Teacher stress and contextual and compositional elements of school environment

Nichola Shackleton[1] (PhD), Chris Bonell[2] (PhD), Farah Jamal[2] (PhD), Elizabeth Allen[3] (PhD), Anne Mathiot[1] (MSc), Diana Ellbourne[3] (PhD) & Russell M. Viner[1] (PhD)

[1]General and Adolescent Paediatrics, Population, Policy & Practice Programme,
Institute Of Child Health, University College London.
[2] Social Science Research Unit, Institute of Education, University College London.
[3] Department of Medical Statistics, London School of Health and Tropical Medicine

30 Guilford St. London
WC1N 1EH
n.shackleton@ucl.ac.uk
02079052112

Acknowledgements: We would like to thank all the young people and teachers in participating schools for providing data and the Inclusive trial research team for undertaking the work that made this paper possible.

Word Count: 3991

Key words: Paediatric, Public Health, Child Health, Inequalities, Trends,

Competing interests: None

Funding: The INCLUSIVE trial is funded by the National Institute of Health Research (NIHR) Public Health Research programme (Grant Reference 12/153/60)

ABSTRACT

BACKGROUND

Teachers report higher levels of stress than most occupational groups. Burnout is a specific psychological condition that results from chronic job stress characterised by emotional exhaustion, low personal accomplishment and depersonalisation. This study considers associations between aspects of the school environment and teacher burnout.

METHODS

Exploratory analysis of baseline data from a cluster randomised controlled trial of 40 schools and 2278 teachers in the UK. Multilevel methods were used to consider the associations between different compositional and contextual aspects of the school environment and teacher burnout.

RESULTS

There was evidence for school effects on teacher burnout, evidenced by ICCs and likelihood ratio tests, supporting the association between school environment and teacher burnout. The factors most consistently associated with teacher burnout in our study were teachers' perceptions of the school's safety and support and student attitudes to learning.

CONCLUSIONS

The school environment does influence teacher burnout. More research is needed to develop and test causal pathways between the school environment and teacher burnout, and to understand ecological and individual predictors of teacher burnout and the interaction between the two.

INTRODUCTION

Teachers report very high levels of stress compared to other occupational groups (1, 2). For example, recent estimates from the Self-reported Work-related Illness questionnaire module in the national Labour Force Survey (UK) demonstrate more than double the average rates of self-reported stress, depression and anxiety for the teaching profession (3). Teacher stress has been defined as the experience of unpleasant emotions in response to the perception of threat in dealing with the demands made of them satisfactorily (4). A closely linked concept is teacher burnout, which has been described as the inability to function effectively in one's job as a consequence of prolonged exposure to stressors on the job (5, 6). Burnout is a psychological condition of three components: emotional exhaustion, reduced personal accomplishment, and depersonalisation (7). Emotional exhaustion refers to feelings of fatigue that develop as emotional energies become drained. Reduced personal accomplishment refers to a decrease in self-competence and dissatisfaction with personal achievements. Depersonalization is the interpersonal component and refers to the development of negative and uncaring attitudes towards others (8).

The two prevailing theories on stress suggest that working in "high strain" jobs (where there are high demands and low control)(9), or jobs which require high efforts and offer few rewards (10), elicits sustained stress reactions with negative long-term consequences for physical and mental health. This is supported by a substantial body of evidence linking adverse psychosocial work environments with an increase in the incidence of cardiovascular disease (11-17), and work-stress related anxiety and depressive illnesses (18).

Teacher burnout has been linked to increases in absenteeism, turnover, and intention to leave, negative work attitudes, and a reduction in teaching performance (19-22). Indeed teacher retention is a crucial issue, with the number of children in state schools in the UK set to increase by one million in the next decade (23). Yet the Ofsted chief, sir Michael Wilshaw, stated that two fifths of teachers in the UK leave the profession in the first five years (24), and recent statistics support this with 73% of newly qualified teachers reporting that they have already considered leaving the profession (25). Teachers who are burned out tend to show reduced commitment to the job and to their students (26). This leads to lower quality student teacher relationships, which have been associated with decreased student engagement with learning and ultimately lower achievement (27), as well as reductions in student well-being and increases in risk taking behaviours (28).

There has been a focus on Individual teacher characteristics as possible predictive factors of burnout, such as ethnicity, experience, personality and psychological resources such as self-efficacy or resilience (8, 29, 30). Yet, there is a burgeoning literature on the important role that context plays in health (21, 31). Research clearly demonstrates the influence that the physical, social and organisational aspects of the school environment can have on student's health behaviours (29, 32). Given that teachers spend more time on the school premises than students, the school environment is also likely to be influential on teachers' health and wellbeing. As teachers form part of the part of the school environment any influence on teacher's well-being may also indirectly affect student well-being. Generally, where researchers have considered the relationship between school environment and teacher burnout, the focus has been on teacher's perceptions of their environment (32-35), which is problematic, as burnout likely influences teachers' perceptions of their environment.

The effects of environments on health can occur due to both compositional factors (which people are found in a place) and contextual factors (the characteristics of a place) (36). Within this paper we explore the relationships between compositional and contextual elements of the school environment and teacher burnout. We consider aspects of the school environment that relate to higher "demand" or "effort" and lower "control" or "rewards" for the teacher, as well as school autonomy and resources.

The compositional elements considered in this paper are: the percentage of students eligible for free school meals, the percentage with special education needs and the percentage who speak English as a second language, whether the school is single sex or mixed, as well as student's attitude to learning. The contextual elements we consider are: the type of school, the size of the school, the student to teacher ratio, school quality, the deprivation of the area in which the school resides, whether teachers feel safe at the school, and whether they feel supported.

This study is important for understanding the relationship between the school environment and teacher burnout. It improves upon other research by using a much larger sample size in terms of number of schools and teachers and by including objective measures of the school environment. These cross-sectional findings will be used to generate hypotheses that will be tested using the longitudinal data that will generated from the INCLUSIVE trial.

METHODS

Participants

We used baseline data from the INCLUSIVE trial, a 3 year cluster randomised controlled trial aimed at reducing student bullying and aggressive behaviours and improving staff health outcomes. It is a universal intervention delivered in secondary schools in England. Only data from the baseline phase of the intervention has been collected to date. The sample consists of 40 secondary schools within the state education system across south-east England. Schools exclusively for those with learning disabilities, pupil referral units and schools with an Ofsted rating of 'inadequate/poor' were not included in the sample (37). Full details of the sampling methodology are available in the study protocol (37).

At baseline, all school teaching and teaching assistant staff were asked to complete a questionnaire. Of these, 2278 responded. In one school (survey ID 'BM'), all teachers and teaching staff refused to complete the teacher survey. National statistics on the school workforce in England were used to calculate denominators to calculate response rates and provide additional information on schools and the school environment (38). However one of the schools (survey ID 'AX') was missing this information is it was impossible to calculate response rates for this school. Response rates in the other schools averaged 65% (SD=16.6; range 12-88%).

instrumentation

Outcome variable

Teacher burnout was assessed using the 22-item Maslach Burnout Inventory (MBI) with subscales measuring emotional exhaustion (EE: 9 items), personal accomplishment (PA: 8 items), and depersonalisation (DP: 5 items). Responses are scaled from "never"(0) to "every day" (6) with subscale scores calculated by summing items. Severe levels of burnout are indicated by higher scores for EE, lower scores for PA and higher scores for DP. High burnout is indicated by scores greater than or equal to 27 on EE, at or below 35 for PA, and greater than or equal to 14 for DP. The MBI consistently performs well in terms of measures of internal consistency (39). Furthermore confirmatory factor analysis supports the three factor structure of the MBI, even across countries (40-44).

Independent Variables

We examined several compositional measures using school level averages from Department for Education performance tables (45). Free school meals entitlement (FSM) is widely used as a proxy

measure for entitlement to benefits receipt and economic deprivation (46, 47). We used six year averages. In England, schools receive additional resources for students entitled to FSM (48) so that FSM may also be indicative of school resources.

Special educational needs (SEN) status refers to children who have learning difficulties or disabilities that make it harder for them to learn than most children of the same age. Research indicates that teachers in schools specifically for those with SEN have higher levels of stress and burnout than in mainstream schools (49) and that higher proportions of children with SEN in schools is also associated with increased teacher burnout (50). English as an additional language (EAL) status refers to the proportion of students within the school whose main language is not English.

Schools were categorised as mixed or single sex. Research suggests that the culture of single sex schools may be different than in mixed schools(51) but evidence for differences in student performance or attitudes in single sex versus mixed schools is inconsistent (51, 52).

Teachers' perceptions of students attitudes to learning were measured using 8 questions previously administered in the class teacher questionnaire of the Avon longitudinal study of parents and children (ALSPAC) survey(53). Example questions include "most students at this school want to do well in tests and exams" and "many students don't do as well as they could because they are afraid that other students won't like them. These questions are scores on a scale from "yes, totally agree"(0) to "No, totally disagree"(3). Items were coded so that lower scores indicated a better attitude to learning and higher scores indicate a worse attitude.

We also measured several contextual characteristics of the school institution. There are five types of schools in our sample: voluntary aided (n=4), community (n=5), sponsor led academy (n=6), converter academy (n=18), or foundation (n=6). Voluntary aided, community and foundation schools are all maintained schools. They differ only in who employs the staff, who owns the land and buildings and who controls the admissions arrangements(54). In our sample all voluntary aided schools were faith schools. Academies don't have to follow the national curriculum except in core subjects and they can set their own term times and change the length of school days. Most sponsor-led academies were poorly performing state schools that have been taken over by new management. They receive additional funding from sponsors such as businesses, faith groups or universities. These sponsors are responsible for improving the performance of their schools. Most academy converter schools are high performing schools which have opted out of local authority control to gain independence and autonomy.

We also measured school quality. Schools inspections are carried out by the Office for Standards in Education, Children's Services and Skills (Ofsted). Schools are given an overall classification based on the quality of the teaching, quality of leadership and management at the school, achievement of students, and behaviour and safety of students at the school. These ratings are outstanding (n=10), good (n=24), requires improvement (n=4), or inadequate (not included in sampling frame).

Size of school: there is a literature on the influence of the size of the school on student, teacher and school outcomes (55). The total number of students enrolled at the school was acquired from school performance tables (38). The total number of students was divided by 100, so that coefficients would be expressed per 100 student increase in school size.

Student/teacher ratio: this has been used as an indicator of resources available and resource allocation in schools (56). These ratios are also used as a general way to measure teacher workloads and the amount of individual attention child is likely to receive. However, there is a cost associated with lowering student-teacher ratios, therefore a lower student-teacher ratio may also signal lower salaries for individual teachers and fewer chances for development, as resources are being allocated to accrue more teachers rather than on salaries or training(56). The student/teacher ratio was obtained from the school workforce census.

Deprivation: the deprivation of the area surrounding the school resides using the income domain affecting children index (IDACI) score, i.e. the percentage of children within a specified geographic area (Lower layer super output area) in households in receipt of means tested low income benefits. We used the postcode of the school to retrieve the IDACI from the Department for Education's website.

Teacher perceived safety was assessed by survey asking teachers/ teaching assistants "do you feel safe at this school?" Teacher perceived support was assessed by survey asking staff "how well are members of staff supported with behaviour management at this school by senior members of staff?"

Potential confounding variables

Several measures of teacher characteristics were treated as potential confounders: gender, ethnicity and teaching experience using information provided in response to the teacher survey. A missing gender category was included in all analyses. Ethnicity was recorded in 7 categories: White British /White Other /Asian or Asian British / Black or Black British / Chinese or Chinese British/ Mixed Ethnicity / Other Ethnic Group.

Teaching experience was captured by responses to the following two questions “how long have you worked at this school?” (less than one year/one to five years/more than 5 years) and “how many other secondary schools have you worked at since you qualified as a teacher/became a teaching assistant?” (none/one/two/more than two. Missing categories were included for all control variables.

Analysis

Data were analysed using Stata version 13 (57). Response rates were analysed first (appendix A) followed by descriptive statistics. Descriptive statistics are shown for the three aspects of teacher burnout as continuous scores. We also show the proportions with ‘high’ emotional exhaustion scores (≥27), low personal accomplishment scores (≤35) and high depersonalisation scores (≥14).The intracluster correlation coefficients (ICCs) were estimated in an intercept only multilevel model. The ICC provides the proportion of total variance that is attributed to the school level (58). School level variance in teacher burnout is detailed more in appendix B.

Initially we considered the associations between each of the independent variables and the continuous scores for Emotional Exhaustion, Personal Accomplishment and Depersonalisation adjusted for teacher characteristics. All independent variables that had a p-value <.10 were included in mutually adjusted models including teacher characteristics as control variables (table 2). Following this, interactions were tested where main effects had a p-value <.10, and interaction as substantively meaningful. Results from the interactions are reported in the main text. All models were random intercept models fit using maximum likelihood estimation.

RESULTS

Data were available for 2278 teachers in 39 schools. The descriptive statistics for all included independent variables are shown in table 1. The Cronbach's alpha value for the teacher's perceptions of student's attitude to learning was 0.83. Cronbach's alphas for the three dimensions of burnout: EE, PA, and DP were .90, .78 and .70 respectively. The descriptive statistics for the MBI are shown in table 2. 98.38% of teachers responded to the items regarding EE, 97.72% to items regarding PA and 97.76% to items regarding DP.

Table 2 shows the teacher scores on the MBI and the ICCs. 36% of teachers had high levels of EE, 46% low levels of PA and 9% high levels of DP. The ICCs suggest that the school accounts for a small (EE=5%, PA=2%, DP=5%) but statistically significant proportion of the total variance in teacher burnout. The significance of the school effects was tested using likelihood ratio(LR) tests comparing the multilevel specification to a single level specification (EE: LR=65.84, $p<0.001$| PA: LR=19.58, $p<0.001$ | DP: LR=75.51, $p<0.001$).

Table 3 shows the associations between measures of the school environment and the three dimensions of teacher burnout, adjusting only for teacher characteristics. Factors with borderline significant associations ($p<0.10$) were included in the mutually adjusted models.

Mutually adjusted associations are presented in table 4. Across all three burnout domains, burnout is more likely where teachers perceive they are less safe, less supported, and where teachers perceive students attitudes to learning more negatively, after adjusting for teacher characteristics and other aspects of the school environment that were shown to be associated with that domain. In the mutually adjusted models, there is no longer any variance in DP at the school level which suggests the included variables have accounted for all of the school level differences.

Teacher perceptions of safety and support had a stronger association to EE than to PA or DP. For example teachers who responded that they are safe "some of the time/never" scored on average 8.42 points higher on the EE scale than those who responded that they felt safe "all of the time", substantially more than the difference in PA (-2.13) or DP (2.74) scores. The same pattern is shown for perceived support.

There was some evidence that PA was associated with school type, student/teacher ratio and FSM ($p<0.10$). Teachers in academy-converter schools reported the highest levels of PA (marginal mean=35.93), whereas teachers in voluntary aided schools reported significantly lower scores on PA (-2.34) on average. Higher student to teacher ratios, and higher percentages of students eligible for FSM was associated with higher levels of PA.

DP was significantly associated with school type and single sex status. DP scores are lowest on average in Academy-converter schools (marginal mean=4.95). DP scores are significantly higher on average in Academy-sponsor led schools (1.30 points higher) and foundation schools (0.97 points higher). DP scores are also significantly higher on average (1.24 points) in boys only schools compared to mixed schools.

There was a significant interaction between school type and percentage FSM for PA ($\chi^2(4)=10.03, p<0.05)$). There was also a significant interaction between student-teacher ratio and school type ($\chi^2(4)=14.49, p<0.05)$). These interactions were driven by teachers in voluntary aided schools responding differentially to teachers in all other school types. PA increased notably with increasing percentage of students eligible for FSM and decreased with increasing student teacher ratios in voluntary aided schools. Interactions between school type and students' attitude to learning were statistically significant for both PA ($\chi^2(4)=13.53$, $p<0.05$) and DP ($\chi^2(4)=17.57$, $p<0.05$). Students' attitude to learning had a stronger association to DP and PA in Academy sponsor led schools. There was some evidence that in boys schools the association between students' attitude to learning and DP is weaker than in girls' schools or mixed schools.

The analysis was repeated using ad-hoc methods of dealing with missingness (appendix C) and the results were substantively no different from those presented here.

DISCUSSION

Ours is the first published study to examine objective aspects of the school environment and their influence on teacher burnout. Teacher burnout was disconcertingly common in our sample; across all schools, just over one-third of teachers reported high EE and just under one-half reported low PA, although only approximately 10% reported high DP. We found that teacher burnout varied significantly between schools, indicating that elements of school composition or institutional context play a role in teacher burnout. The proportion of the variance at the school level was larger for EE and DP, indicating that schools influence PA less than EE or DP.

The factors most consistently associated with teacher burnout in our study were teachers' perceptions of the school's safety and support and student attitudes to learning. Low perceptions of safety or support and poor perceptions of student interest in learning were associated with higher levels of all aspects of burnout independently of teacher gender, ethnicity, experience or other aspects of school environment.

In contrast to these associations between teacher perceptions and burnout, which may not be informative as discussed in the limitations, we found less evidence that more objective contextual elements of school environment were associated with burnout. Notably we did not find that school area deprivation, or the proportion of deprived children in a school, was associated with burnout in multivariable models. Given that such associations were seen at the partially adjusted stage, this suggests that the association between deprivation and burnout operates through factors such as student's attitude to learning, teacher perceived safety, student-teacher ratios and type of school attended (see appendix D for an exploration of the relationship between deprivation and other aspects of the school environment).

School type was associated with PA and DP burnout. Teachers in voluntary aided schools had the lowest levels of PA, and teachers in academy sponsor led and foundation schools had the highest scores for DP on average, with the most favourable burnout outcomes seen amongst academy-converter mainstream schools. This suggests there could be fundamental differences between these types of schools that we have not accounted for in our analysis. For example, in voluntary aided schools, whether or not teachers are of the same faith as the school they teach in may influence their satisfaction in teaching certain aspects of that faith, as well as their chances for progression within that school. Equally there may be aspects of the schools culture or ethos that we have not measured which promote or hinder student-teacher relationships or teacher-teacher relationships.

Finally we found no evidence that school quality ratings in the form of Ofsted ratings were associated with teacher burnout. This is interesting because Ofsted ratings arguably link more closely to the "demand" put on teachers (59). Perhaps we need to consider a more complex system of teacher stress, rather than just the demands made of teachers. In some instances demands may also be indicative of how rewarding teaching can be.

Our findings extend those of previous studies of teacher burn-out. Scores on the burnout inventory in our study were highly similar to previous studies of teachers from the USA,(60) Canada, (43) and Norway,(32) supporting the generalisability of our findings.

Strengths and limitations

Our study included a much larger sample sizes in terms of number of schools and teachers than previous research. We improve upon the literature by including objective measures of the school environment, by adjusting for a number of important teacher individual factors and by accounting for the structure of the data in our analysis in multilevel models.

Nevertheless our data are subject to a number of limitations. Firstly and most importantly, where teacher perceptions of the environment have been used (safety, support and student's attitude) not only can the direction of the association not be established, but because both the dependent and independent rely on teacher responses, it may be that the observed association is a reflection of characteristics of the teacher we haven't observed such as pessimism-optimism, and that both variables are reflecting the same personal trait. Secondly, this analysis is based on cross sectional data, so temporal ordering is not possible. Thirdly, there are low response rates from teachers in some schools, suggesting that the teachers who did respond may not represent the teachers in the school as a whole. However, sensitivity analysis was conducted (Appendix A) on schools with response rates of 50% or higher. The results were consistent with those presented in the main text. Fourthly, we only have small numbers of different school types, for example there are only four voluntary aided schools in our sample. Therefore, the differences we observe in burnout by school type, may be a product of having a small and non-representative sample. Fifthly, our results may not be generalizable as our sample was purposively recruited for a randomised controlled trial.

Future research will use the results presented here to formulate and test hypotheses using the longitudinal data generated from the trial and other existing data sources. Repeated measures over time will allow us to get closer to a causal estimate by controlling for unobserved factors that are stable over time. We will also observe temporal sequencing of events. This will allow us to better understand the relationship between the school environment and teacher burnout and provide

recommendation for changes that can be made to the school environment to influence teacher burnout rates.

Conclusions

This explorative study demonstrates a relationship between school environment and teacher burnout. A high prevalence of teachers reported high emotional exhaustion scores and low personal accomplishment scores, comparatively very few teachers reported high depersonalisation scores. More research is needed to develop and test causal pathways between the school environment and teacher burnout, and to understand ecological and individual predictors of teacher burnout and the interaction between the two.

IMPLICATIONS FOR SCHOOL HEALTH

The health of teachers is an important component of promoting the health of young people within the school context. There is an increasing interest on the role that the school environment plays on student's health, and teachers form an integral part of that environment through their interaction with the students. Students are therefore reliant upon teachers to perform well in their role, so that they can perform well academically, socially and behaviourally. Our findings present evidence for a school effect on teacher burnout, suggesting that aspects of the school environment are associated with teacher burnout above and beyond individual teacher characteristics, and that teacher burnout may be amenable to changes in the school environment. This has possible implications for interventions, whereby interventions could address aspects of the school environment that influence both teacher and student health.

REFERENCES

1. Johnson S, Cooper C, Cartwright S, Donald I, Taylor P, Millet C. The experience of work-related stress across occupations. Journal of Managerial Psychology. 2005;20(2):178-87.
2. Smith A, Brice C, Collins A, Matthews V, McNamara R. The scale of occupational stress: A further analysis of the impact of demographic factors and type of job. Cardiff University: Health and Safety Executive, 2000.
3. HSE. Self-reported work-related illness (SWI) and workplace injuries: Results from the Labour Force Survey (LFS). http://www.hse.gov.uk/statistics/lfs/index.htm#stress: Health and Safety Executive website; 2012.
4. Kyriacou C. Teacher stress: from prevalence to resilience. New Horiz Manag. Cheltenham: Edward Elgar; 2011. p. 161-73.
5. Freudenberger HJ. Staff Burn-Out. J Soc Issues. 1974;30:159–65.
6. Maslach C, Schaufeli WB, Leiter MP. Job burnout. Annual review of psychology. 2001;52:397-422.
7. Maslach C, Jackson SE. The Measurement of Experienced Burnout. J Occup Behav. 1981;2(2):99-113.
8. Byrne BM. Burnout - Investigating the Impact of Background Variables for Elementary, Intermediate, Secondary, and University Educators. Teach Teach Educ. 1991;7(2):97-209.
9. Karasek RA. Job Demands, Job Decision Latitude, and Mental Strain - Implications for Job Redesign. Admin Sci Quart. 1979;24(2):285-308.
10. Siegrist J. Adverse health effects of high-effort/low-reward conditions. Journal of occupational health psychology. 1996;1(1):27-41. Epub 1996/01/01.
11. Karasek R, Theorell T. Healthy Work: Stress, Productivity and the Reconstruction of Working Life. New York: Basic Books; 1990.
12. Schnall PL, Landsbergis PA, Baker D. Job strain and cardiovascular disease. Annual Review of Public Health. 1994;15(381-411).
13. Hemingway H, Marmot M. Evidence based cardiology: psychosocial factors in the aetiology and prognosis of coronary heart disease. Systematic review of prospective cohort studies. BMJ. 1999;318(7196):1460-7. Epub 1999/05/27.
14. Kivimaki M, Leino-Arjas P, Luukkonen R, Riihimaki H, Vahtera J, Kirjonen J. Work stress and risk of cardiovascular mortality: prospective cohort study of industrial employees. BMJ. 2002;325(7369):857. Epub 2002/10/19.
15. Kuper H, Marmot M. Job strain, job demands, decision latitude, and risk of coronary heart disease within the Whitehall II study. Journal of epidemiology and community health. 2003;57(2):147-53. Epub 2003/01/24.
16. Belkic KL, Landsbergis PA, Schnall PL, Baker D. Is job strain a major source of cardiovascular disease risk? Scandinavian journal of work, environment & health. 2004;30(2):85-128. Epub 2004/05/07.
17. Chandola T, Britton A, Brunner E, Hemingway H, Malik M, Kumari M, et al. Work stress and coronary heart disease: what are the mechanisms? European heart journal. 2008;29(5):640-8. Epub 2008/01/25.
18. Stansfeld S, Candy B. Psychosocial work environment and mental health--a meta-analytic review. Scandinavian journal of work, environment & health. 2006;32(6):443-62. Epub 2006/12/19.
19. Dworkin AG. When Teachers Give Up: Teacher Burnout, Teacher Turnover and Their Impact on Children. 1985.
20. Ingersoll RM. Teacher turnover and teacher shortages: An organizational analysis. Am Educ Res J. 2001;38(3):499-534.
21. Ronfeldt M, Loeb S, Wyckoff J. How Teacher Turnover Harms Student Achievement. Am Educ Res J. 2013;50(1):4-36.
22. Seidman SA, Zager J. A Study of Coping Behaviors and Teacher Burnout. Work Stress. 1991;5(3):205-16.

23. DfE. Statistical First Release National Pupil Projections: Future Trends in Pupil Numbers: July 20142014 7th July 2015. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/330261/SFR23_2014_Main_Text.pdf.
24. Press Association. Ofsted Chief: two-fifths of teachers quitting within five years is a 'scandal' The Guardian 2014.
25. Association of Teachers and Lecturers. Press realease: New teachers already demotivated about teaching at the start of their careers London: The Education Union; 2015.
26. Dworkin AG. Teacher burnout in the public schools : structural causes and consequences for children. Albany, N.Y.: State University of New York Press; 1987.
27. Klem AM, Connell JP. Relationships matter: Linking teacher support to student engagement and achievement. J School Health. 2004;74(7):262-73.
28. Bonell. C., Jamal. F., Harden. A., Wells. H., Parry. W., Fletcher. A., et al. Systematic review of the effects of schools and school environment interventions on health: evidence mapping and synthesis. Public Health Res 2013;1(1).
29. Schwarzer R, Hallum S. Perceived teacher self-efficacy as a predictor of job stress and burnout: Mediation analyses. Appl Psychol-Int Rev. 2008;57:152-71.
30. Howard S, Johnson B. Resilient teachers: resisting stress and burnout. Social Psychology of Education. 2004;7(4):399-420.
31. Bronfenbrenner U. The ecology of human development : experiments by nature and design. Cambridge, Mass. ; London: Harvard University Press; 1979.
32. Skaalvik EM, Skaalvik S. Does school context matter? Relations with teacher burnout and job satisfaction. Teach Teach Educ. 2009;25(3):518-24.
33. Collie RJ, Shapka JD, Perry NE. School Climate and Social-Emotional Learning: Predicting Teacher Stress, Job Satisfaction, and Teaching Efficacy. J Educ Psychol. 2012;104(4):1189-204.
34. Dorman J. Relationship Between School and Classroom Environment and Teacher Burnout: A LISREL Analysis. Social Psychology of Education. 2003;6(2):107-27.
35. Grayson JL, Alvarez HK. School climate factors relating to teacher burnout: A mediator model. Teach Teach Educ. 2008;24(5):1349-63.
36. Macintyre S, Ellaway A, Cummins S. Place effects on health: how can we conceptualise, operationalise and measure them? Social science & medicine. 2002;55(1):125-39.
37. Bonell C, Allen E, Christie D, Elbourne D, Fletcher A, Grieve R, et al. Initiating change locally in bullying and aggression through the school environment (INCLUSIVE): study protocol for a cluster randomised controlled trial. Trials. 2014;15.
38. GOV.UK. Statistics: school workforce - GOV.UK. 2013 [cited 2015 5th January]; Available from: https://www.gov.uk/government/collections/statistics-school-workforce.
39. Aguayo R, Vargas C, de la Fuente EI, Lozano LM. A meta-analytic reliability generalization study of the Maslach Burnout Inventory. Int J Clin Hlth Psyc. 2011;11(2):343-61.
40. Green DE, Walkey FH, Taylor AJ. The three-factor structure of the Maslach Burnout Inventory: A multicultural, multinational confirmatory study. Journal of Social Behavior & Personality. 1991.
41. Kokkinos CM. Factor structure and psychometric properties of the Maslach Burnout Inventory - Educators Survey among elementary and secondary school teachers in Cyprus. Stress Health. 2006;22(1):25-33.
42. Aluja A, Blanch A, Garcia LF. Dimensionality of the Maslach Burnout Inventory in school teachers: A study of several proposals. Eur J Psychol Assess. 2005;21(1):67-76.
43. Byrne BM. The Maslach Burnout Inventory - Testing for Factorial Validity and Invariance across Elementary, Intermediate and Secondary Teachers. J Occup Organ Psych. 1993;66:197-212.
44. Byrne BM. Burnout - Testing for the Validity, Replication, and Invariance of Causal-Structure across Elementary, Intermediate, and Secondary Teachers. Am Educ Res J. 1994;31(3):645-73.

45. Education.gov.uk. Performance Tables - The Department for Education. 2015 [cited 2015 5th January]; Available from: http://www.education.gov.uk/schools/performance/.
46. Gorard S. Who is eligible for free school meals? Characterising free school meals as a measure of disadvantage in England. Brit Educ Res J. 2012;38(6):1003-17.
47. Hobbs G, Vignoles A. Is children's free school meal 'eligibility' a good proxy for family income? Brit Educ Res J. 2009;36(4):673-90.
48. Gov.uk. Pupil Premium: Funding And Accountability For Schools - Detailed Guidance - GOV.UK. 2014 [cited 2015 14th April].
49. Iii CF, Martin C, Bender WN. Teacher Burnout in Special Education: The Causes and the Recommended Solutions. The High School Journal. 2002;86(1):36-44.
50. Talmor R, Reiter * S, Feigin N. Factors relating to regular education teacher burnout in inclusive education. European Journal of Special Needs Education. 2005;20(2):215-29.
51. Stables A. Differences between pupils from mixed and single-sex schools in their enjoyment of school subjects and in their attitudes to science and to school. Educational Review. 1990;42(3):221-30.
52. Mael F, Alonso A, Gibson D, Rogers K, Smith M. Single-Sex Versus Coeducational Schooling: A Systematic Review. Doc# 2005-01. US Department of Education. 2005.
53. ALSPAC. Year 6: Questionnaire for the class teacher. Univeristy of Bristol2002; Available from: http://www.bristol.ac.uk/media-library/sites/alspac/migrated/documents/ques-s06-questionnaire-for-the-class-teacher.pdf.
54. newschoolsnetwork.org. Comparison of different types of schools2011 8th January 2015. Available from: http://www.newschoolsnetwork.org.
55. Newman M, Garrett Z, Elbourne D, Bradley S, Noden P, Taylor J, et al. Does secondary school size make a difference?: A systematic review. Educational Research Review. 2006;1(1):41-60.
56. OECD. What is the student-teacher ratio and how big are classes?: OECD Publishing.
57. StataCorp. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP; 2013.
58. Park S, Lake ET. Multilevel Modeling of a Clustered Continuous Outcome: Nurses' Work Hours and Burnout. Nursing research. 2005;54(6):406-13.
59. Case P, Case S, Catling S. Please Show You're Working: A critical assessment of the impact of OFSTED inspection on primary teachers. Brit J Sociol Educ. 2000;21(4):605-21.
60. Abel MH, Sewell J. Stress and burnout in rural and urban secondary school teachers. J Educ Res. 1999;92(5):287-93.
61. Brouwers A, Tomic W. A longitudinal study of teacher burnout and perceived self-efficacy in classroom management. Teach Teach Educ. 2000;16(2):239-53.
62. Sturgis P, Smith P, Hughes G. A study of suitable methods for raising response rates in school surveys: Department for Education and Skills; 2006.

Table 1. Teacher and school characteristics across the whole sample

variable	mean	SD	Skewness[a]	min	max	N
			School level			
IDACI	25.44	20.13	0.48	0	69.82	39
School size[b]	1076.62	321.96	0.32	504	1841	39
FSM	36.4	19.58	0.27	3	79.2	39
Percentage EAL	34.28	25.32	0.54	2.2	90	39
Percentage SEN	8.59	3.88	0.52	0.5	18.7	39
Student/teacher ratio	14.37	1.71	-0.44	10.8	17	38
			Teacher level			
Attitude to learning	7.17	3.52	0.21	0	23	2261
Gender	%					
male	26.55					
female	55.99					
missing	17.46					2278
Ethnicity	%					
White British	65.77					
White Other	12.55					
Asian/Asian British	6.89					
Black/Black British	6.8					
Chinese/Chinese British	0.31					
mixed ethnicity	3.29					
other ethnic group	2.72					
missing	1.67					2278
Schools worked at	%					
none	40.63					
one	21.9					
two	13.91					
three+	21.98					
missing	1.58					2278
Duration at this school	%					
less than 1 year	18.82					
1-5 years	34.23					
more than 5 years	46					
missing	1.14					2278
Feel safe	%					
all the time	62.22					
most of the time	32.69					
some of the time	3.64					
missing	1.44					2278
Feel supported	%					
very well	23.87					
quite well	51.08					
not very well	21.41					
not at all	1.76					
missing	1.88					2278

a, measures the asymmetry of the data. A normal distribution has a skewness of 0, when the mean is less than the median, the skewness value will be negative

b, school size is divided by 100 for it's use in regression models so that a one unit increase represents a 100 pupil increase in school size

Table 2. Distributions of teacher burnout variables across schools.

MBI dimensions	Mean	S.D.	Range	ICC	95% C.I	n	N
Emotional Exhaustion	22.35	11.31	0 - 54	0.05	0.03-0.09	2242	39
Personal accomplishment	35.44	7.16	0 - 48	0.02	0.01-0.04	2227	39
Depersonalisation	5.47	5.08	0 - 28	0.05	0.03-0.09	2228	39
	Proportion			ICC	95% C.I		
High Emotional Exhaustion	0.36			0.06	0.03-0.11		
Low personal accomplishment	0.46			0.01	0.01-0.04		
High Depersonalisation	0.09			0.08	0.03-0.17		

Table 3. Associations between school-level variables and teacher burnout adjusted for teacher characteristics

		Emotional Exhaustion			Personal Accomplishment‡			Depersonalisation		
	N	n	β	95% C.I	n	β	95% C.I	n	β	95% C.I
School Type (ref=Academy – Converter)	39	2,231			2,215			2,217		
Voluntary			-1.22	(-4.41:1.98)		-2.61**	(-3.93:-1.29)		0.25	(-0.99:1.48)
Community School			0.19	(-2.38:2.76)		-0.71	(-1.69:0.28)		0.16	(-0.81:1.12)
Academy - sponsor led			3.69**	(1.20:6.18)		-1.72**	(-2.72:-0.71)		1.97**	(1.02:2.92)
Foundation school			0.61	(-1.82:3.03)		-0.74	(-1.66:0.17)		0.92*	(0.01:1.83)
Joint significance			*$\chi^2(4)=10.37$, p<0.05*			*$\chi^2(4)=22.16$, p<0.01*			*$\chi^2(4)=18.58$, p<0.01*	
Ofsted rating (ref=outstanding)	38	2,195			2,179			2,181		
good			0.30	(-1.94:2.54)		-0.69	(-1.68:0.30)		0.52	(-0.36:1.40)
requires improvement			1.99	(-1.67:5.65)		-0.77	(-2.47:0.93)		1.75*	(0.29:3.21)
Joint significance			*$\chi^2(2)=1.18$, p=0.55*			*$\chi^2(2)=1.97$ p=0.37*			*$\chi^2(2)=5.55$, p=0.06*	
Single sex school status (ref=mixed sex)	39	2,231			2,215			2,217		
all girls			0.56	(-1.92:3.03)		0.44	(-0.61:1.49)		-0.87+	(-1.82:0.07)
all boys			1.50	(-2.09:5.09)		-0.81	(-2.35:0.73)		1.06	(-0.32:2.44)
Joint significance			*$\chi^2(2)$*=0.78, p=0.68			*$\chi^2(2)$*=2.00, p=0.37			*$\chi^2(2)$*=6.39, p<0.05	
Size of school (per 100 students)	39	2,231	-0.10	(-0.41:0.21)	2,215	0.03	(-0.11:0.17)	2,217	-0.00	(-0.13:0.12)
IDACI score	39	2,231	0.06*	(0.01:0.10)	2,215	-0.02*	(-0.05:-0.00)	2,217	0.02*	(0.01:0.04)
Teacher perceived safety (ref=all the time)	39	2,195			2,199			2,202		
most of the time			6.23**	(5.24:7.22)		-1.80**	(-2.46:-1.14)		2.31**	(1.87:2.76)
some of the time/never			11.74**	(9.31:14.17)		-4.31**	(-5.93:-2.69)		4.80**	(3.70:5.89)
Joint significance			*$\chi^2(2)$206.80, p<0.01*			*$\chi^2(2)=48.04$, p<0.01*			*$\chi^2(2)=152.00$, p<0.01*	
Teacher perceived support (ref=very well)	39	2,203			2,189			2,189		
quite well			4.55**	(3.45:5.66)		-2.50**	(-3.23:-1.77)		1.68**	(1.18:2.17)
not very well			9.70**	(8.33:11.06)		-4.02**	(-4.92:-3.13)		3.87**	(3.26:4.48)
not at all			13.92**	10.48:17.36)		-3.62**	(-5.89:-1.35)		5.50**	(3.95:7.04)
Joint significance			*$\chi^2(3)=219.97$, p<0.01*			*$\chi^2(3)=82.96$, p<0.01*			*$\chi^2(3)=174.80$, p<0.01*	
Student:Teacher Ratio	38	2,153	-0.21	(-0.79:0.37)	2,137	0.31*	(0.05:0.57)	2,139	-0.14	(-0.36:0.09)
Student attitude to learning	39	2,227	0.98**	(0.83:1.12)	2,211	-0.57**	(-0.66:-0.48)	2,213	0.48**	(0.41:0.54)
Free school meals	39	2,231	0.08**	(0.04:0.12)	2,215	-0.02+	(-0.04:0.00)	2,217	0.03**	(0.01:0.05)
SEN	39	2,231	0.30**	(0.08:0.52)	2,215	-0.06	(-0.17:0.04)	2,217	0.15**	(0.06:0.24)
EAL	39	2,231	0.04+	(-0.00:0.08)	2,215	-0.00	(-0.02:0.02)	2,217	0.01	(-0.01:0.02)

** p<0.01, * p<0.05, + p<0.1, N refers to schools, n refers to teachers. ‡lower scores on personal accomplishment indicate burnout, whereas higher scores on emotional exhaustion and depersonalisation indicate burnout.

Table 4. Mutually adjusted relationships between school environment and teacher burnout, also adjusted for teacher characteristics.

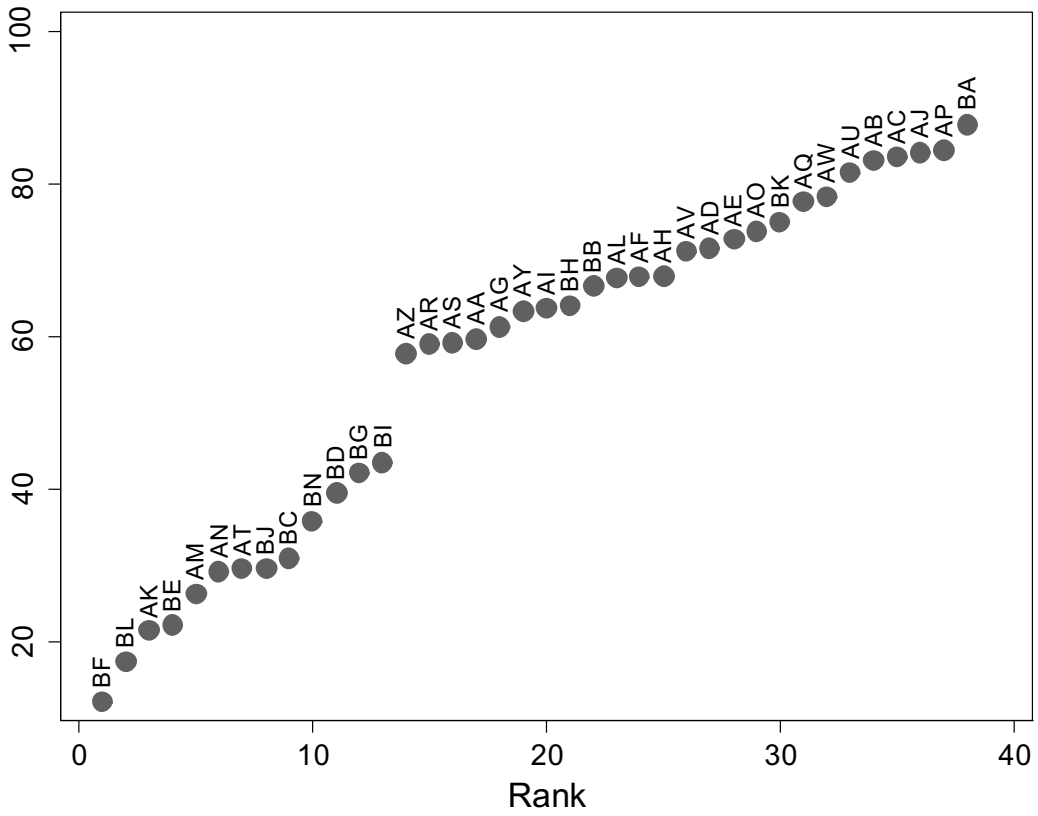
VARIABLES	**Emotional Exhaustion** β	95% C.I	**Personal Accomplishment**‡ β	95% C.I	**Depersonalisation** β	95% C.I
School Type						
Voluntary Aided	0.32	(-2.76:3.40)	-2.34**	(-3.91:-0.76)	0.67	(-0.33:1.68)
community school	0.28	(-2.32:2.89)	-0.70	(-1.90:0.50)	0.29	(-0.36 :0.95)
Academy - Converter Mainstream	*ref*	*Ref*	*ref*	*Ref*	*ref*	*Ref*
Academy - sponsor led	1.43	(-1.46:4.31)	-0.24	(-1.61:1.13)	1.30***	(0.43:2.17)
Foundation school	-0.51	(-2.99:1.96)	-0.59	(-1.78:0.60)	0.97***	(0.34:1.60)
Joint significance test	$\chi^2(4)=1.63$, p=0.80		$\chi^2(4)=8.84$, p=0.07		$\chi^2(4)=15.41$, p<0.01	
Ofsted Rating						
Excellent					*ref*	
Good					-0.18	(-0.77:0.42)
Requires Improvement					-0.34	(-1.30:0.63)
Joint significance test					$\chi^2(2)=0.57$, p=0.75	
Single Sex school						
Mixed					*ref*	
Girls					-0.01	(-0.66:0.64)
Boys					1.24**	(0.31:2.16)
Joint significance test					$\chi^2(2)=6.90$, p=0.03	
Perceived Safety						
All of the time	*ref*	*Ref*	*ref*	*Ref*	*ref*	*Ref*
most of the time	4.32**	(3.31:5.32)	-0.56	(-1.24:0.13)	1.32**	(0.86:1.78)
some of the time/never	8.42**	(5.96:10.87)	-2.13*	(-3.84:-0.41)	2.74**	(1.58:3.90)
Joint significance test	$\chi^2(2)=94.92$, p<0.01		$\chi^2(2)=7.07$, p=<0.05		$\chi^2(2)=43.75$, p<0.01	
Perceived support						
very well	*ref*	*Ref*	*ref*	*Ref*	*ref*	*Ref*
quite well	3.01**	(1.91:4.11)	-1.65***	(-2.40:-0.91)	0.79***	(0.29:1.29)
not very well	6.42**	(4.98:7.85)	-2.31***	(-3.28:-1.33)	1.99***	(1.34:2.63)
not at all	9.22**	(5.76:12.68)	-1.63	(-4.06:0.80)	2.52***	(0.92:4.13)
Joint significance test	$\chi^2(3)=85.32$, p<0.01		$\chi^2(3)=25.19$, p<0.01		$\chi^2(3)=29.51$, p<0.01	
IDACI score	-0.03	(-0.10:0.04)	-0.00	(-0.04:0.03)	-0.01	(-0.03:0.01)
Student:Teacher Ratio			0.31	(-0.02:0.64)	-0.06	(-0.27:0.16)
Student attitude to learning	0.48**	(0.33:0.64)	-0.43**	(-0.53:-0.32)	0.31**	(0.24:0.38)
SEN	-0.13	(-0.38:0.12)			-0.04	(-0.11:0.03)
FSM	0.03	(-0.07:0.14)	0.04	(-0.00:0.07)	0.01	(-0.02:0.03
EAL	0.02	(-0.04:0.08)				
Constant	12.25**	(4.26:12.62)	35.00**	(29.44:40.57)	2.50	(-1.06:6.06)
Observations (n)	2,186		2,097		2,062	
Number of groups (N)	39		38		37	
School variance σ^2_{u0}	3.76	(1.85:7.62)	0.50	(0.13:1.89)	0.00	(0.00-0.00)
Student variance σ^2_{e0}	100.14	(94.33:106.32)	45.64	(42.93:48.52)	19.93	(18.75:21.19)
Adjusted ICC	0.036	(0.018:0.071)	0.011	(0.003:0.040)	0.00	(0.00-0.00)

** p<0.01, * p<0.05

‡ lower scores on personal accomplishment indicate burnout, whereas higher scores on emotional exhaustion and depersonalisation indicate burnout.

Appendix A: Response rates and sensitivity checking

Fig A.1 Teacher response rates to survey by school



Response rates were estimated using information from the school workforce census. In one school none of the teachers responded and information was not available in the school census for one school. Therefore we have information on response rates for 39 schools, but we include only 38 in our estimations. There was large variation in response rates to the survey between schools with response rates ranging between 12-88% and an average of 57% overall, as shown in figure A.1. Response rates are important to consider as they can be an indication of how representative the responses are. Teachers who respond may be different in important ways from those who do not respond to the survey, for example teachers experiencing burnout may well have a different propensity to respond than teachers who are not burned out. In schools with low response rates it is more likely that responses are not representative of teachers' views on average in that school. Many of the papers that consider the school environment and teacher burnout discussed in the main text do not report response rates (32, 34, 35). Nevertheless, the response rates achieved here are typical of teacher surveys (61, 62).

In order to assess the extent to which non-response may bias the results, we compare teacher reported gender and ethnicity with those obtained from the school workforce census to consider the extent of disparities in characteristics we can observe (figure A.2 and A.3), we also re-ran the analysis using only schools where response rates are higher than 50% (table A.1). There were 26 schools with response rates >=50%.

Figure A.2. Percentage of male teachers according to teacher survey responses and official school census data.

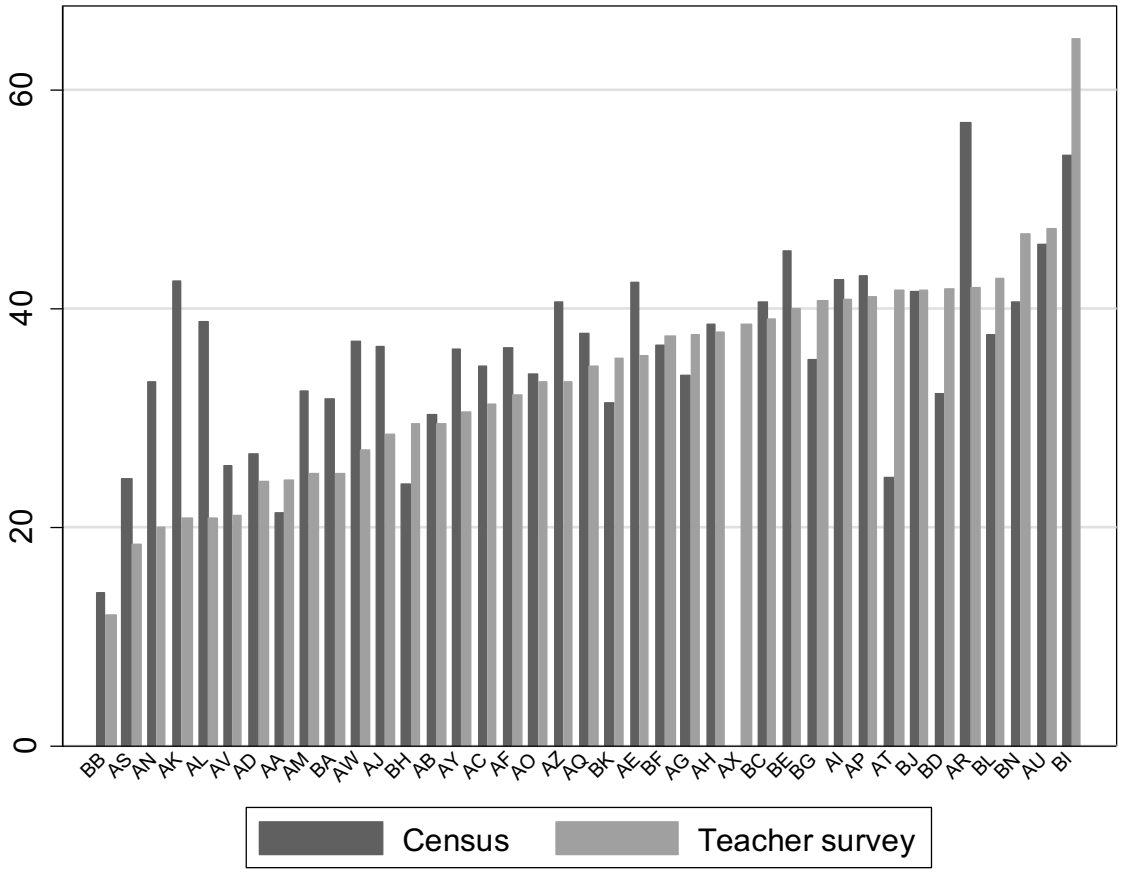
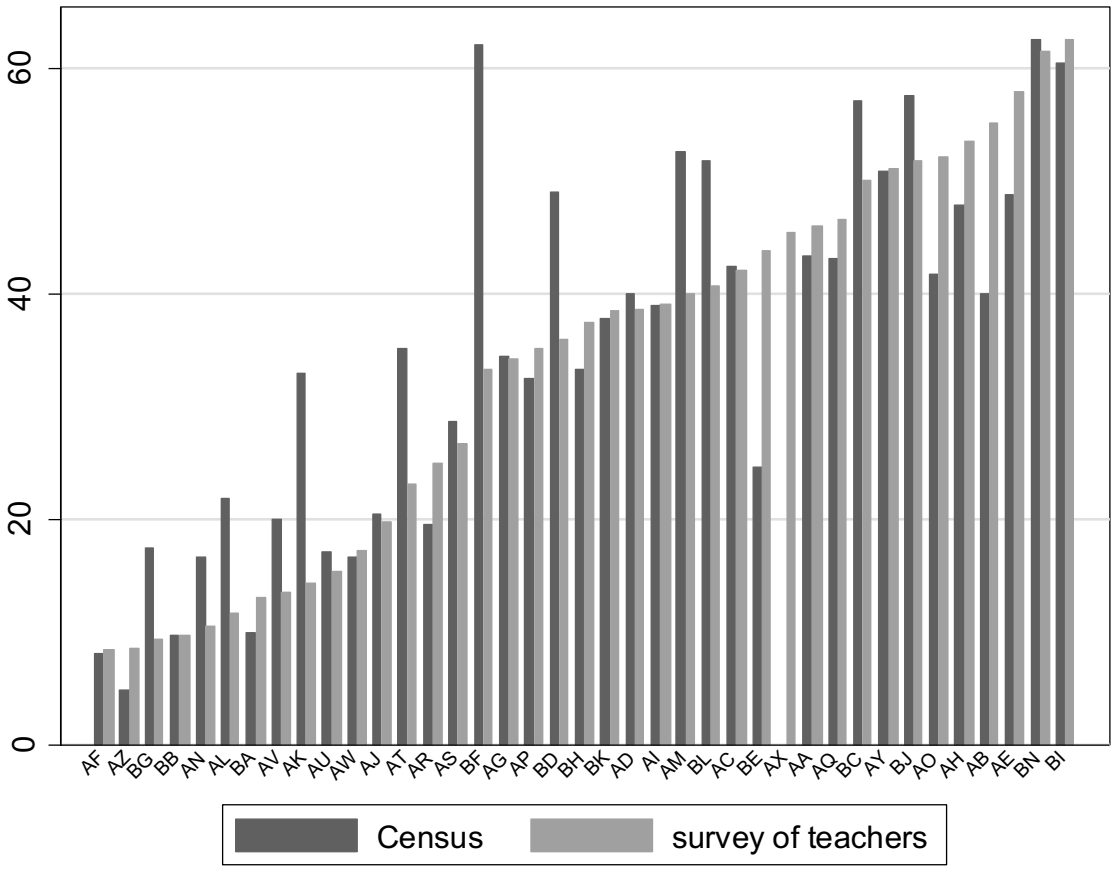


Figure A.3. Percentage of teachers from ethnic minority groups according to teacher survey responses and official school census data.



We can only compare teacher responses and the school workforce census data for teachers' gender and ethnicity, as these are the only comparable characteristics we ask for in the teacher survey. The data taken from the workforce census suggests that 36% of teachers are male (ranging from 4.9-62.5%), and 35% (ranging from 14.1 – 57.1%) of teachers across the schools belong to ethnic minority groups. School level averages from teacher responses indicate that on average 34% of respondents are male (range8.4 - 63%). School level averages of teacher responses indicate that 34% were from ethnic minorities (range 12% - 65%). The overall averages in gender and ethnicity suggest that the teachers in the sample are similar to those who belong to the schools overall, however as shown in figure A.2 and A.3 there is a great deal of variability in the disparities by school. For several schools the teachers who responded have different characteristics to those who work in the school according to the school workforce census data.

The results from the mutually adjusted models which included only the schools with 50% or above response rates (table A.1) are very similar to those in the main text. The patterning of results is similar across all variables and domains. The main differences are observed for the personal accomplishment outcome. School type is no longer associated with personal accomplishment in the mutually adjusted models; however the patterning of the results is similar with teachers in academy converter schools reporting the highest scores on personal accomplishment. Consistent with the main results, teachers in voluntary aided schools also reported significantly lower personal accomplishment scores (-1.78) than teachers in academy-converter schools. Student-teacher ratio was also no longer associated with personal accomplishment. The direction of the coefficient is consistent with the main results, although the magnitude of the coefficient is considerably less at 0.12 compared to 0.31.

Table A.1. Mutually adjusted relationships between school environment and teacher burnout in the 26 schools where response rates >=50%.

	Emotional Exhaustion		**Personal Accomplishment**		**Depersonalisation**	
VARIABLES	β	95% C.I	β	95% C.I	β	95% C.I
School Type						
Voluntary Aided	-0.57	-4.54 - 3.41	-1.77+	-3.81 - 0.27	0.18	-1.40 - 1.76
community school	-0.23	-3.21 - 2.75	-0.58	-2.01 - 0.85	0.07	-0.67 - 0.80
Academy - Converter Mainstream	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
Academy - sponsor led	1.34	-1.97 - 4.64	-0.78	-2.41 - 0.85	1.51**	0.36 - 2.66
Foundation school	0.04	-2.68 - 2.76	-0.73	-2.09 - 0.63	0.87*	0.10 - 1.64
Joint significance	$\chi2$(4)=1.00, p=0.91		$\chi2$ (4)=3.56, p=0.47		$\chi2$ (4)= 9.76, p<0.05	
Ofsted Rating						
Excellent					*ref*	
Good					0.13	-0.68 - 0.95
Requires Improvement					0.22	-1.54 - 1.99
Joint significance					$\chi2$ (2)=0.11, p=0.95	
Single Sex school						
Mixed					*ref*	
Girls					0.32	-0.41 - 1.06
Boys					1.61**	0.42 - 2.79
Joint significance					$\chi2$ (2)=7.22, p<0.05	
Perceived Safety						
All of the time	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
most of the time	4.35**	3.25 - 5.44	-0.44	-1.20 - 0.31	1.25***	0.74 - 1.75
some of the time/never	8.25**	5.54 - 10.95	-1.86*	-3.76 - 0.03	2.88***	1.58 - 4.17
Joint significance	$\chi2$(2)=79.25, p<0.05		$\chi2$(2)=4.31, p=0.12		$\chi2$ (2)=35.17,p<0.05	
Perceived support						
very well	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
quite well	2.66**	1.48 - 3.85	-1.75**	-2.55 - -0.94	0.90**	0.36 - 1.43
not very well	6.44**	4.88 - 8.00	-2.61**	-3.68 - -1.55	2.07**	1.36 - 2.78
not at all	9.84**	5.89 - 13.79	-1.85	-4.68 - 0.98	1.96*	0.09 - 3.83
Joint significance	$\chi2$ (3)=75.09, p<0.05		$\chi2$ (3)=26.03, p<0.05		$\chi2$ (3)=33.40,p<0.05	
IDACI score	-0.01	-0.10 - 0.07	-0.02	-0.07 - 0.02	0.00	-0.02 - 0.03
Student:Teacher Ratio			0.12	-0.27 - 0.51	0.05	-0.23 - 0.33
Student attitude to learning	0.51**	0.34 - 0.69	-0.45**	-0.56 - -0.33	0.33**	0.25 - 0.41
SEN	-0.23	-0.51 - 0.05			-0.04	-0.12 - 0.04
FSM	0.08	-0.05 - 0.20	0.05*	0.01 - 0.10	-0.01	-0.04 - 0.02
EAL	-0.03	-0.10 - 0.04				
Constant	8.63**	5.11 - 12.15	40.37**	33.84 - 46.90	-0.26	-4.96 - 4.44
Observations	1,841		1,753		1,719	
Number of groups	26		25		24	

** p<0.01, * p<0.05, + p<0.1.

Also adjusted for teacher gender, teacher ethnicity and teaching experience.

Appendix B variation in burnout between and within schools

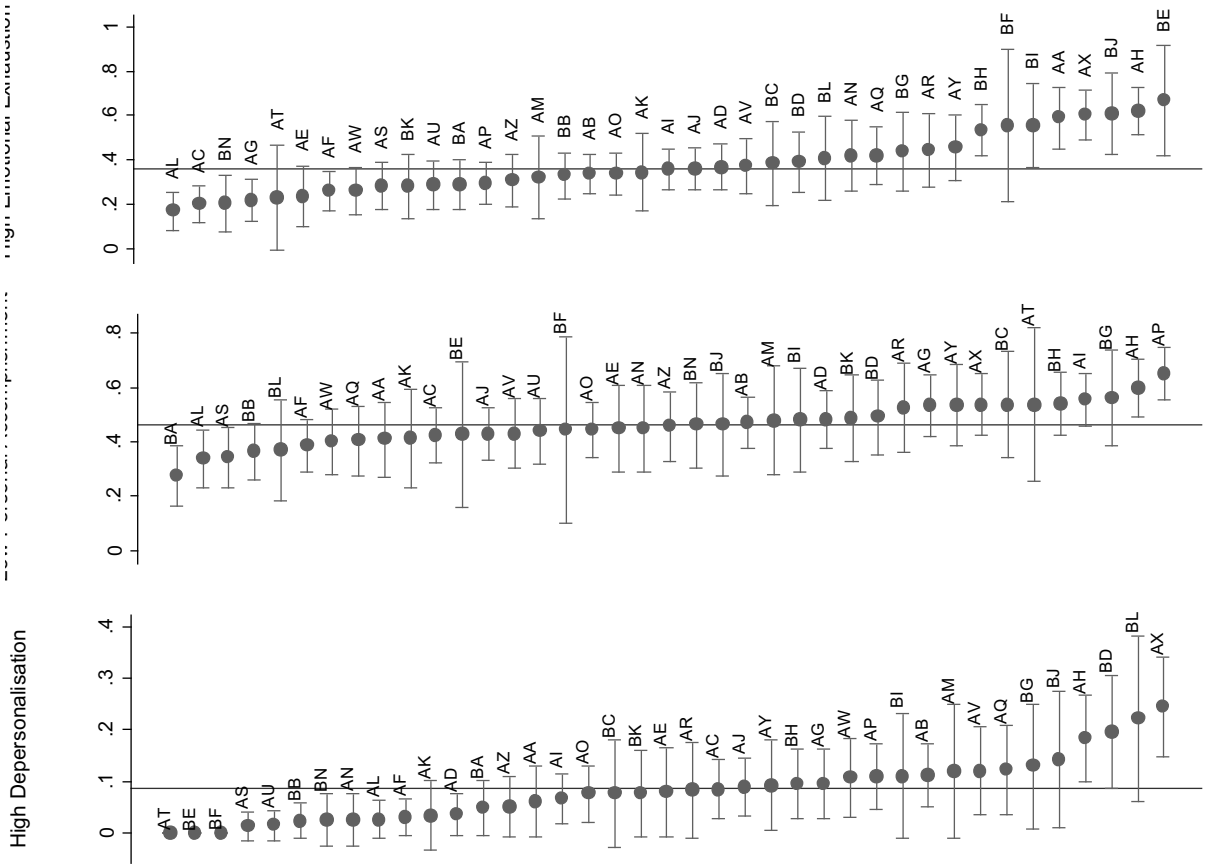
The variance in the three dimensions of burnout is partitioned into between and within school variance in table A.2. The overall row shows the global mean and standard deviation with the total range in burnout scores across all teachers in all schools. The between number refers to the variability of school level means in burnout scores. The within number refers to the teachers deviations from each school's average. To interpret the within variance the global mean must be added back in, for example some teachers did not deviate by 57.78 points from the school level mean on emotional exhaustion, they deviated by 35.43 points (57.78(max)-22.35(global mean)). The majority of the variance in burnout scores is within schools, as shown by the larger standard deviations within schools compared to between schools. The between school variation is largest for emotional exhaustion, with less variation between schools for personal accomplishment and depersonalisation.

Figure A.4 demonstrates the rankings by school in terms of school level averages in the proportion of teachers with high emotional exhaustion, low personal accomplishment and high depersonalisation. There are several schools who sit in similar positions in the ranking for the different dimensions of burnout (e.g. low burnout ranking "AL" "AS", high burnout ranking "AX" "AH") but there are no clear similarities in ranking for the majority of schools.

Table A.2 Variation in Burnout scores

Variable		Mean	S.D	Min	Max	Observations
Emotional Exhaustion score	overall	22.35	11.31	0.00	54.00	N = 2242
	between		3.00	15.58	27.93	n = 39
	within		10.93	-5.58	57.78	T-bar = 57.5
Personal accomplishment score	overall	35.44	7.16	0.00	48.00	N = 2227
	between		1.40	32.15	38.22	n = 39
	within		7.03	1.75	50.28	T-bar = 57.1
Depersonalisation score	overall	5.47	5.08	0.00	28.00	N = 2228
	between		1.33	3.11	8.78	n = 39
	within		4.90	-3.31	27.88	T-bar = 57.1

Figure A.4. Variation between schools in the three dimensions of burnout



Appendix C: Missing variable dummies

To ensure the same sample is used in the partially and fully adjusted models, missing dummy variables were used to keep cases that had missing information on any of the covariates in the models. For continuous variables this involves setting the value of the missing response to the mean value, and including a variable indicating that this response was missing. For categorical variables, this involves including a missing variable category. There are advantages to this 'ad-hoc' approach for dealing with missingness. With large numbers of covariates in the model, it is almost inevitable that some item non-response will be present. Where questions are more sensitive they are less likely to elicit responses. This item specific non-response is seldom random. Where full case analysis is conducted, only the sample which responded to all possible covariates is included in the analysis.

In a simple single variable regression the use of missing categories and missing dummies does not alter the point estimates for each covariate. For multiple regressions the same is also true, the point estimates are identical to full case analysis, except where a teacher did not respond to one covariate, for example perceived safety, but they did respond to another, for example student's attitude to learning, their response to student's attitude to learning is included in the estimation of the student's attitude coefficient. This approach could be conceptually compared to looking at pairwise correlations, rather than correlations following listwise deletion.

Table A.3 shows the results of the mutually adjusted models using this missing dummy approach. The results are substantively no different from those achieved by using complete case analysis.

Table A.3 Mutually adjusted relationships between school environment and teacher burnout including missing data.

	Emotional Exhaustion		Personal Accomplishment‡		Depersonalisation	
VARIABLES	β	95% C.I	β	95% C.I	β	95% C.I
School Type						
Voluntary Aided	0.32	-2.70 - 3.34	-2.38**	-3.93 - -0.83	0.59	-0.42 - 1.60
community school	0.29	-2.26 - 2.83	-0.69	-1.87 - 0.49	0.34	-0.31 - 0.99
Academy - Converter Mainstream	*ref*	*Ref*	*ref*	*Ref*	*ref*	*Ref*
Academy - sponsor led	1.58	-1.25 - 4.40	-0.31	-1.66 - 1.03	1.23**	0.36 - 2.10
Foundation school	-0.57	-2.99 - 1.84	-0.62	-1.79 - 0.55	0.98**	0.35 - 1.61
Joint significance test	$\chi^2(4)=2.09$, p=0.72		$\chi^2(4)=9.41$, p=0.052		$\chi^2(4)=14.41$, p<0.01	
Ofsted Rating						
Excellent					*ref*	
Good					-0.18	-0.78 - 0.41
Requires Improvement					-0.44	-1.40 - 0.52
missing					-1.64	-3.59 - 0.30
Joint significance test					$\chi^2(2)=0.87$, p=0.65	
Single Sex school						
Mixed					*ref*	
Girls					-0.07	-0.73 - 0.58
Boys					1.32**	0.40 - 2.25
Joint significance test					$\chi^2(2)=7.91$, p<0.05	
Perceived Safety						
All of the time	*ref*	*Ref*	*ref*	*Ref*	*ref*	*Ref*
most of the time	4.28**	3.28 - 5.28	-0.61	-1.29 - 0.06	1.29**	0.85 - 1.74
some of the time/never	8.18**	5.76 - 10.60	-2.23**	-3.86 - -0.60	2.87**	1.78 - 3.96
missing	1.81	-3.37 - 6.99	1.38	-2.10 - 4.87	1.74	-0.58 - 4.07
Joint significance test[a]	$\chi^2(2)=93.51$, p<0.01		$\chi^2(2)=8.63$, p<0.05		$\chi^2(2)=47.57$, p<0.01	
Perceived support						
very well	*ref*	*Ref*	*ref*	*Ref*	*ref*	*Ref*
quite well	2.92**	1.82 - 4.02	-1.64**	-2.38 - -0.91	0.81**	0.32 - 1.30
not very well	6.30**	4.87 - 7.73	-2.33**	-3.28 - -1.38	2.12**	1.49 - 2.75
not at all	9.42**	6.02 - 12.82	-1.34	-3.62 - 0.93	3.09**	1.57 - 4.60
missing	-2.91	-8.38 - 2.55	-0.90	-4.72 - 2.92	-1.77	-4.22 - 0.69
Joint significance test[a]	$\chi^2(3)=85.08$, p<0.01		$\chi^2(3)=26.43$, p<0.01		$\chi^2(3)=50.02$, p<0.01	
IDACI score	-0.03	-0.10 - 0.04	-0.00	-0.04 - 0.03	-0.02	-0.04 - 0.01
Student:Teacher Ratio			0.31	(-0.02:0.63)	-0.07	-0.28 - 0.14
missing student:teacher ratio			-1.00	-3.47 - 1.48	1.44	-0.04 - 2.92
Student attitude to learning	0.49**	0.34 - 0.65	-0.43**	-0.53 - -0.33	0.30**	0.24 - 0.37
missing attitude	8.80	-2.63 - 20.23	-8.24*	-15.93 - -0.55	6.15*	1.02 - 11.28
SEN	-0.12	-0.37 - 0.12			-0.04	-0.11 - 0.03
FSM	0.03	-0.07 - 0.13	0.04	-0.00 - 0.07	0.01	-0.02 - 0.03
EAL	0.02	-0.04 - 0.08				
Constant	11.88**	9.24 - 14.53	34.14**	28.74 - 39.54	4.39*	0.84 - 7.93
Observations (n)	2,217		2,201		2,203	

Number of groups (N)	39		39		39	
School variance	3.54	(1.73:7.25)	0.47	(0.12:1.79)	0.00	(0.00-0.00)
Student variance	100.04	(94.27:106.16)	45.54	(42.90:48.33)	20.32	(19.15:21.56)
Adjusted ICC	0.034	(0.017:0.068)	0.010	(0.003:0.039)	0.000	(0.000-0.000)

** p<0.01, * p<0.05

[a] joint significance test does not include missing category

Appendix D: Relationships between Student and school area deprivation and other aspects of the school environment

Figure A.5 FSM composition of student in different school types

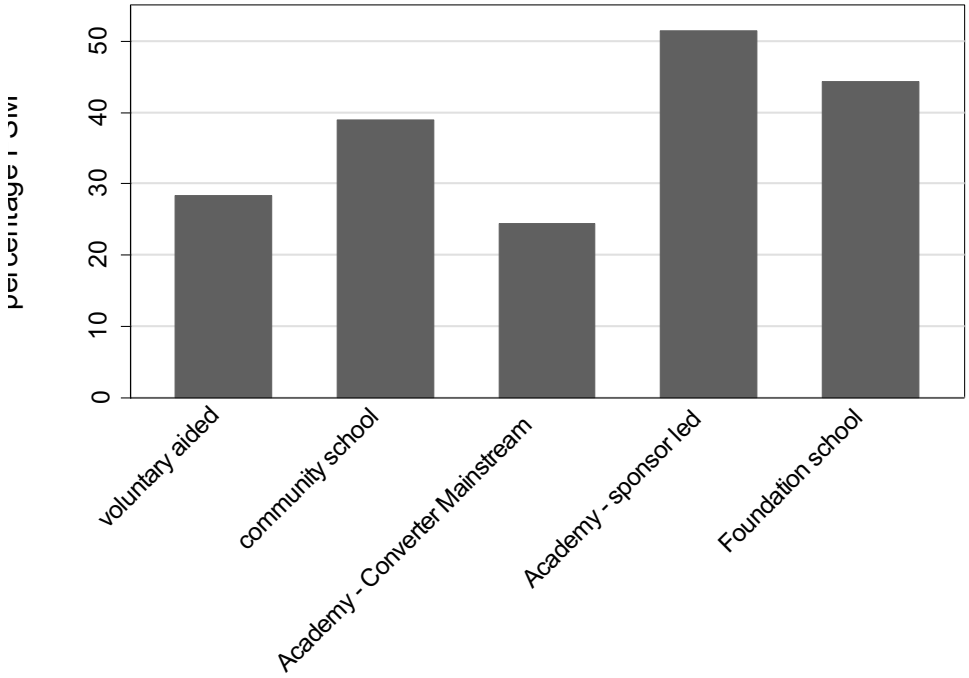


Figure A.6 Relationship between FSM composition of the school and perceived attitude towards learning, and school area level deprivation and perceived attitude towards learning.

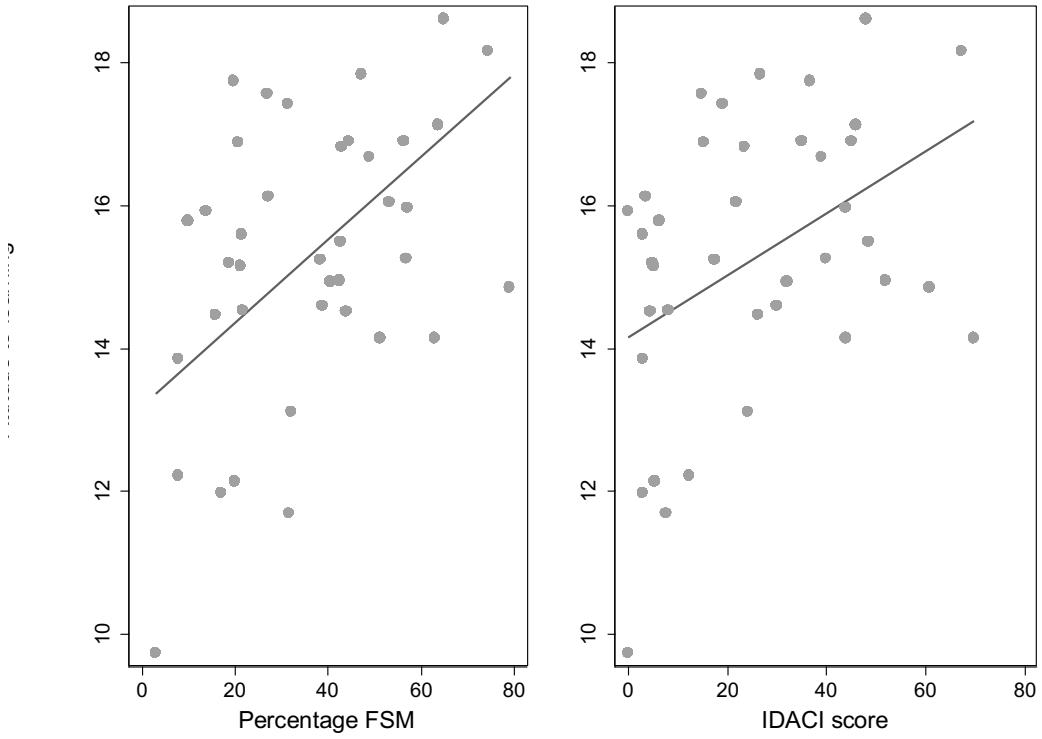


Figure A.7 FSM composition of students and teacher perceived safety

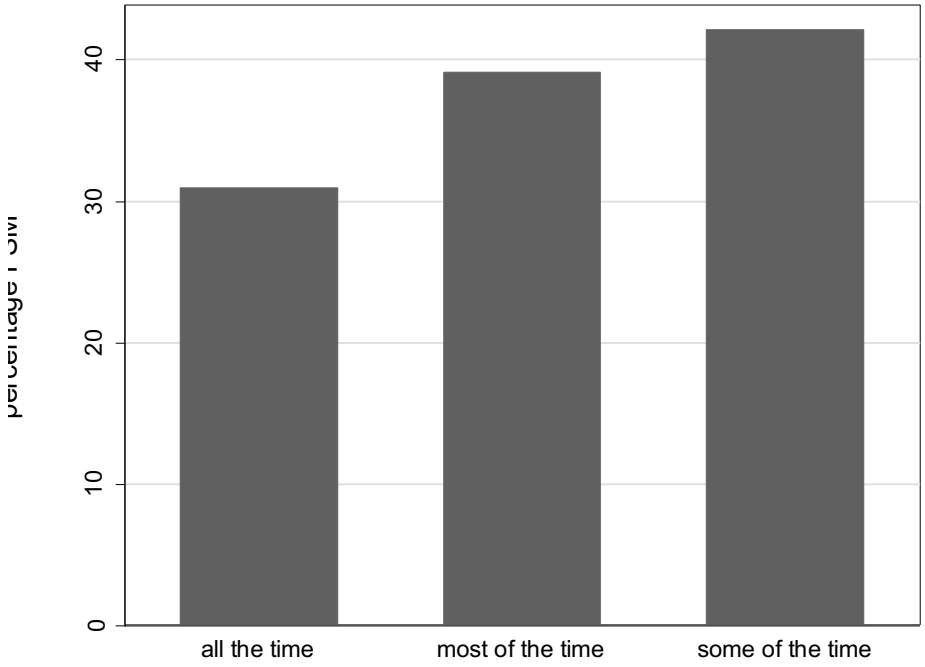


Figure A.8. Relationship between FSM composition and Student-teacher ratios, and area deprivation and student teacher ratios.