Bridging the gap: the role of social capital and ethnicity in medical student achievement

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Abstract

Objectives

Within medical education, patterns of achievement indicate that white students outperform their ethnic minority peers. The processes behind these patterns have not been adequately investigated or explained. This study utilises social network analysis to investigate the impact of relationships on medical student achievement by ethnicity, specifically by examining homophily (the tendency to interact with others in the same group) by ethnicity, age and role.

Methods

Data are presented from a cross-sectional social network study in one UK medical school, analysed alongside examination records obtained from the medical school. Participants were sampled across the four hospital placement sites at this university, a total of 159 medical students in their clinical phase (year 3) completed the survey. The research was designed and analysed using social capital theory.

Results

Although significant patterns of ethnic and religious homophily existed, no link was found between these factors and achievement. Interacting with PBL group peers in study-related activities, and having seniors in a wider academic support network were directly linked to better achievement. Students in higher academic quartiles were more likely to name at least one tutor or clinician in their network. Different patterns of relationship formation and social network features were observed by ethnicity. Students from non-white, Muslim and lower achieving groups are least likely to have indicate the social capital enabling and resulting from interaction with members from more expert social groups.

Conclusions

Lower levels of the social capital that mediates interaction with peers, tutors and clinicians may be the cause of underperformance by ethnic minority students. Due to gaps in their social network, minority students may be cut off from potential and actual resources that facilitate learning and achievement.

Introduction

Over the last decade, research has emerged to indicate an achievement gap between white and ethnic minority students and postgraduate trainees within medical education. This achievement pattern is not unique to this domain, being replicated across Higher Education (1); however, it challenges notions of equality in medical training (2). Being non-white has been linked to lower achievement in medical students and doctors alike, with 22 reports (n=23,742 students and trainees) indicating that ethnic minority candidates as a group under-performed compared with white candidates. Under certain statistical circumstances, ethnic minority students were 2.5 times more likely to fail an exam than white students (3).

What causes this difference in achievement of ethnic minority students and trainees is unclear; it cannot be explained by discrimination alone, though several studies have identified this as an issue, as the effect remains when multiple choice questions are anonymously marked. (4-6). The problem is complex, as we do not know if this is an examination issue or is a reflection of different learning and experience at medical school. Although language difficulties may be a problem for some overseas ethnic minority students (7), along with additional personal and social issues (8), differences in attainment remain for UK-born ethnic minority students. 'Stereotype threat' has been offered as one explanation, suggesting performance is impaired due to a stereotype-based, societal expectation of poor performance (9). However, a later experiment failed to confirm this as a factor (10).

Several studies have made links between students' interactions and their achievement. A positive relationship between improved achievement and access to formal peer-assisted learning schemes has been demonstrated (11,12). Social factors are extremely important in students' self-efficacy, achievement and retention, as students who lack a sense of belonging are more at risk of underachievement and suspending their studies (13). The transition into the unfamiliar culture of

medical education (and for some ethnic minority students, being in the UK higher education system for the first time) is difficult (14). This may be more acute for minority students in a setting where they encounter 'everyday racism' (15). Relationships are instrumental in developing a sense of belonging; evidence suggests international students benefit from being linked to a host national student, with improved academic achievement and reduced drop out rates (16).

Relationships are a critical mediating factor in how students experience medical school (17), helping students cope with the stresses and strains they face. Engagement with faculty is crucial in understanding how university 'works' (18). Though their effect on students' behaviour is not always positive (19), role models and mentors play an important part in shaping future doctors, enabling students to master explicit academic knowledge and the implicit knowledge relating to the medical world (20). Despite this, there is little work focusing on the peers and faculty to whom medical students relate during training (21,22).

Social networks and social capital

Social networks provide access to a number of resources, creating channels through which resources can potentially flow. Social capital is both a cause and effect of engaging in social groups. 'Bonding' social capital refers to the connections within a close social circle, such as with family and close friends. These ties help individuals to 'get by', through support and reinforcement of identity; they are links between like-minded people, serving to reinforce homogeneity and homophily (23). Homophily, the tendency for individuals to be connected to others of the same group, has been observed in medical education for decades. Becker found that cohesive groups of 'fraternity men' did better in medical school exams than the 'independents' outside these networks (24). More recently Woolf found that students were more likely to be friends with others of the same gender and ethnicity, important as the achievement of an individual's friends was a predictor of achievement in the next examination (25). 'Bridging' social capital describes the connections and

resources developed with individuals who are members in other social groups, bringing people from different social and cultural backgrounds together (26,27). Bridging social capital helps individuals to 'get on' (23), allowing them access to resources unavailable within their close network, useful in terms of gaining employment (26) or increasing pay and promotion (28).

The role that social capital plays in ethnic achievement gap is currently unclear. This study therefore aims to investigate medical students with the concept of social capital in mind, focusing specifically on connectedness and homophily as indicators of bonding and bridging capital.

Methods

Setting and participants

The sample was drawn from a study population of students (approximately 450) in their first clinical year (Year 3) of a problem-based learning (PBL) course in a large UK medical school. 28 PBL groups, comprising over 50% of the population, were selected purposively by teaching hospital site to account for differences in learning environment. Surveys were distributed in PBL group sessions, where all participants had an opportunity to read an information sheet and ask any questions before deciding to participate. Four groups declined to participate, giving a response rate of 24 PBL groups (86%) and final sample of 159 medical students. Written consent was obtained from all participants. Ethical approval was granted by The University of Manchester ethics committee (reference number 09232).

Design

A social networks survey was developed using existing literature, findings from a qualitative pilot phase and through collaboration with domain experts situated within medical education and sociology. Participants were asked about interactions with members of their PBL group outside of formal sessions, to name up to 10 people participants interacted with in activities important for

academic success, and relevant demographic factors previously shown to mediate achievement and relationship formation.

Glossary	
Problem-based learning (PBL) network	A small group, allocated by the medical school, who engage in self-directed learning sessions two days per week. Students were asked about interactions **outside** of formal timetabled sessions.
Personal academic support (PAS) network	The network of up to 10 individuals named by participants as people they interact with in 'activities important for academic success'.
Alters	The social network analysis (SNA) term for 'others' in a participants' network
Ties	The connections between individuals in a network. We refer to ties 'sent', where the subject names an alter in interactions; and 'received', where an alter names the subject. PBL ties indicate interaction 'study-related activities' and PAS ties as interactions in 'activities important for academic success'.
Degree centrality	The number of ties a student sends or receives as a percentage of all possible ties. In order to account for inter-group differences in interaction, we present students' score in relation to the mean of their PBL group as 'relative connectedness'.
E-I index	A measure of homophily used to describe the number of ties an ego has to others outside their own group, compared to the ties they have to others within their group. An E-I index score ranges from -1 (interacting only within a group) to 1 (interacting only with others from another group).

Measures

Students at this medical school were ranked according to achievement and placed in an academic quartile in their fourth year. These measures of achievement formed the basis of competitive selection into Foundation Training, the two years as a junior doctor immediately following medical school in the UK, and was a composite measure of achievement in different assessments. With regard to both measures, 1 indicates highest achievement in relation to peers. Ethnic group was self-identified then categorized using the UK census guidelines (29). Participants were assigned to one

of four ethnic groups for statistical analysis, white, Asian, Chinese and other. Religious beliefs were also self-identified and were grouped into none, Christian, Muslim and other.

Network analysis

Homophily was calculated using 'E-I index'. Groups were assigned according to variables under investigation. We measured the number of ties a student sent to, and received from, others in their network (degree centrality). This was completed for all PBL network members, giving each participant an individual score indicating the number of ties as a percentage of all possible ties. To account for variations in PBL group interaction, a mean score for each group was calculated and data are presented relative to this mean. Measures were calculated using UCINet (30).

Statistical analysis

Analyses of variance were undertaken to assess whether any variances in mean scores obtained between groups were statistically significant. Statistical analyses were carried out using UCINet (30) and, where appropriate, SPSS (31).

Results

The personal and achievement characteristics of our participants are shown below (Table 1), along an illustration of achievement by ethnicity and religion (figure 1).

Personal characteristic	n	%
Age		
20	28	18%
21	68	43%
22	37	23%
23-39	24	16%
Unknown	2	1%
Gender		
Female	99	62%
Male	60	38%
Ethnicity		
White	101	64%
Asian	28	18%
Chinese	15	9%
Other	13	8%
Unknown	2	1%
Religion		
None	62	39%
Christian	50	31%
Muslim	22	14%
Other	17	11%
Unknown	16	5%

Achievement characteristic	n	%
Graduation year		
2011	83	52%
2012	25	16%
Unknown	51	32%
Self-rated achievement		
Mostly honours	16	10%
Some honours	61	38%
Mostly satisfactory	77	48%
Mostly low passes	2	1%
Unknown	3	2%
Previously failed exam		
Yes	27	17%
No	131	82%
Unknown	1	1%
Achievement quartile		
1	33	21%
2	26	16%
3	26	16%
4	16	10%
Unknown	58	37%

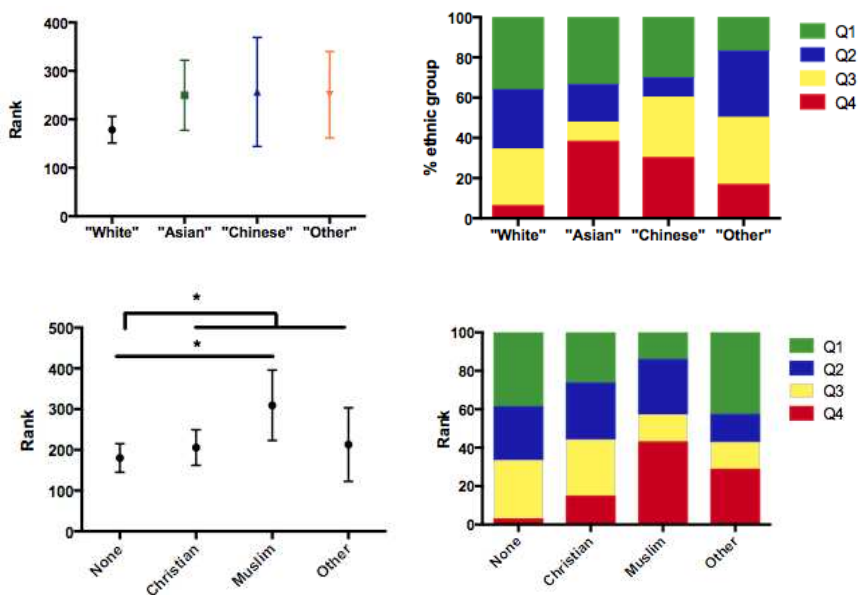**Table 1: Participants' characteristics by demographics and achievement**

Figure 1: Achievement by ethnic and religious group. Ranked data are mean ±95% CI, *P<0.05. This shows white students to be achieving more highly as a group compared to non-white peers. Quartile data show the proportion of students achieving in each quartile by ethnicity and religion, indicating that a higher proportion of non-white and Muslim and other students are placed in the lowest quartile.

Personal academic support (PAS) networks

With regard to their self-selected personal academic support networks, students named an average

of eight individuals they interacted with in 'activities important for their academic success'. These

were most often other students. Neither size nor interconnectedness of students' self-selected

networks had an impact on their exam success. Students' networks were homophilous by ethnic group, with participants more frequently naming others from their own ethnic group. In a diagram representing all participants' personal academic support networks, clustering by ethnic background was clearly evident (figure 2).
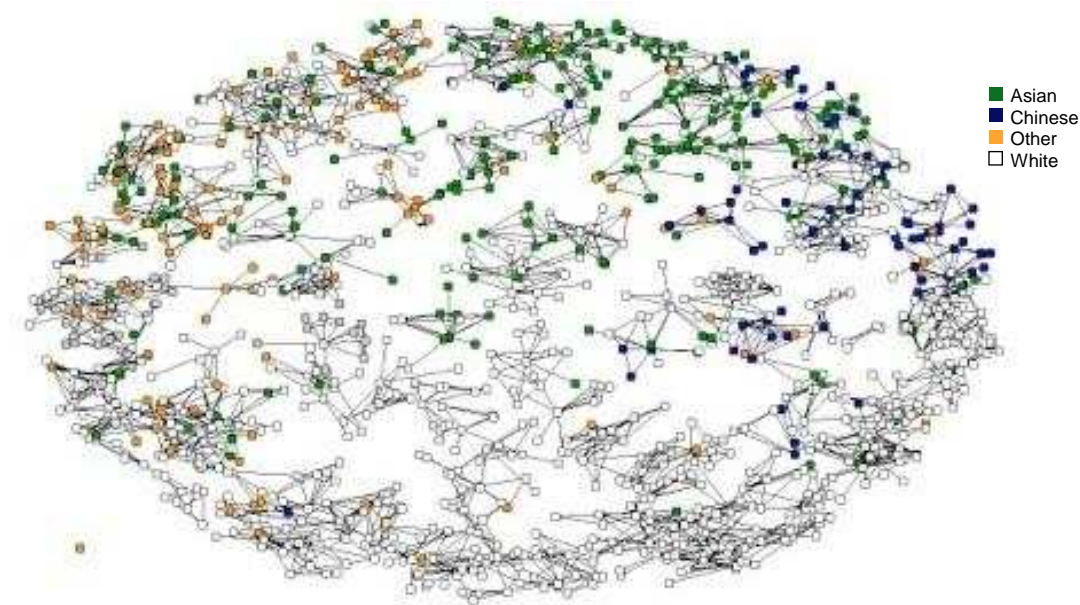

Figure 2: Participants' PAS networks coloured by ethnic group. Clustering by ethnic group is evident in this network diagram.

Upon further examination, white students were significantly more homophilous by ethnicity compared to all other ethnic groups, with an E-I score of -0.67 indicating that out of ten people mentioned by students as important in their academic success, no more than two would be from a different ethnic group (figure 3).
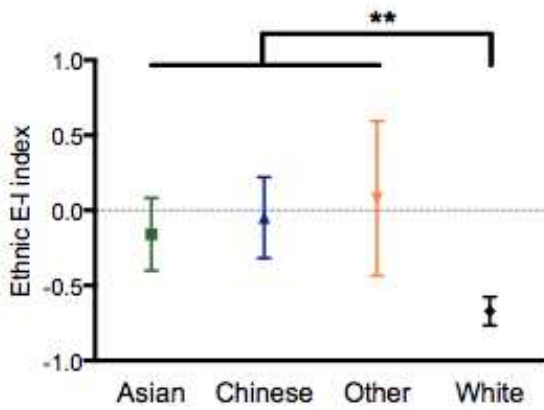
Figure 3: Comparison of ethnic homophily by ethnic group. Data are mean ±95% CI. **P<0.01, via one-way ANOVA.

Ethnic homophily was not, however, significantly related to exam achievement, even after accounting for the ethnic differences in achievement. Furthermore, analyses of homophily by gender and religion indicated these factors to also be independent of exam achievement.

Interaction with tutors, clinicians and seniors

Two thirds of the students in our study did not mention any faculty or medically qualified people in their network. With regard to age, the majority (74%) of alters named by participants were under 25. Trends towards homophily by age (P=0.09) and role (P=0.28) were observed, with the number of seniors and non-students in students' networks increasing in higher achieving quartiles (figure 4).
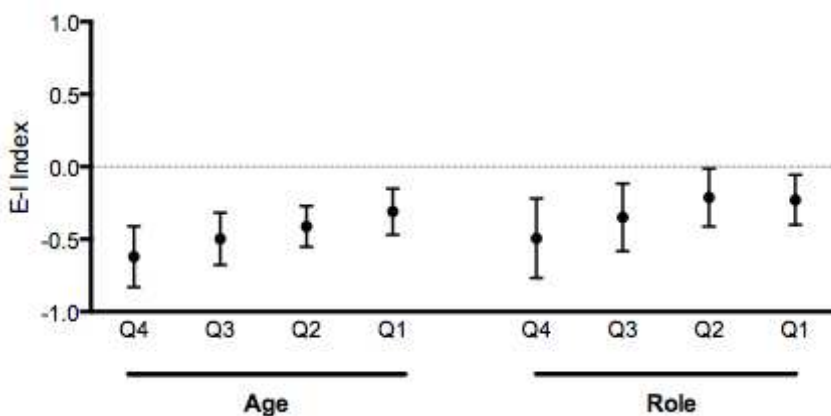

Figure 4: Age and role homophily by achievement quartile. Data are mean ±95% CI. 'Age' indicates relationships with others outside own age group, for most students this equates to connections to seniors. 'Role' indicates relationships with non-student alters and includes tutors, clinicians and family members.

Naming at least one tutor or clinician in a personal academic support network was related to students' success; those in the lower quartiles were significantly less likely to name any tutors or clinicians in their network (figure 5a). Patterns suggested ethnicity and religion to be a mediating factor in these interactions (figure 5b), with students from Chinese and Other ethnic backgrounds less frequently naming tutors or clinicians in their network; 20% and 8% of these students respectively named at least one tutor or clinician compared with 32% Asian students and 39% white (p=0.09). By religion, only 13% Muslim students named at least one member of staff in their PAS network, in contrast with between 32% - 40% of non-Muslim students (p=0.18).
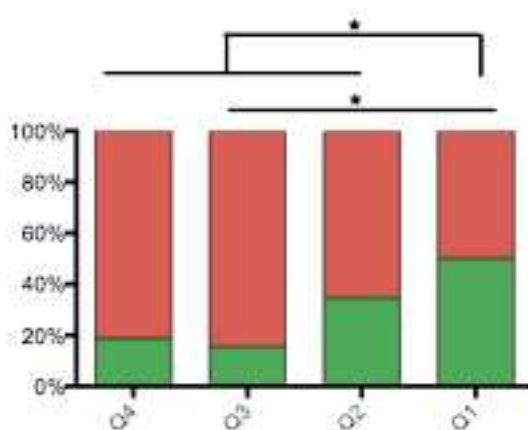

Figure 5a: Proportion of participants naming at least one tutor or clinician in their PAS network by achievement quartile. *p<0.05, via one-way ANOVA with post-hoc Scheffé test.
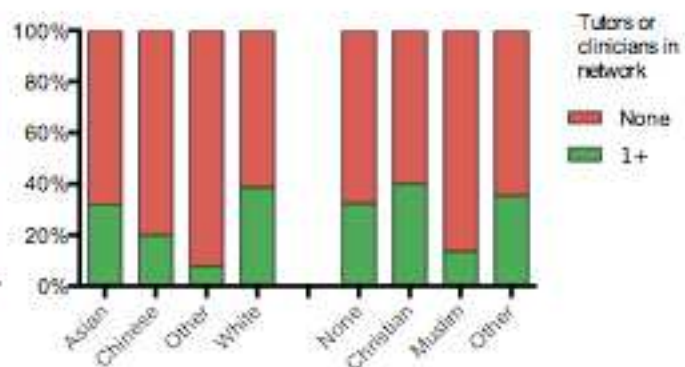
Figure 5b: Proportion of participants naming at least one tutor or clinician in their PAS network by ethnic and religious group.

PBL networks

We also investigated if interaction with PBL peers was linked to achievement. To account for inter-group differences in overall interaction, a relative degree centrality score was calculated using the difference from their PBL group mean. A strong trend emerged indicating students in the lowest quartile named more of their group in study-related activities. These ties were not reciprocated however, as students in the lowest quartile were significantly less likely to be named by members of their PBL group in study-related activities (figure 6).
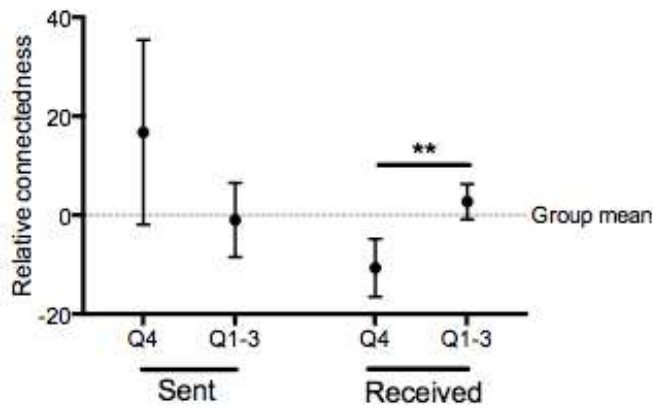
Figure 6: Comparison of participants' PBL network relative centrality by achievement quartile. Data are mean ±95% CI.. **p<0.01, via t-test.

Relative to the mean study interactions of their PBL network, fourth quartile students were named 9% less often than third quartile students, 14% less often than second quartile students and 16% less often than first quartile students (p=. Fourth quartile students received significantly fewer ties from their PBL group (figure 7). We found no significant differences in the relative centrality scores by ethnicity or religion.

Discussion

As reported in wider studies of achievement, participants' academic success was mediated by ethnicity, with students from non-white backgrounds more often achieving lower grades. We also found that religion had a significant impact on achievement, as Muslim students in our study had a lower mean rank and were more likely to appear in the lowest academic quartile. Despite these differences, our study suggests that network factors have a greater impact on achievement than ethnicity or religion.

Findings are presented in the context of certain limitations. Data were from one cohort at one medical school; the generalisability to other locations, curriculums and cultures must be carefully considered. Social network data were collected several months before the academic achievement measure we used and students' social networks may have changed in this time. Questions about

participants' networks may have been interpreted in different ways and we cannot be sure if their self-reported interaction accurately reflects reality. As with the wider limitation to quantitative work, we were unable to investigate how and why these different network structures exist. Our work was strengthened by an interdisciplinary research team situated across medical education, sociology and education; our different knowledge and practices provided a constructive tension that enabled a deeper interrogation of the data. Social network analysis enabled us to investigate the achievement gap from a mid-level perspective, focusing on network features as the point between wider social structures and individual agency, furthering our understanding of how macro patterns of inequality are maintained at the micro-level.

We found clear evidence for homophily by ethnicity, supporting previous research that has found higher interaction rates between medical students of similar ethnic backgrounds (25)Our findings indicate medical students may be benefiting in some way from being part of a homogenous network. Despite previous research showing such networks to be important for minority students' academic success (32), we found no relationship between homophily and achievement for any ethnic or religious group. That white students were significantly more homophilous than their non-white peers is an important finding that cannot be explained by opportunity alone, as cohorts at this medical school comprised around 40% students from ethnic minority backgrounds. 'Integration' is a term associated with greater need for minority groups to assimilate into the majority group by adopting the latter's activities, norms and values (15). Our findings challenge the assumption underlying this discourse; rather than placing the impetus on minority students, we suggest white students need to be less socially exclusive.

Naming a tutor or clinician in a personal academic support network was significantly linked to higher achievement, and the proportion of students naming at least one staff member increasing in better achieving quartile groups. Being an individual with connections that span some of the

unconnected groups in a network, 'bridging', can create an advantage for individuals as they have access to, and can potentially control, information or resources that are unavailable to others (28,33). At this large medical school there were many unconnected groups, including friendship groups, PBL groups, faculty and clinical teams. In this context, bridging social capital may be translating into better exam performance, as participants who were less homophilous (i.e. were bridging different social group by age and role) more frequently achieved higher grades than their peers. Our work indicates that ethnicity and religion may be mediating relationships with more expert individuals, whether these be higher achieving peers, tutors or clinicians. This was particularly notable amongst students from ethnic backgrounds here analysed as 'other' (a group that included but was not limited to students from black, Malaysian and Middle Eastern ethnic origins) and for Muslim students. Although our group sizes were too small to draw statistically significant findings, these emergent patterns are extremely important and warrant further research as these groups are least likely to achieve in the first quartile. Testing these hypotheses on a larger sample would also enable a more sophisticated analysis to account for differences within the ethnic groups analysed here, and to investigate the 'intersectionality' of ethnicity, religion, gender and class (34).

Lower achievers were more likely to be peripheral actors in their PBL networks. Students in the 4th quartile were significantly less likely to be identified by others in their PBL group in study-related activities, despite naming more of their group in such interactions. This suggests they lack the bridging social capital associated with interaction with more successful members of the student population and poses a wider question about how higher and lower achieving students are conceptualising study activities. Students who underachieve may be excluding themselves from study interaction in order to avoid being identified as academically poor, however, our data supports the theory they are excluded from the activities of higher achievers (35). Lacking these connections doubly disadvantages lower achieving students as they not only miss out on the

resources flowing directly from their higher achieving peers, but also from those resources flowing from tutors and clinicians indirectly via these peers.

Achievement in medicine, particularly in the clinical years, is not simply a case of learning and regurgitating information. Students must learn to become a doctor, embodying the practices of the medical world (36). As members of the dominant culture of medicine, white students' homophily disadvantages non-white students by excluding them from the networks through which resources and practices can be shared. Relationships with seniors impact on this process as students gain access to the role models and other capital such as influence, social credentials and reinforcement of their identity (37). Lacking bridging social capital in the form of relationships with senior colleagues and more successful peers cuts lower achievers off from the discourses, experiences and resources valued in the medical domain, creating a cycle of non-participation and impaired learning. This relational theory of underachievement is in direct contrast to explanations of the achievement gap in terms of natural academic ability or deficit. Whilst a small achievement gap is evident between white and ethnic minority pupils prior to medical school, this does not explain the amount of variance observed in examination performance, suggesting there is a 'medical education effect' (38). We suggest that interaction with peers and seniors, mediated by ethnicity and religion, are underlying processes in this effect.

Recommendations

The relational nature of achievement must be made explicit to all members of a medical school. Preparing students to network and take advantage of interactions with seniors must be part of their training, particularly for struggling students. Faculty must also be supported to maintain a critical reflexivity about their own interactions with students, to ensure they are able to interpret and respond to networking efforts from students in an unbiased way. Struggling students should be supported to enhance their existing relationships and to utilise untapped potential bridging social

capital. With regard to policy and planning, medical schools and clinical placements could develop targeted peer and senior mentoring programmes. This has implications for Higher Education more broadly, as the graduate job market becomes more competitive, achievement and experience will determine who is successful and who is left behind. We recommend that social capital must be taken into account in student support to ensure social mobility is not restricted to the already advantaged.

Conclusion

Achievement is mediated by social networks. Students who underachieve are less likely to have tutors or clinicians in their networks and are more likely to be marginalised by their PBL group in study-related activities. Although ethnicity and religion appeared to mediate these relationships, further work is needed to test these hypotheses.

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