5 (14.1)	19.3 (3.0)	86 (11.2%)	115 (15.1%)	60 (9.1%)	4.1 (1.1)	2.0 (0.9)

BMI, body mass index; SD, standard deviation

TABLE A3   Sero-positive results and participants demographics

	Frequency of Participation	Sero-positiv antibody results						Age (years)	Sex	Body Mass Index	Prevoius PCR Test	Previous Antibody - Test	Smoking (past)	Chronic disease	Hhousehold Size	No. of different activities Ø	Travel	Selfestimated compliance with protective Measures Ø	Selfestimated compliance with protective Measures - Familiy -
		TP0	TP1	TP3	TP5	Neutralizing antibody													
		Roche	Roche	Roche	Roche	NT50	NT 90												
Student 1	1x	4,01	-	-	-	1:400 – 1:600	1:100 – 1:400	17	m	22,8	-	-	0 (1)	-	4 Children, 2 Adults	-	0	8	7
Student 2	4x	118,4	185	142,3	-	1:400 – 1:600	1:100 – 1:400	12	f	26	-	-	0	-	1 Child, 1 Adults	9,7	2xEU 3x DE	9	8
Student 3	6x	104,9	-	124	-	1:100 – 1:400	1:25 – 1:100	12	m	16,2	-	positive 23.06.20	0	-	2 Children, 2 Adults	6,8	1xEU 1xD	7	8
Student 4	5x	128,7	117,9	64,34	-	1:400 – 1:600	1:100 – 1:400	15	m	-	-	-	0	-	1 Child, 2 Adults	5,8	1xD	7	5
Student 5	6x	4,66	7,7	6,44	3,82	no neutralization		17	f	20,8	-	-	0	Asthma	1 Child, 2 Adults	8,8	0	7	4
Student 6	5x	49,96	42,94	58,36	-	1:25 – 1:100	<1:25	16	f	24,2	-	-	0 (1)	-	2 Children, 2 Adults	11,75	1xEU	6,2	8
Student 7	5x	neg.	neg.	neg.	114,9	1:100 - 1:400	1:25 - 1:100	12	f	18.1	positive 18.12.20	-	0	-	4 Children, 2 Adults	6,25	1xDE	7,6	7
Student 8	6x	neg.	neg.	neg.	85,45	1:400 - 1:600	1:100 - 1:400	19	m	22.7	positive 29.12.20	-	0	DM I	1 Children, 3 Adults	8,2	2xEU 4x DE	4,2	2
Student 9	5x	neg.	neg.	neg.	186,2	1:100 - 1:400	1:25 - 1:100	13	f	16.9	positive 15.03.21	-	0	-	2 Children, 2 Adults	6,5	5x DE	8,2	8
Student 10	6x	neg.	neg.	neg.	5,47	no neutralization		16	f	-	positive 13.03.21	-	0	-	2 Children, 2 Adults	5,8	2xEU	7	9
Student 11	5x	neg.	neg.	-	41,63	1:25 - 1:100	< 1:25	18	f	23.9	positive 18.12.20	-	1 (1)	-	2 Children, 2 Adults	9,5	1x EU	7	6
Student 12	5x	-	neg.	neg.	69,65	1:25 - 1:100	< 1:25	15	f	19.8	-	-	0	-	1 Children, 2 Adults	1,8	0	9,2	10
Student 13	5x	-	neg.	neg.	203,2	1:25 - 1:100	< 1:25	11	m	-	positive 15.01.21	-	0	-	3 Children, 2 Adults	6,6	1x EU	8,2	8

TP, time point; NT50, 50% neutralizing titer; NT90, 90% neutralizing titer; neg., negative; f, female; m, male; DM I , Diabetes mellitus Typ I; Ø, average of all time points; EU, Europe; DE, Germany;

TABLE A4   Sex and age differences of individual activities

	Sex difference *female vs. male*			Age difference *16-20 years vs. 9-12 years*		
	OR (female)	95% CI	p-value	OR (16-20 years)	95% CI	p-value
Activities permitted during whole study period						
Meeting Friends	1.39	[1.02 - 1.9]	0.04	1.83	[1.13 - 2.95]	0.0080
Meeting Family	1.12	[0.89 - 1.41]	0.31	1.23	[0.87 - 1.72]	0.39
Meeting Elderly Relatives	0.99	[0.78 - 1.25]	0.92	0.78	[0.55 - 1.09]	0.22
Grocery Store	1.67	[1.25 - 2.23]	<0.0001	6.79	[4.19 - 10.98]	<0.0001
Lake, River or Ocean	0.69	[0.52 - 0.89]	0.01	1.71	[1.12 - 2.59]	0.0068
Church	1.09	[0.80 - 1.47]	0.59	0.69	[0.42 - 1.34]	0.21
Protest	2.82	[0.81 - 9.85]	0.10	..	..	..
Local Public Transit	1.58	[1.25 - 2.00]	<0.0001	2.31	[1.64 - 3.26]	<0.0001
Long Distance Public Transit	1.01	[0.77 - 1.34]	0.93	4.91	[3.19 - 7.55]	<0.0001
Activities not permitted at time point 4 and/or 5						
Restaurant	0.89	[0.71 - 1.12]	0.32	3.1	[2.16 - 4.44]	<0.0001
Café	1.67	[1.31 - 2.12]	<0.0001	2.47	[1.70 - 3.61]	<0.0001
Bar	0.96	[0.60 - 1.53]	0.85	9.55	[4.40 - 20.71]	<0.0001
Party	1.10	[0.88 – 1.38]	0.39	2.08	[1.48 - 2.92]	<0.0001
Clothing Store	2.29	[1.85 - 2.82]	<0.0001	2.26	[1.63 - 3.13]	<0.0001
Store (except food or clothing)	2.23	[1.82 - 2.71]	<0.0001	1.52	[1.13 - 2.05]	0.0025
Music Lesson	1.15	[0.86 - 1.55]	0.31	0.33	[0.21 - 0.54]	<0.0001
Gym	0.73	[0.53 - 0.99]	0.05	7.10	[4.45 - 11.32]	<0.0001
Swimming Pool	1.09	[0.81 - 1.45]	0.58	0.45	[0.29 - 0.71]	<0.0001
Sauna	1.05	[0.61 - 1.81]	0.86	1.13	[0.49 - 2.60]	0.98
Museum	1.01	[0.73 - 1.40]	0.93	1.51	[0.93 - 2.45]	0.13
(Movie-) Theater	1.56	[1.08 - 2.25]	0.02	2.48	[1.40 - 4.38]	<0.0001
Concert	0.86	[0.35 - 2.11]	0.75	1.80	[0.49 - 6.55]	0.63
Sport event	0.58	[0.33 - 0.99]	0.05	1.31	[0.60 - 2.89]	0.79

Figure A2　　　　　Travel modes
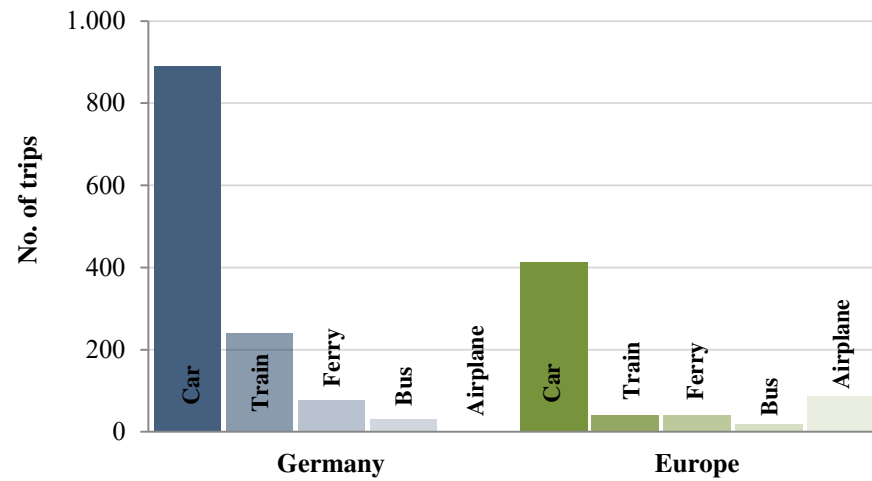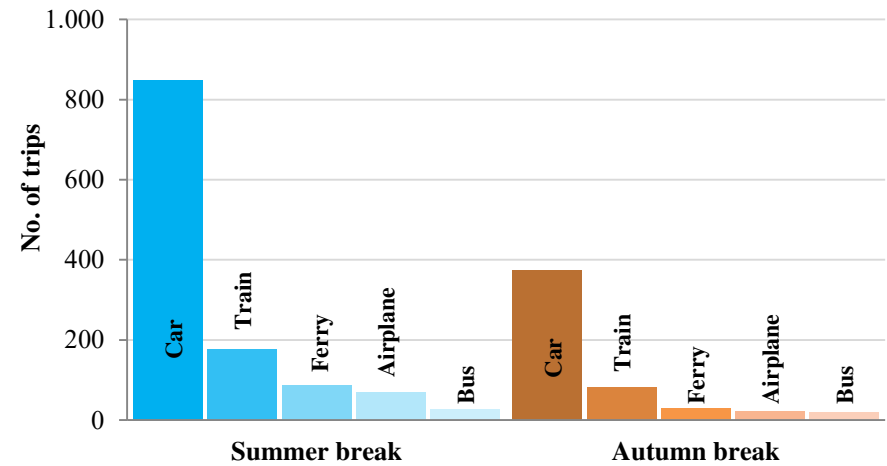
a
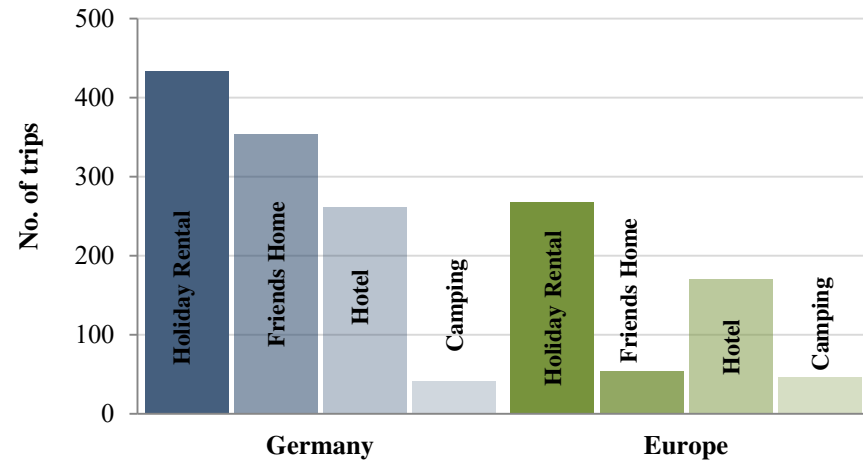
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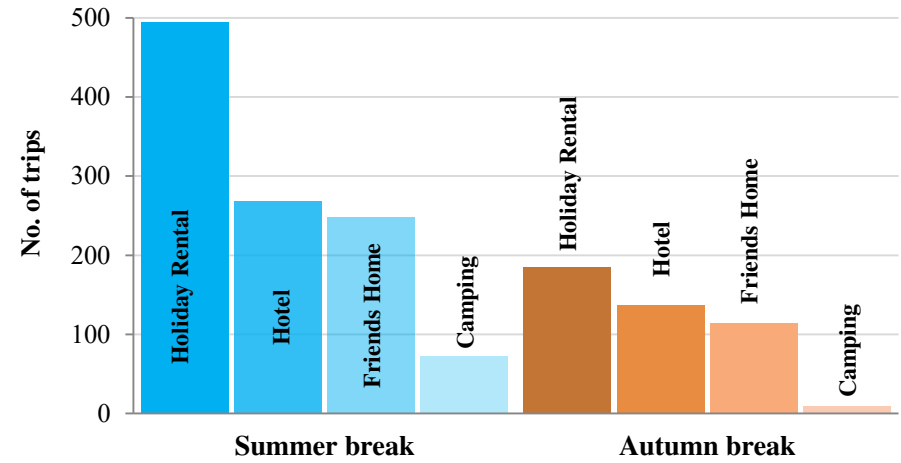
c

d

Travel modes. Number of trips by accommodation in Germany and Europe (**a**) and summer break versus autumn break (**b**). Number of trips by transportation in Germany and Europe (**c**) and summer break versus autumn break (**d**).

TABLE A5 **Linear mixed regression models for other factors influencing behavioral patterns**

| Covariate	Model I - Activity engagement			Model II - Number of trips			Model III - Self-estimated compliance with protective measures		
	ß	SE	p - value	ß	SE	p - value	ß	SE	p - value
Intercept	7.77	0.39	<0.0001	1.37	0.08	<0.0001	7.98	0.19	<0.0001
Time point 2	-2.22	0.11	<0.0001	-1.40	0.04	<0.0001	-0.09	0.05	0.08
Time point 3	-2.11	0.11	<0.0001	-0.88	0.04	<0.0001	0.06	0.05	0.29
Time point 4	-4.62	0.12	<0.0001	-1.44	0.04	<0.0001	0.23	0.06	<0.0001
Time point 5	-4.28	0.13	<0.0001	-1.17	0.04	<0.0001	0.24	0.06	<0.0001
Time point 1		Reference			Reference			Reference	
Sex (female)	0.72	0.16	<0.0001	0.05	0.04	0.10	0.13	0.08	0.11
Sex (male)		Reference			Reference			Reference	
Age (13-15 years)	0.87	0.17	<0.0001	0.03	0.04	0.37	-0.37	0.08	<0.0001
Age (16-20 years)	1.53	0.19	<0.0001	-0.03	0.04	0.48	-0.57	0.09	<0.0001
Age (9-12 years)		Reference			Reference			Reference	
Chronic disease	0.18	0.40	0.66	0.11	0.08	0.15	-0.34	0.20	0.08
No chronic disease		Reference			Reference			Reference	
Asthma	-0.73	0.57	0.20	-0.11	0.11	0.34	0.45	0.28	0.11
No Asthma		Reference			Reference			Reference	
One college educated adult	0.49	0.23	0.033	0.095	0.05	0.03	-0.07	0.11	0.54
Two college educated adults	0.20	0.23	0.39	0.14	0.05	0.002	-0.04	0.11	0.75
No college educated adult		Reference			Reference			Reference	
Healthcare worker	0.16	0.18	0.38	0.03	0.03	0.43	-0.06	0.09	0.53
No healthcare worker		Reference			Reference			Reference	
Household size	-0.06	0.08	0.46	-0.01	0.02	0.59	-0.06	0.04	0.12

ß, regression coefficient; SE, standard error

Figure A3 **Behavior depending on chronic disease**

a

b
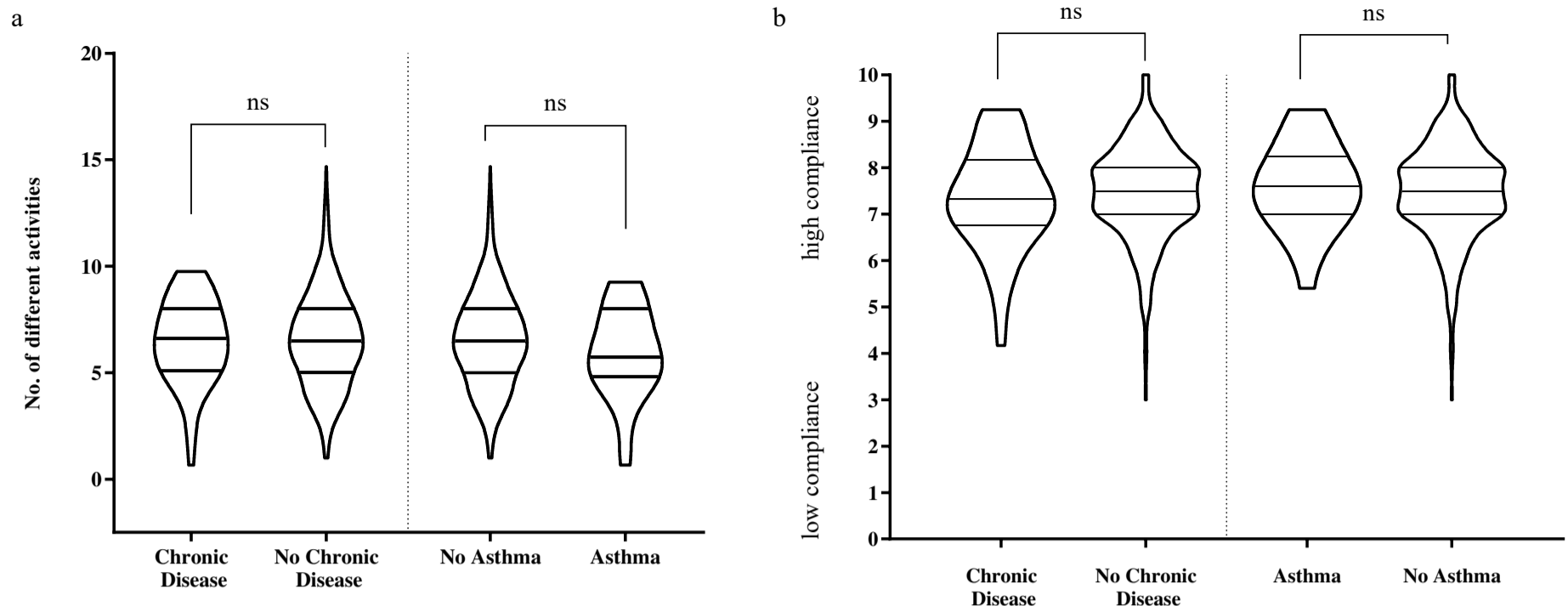
Behavior depending on chronic disease. (**a**) No difference in activities for students with chronic disease and no chronic disease reported. (**b**) No difference in self-estimated protection measures between students with chronic disease and no chronic disease reported.

Figure A4 **Behavior depending on social factors by profession**

a

b

c

d
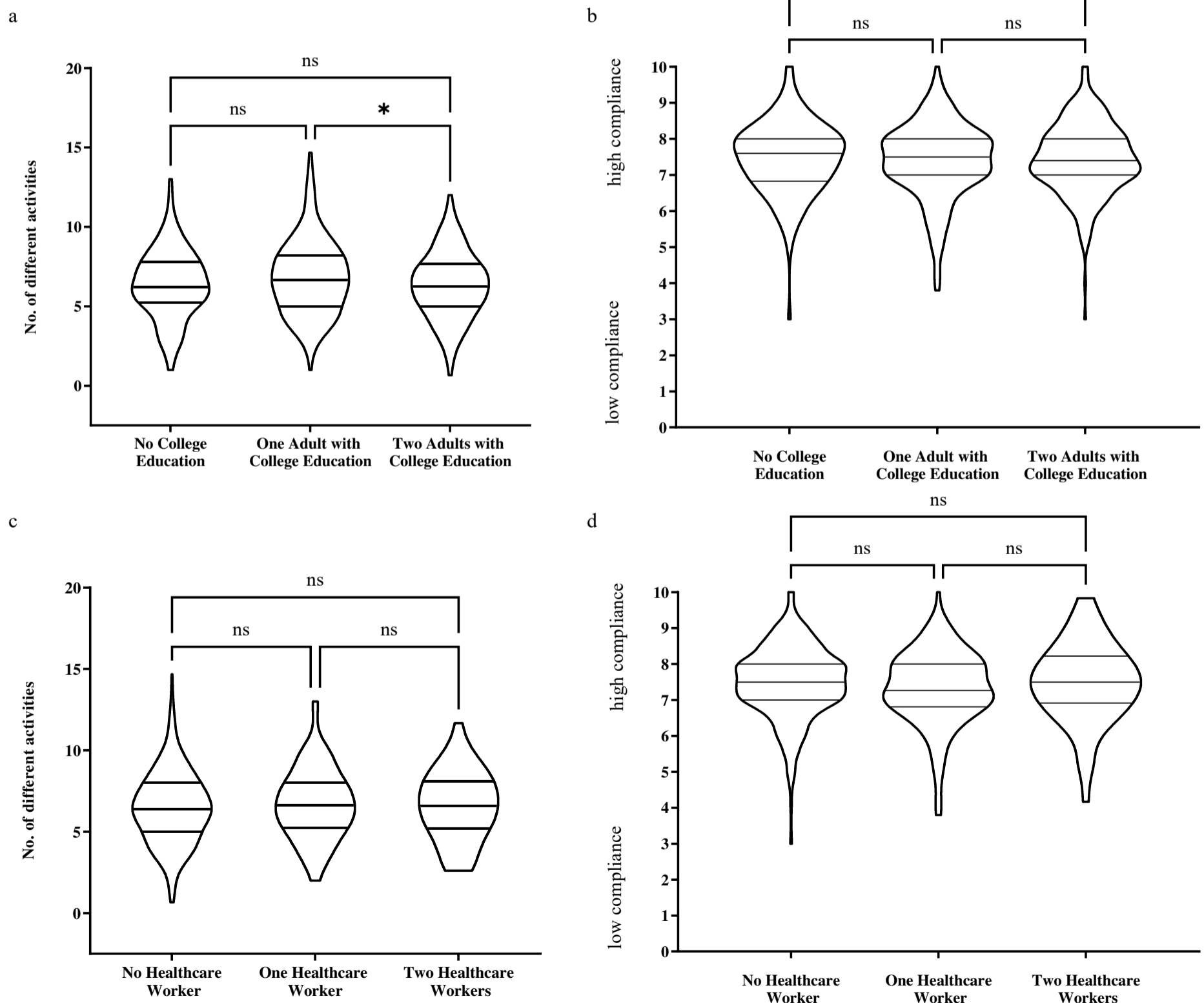
Behavior depending on social factors by profession. No difference in activities for students living in one household with no, one, or two "adults with college education" (**a**) or "healthcare workers (**b**) No difference in self-estimated protective measures between students living students living in one household with no. one. or two "adults with college education" (**c**) or "healthcare workers (**d**).