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PSYCHIATRIC EPIDEMIOLOGY

Does cultural integration explain a mental health advantage for adolescents?

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Background A mental health advantage has been observed among adolescents in urban areas.

This prospective study tests whether cultural integration measured by cross-cultural friendships explains a mental health advantage for adolescents.

Methods A prospective cohort of adolescents was recruited from 51 secondary schools in 10 London boroughs. Cultural identity was assessed by friendship choices within and across ethnic groups. Cultural integration is one of four categories of cultural identity. Using gender-specific linear-mixed models we tested whether cultural integration explained a mental health advantage, and whether gender and age were influential. Demographic and other relevant factors, such as ethnic group, socio-economic status, family structure, parenting styles and perceived racism were also measured and entered into the models. Mental health was measured by the Strengths and Difficulties Questionnaire as a 'total difficulties score' and by classification as a 'probable clinical case'.

Results A total of 6643 pupils in first and second years of secondary school (ages 11–13 years) took part in the baseline survey (2003/04) and 4785 took part in the follow-up survey in 2005–06.

Overall mental health improved with age, more so in male rather than female students. Cultural integration (friendships with own and other ethnic groups) was associated with the lowest levels of mental health problems especially among male students. This effect was sustained irrespective of age, ethnicity and other potential explanatory variables. There was a mental health advantage among specific ethnic groups: Black Caribbean and Black African male students (Nigerian/Ghanaian origin) and female Indian students. This was not fully explained by cultural integration, although cultural integration was independently associated with better mental health.

Conclusions Cultural integration was associated with better mental health, independent of the mental health advantage found among specific ethnic groups: Black Caribbean and some Black African male students and female Indian students.

Keywords Adolescents, mental health, advantage, cultural integration

Introduction

Adolescence is an especially challenging period of biological, emotional and psychological maturation during which there is a negotiation of new identities, growing independence from parental influence, new friendship choices and an interest in intimate sexual relationships.¹ These complex maturational processes occur within specific social, cultural and family contexts.¹ Adolescent mental health problems are common, and increase the likelihood of adult illness (psychiatric and physical) with associated loss of employment, a higher mortality, marital breakdown and adverse life events, and the potential transmission of health risk behaviours to future generations.¹⁻³ Gender differences in depression rates also emerge in adolescence.⁴ Adolescence is therefore a critical period of development and might be the most appropriate time to deliver health interventions with maximal benefits over the life-course.^{3,6}

The bio-psycho-social causes of adolescent depression cluster in urban, deprived and socially fragmented areas.^{3,6} These areas have historically been a home to economic migrants and their descendants, asylum seekers and refugees and international students and workers. Studies of adolescent health and cultural diversity are important for a number of reasons. The relationship between health and multiculturalism is hotly debated. Cultural diversity is said to generate greater mistrust of neighbours,⁷ and to lead to poorer health. These effects may be mediated by low social capital. Social capital is defined as social relationships that cut across demographic differences such as age, gender and ethnicity (called bridging social capital) and relationships that strengthen within-group support (bonding social capital). The social effects are complex; for example, prejudice and discrimination against another group (for example new migrants) attacks bridging social capital but may strengthen bonding social capital. The implications for adolescent health are significant.^{3,6} For example, unemployed youth or migrants or those living in poorer neighbourhoods might be vulnerable to social exclusion, poor educational achievements and a breakdown of bridging social capital. This may lead to less bridging social capital and subsequent recruitment to gangs and violent crime. Male students are particularly likely to fall into these high-risk groups

Although the risks for adolescent mental health are commonly debated and investigated with a focus on health services, less is known about the health advantages found in adolescent populations living in a defined geographical area. Mental health is conceptualized as an absence of significant symptoms of mental illness, as for example, measured in epidemiological studies as well as in accord with clinical definitions

based on categories of specific mental disorders; but mental health may also incorporate notions of resilience. Understanding resilience may provide clues about improving adolescent health in general. A systematic review of adolescent mental health in the UK found that Indian and Black African children had better mental health compared with White British children.⁸ Pakistani, Black Caribbean and Bangladeshi children showed no prevalence differences when compared with White British children. In contrast, a study of 2790 adolescents (11- to 14-year-olds) in East London, England, found a lower prevalence of mental health problems in Bangladeshi adolescents despite significant levels of social and material disadvantage.⁹ Another cross-sectional study of 6632 adolescents (11- to 13-year-olds) in London found better mental health among Black African male students and among female students.^{10,11}

What might explain the mental health advantage?

Research shows that greater parental care and lower parental control are protective of mental health but do not fully explain a mental health advantage found in some ethnic groups.¹² Social support from friends and family,¹³ and religious worship protect against mental health problems and buffer social adversity such as discrimination and bullying.¹⁴ Acculturation, a process of adaptation to a new society or culture, involves changes in beliefs, behaviours and knowledge; as part of the acculturation process unhealthy behaviours and lifestyles might be adopted or exchanged for healthier ones. However, this process places strain on social relationships (within and across ethnic groups) and can affect mental health.¹⁵ International research shows that acculturation can lead to a change in choice of friendships, clothing, consumption behaviours, preferred language, choice of reading materials and leisure activities, religious practices and parenting style.^{16,17} The research methods used to measure acculturation and the cultural groups under investigation often differ across studies, making it difficult to draw any comparative conclusions across ethnic groups, and within the same country, let alone across countries.¹⁷ The terms used for ethnic groups also differ across countries; for example, Asians in the UK refers to Indian, Pakistani or Bangladeshi origin people who are conspicuous Asian migrants to the UK, whereas Asians in the USA often refers to East Asians such as Vietnamese, Chinese or Cambodian origin. When dealing with young adolescents, there is an added complication that the country of origin of parents is often used to classify adolescents into specific ethnic groups. Their level of adherence to cultural practices in their parents' country of origin is likely to vary by their

acculturation status. Therefore, studies of acculturation and cultural identity are important subjects for further investigation as ethnic group patterns of health status may be better explained by acculturation variables like cultural identity.

In a London cohort of adolescents, using the same method to assess cultural identity in different ethnic groups, cultural integration was defined by choice of friends; whether friends were mainly from the same ethnic group as the respondent (traditional cultural identity), from the dominant ethnic group (assimilated cultural identity), from neither (marginalized cultural identity) or equally from both ethnic group of origin and the dominant ethnic group; this last category defined cultural integration. Cultural integration was associated with a lower prevalence of mental health problems in cross-sectional analyses, but these did not exclude reverse causality as a possible explanation.^{16,18} Therefore, longitudinal studies of cultural integration are necessary as are comparative studies using similar methods in different cultural groups. Building on improved methods to measure cultural identity in a comparative survey,^{16,18} this article presents prospective analyses, from the Determinants of Adolescent Social Well-being and Health (DASH) study of adolescent health, testing whether cultural integration explains the mental health advantage of adolescents in ethnically diverse inner city areas. By 'explain a mental health advantage', following conventions in previous work,⁸ we refer to both showing independent associations with better mental health; and, that on adjustment for cultural identity, a mental health advantage for some ethnic groups is no longer evident.

Research questions

- (1) Is cultural integration associated with a mental health advantage in adolescent populations (independent of other risk and protective factors such as place of birth, ethnic group, place of worship attendance, family structure, parental care and control; and adversity such as perceived racism, material deprivation and low socio-economic status).
- (2) Does the mental health advantage of cultural integration vary with age, gender and ethnic group?
- (3) Does cultural integration explain the mental health advantage of specific ethnic groups?

Methods

DASH study

The DASH sample was recruited between 2003 and 2004, from 51 secondary schools in 10 London boroughs. A total of 6643 students in first and second years of secondary school (ages 11–13 years) took part in the baseline survey and 4785 (88% of the invited

children) took part in the follow-up survey in 2005–06. Ethics approval was obtained from the Multi-centre Research Ethics Committee and from local education authorities. Full details of the DASH study protocol have previously been reported (<http://dash.sphsu.mrc.ac.uk/Researchers.html>).¹⁰

Cultural identity and ethnicity

Ethnic group was measured by combining self-reported ethnicity, having at least one parent of that same ethnic group, and having at least three grandparents born in the country of origin.¹⁰ Ethnic groups also show considerable heterogeneity within them. For example, Black Africans include Black Ghanaians and Nigerians who arrived in the 1950s and 1960s with right of entry to UK. Other African groups arrived later, such as Somalis, often as asylum seekers. Therefore, where the findings are patterned by relevant ethnic sub-groups, we have attempted to show this finer grain analysis. Information from questions about friendships with peers of the respondent's own or other ethnic group was used to classify pupils into one of four acculturation outcomes: an integrated cultural identity (friendships with own and with other ethnic groups), a traditional cultural identity (friendships only with own ethnic group), an assimilated cultural identity (friendships only with other ethnic groups) and marginalized cultural identity (friendships with neither own nor the dominant other ethnic group).^{18,19,20} In this study, the integrated form of cultural identity is used as the measure of cultural integration, and as a reference group for comparison with other cultural identity groups. Ethnicity was self-identified, and consistency checked with the reported ethnicity of parents and the country of birth of grandparents.¹⁰ For reporting convenience, we referred to White UK as 'White' or 'White British'.

Age and socio-economic status

Age was determined from the reported date of birth, and generational status from country of birth (abroad or UK). Socio-economic circumstances (SEC) were measured using questions about access to 17 standard of living items (in tertiles).²¹ Multidimensional measures such as this are better at capturing disadvantage in ethnic minorities than traditional measures, such as occupational class.^{21,22} This proxy measure of SEC correlates well with parental employment status.²³

Family life, discrimination, place of worship attendance

Family life was captured by asking about family type (living with both parents, one parent and one other in a parental role, one parent only and neither parent); and about perceived quality of relationship of adolescents living with at least one parent (get on very well/quite well, compared with not so well).

The eight-item Parental Bonding Instrument (PBI) rates each item on a four-point Likert scale from which scores for parental care and parental control are derived. Higher scores represent greater care and greater control. These scores were recoded into tertiles (1 = low, 3 = high care/control). The PBI also notes the number of activities that are shared with parents in a week (<12 vs >25).²⁴ Perceived racism was measured using questions on experiences of discrimination or hassles about race, skin colour or place of birth (yes or no). Frequency of attending a place of worship measured religiosity (often/regularly vs seldom/never).

Deprivation: school and area levels

Deprivation at the school level was measured using the proportion of pupils eligible for free school meals, derived from the 2003 and 2006 School Censuses kept by the UK Government Department of Children, Schools and Families. Deprivation at the area of residence level was measured using the income dimension of the Index of Multiple Deprivation for the periods 2001–02 and 2004–06 (<http://www.neighbourhood.statistics.gov.uk>). School- and area-level ethnic density did not show any associations with the presence of mental disorders, and so were not included in analyses (data not shown).

Mental health

The Strengths and Difficulties Questionnaire (SDQ) was used to measure clinically significant and common (non-psychotic) mental disorders.^{25,26} The measure is well tested in multi-cultural settings and functions as well as the Rutter questionnaires. The total difficulties score (TDS) is based on 20 items assessing hyperactivity, emotional disorders, conduct disorders and peer relationships. The total score gives a measure of psychological distress, a higher score indicating more psychological distress. The TDS correlates well with clinician rated measures of change.²⁶ A cut-off of $TDS > 17$ was used to identify potentially clinical cases (<http://www.sdqinfo.org/py/doc/c0.py>) based on normative score distributions that show that ~10% of adolescent populations, those with clinically significant psychological distress, score over 17. The SDQ has been validated in multiple cultures and languages (see <http://www.sdqinfo.org/py/doc/c0.py>). The results by $TDS > 17$ ('probable clinical case') will also be shown to reflect clinically significant findings.

Statistical analysis

Repeated measures were obtained from the same pupils at baseline and at follow-up. Although pupils were nested within schools and neighbourhoods, preliminary analyses showed that clustering at the neighbourhood and school levels was not statistically significant. A simple two-level random intercepts and random

slopes (on age) model with measurements nested within pupils was used. We used gender-specific linear-mixed models to explore the influence of cultural identity on a continuous measure of TDS.

Age trends were modelled as polynomial functions of age. Age was fitted as a quadratic or cubic function, the choice dependent on statistical significance. TDS was initially regressed on cultural identity, age and ethnicity. We then adjusted for generational status, standard of living, racism and religious attendance. In a third model, we took into account the family structure, parenting style (care and control) and perceived quality of relationship with parent(s). Finally, we adjusted for the contextual school and neighbourhood effects. Effect estimates and 95% confidence intervals (CI) are presented.

The different covariates were considered as time (age)-dependent (except generational status).

The average age at baseline was 12.6 years (11.2–14.5) and at follow-up 15.2 years (13.8–16.9). We used information on all of the ages simultaneously to estimate 'mean TDS' between 12- and 16-year-olds by cultural identity status from the fully adjusted models. The predictions were limited to the 12–16-year age range, because <2% of the sample were <12 years at baseline or >16 years at follow-up. Finally, we investigated any interaction between cultural identity and the explanatory variables using the log-likelihood ratio or Wald test.

The association between cultural identity and 'probable clinical caseness' ($TDS > 17$) was examined using logistic generalized estimating equations models (with exchangeable 'working' correlation matrix and robust standard errors). This is an extension of the logistic regression that allows for dependence within clusters and provides population-averaged effects. The model building approach corresponded with that described for 'mean TDS'.

The Multiple Imputation by Chained Equations approach was used to handle missing data.²⁷ Forty-five imputations were generated and estimates were combined using Rubin's rules. Less than 2% of the sample had missing data for TDS and <12% had missing data for cultural identity; overall, 90% of the sample had less than three missing variables. Missing data on covariates tended to be higher for the marginal than other cultural identity groups.

Results

Table 1 gives a description of the sample by cultural identity. Pupils showed greater cultural integration with older age. Compared with their White peers, ethnic groups were generally less likely to be classified as having traditional friendships. For example, of the 11- to 13-year-olds, 34.2% of the White vs 18.8% of the Other African group ($P < 0.0001$), and 25.7% of the Indian group ($P = 0.004$), showed traditional friendships; and for those aged 14–16 years, the respective figures were

Table 1 Cultural identity by sample characteristics (%) at each measurement point

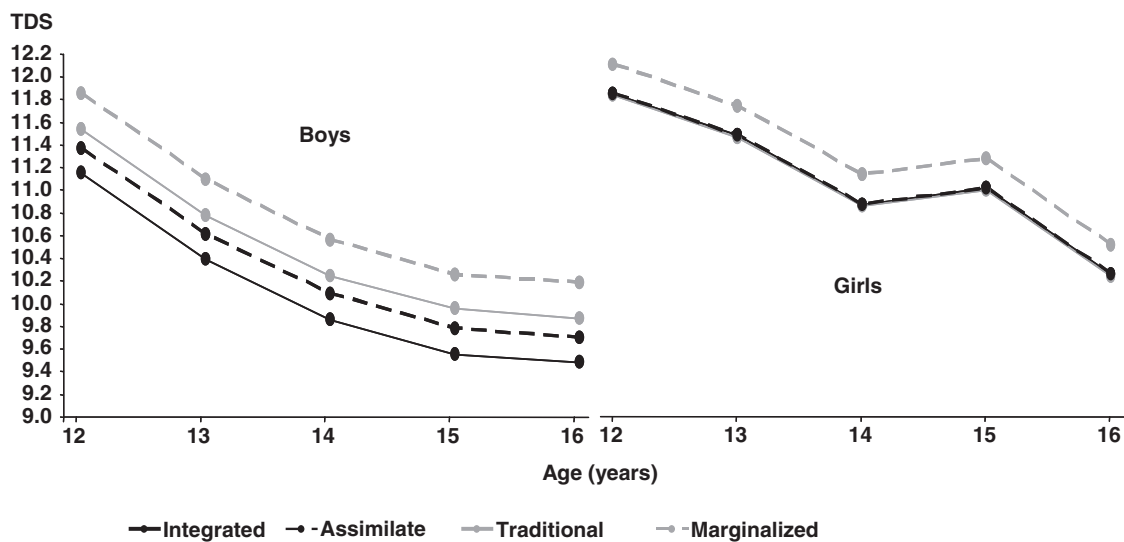
Sample characteristics	11–13 years					14–16 years				
	n =	Integrated	Traditional	Assimilated	Marginalized	n =	Integrated	Traditional	Assimilated	Marginalized
	4785	29.0	27.5	26.3	17.2	4785	34.5	27.6	26.7	11.3
Gender										
Male	2615	30.6	27.4	25.2	16.8	2615	37.9	25.6	24.6	11.9
Female	2170	27.1	27.7	27.6	17.6	2170	30.4	30.0	29.2	10.5
Ethnicity										
White UK	0873	28.7	34.2	19.7	17.4	0873	33.6	33.3	20.8	12.3
Other White	0464	21.7	22.0	35.2	21.2	0464	32.4	15.4	40.1	12.1
Black Caribbean	0780	31.7	38.2	14.0	16.1	0780	31.7	40.6	13.4	14.3
Nigerian/Ghanaian	0505	33.8	28.6	24.2	13.5	0505	37.5	31.8	21.7	9.0
Other African	0387	29.9	18.8	35.2	16.1	0387	35.0	19.2	32.2	13.6
Indian	0419	29.4	25.7	26.1	18.9	0419	40.5	24.6	28.5	6.5
Pakistani	0295	33.0	32.1	18.2	16.7	0295	43.8	28.5	20.5	7.2
Bangladeshi	0151	29.1	26.1	31.2	13.6	0151	43.0	31.2	16.1	9.7
Mixed Black Caribbean/White	0262	29.8	19.6	32.8	17.8	0262	28.4	17.1	40.3	14.2
Other	0649	24.9	16.9	39.7	18.6	0649	30.4	19.6	40.1	10.0
Generational status										
Born abroad	3604	27.4	23.8	28.3	20.5	3604	34.1	22.7	28.5	14.8
Standard living										
Least advantaged	1357	25.6	26.3	28.7	19.5	1685	29.2	26.5	29.8	14.5
Most advantaged	1497	32.8	28.4	23.2	15.5	1222	38.9	28.7	23.6	8.8
Racism										
Experienced	1191	31.3	23.1	28.4	17.2	1361	35.3	23.8	29.3	11.6
Religious attendance										
Often/regularly	2558	31.3	28.0	25.2	15.5	2262	38.2	27.8	23.6	10.4
Family structure										
Single parent household	1227	28.7	27.1	28.3	16.0	1292	31.6	28.7	27.9	11.8
Parent care score										
Low care	1480	25.7	27.6	27.5	19.3	2338	32.7	28.6	27.2	11.6
High care	1869	32.4	27.7	24.0	15.9	1121	36.8	24.3	26.7	12.3
Parent control score										
Low control	1221	32.6	28.2	24.7	14.6	1431	36.0	27.7	26.1	10.1
High control	1518	26.0	26.7	27.3	20.1	1683	32.3	26.7	27.8	13.2
Activities shared with parents										
<12 activities/week	1147	23.3	27.6	31.1	17.9	2187	32.2	28.1	28.6	11.1
≥24 activities/week	1122	33.3	27.0	23.3	16.5	0393	41.1	22.0	23.9	13.1
Free school meals^a										
≥50% of pupils	1095	26.3	25.4	27.3	21.0	1001	34.8	20.6	29.4	15.2
Income IMD^{a,b} score										
Low score	0819	28.3	34.0	23.5	14.3	0554	36.1	32.0	23.3	8.6
High score	1461	27.9	26.2	28.5	17.4	1931	34.3	25.9	27.5	12.4

^aFree school meals and Index of Multiple Deprivation scores are proxies for deprivation at school and area levels, respectively.

^bIndex of Multiple Deprivation.

Table 2 Total difficulty score (TDS) by cultural identity status, ethnicity and gender (adjusted for age) at each measurement point

TDS by gender	Integrated Mean (95% CI)	Traditional Mean (95% CI)	Assimilated Mean (95% CI)	Marginalized Mean (95% CI)	All Mean (95% CI)
Male students					
TDS (years)					
11–13	10.1 (9.7–10.5)	10.8 (10.4–11.1)	10.6 (10.2–11.0)	11.3 (10.8–11.8)	10.6 (10.4–10.8)
14–16	9.4 (9.1–9.7)	9.8 (9.4–10.1)	10.0 (9.6–10.3)	10.7 (10.2–11.2)	9.8 (9.6–10.0)
TDS > 17 (%; years)					
11–13	8.0 (6.0–10.0)	10.5 (8.1–12.8)	8.9 (6.5–11.2)	12.7 (9.4–16.0)	9.7 (8.5–10.8)
14–16	4.6 (3.3–5.6)	5.3 (3.6–7.1)	7.3 (5.2–9.3)	7.9 (4.8–10.9)	5.8 (4.9–6.7)
Female students					
TDS (years)					
11–13	11.2 (10.7–11.6)	10.9 (10.4–11.3)	11.0 (10.6–11.5)	11.4 (10.9–12.0)	11.1 (10.9–11.3)
14–16	10.7 (10.3–11.1)	10.9 (10.5–11.3)	11.3 (10.9–11.7)	11.9 (11.3–12.6)	11.0 (10.8–11.3)
TDS > 17 (%; years)					
11–13	11.6 (8.9–14.3)	10.1 (7.5–12.6)	11.0 (8.4–13.6)	16.5 (12.7–20.4)	11.9 (10.5–13.2)
14–16	9.9 (7.6–12.2)	9.3 (7.0–11.5)	11.8 (9.3–14.3)	12.9 (8.5–17.4)	10.6 (9.3–11.9)

**Figure 1** Trajectories of total difficulty score (TDS) between 12–16-year-olds by cultural identity and gender-adjusted mean TDS predicted from linear-mixed regression models. Age-specific TDS means predicted from gender-specific linear-mixed models adjusted for age, generational status, standard of living, experience of racism, place of worship attendance, family structure, parental care, parental control (control and control \times age interaction), quality of the relationship with parents, proportion of free school meal and income dimension of the Index of Multiple Deprivation. The regressions were performed using 45 multiple imputations of missing outcome and covariate values. Predictions were derived using Rubin's rules

33.3% vs 19.2% ($P < 0.0001$), and 24.6% ($P = 0.002$). A general pattern of a reduction with age in 'mean TDS' and in 'potential clinical cases' was observed (Table 2, adjusted for age and gender). For male students, mean age-adjusted TDS score decreased from 10.6 (95% CI 10.4–10.8) to 9.8 (95% CI 9.6–10.0) between early and late adolescence ($P < 0.0001$). Potential clinical cases also decreased among male ($P < 0.0001$) and female ($P = 0.025$) students.

Figure 1 shows 'mean TDS' by cultural identity, age and gender, derived from fully adjusted gender specific linear-mixed models. Among male students, decreases in 'mean TDS' with age were found for all identity groups. For male and female students, 'mean TDS' was highest in the marginalized group and lowest in the integrated group at all ages. The cultural identity differences were consistent, but not as great for female students.

Table 3 Total difficulty score (TDS) (coefficient and 95% CI) by cultural identity status and ethnicity for male and female students, derived from multivariate linear mixed regression models

Sample characteristics	Model 1 ^a		Model 2 ^b		Model 3 ^c		Model 4 ^d	
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Male students								
Cultural identity								
Integrated	Ref		Ref		Ref		Ref	
Assimilated	+0.40 (0.07, 0.73)		+0.35 (0.03, 0.68)		+0.27 (-0.06, 0.59)		+0.25 (-0.07, 0.58)	
Traditional	+0.51 (0.19, 0.83)		+0.51 (0.20, 0.83)		+0.38 (0.07, 0.70)		+0.39 (0.08, 0.71)	
Marginalized	+0.87 (0.47, 1.26)		+0.87 (0.47, 1.26)		+0.73 (0.34, 1.13)		+0.74 (0.35, 1.13)	
Ethnicity								
White UK	Ref		Ref		Ref		Ref	
Other White	-0.59 (-1.21, 0.03)		-0.67 (-1.31, -0.04)		-0.64 (-1.25, -0.03)		-0.72 (-1.34, -0.11)	
Black Caribbean	-0.62 (-1.17, -0.08)		-0.67 (-1.23, -0.12)		-1.00 (-1.54, -0.45)		-1.10 (-1.65, -0.55)	
Nigerian/Ghanaian	-1.88 (-2.55, -1.21)		-1.98 (-2.69, -1.27)		-2.22 (-2.90, -1.53)		-2.34 (-3.04, -1.65)	
Other African	-0.81 (-1.48, -0.13)		-0.92 (-1.66, -0.19)		-1.01 (-1.72, -0.30)		-1.08 (-1.80, -0.36)	
Indian	-0.60 (-1.24, 0.04)		-0.60 (-1.26, 0.06)		-0.46 (-1.11, 0.18)		-0.56 (-1.21, 0.08)	
Pakistani	-1.04 (-1.70, -0.37)		-0.98 (-1.67, -0.28)		-0.83 (-1.50, -0.15)		-1.00 (-1.68, -0.31)	
Bangladeshi	-1.05 (-1.96, -0.13)		-1.13 (-2.06, -0.20)		-1.22 (-2.13, -0.32)		-1.29 (-2.20, -0.37)	
Mixed Black Caribbean/White	-0.34 (-1.15, 0.47)		-0.62 (-1.42, 0.18)		-0.70 (-1.48, 0.07)		-0.77 (-1.55, 0.00)	
Other ethnicity	-0.60 (-1.16, -0.04)		-0.78 (-1.36, -0.20)		-0.96 (-1.52, -0.40)		-1.04 (-1.60, -0.48)	
Female students								
Cultural identity								
Integrated	Ref		Ref		Ref		Ref	
Assimilated	+0.03 (-0.35, 0.42)		+0.02 (-0.36, 0.40)		-0.01 (-0.38, 0.36)		-0.02 (-0.39, 0.35)	
Traditional	-0.05 (-0.42, 0.32)		+0.02 (-0.35, 0.39)		-0.02 (-0.38, 0.34)		-0.03 (-0.39, 0.33)	
Marginalized	+0.37 (-0.09, 0.83)		+0.33 (-0.13, 0.79)		+0.25 (-0.20, 0.70)		+0.23 (-0.22, 0.68)	
Ethnicity								
White UK	Ref		Ref		Ref		Ref	
Other White	+0.10 (-0.64, 0.85)		+0.06 (-0.69, 0.81)		-0.24 (-0.96, 0.48)		-0.28 (-1.00, 0.44)	
Black Caribbean	0.00 (-0.61, 0.61)		-0.03 (-0.65, 0.59)		-0.47 (-1.07, 0.14)		-0.49 (-1.10, 0.12)	
Nigerian/-Ghanaian	-0.11 (-0.76, 0.54)		-0.11 (-0.80, 0.59)		-0.53 (-1.20, 0.14)		-0.60 (-1.27, 0.08)	
Other African	-0.36 (-1.13, 0.41)		-0.28 (-1.12, 0.55)		-0.65 (-1.45, 0.15)		-0.70 (-1.51, 0.11)	
Indian	-1.62 (-2.39, -0.86)		-1.63 (-2.39, -0.87)		-1.61 (-2.34, -0.88)		-1.62 (-2.35, -0.88)	
Pakistani	+0.01 (-1.02, 1.04)		-0.17 (-1.17, 0.84)		-0.15 (-1.12, 0.81)		-0.15 (-1.13, 0.82)	
Bangladeshi	-0.16 (-1.36, 1.03)		-0.43 (-1.60, 0.73)		-0.56 (-1.68, 0.55)		-0.71 (-1.84, 0.42)	
Mixed Black Caribbean/White	+0.57 (-0.27, 1.42)		+0.42 (-0.40, 1.25)		+0.02 (-0.77, 0.81)		-0.02 (-0.82, 0.77)	
Other ethnicity	-0.09 (-0.77, 0.59)		-0.20 (-0.88, 0.49)		-0.45 (-1.10, 0.21)		-0.50 (-1.16, 0.16)	

^aModel 1: coefficients were estimated with linear-mixed models with random intercept and slope for age (the random slope only for male students). Regressions were performed using 45 multiple imputations of missing outcome and covariate values. Parameter point and variance estimates were combined using Rubin's rules.

^bModel 2: same as model 1 + adjustment for generational status, standard of living, experience of racism and place of worship attendance.

^cModel 3: same as model 2 + adjustment for family structure, parental care, parental control (control and control x age interaction) and quality of the relationship with parents.

^dModel 4: same as model 3 + adjustment for contextual variables: proportion of free school meals, Income dimension of the Index of Multiple Deprivation.

Table 3 shows the association between cultural identity and 'mean TDS', adjusted for age, ethnicity and then for other potential modifying factors, added in a step-wise manner. Cultural identity was independently associated with 'mean TDS' among male students ($P=0.0014$). The integrated cultural identity group had lower 'mean TDS' scores compared with the assimilated [$+0.40$, 95% CI (0.07–0.73), $P=0.018$], traditional [$+0.51$, 95% CI (0.19–0.83), $P=0.002$] and marginalized groups [$+0.87$, 95% CI (0.47–1.26), $P<0.0001$]. The differences remained for the traditional ($P=0.015$) and marginalized groups ($P<0.0001$) after adjusting for generational status, standard of living, racism, religious attendance, family factors and area/school deprivation. The 'mean TDS' was generally higher among White male students [mean TDS 11.47, 95% CI (11.07–11.88) at 12 years of age; mean TDS = 10.41, 95% CI (9.99–10.82) at 16 years of age], with the Nigerian/Ghanaian male students showing the lowest scores [-1.88 , 95% CI (-2.55 , -1.21), $P<0.0001$]; adjustments amplified the relative differences [-2.34 , 95% CI (-3.04 , -1.65), $P<0.0001$]. In contrast to male students, cultural identity was not generally associated with mean TDS among female students ($P=0.670$), and only the Indian female students had a lower mean TDS [-1.62 , 95% CI (-2.35 , -0.88), $P<0.0001$] than their White peers [mean TDS 11.20, 95% CI (10.72–11.68) at 12 years of age; mean TDS = 10.70, 95% CI (10.19–11.21) at 16 years of age]. Adjusting for family structure and parenting style (Model 3—penultimate model) led to the largest reduction in the differences in mean TDS across the different cultural identity groups.

The absence of interactions between cultural identity and age or ethnicity suggested that cultural identity effects shown in Figure 1 and Table 3 were constant by age or ethnicity. Thus, cultural identity does not explain the mental health advantage found in some ethnic groups. Reports of racism were associated with mean TDS among female students and this varied by a marginalized cultural identity ($P=0.059$). It was only among those reporting racism that mean TDS was higher among the marginalized groups [$+0.99$, 95%CI (0.14–1.85), $P=0.023$] than the integrated group.

Table 4 shows the association of cultural identity and 'probable clinical cases' (TDS > 17) by gender, adjusted for age, ethnicity and then for other potential modifying factors. The marginalized group was more likely than the integrated group to be 'probable clinical cases' [male students: odds ratio (OR) = 1.57, 95% CI (1.13–2.18), $P=0.006$; female students: OR = 1.36, 95% CI (1.02–1.82), $P=0.04$]. The relative difference attenuated with adjustment, especially among the female students ($P=0.068$). The pattern by ethnicity was similar as seen for mean TDS. Compared with their White peers, Nigerian/Ghanaian [OR = 0.44, 95% CI (0.25–0.75), $P=0.005$] male students and

Indian female students [OR = 0.54, 95% CI (0.32–0.91), $P=0.023$] were less likely to be 'probable clinical cases' before or after adjustments ($P<0.0001$ and $P=0.018$, respectively).

Discussion

Principal findings

Cultural integration is associated with better mental health, especially amongst male students, and this is independent of a mental health advantage found among some ethnic groups. Our findings also show improvements in mental health or psychological well-being in male students during adolescence and no evidence of poorer mental health in female students during adolescence.

Explaining the findings and study limitations

Our findings of lower mental health problems with increasing age during adolescence need replication as previous longitudinal studies have not found this.^{3,4,5} A previous school-based study in London, the RELACHS study, used two different outcome measures ('probable clinical case' on the SDQ and a moods and feelings questionnaire that measured depressive symptoms) and found that male students in year 11 (aged 13–14 years) had lower levels of mental health problems compared with male students in year 7 (aged 11–12 years).⁹ Conversely, the levels of mental health problems were higher in year-11 female students compared with year-7 female students.⁹ However, these findings were baseline cross-sectional results and not in the same school students. Only one other study to our knowledge has a similar finding to ours of reduced levels of symptoms with age, following adverse life events which are usually associated with higher levels of symptoms. The study was a 3-year follow-up of 3811 students between the ages of 15 and 18 years in Oslo, Norway.²⁸ The Oslo study reported that recovery from mental distress is substantial and higher among boys than among girls. Mental distress was measured with the Hopkins symptom checklist (HSCL). They report that: 'The proportion of the youth that had a high HSCL score related to reporting adverse life experiences at age 15, followed by a low HSCL score three years later proved to be between 44% and 89% among boys and between 16% and 31% among girls'. In our study, it is possible that resilience or other unmeasured influences had benefits for mental health over time. Thus, cultural integration may be a proxy for other relevant and more fundamental protective factors. For example, some personality attributes may independently lead to more socialization and cross-cultural friendships, and at the same time lead to better mental health; none of the studies to date on acculturation have been able to identify such a characteristic, so replication studies and in-depth studies of mechanisms to identify such characteristics are needed.

Table 4 Probable clinical caseness (TDS > 17), OR (95% CI), by cultural identity status and by ethnicity for male and female students, derived from multivariate logistic GEE regression models

Sample characteristics	Model 1 ^a OR (95% CI)	Model 2 ^b OR (95% CI)
Male students		
Age	0.84 (0.78–0.90)	0.78 (0.71–0.86)
Cultural identity		
Integrated	Ref	Ref
Assimilated	1.29 (0.96–1.72)	1.19 (0.88–1.60)
Traditional	1.28 (0.96–1.72)	1.26 (0.93–1.71)
Marginalized	1.57 (1.13–2.18)	1.45 (1.03–2.04)
Ethnicity		
White UK	Ref	Ref
Other White	0.86 (0.56–1.30)	0.82 (0.51–1.30)
Black Caribbean	0.81 (0.55–1.19)	0.60 (0.40–0.91)
Nigerian/Ghanaian	0.44 (0.25–0.75)	0.34 (0.19–0.62)
Other African	0.82 (0.51–1.32)	0.69 (0.40–1.19)
Indian	1.09 (0.72–1.65)	1.11 (0.71–1.73)
Pakistani	0.66 (0.40–1.07)	0.65 (0.38–1.09)
Bangladeshi	0.65 (0.34–1.23)	0.56 (0.28–1.11)
Mixed Black Caribbean/White	0.85 (0.51–1.44)	0.63 (0.37–1.09)
Other ethnicity	0.75 (0.51–1.11)	0.58 (0.38–0.90)
Female students		
Age	0.94 (0.88–0.99)	0.80 (0.73–0.87)
Cultural identity		
Integrated	Ref	Ref
Assimilated	1.04 (0.80–1.35)	1.01 (0.77–1.33)
Traditional	0.87 (0.67–1.12)	0.88 (0.68–1.16)
Marginalized	1.36 (1.02–1.82)	1.33 (0.98–1.80)
Ethnicity		
White UK	Ref	Ref
Other White	1.13 (0.75–1.70)	1.00 (0.64–1.56)
Black Caribbean	1.05 (0.74–1.49)	0.87 (0.59–1.28)
Nigerian/Ghanaian	1.25 (0.87–1.80)	1.11 (0.72–1.71)
Other African	0.74 (0.46–1.19)	0.65 (0.37–1.13)
Indian	0.54 (0.32–0.91)	0.52 (0.31–0.90)
Pakistani	1.14 (0.63–2.08)	1.04 (0.56–1.94)
Bangladeshi	1.18 (0.63–2.23)	1.11 (0.58–2.10)
Mixed Black Caribbean/White	1.28 (0.83–1.98)	1.00 (0.63–1.60)
Other ethnicity	0.93 (0.62–1.39)	0.79 (0.51–1.21)

^aModel 1: coefficients were estimated with gender-specific logistic GEE models. Regressions were performed using 45 multiple imputations of missing outcome and covariate values. Parameter point and variance estimates were combined using Rubin's rules.

^bModel 2: same as model 1 + adjustment for generational status, standard of living, experience of racism, place of worship attendance, family structure, parental care, parental control, quality of the relationship with parents, proportion of free school meal, Income dimension of the Index of Multiple Deprivation.

Potential sources of bias in our study need to be considered. Although the use of TDS may be more sensitive to sub-threshold disorders, this cannot explain our findings, as the trends for 'probable clinical cases' in our data were similar to trends for TDS. The results presented in the tables and figure are from analysis of multiple imputed data but we also analysed the non-imputed data. In summary, the effect sizes associated with mean TDS reported in the tables and figure showed little change, and mainly at the second decimal point. Thus, imputation methods cannot account for the findings of fewer mental health problems with age during adolescence. Non-random attrition may explain our findings as although attrition was low, attriters were more likely than not to be cases. The actual number of probable clinical cases lost was low and did not vary by ethnicity. Sensitivity analyses suggest that if attriters had twice the levels of probable clinical caseness as non-attriters, this might increase the prevalence of probable clinical caseness by 1–2%, only partially explaining our findings.

Another possible explanation is that the TDS may be less sensitive to externalizing mental health and behavioural problems, and these are the ones that increase in adolescence for male students. However, it is usually in female students that there is an increase in internalizing symptoms (depression and emotional complaints).^{29,30} Therefore, although sensitivity to externalizing symptoms might explain the findings in male students, it does not account for the findings in female students and nor does it negate the consistency of trends for male and female students, or the relative differences between sub-groups of male students. We also undertook some sub-analysis (not reported) of the sub-scales scores of the TDS. These showed reductions in mean TDS between the two time points, but this was not evident for the hyperactivity or conduct disorder sub-scales.

Previous studies may have found stable or increasing mental health problem due to the use of different outcome measures and analytic methods. There are few cohorts in inner city and ethnically diverse areas, DASH and RELACHS being the only two using similar outcomes and methods of recruitment.^{9,10} Future analyses are planned on the RELACHS cohort data which have not been subjected to similar statistical analyses.

Strengths

A key strength of this study is that DASH is a multi-ethnic cohort with large sample sizes for at least six ethnic groups; and that longitudinal data allowed us to examine the impact of cultural identity and potential correlates on the trajectories of psychological well-being in a cohort of adolescents rather than in consecutive cross-sectional surveys which have been more popular. Although we do not report social support and numbers of friends, including these

did not change the findings of the models, in accord with a previous study that showed social support does not mitigate the lower risk of mental health problem associated with cultural integration.¹⁹

Previous research and implications

Cultural integration measured by friendship choices was associated with the greatest mental health advantage,^{16,17,18} notably in male but to a lesser extent in female students. Most groups were more likely to be classified as culturally integrated or culturally assimilated at the later age, and less likely to be culturally traditional. This suggests that friends from different cultural groups increase with age, and that bridging social capital generally improves with adolescence in all groups.

Black Caribbean and Nigerian/Ghanaian male students' and Indian female students' mental health advantage, when compared with their White peers, was evident whether measured by mean TDS or by classification as 'probable clinical cases'. An integrated cultural identity did not explain lower rates of adolescent mental health problems in these specific ethnic groups, these being sustained when cultural identity was included in the models; nor did many other potential explanatory cultural and social factors attenuate the findings of a mental health advantage when included in the models. Racism was an important risk factor only among female students with marginalized friendship choices; marginalization is inevitably associated with reduced social support and less buffering against adversity, so targeting this vulnerable group may be important for preventing psychological problems and social exclusion. Adjusting for family environment seemed to explain some ethnic variations of mean TDS, suggesting family environments may mediate ethnic-specific influences on friendships. Future studies might investigate these influences of family environment.

This study is the first to show that mental health improved through adolescence, especially for male students; the relative differences by cultural identity remained constant by age and ethnicity. Previous studies show that female students develop more emotional or internalizing mental health problems during adolescence than do male students who develop more externalizing or behavioural problems.^{29,30} More recent research, along with our findings, suggest that the gender differences emerging in adolescence can no longer be uncritically assumed in all populations or that these are always biologically driven. There are several trajectories for developing adolescent depression influenced by gender and culture.^{30,31} Ethnically diverse environments may influence these trajectories and offer a mental health advantage through opportunities for bridging social capital.

Although social capital is supposed to confer benefits to health and mental health, a systematic review

of the literature found inconsistent evidence for ecological level evidence, but as in our study, there is some evidence of individual level effects.³² Bridging social capital has been shown to confer general health benefits among adolescents but more attention is needed to culturally diverse and socially excluded groups.³³ A WHO-Europe report on adolescent health and social cohesion emphasizes the evidence for health benefits of social capital, but there is little evidence for cultural influences on social cohesion, ethnicity only being seen as a source of risk rather than a potential factor in resiliency.³⁴ This absence of attention to cultural integration is surprising given the concerns about social exclusion, education, crime and more recent concerns about violent radicalization and international conflicts and how to help young people cope in school settings.³⁵

Future research might explore specific measures of social capital and its links with cultural integration, and not assume that the effects of cultural integration are the same as the effects of ethnic group membership. Future research might also investigate transitions from marginalization and traditionalism towards cultural integration, at an individual and family and community level, and the effects on individual mental health.

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Ethics: Approval was obtained from the Multicentre Research Ethics Committee and from local education authorities. Parents were provided with information packs prior to the start of the study, via head teachers and a parental opt-out consent procedure was followed. Active consent was required from pupils.

Conflict of interest: All authors have completed the authorship responsibility, financial disclosures,

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Commentary: When in Rome? Integration and the rates of mental illness in black and minority ethnic youth

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Rates of mental illness vary in different ethnic groups within a country. The risk of mental illness and the overall rate in a group are influenced by at least four dimensions: individual factors; ecological factors;

interactions between individual and ecological factors; and time.¹ Groups with different histories, reasons for migration, social realities, school performance, family supports, maturational trajectories, cultures and