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Pupils with special educational needs in basic education schools and teachers' sickness absences – a register-linkage study

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Objectives We examined whether having a high percentage of pupils with special educational needs (SEN) in basic education schools increases the risk of sickness absence among teachers and whether this risk is dependent on the pupil–teacher ratio (PTR), an indicator of teacher resources at school.

Methods We obtained register data on 8089 teachers working in 404 schools in 10 municipalities in Finland during the school year 2004–2005. We used multilevel multinomial regression models to examine the risk of teachers' short- and long-term sickness absence in relation to the percentage of SEN pupils and the PTR at school. We tested the equality of trends in groups with high and low the PTR using PTR × SEN interaction term.

Results After adjustment for teacher and school characteristics, the risk for long-term absences was higher among teachers at schools with a high percentage of SEN pupils than among teachers at schools with a low percentage of SEN pupils [odds ratio (OR) 1.5, 95% confidence interval (95% CI) 1.2–1.8]. This was also the case for short-term absences (OR 1.4, 95% CI 1.2–1.7). In analyses stratified by the PTR levels, the association between the percentage of SEN pupils and long-term absences was 15% higher among teachers with a high PTR than among those with a low PTR (P-value for interaction=0.10).

Conclusions Teachers' sickness absenteeism seems to increase with a higher percentage of SEN pupils, especially when the PTR is high. Teacher resources at schools that have a high percentage of SEN pupils should be well maintained to ensure the health of teachers.

Key terms absenteeism; children; comprehensive school; exceptional children; multilevel modeling; pupil–teacher ratio; register study; school resource; sick leave; special education; student.

An increasing number of school children have special educational needs (SEN) related to physical, mental, or emotional challenges, although the definition may vary in different countries. In the US, the percentage of SEN pupils has grown steadily from 8% in 1976–1977 to 13% in 2008–2009 (1). Similarly in Finland, the percentage of SEN pupils has grown from 3% in 1995 to 9% in 2009 (2). In the UK during 2006–2010, the percentage of pupils with formal evaluation of SEN has remained at 3%, but the percentage of SEN pupils without formal

evaluations has increased from 16% to 18% (3). Inclusion of SEN pupils in regular education, also referred to as mainstreaming, was part of the United Nation's Salamanca Declaration (4) in 1994, and the development of education for SEN pupils shows that developed countries seem to follow this declaration (5).

Although from the perspective of SEN pupils' well-being, inclusive education is probably a better alternative than segregated special education (6–8), there are some data that suggest that teachers may perceive the

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inclusion of SEN pupils in general classes as emotionally straining. This is because inclusion may be associated with increased disciplinary problems in the class leading to increased risk of burnout symptoms (9) and sick leave among teachers (10).

From a societal perspective, the key to the well-being of both pupils and teachers may lie in school resource allocation, usually defined as the pupil-teacher ratio (PTR). In both the short- and long-term, small classes (<20 pupils) in the first three grades have been found to have a positive effect on pupil outcomes such as academic achievement, referrals to special education, and discipline problems (11, 12). Studies on the benefits of reduced class sizes for pupils' health have shown mixed findings (13), and the health benefits of reduced class sizes for teachers are unknown. However, general education teachers indicate that they would have more positive attitudes towards the inclusion of SEN pupils if class sizes were reduced to 20 pupils (14).

In the present study, we examined whether the percentage of SEN pupils at Finnish basic education schools was associated with the rate of sickness absence among teachers. Furthermore, we examined whether teacher resources at school, represented as PTR, had an impact on the association between the percentage of SEN pupils and teacher sickness absence.

Methods

Participants

Data were obtained as a part of the Finnish Public Sector Study (10, 15, 16) from the employers' registers of 11 municipalities for the school year 2004–2005, pertaining to 10 266 teachers working in 470 schools that provide basic education. Teacher sickness absence records for short (1–3 days) and long (>3 days) absence spells and records concerning teachers' age, gender, occupation, and job contract, were obtained from employer registers. School-level information was collected from school administrations, including the number of pupils stratified by pupils in general education and pupils with SEN. The Ethics Committee of the Finnish Institute of Occupational Health approved the study.

We excluded teachers in one municipality (43 schools) and 23 schools in another municipality due to missing school-level data on the percentage of SEN pupils, leaving a sample of 8880 teachers working in 404 schools in 10 municipalities. Furthermore, we excluded 791 teachers with <6 months of service. Thus, the final analytic sample consisted of 8089 teachers (79% of the original teacher sample). The majority (92%) of the teachers worked in the five largest cities in Finland

(Helsinki, Vantaa, Espoo, Turku, and Tampere), and 8% worked in smaller municipalities. These participating schools provided education for 124 034 pupils.

Measurements

Percentage of pupils with SEN at school. Each school routinely records the numbers of pupils in general and special education each year. SEN pupils were those that were (i) fully integrated within general classes, (ii) partly integrated, or (iii) not integrated (ie, placed in special classes in general schools). Special education schools were not included in this study. Fully integrated pupils are taught by general education teachers. Partly integrated pupils are taught by special education teachers in special classes, but they spend most of their school day in general classes (17). SEN pupils are integrated during lunch hours and other breaks even in the cases where they spend their whole school day in special classes. The percentage of SEN pupils at each school was calculated as the number of SEN pupils at a school divided by the total number of pupils at school, multiplied by 100. The SEN pupil percentage ranged from 0–37%, with a mean of 4.9%. We classified the variable into quartiles: 1=<1.2%; 2=1.2–4.9%; 3=5.0–9.5%; 4=>9.5%.

In Finland, the grounds for decision of acceptance or transfer to special education are determined by local school authorities. In 2010, a total of 21% of pupils who were accepted/transferred to special education were assessed as having learning difficulties caused by impaired linguistic development (dysphasia). A further 16% were assessed as having cerebral dysfunction, physical disability, or similar, 13% as having emotional disturbance or social maladjustment, 16% as having slightly delayed development, 6% as having severely delayed development, 3% as having learning difficulties related to autism or Asperger's syndrome, and 1% as having visual or hearing impairment (18).

Pupil-teacher ratio. PTR were calculated for each school by dividing the number of all pupils at a school by the number of teachers at the beginning of the school year (1 September 2004). In the 404 schools for which there was also SEN pupil percentages, the PTR variable ranged from 8.0–53.1. We classified the variable into quartiles: 1= \leq 12.8; 2=12.9–15.3; 3=15.4–18.0; 4= $>$ 18.0.

Teachers' sickness absence. Data on short- (1–3 days) and long-term (>3 days) sickness absence spells over a timeframe (school year) from 1 September 2004 to 31 May 2005 were obtained from employers' registers. In the target organizations, as in other public sector workplaces in Finland, all sickness absence certificates, irrespective of where they are issued, must be forwarded to the employer for recording. From these records, we

calculated the number of short- and long-term absence spells for each teacher. Our outcome variable was 0=no sickness absences; 1=only short-term spells; 2=long-term absence spells (with or without short-term spells).

Individual and school-level covariates. Individual-level covariates included teachers' age, gender, type of job contract (permanent versus fixed-term), and occupation (general education teacher/special education teacher/headmaster). School-level covariates included school type [primary (grades 1–6)/lower secondary (grades 7–9)/all comprehensive school (grades 1–9)] and school size (total number of pupils on 1 September 2004).

Statistical analysis

Because individual teachers were nested in schools and schools were nested in municipalities, we used a multilevel data structure with teachers at the first level, schools at the second level, and municipalities at the third level [SAS software, GLIMMIX Procedure, (SAS Institute, Cary NC, USA)]. We used multinomial regression models with a generalized logit link function to examine the risk of sickness absence and estimate the odds ratios (OR) with their 95% confidence intervals (95% CI) for quartiles of SEN pupil percentages adjusting for individual- and school-level covariates. Teachers with only short-term absence spells and teachers with long-term absence spells (with or without short-term spells) were simultaneously compared to teachers without absences (reference group).

With the PTR \times SEN pupil percentage interaction, we tested the equality of trends in groups of low and high PTR (median split to obtain the necessary statistical power). To control for the possible confounding factors, we adjusted the models using teachers' individual and school-level characteristics. We also estimated the variance components (random effects) of sickness absence to take into account the school- and municipality-level variance. The median OR (MOR) was calculated to translate the school- and municipality-level variance to the OR scale (19). MOR is always ≥ 1 , with 1 indicating no second- or third-level variation.

Results

In the sample, 76% were women and 24% were men, 67% had a permanent job contract, and 33% had a fixed-term job contract. A total of 87% were general education teachers, 9% were special education teachers, and 3% were headmasters. The mean age in the study group was 42.4 [standard deviation (SD) 10.3] years. With regard to school type, 58% worked in primary schools (grades

1–6), 31% in lower secondary schools (grades 7–9), and 11% in comprehensive schools that included grades 1–9. The number of pupils in school (ie, school size) varied from 19–1088.

Table 1 shows the characteristics of teaching staff and the characteristics of schools by school-level percentage of SEN pupils. Schools having the highest percentage ($>9.5\%$ of SEN pupils) had fewer male teachers, fewer teachers with permanent job contracts, and more special education teachers. These schools were also larger in size. The PTR decreased as the percentage of SEN pupils at school increased. A high percentage of SEN pupils was more common in lower secondary than primary schools.

Table 2 shows the characteristics of teaching staff and schools by the PTR. In schools with the lowest PTR (ie, highest teacher resources), teachers were older and there were more special education teachers and a higher SEN pupil percentage. Furthermore, the PTR was higher in primary (mean 18.0, SD 4.0) than lower secondary schools (mean 12.5, SD 1.9). This is in line with OECD statistics from 2008 that showed the average PTR in Finnish primary and lower secondary schools were 14.4 and 10.6, respectively (20).

During the study period, 28% of teachers (N=2291) had no sickness absences. A total of 41% (N=3285) had at least one short-term (1–3 days) but no long-term absences, with the number of short-term absence spells ranging from 1–15 per person. A total of 31% (N=2513) had at least one long-term sickness absence (with or without short-term absences). The number of absence spells ranged from 1–20 and 1–7 for short- and long-term absences, respectively.

In the final model adjusted for teacher- and school-level covariates, the OR of short-term sickness absence (versus no absences) among teachers working in schools with the highest percentage of SEN pupils was 1.4 (95% CI 1.2–1.7) when compared to teachers working in schools with the lowest percentage. Working at a school with a moderate (second) level of SEN pupils was associated with 1.2-fold (95% CI 1.0–1.5) risk for teachers' short-term absence compared to schools with the lowest percentage of SEN pupils. After adjustment for all covariates, the risk of having long-term absences (versus no absences) was higher (OR 1.5, 95% CI 1.2–1.8) for teachers in schools with the highest percentage of SEN pupils. The risk was also higher for teachers working at schools with a moderate (second) level of SEN pupils (OR 1.3, 95% CI 1.0–1.5) compared to schools with the lowest levels (table 3).

As shown in table 3, the OR for the effect of SEN pupil percentage on both short- and long-term absence increased substantially in the adjusted compared to the unadjusted model, which indicates a suppression effect of some or one of the covariates (21). Of the covariates,

Table 1. Teacher and school characteristics by percentages of pupils with special educational needs. Figures are means and standard deviations (SD) at school level.

Teacher and school characteristics	Percentage of pupils with special educational needs (by quartiles)																P-value ^a				
	All schools				Lowest (<1.2%)				Second (1.2–4.9%)				Third (5.0–9.5%)					Highest (>9.5%)			
	N	Mean	SD		N	%	Mean	SD	N	%	Mean	SD	N	%	Mean	SD		N	%	Mean	SD
Schools	404			138				108				81				77					
Primary schools	289				38.1				27.7				18.3				15.9				
Lower secondary schools	83				24.1				26.5				22.9				26.5				
Age of teachers (years)		42.4	3.6			42.7	3.9			41.4	3.5			42.9	3.6			42.7	3.1	0.52	
Male teachers (percent)		24.0	10.1			26.3	11.7			23.5	9.3			21.4	9.0			23.0	8.3	0.003	
Teachers with fixed-term job contract (percent)		34.1	16.8			28.5	18.3			35.6	15.9			35.0	14.9			41.1	13.8	<0.001	
Special education teachers (percent)		8.3	7.9			4.4	5.2			6.3	5.0			10.3	6.3			16.1	10.1	<0.001	
School size (number of pupils)		307	159			244	153			305	144			375	172			351	132	<0.001	
Pupil-teacher ratio		16.7	4.6			17.9	4.8			17.7	5.1			16.0	3.7			14.2	2.7	<0.001	

^a Indicates the statistical significance of the Pearson correlation between the percentage of pupils with special educational needs variable and teacher and school characteristics.

Table 2. Teacher and school characteristics by pupil-teacher ratio at school. Figures are means and standard deviations (SD) at school level.

Teacher and school characteristics	Pupil-teacher ratio at school (by quartiles)												P-value ^a				
	Lowest (<12.9)				Second (12.9–15.3)				Third (15.4–18.0)					Highest (>18.0)			
	N	%	Mean	SD	N	%	Mean	SD	N	%	Mean	SD		N	%	Mean	SD
Number of schools	69				83				112				140				
Primary schools (N=289)		4.8				15.6				33.2				46.4			
Lower secondary schools (N=83)		56.6				37.4				6.0				0			
Mean age of teachers (years)			43.4	4.0			42.9	2.8			42.1	3.5			41.8	3.9	0.001
Male teachers (percent)			26.6	9.5			23.8	9.8			23.1	9.6			23.4	10.8	0.05
Teachers with fixed-term job contracts (percent)			33.0	14.7			38.1	15.5			34.1	16.6			32.4	18.3	0.26
Special education teachers at school (percent)			9.8	9.3			10.9	9.8			8.4	6.6			5.9	5.9	<0.001
School size (number of pupils)			298	124			334	156			320	173			285	162	0.23
Pupils with special educational needs (percent)			7.1	6.5			7.4	7.0			4.3	4.4			2.9	4.5	<0.001

^a Indicates the statistical significance of the Pearson correlation between the pupil-teacher ratio variable and teacher and school characteristics.

teachers' age, gender, occupation, school type, and PTR were significantly associated with teachers' absences. The association between SEN pupil percentage and teacher absences emerged only after adding school type and PTR into the model.

Since PTR were higher in primary than lower secondary schools, we tested the interaction of PTR × school type in explaining teachers' sickness absences. The interaction was however not significant (P=0.38). Thus, school type was used as a covariate in the adjusted

model. PTR were associated with short-term absences; having a higher number of pupils per teacher at school increased the risk for teachers' short-term absences. The risk of short-term absences for teachers was 1.3–1.4 fold in schools having a PTR higher than the lowest quartile. PTR were not associated with the odds of having long-term absences in the adjusted model (table 4.)

There was significant variance in the type of teachers' sickness absence at both the municipality- and school-level. Regarding short-term absences only, both

Table 3. Associations between the percentage of pupils with special educational needs (SEN) at school and teachers' (N=8089) sickness absences. Multinomial regression models. [OR=odds ratio; 95% CI=95% confidence interval; Ref=referent]

Percentage of pupils with SEN at school	N	Short-term absences only versus no sickness absences						Long-term absences (with or without short-term absences) versus no sickness absences					
		Unadjusted model			Adjusted model ^a			Unadjusted model			Adjusted model ^a		
		OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
<1.2%	2008	Ref			Ref			Ref			Ref		
1.2–4.9%	2019	0.87	0.73–1.03	0.10	0.94	0.80–1.11	0.46	0.98	0.81–1.17	0.79	1.05	0.87–1.26	0.61
5.0–9.5%	2042	1.05	0.88–1.25	0.58	1.22	1.02–1.45	0.03	1.12	0.92–1.35	0.26	1.27	1.04–1.54	0.02
>9.5%	2020	1.13	0.94–1.35	0.19	1.39	1.15–1.68	<0.001	1.20	0.98–1.46	0.07	1.45	1.17–1.80	<0.001
P for trend ^b				0.03			<0.001			0.03			<0.001

^a Adjusted for teachers' gender, age, employment contract (permanent/fixed-term), occupation (general/special education/head teacher) and for school-level variables of school size, school type (elementary/lower secondary/comprehensive), and pupil–teacher ratio.

^b Percentage of pupils with special educational needs variable entered as continuous.

Table 4. Associations between pupil–teacher ratios at school and teachers' sickness absences. Multinomial regression models. [OR=odds ratio; 95% CI=95% confidence interval; Ref=referent]

Pupil–teacher ratio	N	Short-term absences only versus no sickness absences						Long-term absences (with or without short-term absences) versus no sickness absences					
		Unadjusted model			Adjusted model ^a			Unadjusted model			Adjusted model ^a		
		OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
≤12.8	1850	Ref			Ref			Ref			Ref		
12.9–15.3	2017	1.39	1.18–1.63	<0.001	1.26	1.06–1.50	0.009	1.11	0.92–1.32	0.27	0.98	0.81–1.20	0.87
15.4–18.0	2190	1.68	1.44–1.97	<0.001	1.35	1.08–1.68	0.008	1.49	1.26–1.78	<0.001	1.14	0.89–1.46	0.29
>18.0	2032	1.64	1.39–1.93	<0.001	1.31	1.03–1.69	0.03	1.59	1.34–1.90	<0.001	1.20	0.92–1.58	0.18
P for trend ^b				<0.001			0.08			<0.001			0.08

^a Adjusted for teachers' gender, age, employment contract (permanent/fixed-term), occupation (general/special education/head teacher), and for school-level variables of school size, school type (elementary/lower secondary/comprehensive), and percentage of pupils with special educational needs at school

^b Pupil–teacher ratio variable entered as continuous.

school- and municipality-level MOR were small in size (1.18 and 1.19, respectively). The school- and municipality-level MOR for long-term absences were also rather small (1.24 and 1.23, respectively). The municipality- and school-level variances were no longer significant after adjustments for the SEN pupil percentage, PTR, and other relevant covariates (table 5).

We tested for equality of trends (in SEN pupil percentage) in groups of low and high PTR (median split) using a PTR × SEN pupil percentage interaction. In the adjusted model, the differences in the risk of short- or long-term absences between PTR groups approached, but did not reach statistical significance (P for interaction=0.10). Regarding long-term absences, we found that when the PTR was below the median (<15.3), having a higher percentage of SEN pupils was associated with slightly (7%) higher risk of absence (95% CI 0.99–1.17). However, when the PTR was above the median (>15.3), having a higher percentage of SEN pupils was associated with a considerably (22%) higher risk for long-term absence (95% CI 1.1–1.4). By increasing number of SEN pupils, the risk for short-term absence was slightly (10% and 16%) higher on both groups of PTR (table 6).

Since it was possible that, despite adjustment, differences in the number of special education teachers between schools were driving the results regarding SEN pupil percentage and teacher sickness absence, we performed sensitivity analyses with general education teachers only (N=7068). This diluted the association between the PTR and short-term sickness absence. The OR of both long- and short-term sickness absence (versus no absences) among teachers working in schools in the highest quartile of SEN pupil percentage was 1.4 (95% CI 1.1–1.7) when compared to teachers working in schools in the lowest quartile. The interaction effect of PTR × SEN pupil percentage was similar to that presented earlier.

Moreover, we performed additional sensitivity analyses where teachers in schools with extremely high percentage of SEN pupils (>20%; 8 schools) and extremely high PTR (>25%; 9 schools) were excluded. A total of 267 teachers (3%) were excluded, resulting in a sample size of 7822. The associations between percentage of SEN pupils, PTR, and teachers' absences however remained similar to those presented in tables 3–5. Furthermore, although controlling for random effects (ie, the variances between municipalities and schools)

Table 5. Summary of random effects of associations between the percentage of pupils with special educational needs (SEN) and pupil-teacher ratio (PTR) at school and teachers' (N=8089) sickness absences. Multinomial regression models. [SE=standard error; MOR=median odds ratio]

	School variance	SE	P-value	MOR	Municipality variance	SE	P-value	MOR
Short-term absences only versus no sickness absences								
Empty model	0.031	0.016	0.03	1.18	0.035	0.021	0.05	1.19
Unadjusted model with percentage of SEN pupils at school as a predictor	0.028	0.016	0.04	1.17	0.034	0.021	0.05	1.19
Unadjusted model with PTR at school as a predictor	0.016	0.015	0.14	1.13	0.037	0.022	0.05	1.20
Adjusted model with both percentage of pupils with SEN and PTR at school as predictors ^a	0.003	0.014	0.42	1.05	0.015	0.012	0.09	1.13
Long-term absences (with or without short-term absences) versus no sickness absences								
Empty model	0.052	0.020	0.006	1.24	0.047	0.033	0.08	1.23
Unadjusted model with percentage of SEN pupils at school as a predictor	0.049	0.020	0.007	1.19	0.044	0.032	0.09	1.22
Unadjusted model with PTR at school as a predictor	0.041	0.019	0.02	1.24	0.050	0.034	0.07	1.24
Adjusted model with both percentage of SEN pupils and PTR at school as predictors ^a	0.029	0.018	0.06	1.18	0.023	0.022	0.15	1.16

^a Adjusted for teachers' gender, age, employment contract (permanent/fixed-term), occupation (general/special education/head teacher) and for school-level variables of school size, school type (elementary/lower secondary/comprehensive).

Table 6. Associations between increase of one quartile in the percentage of pupils with special educational needs (SEN) at school and teachers' sickness absences (versus no sickness absences) according to the level of pupil-teacher ratio (PTR) (median split). Multinomial regression models. [OR=odds ratio; 95% CI=95% confidence interval]

PTR and increase of one quartile in the percentage of pupils with SEN at school ^a	Short-term absences only versus no sickness absences						Long-term absences (with or without short-term absences) versus no sickness absences					
	Unadjusted model			Adjusted model ^b			Unadjusted model			Adjusted model ^b		
	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
PTR below median (≤ 15.3)	1.14	1.05–1.23	<0.001	1.10	1.02–1.19	0.01	1.12	1.04–1.22	0.005	1.07	0.99–1.17	0.09
PTR above median (>15.3)	1.14	1.05–1.24	0.002	1.16	1.06–1.26	<0.001	1.20	1.10–1.32	<0.001	1.22	1.11–1.33	<0.001

^a The P-value for the interaction term "PTR \times percentage of pupils with special educational needs at school" was 0.45 in the unadjusted and 0.10 in the adjusted model.

^b Adjusted for teachers' gender, age, employment contract (permanent/fixed term), and occupation (general/special education/head teacher), and for school-level variables of school size, and school type (elementary/lower secondary/comprehensive).

accounts for the differences between them, our results were also robust for additional adjustment for average income level of the residents in the school neighborhood (data not shown).

Finally, we analyzed whether SEN pupil percentage and PTR were associated with the total number of days absent due to illness. There was no school- or municipality-level variance in total days absent. On average, teachers were absent for 9 (SD=21, range 0–273) days during the study period. With multilevel negative binomial regression analyses adjusted for the same covariates as in previous models, we found no association between SEN pupil percentage or PTR and number of days absent due to illness. The interaction of SEN \times PTR when explaining total days absent was also nonsignificant (P=0.50). The only significant predictors of total days absent were teachers' female gender and higher age.

Discussion

We found that having a higher percentage of pupils with SEN at school was associated in a graded manner with an increased risk of short- and long-term sickness absences among teachers. In addition, PTR >12.8 was associated with increased risk for teachers' short-term absences. In the unadjusted models, PTR seemed to have a stronger effect on teachers' absence (especially short-term), but after adjustment for school type and PTR, the effect of SEN pupil percentage on teacher absences emerged. Further analyses on the relationship between SEN pupil percentage at school, PTR, and teachers' absences suggest an effect modification so that the higher the prevalence of pupils with SEN at school, the stronger the association between PTR ("pupil overcrowding") and teachers' sickness absence, especially long-term absence.

Our findings on the adverse effects of a high percentage of pupils with SEN on teachers' well-being are in line with previous studies showing an association between the percentage of SEN pupils in class and teachers' perceptions of depersonalization (cynicism, a component of burnout) (9) and an association between pupils' problem behavior and teachers' short-term sickness absences (10). Problem behavior is arguably more common among SEN pupils, especially those who are emotionally disturbed or socially maladjusted; behavioral and emotional disorders, and socioeconomic, cultural, and linguistic disadvantages are known risk factors for delinquency (22). Earlier research has also shown that special education teachers are exposed to both mental abuse and physical violence far more often than teachers in general education (23, 24). In the present study, adjustment for teacher type (general, special education, or head teacher) did not affect the results, but the association between short-term absences and PTR was diluted when the analyses were restricted to general education teachers only. This may indicate that, with increasing PTR, the risk for short-term sickness absences may increase especially among special education teachers.

The total-days-absent variable, which was not associated with SEN pupil percentage or PTR, is usually dominated by few individuals with very long absences. Thus, we conclude that the increased risk for absences among teachers in schools with high SEN pupil percentage and PTR is likely to be due to shorter, rather than longer absence periods.

While inclusion of SEN pupils to general education has been shown to promote the well-being of these pupils (6–8), many teachers in general education perceive it to be emotionally straining (9, 25). Teachers might feel that they do not possess the qualifications to deal with SEN pupils and that the education of other pupils in general education suffers due to discipline problems and the extra time devoted to SEN pupils and their families. In an Australian survey, 89% of teachers believed that their ability to teach other pupils as effectively as they would like to was reduced, and 96% felt that their possibility to monitor other pupils in the class was diminished when having a child with an intellectual disability in the class (26). Our results highlight the role of teacher resources. The association between increasing percentage of SEN pupils and long-term sickness absences among teachers was not as strong in schools where the PTR was below the median (<15.3) compared to schools where the PTR was above the median. Providing good resources in terms of fewer pupils per teacher is therefore likely to promote the well-being of teachers.

We observed a statistically significant variation between schools and municipalities with regard to teachers' sickness absences. The observed variance

in teachers' sickness absence between schools and municipalities diluted after individual- and school-level covariates were included in the models, suggesting that our predictor variables and covariates explained to a large degree the variance in teachers' absences at both the municipality and school level.

Strengths and limitations

The major strength of our study was the use of extensive register data from independent sources. Furthermore, our findings were based on multilevel modeling that took into account the hierarchical structure of the dataset (teachers nested in schools and schools nested in municipalities).

However, this study also had some limitations. First, we were unable to distinguish the different types of SEN pupils at schools. It is plausible that the type of handicap/disability the pupil has plays a role in the mechanism through which the percentage of SEN pupils is associated with teachers' sickness absence. A further limitation is that we were not able to control for all potential confounding factors for sickness absences, such as teachers' socioeconomic status and health behaviors, variables related to pupils' school satisfaction, and other indicators of the psychosocial climate at school, which have been shown to predict teachers' absences (15). For example, absence due to illness is more common among workers in lower occupational grades (27, 28). Thus, residual confounding is possible. However, in Finland, all permanent teachers have a Master's degree, and the salary of municipal sector school teachers is based on a collective labor agreement, which leads to little variation in teachers' socioeconomic position (16). The socioeconomic differences between schools were taken account since the variance between schools (random effects) was controlled in our models, and further adjustment for average income level of the residents in the school neighborhood did not change the results found.

In addition, the measure of PTR was based on administrative data sources, and we could not use actual class size as an outcome variable. In earlier studies, low PTR have failed to show any correlation with pupil achievement, which has led researchers to argue that PTR aggregated at school levels do not accurately describe the day-to-day setting in which pupils are learning. PTR include also teachers' non-contact time (ie, time teachers spend at school performing tasks other than teaching) (29). Moreover, it is possible that within schools, there is variation in class sizes that we were not able to take into account.

Due to the fact that PTR and class sizes are calculated differently, PTR are somewhat lower than class sizes. The average class size in Finnish primary schools in 2008 was 19.8 pupils, and the corresponding PTR

was 14.4. According to OECD statistics (30), the PTR seems slightly lower in Finland than other EU or OECD countries, but the PTR are not totally comparable across countries, which limits the generalizability of the results.

These limitations related to the use of specific register-based data may have had an effect on the estimates of risk of teachers' absence. For example, the use of PTR instead of class size may have somewhat weakened the effect. Moreover, psychosocial work climate at school, pupils' socioeconomic background, and percentage of pupils needing special education are interrelated (ie, there are more problems in psychosocial school environment in schools located in disadvantaged neighborhoods) (31). Most likely, psychosocial problems are also more prevalent with increasing number of pupils with SEN. This would indicate that the estimates presented in this study are somewhat confounded.

Concluding remarks

A higher prevalence of SEN pupils at school was associated with a higher risk of short- and long-term sickness absences among teachers. The reasons behind these associations are unknown but may be related to work overload and associated emotional strain among teachers. This hypothesis is supported by the finding that the association between the percentage of SEN pupils and teachers' long-term sickness absence was significantly increased when the number of pupils per teacher was high, indicating work overload. While inclusion of SEN pupils to general education has been shown to promote the well-being of these pupils, our results suggest that to ensure the well-being of teachers as well, more teacher resources may be needed at schools with a large percentage of SEN pupils.

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