Exploring performance differences between UCAT candidates who sit standard and extended versions of the test: report for the UCAT Board

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BACKGROUND

There has been extensive research published on the UCAT, such as the relationship between demographic variables and performance on the different subtests. However, much of the published research does not distinguish between those who take the UCAT and those who take an extended version. There are four such extended versions: UCATSEN, UCATSA, UCATSEN50 and UCATSENSA.

This report will aim to inform considerations regarding UCATSEN, as well as future research in the area. We have three research questions:

1) What are the demographic and educational profiles of those who take an extended version of the UCAT? Are they meaningfully different?

2) What are the relationships between demographic factors and performance on each component of the UCATSEN, including the SJT, and how does this differ from those relationships observed for UCAT performance?

3) What is the feasibility of a future study, using data from the UK Medical Education Database (UKMED), exploring the relationship between UCATSEN performance and other educational attainment (such as secondary school grades or performance in medical school examinations)?

METHODS

Data

Data were available for 150,318 tests taken since 2006. For our analyses, we only used data from the 2022 UCAT sitting, which consisted of 36, 423 tests.

Outcome variables

Data were available for performance on each subtest of the UCAT (*abstract reasoning, decision making, quantitative reasoning, verbal reasoning,* and *SJT*). We also had total UCAT score, and SJT band.

Previous research (Tiffin 2013) has shown that the UCAT can be conceptualised as measuring two dimensions of cognitive functioning: verbal and non-verbal reasoning. As such, we also defined a 'rebalanced' total score, which is calculated as the verbal reasoning score and the average of the other three cognitive components.

Additionally, the UCAT board is considering removing *abstract reasoning* from the test in 2025. As such, under the assumption that this would not change performance on the other three cognitive subtests, we recalculated 'total' score as the sum of the three remaining cognitive subtests.

Predictor variables

Details of the test taken were available. That is, we had information on whether a candidate sat UCAT, UCATSA, UCATSEN, UCATSEN50 or UCATSENSA. These were prefixed with '*TC*', for those who took the test in a test centre, or '*VUE*' for those who took the test via the OnVUE online platform. We therefore:

- Created a variable *test* which detailed which version of the UCAT was sat (0=UCAT, 1=UCATSEN, 2 = UCATSA, 3 = UCATSEN50, 4=UCATSENSA)
- Given the small number of individuals who take an extended version of the UCAT other than UCATSEN, we also dichotomised test taken those who took UCAT vs any extended version.
- We also created a binary variable to represent whether an individual took the test in a test centre or not.

We handled predictor variables in line with our previous research in this area. Specifically:

School type (dichotomised into those who went to a private/selective grammar school, or those who went to a state school), *ethnicity* (white, or those of any other ethnicity), *age* (20 years of age or older at taking the test, or under 20 years of age), *socioeconomic status* (high or low socioeconomic status, based on the NS-SEC), *gender* (male or female), *highest qualification* (higher education qualification or lower), and *regional identity* (English, Scottish, Welsh, or Northern Irish). We used regional identity, alongside the given variable national identity, to identify those individuals from the UK as opposed to outside of the UK.

Other variables provided (e.g. mother tongue) had substantial missingness, and therefore were not included in the analyses.

Statistical analyses

The total number of individuals sitting each version of the UCAT was tabulated for the last four years of data. For the 2022 sitting, descriptive statistics were produced, to identify the

demographic profiles of those who undertook each extended version of the UCAT. Logistic regression models were used to identify the relationship between demographic variables, and whether an individual took UCATSEN or UCAT. A secondary analysis was performed, modelling the relationship between demographic variables, and whether an individual took an extended version of the UCAT or not.

Then, the observable relationship between these sociodemographic characteristics and performance on the UCATSEN was modelled, using linear regression models. Finally, the relationship between test taken and performance on the test was modelled, both unadjusted and adjusted for demographic variables, using linear regression models.

Note that school type was only available for those applicants who were UK nationals. Given the relatively small number of individuals from outside the UK who took an extended version of the UCAT, we did not include this variable in any multivariable regression models.

We also performed a latent profile analysis for those individuals who sat the UCATSEN. A latent profile analysis is equivalent to a latent class analysis, except with continuous indicator variables. We used the scores on the four cognitive components, as well as the SJT, as our indicators. In this, we started with a two profile model, before progressively increasing the number of modelled profiles until i) entropy (a measure of profile separation) had been maximised, and ii) until Bayesian Information Criteria (a measure of model fit) had been minimised.

Once the final latent model(s) had been identified, multinomial logistic regression models were used to model the relationship between latent profile membership and observed sociodemographic variables.

All data cleaning and regression analyses were performed in Stata v17. Latent profile analyses were performed in MPlus v8.1

RESULTS

Data were available for 36,243 individuals who sat a version of the UCAT in 2022, including n=1612 individuals who sat UCATSEN. This included data relating to 10,197,054 items and timings.

	All tests	UCAT	All extended versions	UCATSEN	UCATSA	UCATSEN50	UCATSENSA
2019	29,366	27,993 (95.3%)	1,373 (4.68%)	1,162 (84.6%)	47 (3.42%)	61 (4.44%)	103 (7.50%)
2020	34,304	32,441 (94.6%)	1,863 (5.43%)	1,514 (81.3%)	56 (3.01%)	139 (7.46%)	154 (8.27%)
2021	37,397	34,984 (93.5%)	2,416 (6.46%)	1,922 (80.0%)	96 (3.97%)	140 (7.28%)	255 (10.6%)
2022	36,423	34,216 (93.9%)	2,207 (6.06%)	1,612 (73.0%)	129 (5.85%)	136 (6.16%)	330 (15.0%)

Table 1: Total number of tests taken, across 2019-2022.

As can be seen in Table 1, the proportion of extended tests had been gradually increasing from 2019 (4.68%) to 2021 (6.46%), before decreasing slightly in 2022 (6.06%). Of the extended tests, the vast majority sit the UCATSEN, although this proportion has been falling consistently from 2019 (84.6%) to 2022 (73.0%). Over the same time period, there have been increases in all three of the other extended test forms. Given the number of individuals who sit an extended version of the test, it is likely that a future research programme using the UKMED would be feasible.

What are the demographic and educational profiles of those who take an extended version of the UCAT?

	All tests	UCAT	All extended versions	UCATSEN	UCATSA	UCATSEN50	UCATSENSA
Male	13246/36186 (36.6%)	12512/34012 (36.8%)	734/2174 (33.8%)	564/1592 (35.4%)	36/125 (28.8%)	51/131 (38.9%)	83/326 (25.5%)
Non-white	19376/29084 (66.6%)	18393/27132 (67.8%)	983/1952 (50.4%)	721/1438 (50.1%)	68/119 (57.1%)	55/103 (53.4%)	139/292 (47.6%)
Older	7211/36423 (19.8%)	6424/34216 (18.8%)	787/2208 (35.7%)	546/1612 (33.9%)	17/129 (13.2%)	82/136 (60.3%)	142/330 (43.0%)
State school	16273/24859 (65.5%)	15396/23398 (65.8%)	877/1461 (60.0%)	672/1102 (61.0%)	57/111 (51.4%)	37/58 (63.8%)	111/190 (58.4%)
Low SES	3381/20048 (16.9%)	3169/18657 (17.0%)	212/1391 (15.2%)	148/1012 (14.6%)	10/92 (10.9%)	10/67 (14.9%)	44/220 (20.0%)
Higher education	5836/36423 (16.0%)	5215/34216 (15.2%)	621/2207 (28.1%)	427/1612 (26.5%)	14/129 (10.9%)	63/136 (46.3%)	117/330 (35.5%)
UK national	30298/36423 (83.2%)	28225/34216 (82.5%)	2073/2207 (93.9%)	1517/1612 (94.1%)	124/129 (96.1%)	118/136 (86.8%)	314/330 (95.2%)
English	26476/30028 (88.2%)	24612/27964 (88.0%)	1864/2064 (90.3%)	1355/1513 (89.6%)	109/122 (89.3%)	109/116 (94.0%)	291/313 (93.0%)
Northern Irish	804/30028 (2.68%)	762/27964 (2.72%)	42/2064 (2.03%)	34/1513 (2.25%)	3/122 (2.46%)	0/116 (0%)	5/313 (1.60%)
Scottish	1789/30028 (5.96%)	1688/27964 (6.04%)	101/2064 (4.89%)	84/1513 (5.55%)	8/122 (6.56%)	3/116 (2.59%)	6/313 (1.92%)
Welsh	959/30028 (3.19%)	902/27964 (3.23%)	57/2064 (2.76%)	40/1513 (2.64%)	2/122 (1.64%)	4/116 (3.45%)	11/313 (3.51%)

Table 2: Descriptive statistics of the demographic and educational profiles for each test. SES = socioeconomic status.

Table 2 displays the demographic and educational profiles of those who took a UCAT test in 2022, and further broken down by test type. As can be seen, there are some differences in demographics across between the UCAT and the extended UCAT cohorts. For example, those reporting non-white ethnicity make up around two thirds of the cohort for the UCAT (67.8%; 18,393/27,132), but approximately half of the extended version cohort (50.4%; 983/1,952). UK nationals are a much greater percentage of test takers for extended tests than for the UCAT.

To explore these differences further, a series of regression models (Table 3) were run to model whether an individual had sat the UCAT or UCATSEN. Univariate logistic regression

was performed for each available variable. A multivariable logistic model was subsequently fit, including those variables statistically significant on univariable analysis. A similar analysis was performed, analysing the difference between taking the UCAT and taking any extended version of the test (see, Appendix, Table A1).

Variable	Unadjusted odds ratio (95% CI) p-value	Adjusted odds ratio (95% CI) p-value
Male	0.94 (0.85 to 1.05) p=0.27	n/a
Non-white ethnicity	0.48 (0.42 to 0.53) p<0.001	0.45 (0.40 to 0.51) p<0.001
20 years of age or older	2.22 (1.99 to 2.47) p<0.001	2.37 (1.85 to 3.03) p<0.001
Attended state school	0.81 (0.72 to 0.92) p=0.001	0.79 (0.69 to 0.90) p<0.001
Low SES	0.84 (0.70 to 1.00) p=0.05	n/a
Higher education	2.00 (1.79 to 2.25) p<0.001	0.99 (0.67 to 1.45) p=0.96
UK	3.39 (2.75 to 4.18) p<0.001	(omitted)
Regional identity		
Northern Irish (v English)	0.81 (0.57 to 1.15) p=0.24	n/a
Scottish (v English)	0.90 (0.72 to 1.13) p=0.38	n/a
Welsh (v English)	0.81 (0.58 to 1.11) p=0.19	n/a

Table 3: Results from univariable and multivariable logistic regression models, modelling the relationship between available demographic variables and whether an individual took UCAT or UCATSEN. CI = confidence interval. SES = socioeconomic status.

As can be seen in Table 3, on univariable analysis, a number of demographic groups were less likely to have taken UCATSEN than the UCAT. These include those identifying as non-white (unadjusted OR 0.48, 0.42 to 0.53, p<0.001). The interpretation of this is as follows: those identifying as non-white had approximately half the odds of taking an extended version of the UCAT than those identifying as white. Similarly, those who attended a state school (0.81, 0.72 to 0.92, p<0.001), also had lower odds of taking UCATSEN than the UCAT. In contrast, those applicants aged 20 years or older had higher odds of taking UCATSEN (OR 2.22, 1.99 to 2.47, p<0.001), as did those who already had a higher education qualification (OR 2.00, 1.79 to 2.25, p<0.001).

On multivariable analysis, the majority of these predictors remained statistically significant independent predictors, with the exception being higher education status. That is, controlling for the other demographic variables included in the model, those who reported being non-white had 56% lower odds of taking UCATSEN than those who reported being white (OR 0.45, 0.40 to 0.51, p<0.001). Similarly, controlling for those other variables in the model, those who attended a state school had 21% lower odds of taking the UCATSEN than the UCAT (OR 0.79, 0.69 to 0.90, p<0.001). Those applicants aged 20 years of older had over twice the odds of taking the UCATSEN than the UCAT (OR 2.37, 1.85 to 3.03, p<0.001). Note that being a UK national or not was omitted from the multivariable model, due to the lack of variation in these observed data in relation to this variable, as discussed earlier.

What are the relationships between demographic factors and performance on each component of the UCATSEN, including the SJT, and how does this differ from those relationships observed for UCAT performance?

	All tests n=36423	UCAT n=34216	All extended versions n=2207	UCATSEN n=1612	UCATSA n=129	UCATSEN50 n=136	UCATSENSA n=330
Total score	2499.8 (293.9)	2493.3 (292.5)	2599.9 (297.9)	2583.7 (292.6)	2588.1 (304.6)	2655.7 (321.1)	2660.3 (302.0)
Abstract Reasoning score	659.3 (99.0)	657.8 (98.9)	686.3 (96.0)	683.6 (93.5)	679.5 (98.6)	701.3 (106.4)	695.8 (101.6)
Decision Making score	615.8 (91.7)	614.4 (91.4)	638.5 (93.4)	634.5 (94.2)	641.2 (96.0)	651.0 (87.1)	651.8 (89.8)
Quantitative Reasoning score	657.7 (90.4)	656.0 (90.0)	684.0 (92.8)	679.9 (91.4)	680.9 (89.9)	692.5 (99.1)	701.4 (96.1)
Verbal Reasoning score	566.9 (74.3)	565.3 (73.5)	591.1 (82.0)	585.6 (80.9)	586.5 (76.7)	610.9 (95.9)	611.3 (79.2)
SJT score	591.7 (79.4)	590.7 (79.8)	607.4 (71.7)	604.8 (72.9)	610.2 (70.0)	617.1 (70.5)	615.1 (66.4)
'Rebalanced' total score	1211.2 (139.5)	1208.0 (138.5)	1260.7 (145.1)	1251.7 (142.4)	1253.7 (144.8)	1292.5 (161.5)	1294.3 (144.7)

Table 4: Summary statistics for performance across each subtest in each version of the UCAT in 2022

As can be seen in Table 4, average performance on the UCAT, and each subtest of the UCAT, was lower than the equivalent score on each extended version of the test. Mean differences between scores on the UCAT, and all extended versions of the test, were all statistically significant on difference in means testing ($p < 0.001$).

The relationship between sociodemographic variables and UCATSEN performance

Tables 5-10 display the results of both univariable and multivariable linear regression models, exploring the relationship between the available demographic variables scores on the UCATSEN. Table 5 displays results for total UCATSEN score, Abstract Reasoning scores are available in Table 6, Decision Making scores in Table 7, Quantitative Reasoning scores in Table 8, Verbal Reasoning scores in Table 9, and scores on the SJT in Table 10. For comparison, the corresponding analyses exploring the relationships between sociodemographic variables and scores on the UCAT are available in the Appendix (Tables A2 – A7).

UCATSEN: total score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	33.0 (2.90 to 63.1) p=0.03	35.4 (-6.03 to 76.9) p=0.09
Non-white ethnicity	-151.4 (-180.5 to -122.3) p<0.001	-110.7 (-151.4 to -70.0) p<0.001
20 years of age or older	-24.2 (-54.4 to 6.01) p=0.12	n/a
Attended state school	-118.8 (-153.3 to -84.3) p<0.001	-96.8 (-138.2 to -55.4) p<0.001
Low socioeconomic status	-122.3 (-172.1 to -72.6) p<0.001	-111.8 (-173.2 to -50.5) p<0.001
Higher education	-14.9 (-47.3 to 17.5) p=0.37	n/a
UK	51.1 (-9.61 to 111.7) p=0.10	n/a

Table 5: Results from univariable and multivariable linear regression models, modelling the relationship between sociodemographic variables and total UCATSEN score.

UCATSEN: Abstract Reasoning score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	-1.15 (-10.8 to 8.46) p=0.82	n/a
Non-white ethnicity	-28.4 (-38.0 to -18.9) p<0.001	-12.3 (-25.7 to 1.02) p=0.07
20 years of age or older	-13.9 (-23.6 to -4.33) p=0.01	-3.07 (-25.7 to 19.5) p=0.79
Attended state school	-29.1 (-40.2 to -18.0) p<0.001	-22.6 (-36.2 to -8.91) p=0.001
Low socioeconomic status	-22.8 (-39.0 to -6.66) p=0.01	-29.8 (-50.2 to -9.31) p<0.01
Higher education	-9.47 (-19.8 to 0.88) p=0.07	n/a
UK	20.2 (0.81 to 39.6) p=0.04	(omitted)

Table 6: Results from univariable and multivariable linear regression models, modelling the relationship between sociodemographic variables and score on the *abstract reasoning* subtest of the UCATSEN.

UCATSEN: Decision Making score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	18.3 (8.97 to 19.9) p=0.04	9.82 (-3.16 to 22.8) p=0.14
Non-white ethnicity	-53.6 (-63.0 to -44.3) p<0.001	-44.7 (-57.5 to -32.0) p<0.001
20 years of age or older	-10.7 (-20.5 to -1.03) p=0.03	5.12 (-17.2 to 25.5) p=0.71
Attended state school	-33.0 (-44.1 to -21.9) p<0.001	-28.8 (-41.8 to -15.9) p<0.001
Low socioeconomic status	-41.5 (-57.2 to -25.7) p<0.001	-33.1 (-52.4 to -13.8) p=0.001
Higher education	-6.24 (-16.7 to 4.18) p=0.24	n/a
UK	11.8 (-7.77 to 31.3) p=0.24	n/a

Table 7: Results from univariable and multivariable linear regression models, modelling the relationship between sociodemographic variables and score on the *decision making* subtest of the UCATSEN.

UCATSEN: Quantitative Reasoning score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	18.3 (8.97 to 27.7) p<0.001	23.3 (9.93 to 36.7) p=0.001
Non-white ethnicity	-30.8 (-40.1 to -21.5) p<0.001	-22.2 (-35.3 to -9.04) p=0.001
20 years of age or older	-15.0 (-24.4 to -5.57) p<0.01	22.2 (-4.03 to 48.5) p=0.10
Attended state school	-31.1 (-42.1 to -20.1) p<0.001	-28.9 (-42.3 to -15.5) p<0.001
Low socioeconomic status	-30.8 (-46.6 to -15.1) p<0.001	-24.1 (-44.0 to -4.20) p=0.02
Higher education	-15.3 (-25.4 to -5.22) p<0.01	-33.3 (-73.3 to 6.70) p=0.10
UK	13.5 (-5.49 to 32.4) p=0.16	n/a

Table 8: Results from univariable and multivariable linear regression models, modelling the relationship between sociodemographic variables and score on the *quantitative reasoning* subtest of the UCATSEN.

UCATSEN: Verbal Reasoning score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	5.63 (-2.67 to 13.9) p=0.18	n/a
Non-white ethnicity	-38.5 (-46.6 to -30.5) p<0.001	-31.1 (-42.3 to -19.8) p<0.001
20 years of age or older	15.5 (7.20 to 23.8) p<0.001	30.6 (7.85 to 53.3) p=0.01
Attended state school	-25.6 (-35.2 to -16.0) p<0.001	-18.4 (-29.9 to -6.84) p<0.01
Low socioeconomic status	-27.2 (-41.3 to -13.2) p<0.001	-28.4 (-45.6 to -11.2) p=0.001
Higher education	16.1 (7.20 to 25.0) p<0.001	-10.5 (-45.2 to 24.2) p=0.56
UK	5.66 (-11.1 to 22.4) p=0.51	n/a

Table 9: Results from univariable and multivariable linear regression models, modelling the relationship between sociodemographic variables and score on the *verbal reasoning* subtest of the UCATSEN.

UCATSEN: SJT score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	-17.7 (-25.1 to -10.3) p<0.001	-19.2 (-28.2 to -10.2) p<0.001
Non-white ethnicity	-17.8 (-25.2 to -10.5) p<0.001	-14.0 (-22.7 to -5.30) p<0.01
20 years of age or older	9.65 (2.14 to 17.2) p=0.01	6.52 (-10.9 to 23.9) p=0.46
Attended state school	-16.7 (-25.5 to -7.94) p<0.001	-16.0 (-23.9 to -7.14) p<0.001
Low socioeconomic status	-10.0 (-21.8 to 1.76) p=0.10	n/a
Higher education	12.0 (3.98 to 20.1) p<0.01	14.5 (-12.5 to 41.4) p=0.29
UK	23.0 (7.88 to 38.0) p<0.01	(omitted)

Table 10: Results from univariable and multivariable linear regression models, modelling the relationship between sociodemographic variables and score on the SJT of the UCATSEN.

As can be seen in Tables 5 to 10, there are a number of independent statistically significant relationships between sociodemographic variables and performance on the UCATSEN. Interestingly, gender differences are not independent statistically significant predictors of *total score*, *abstract reasoning* score, *decision making* score, or *verbal reasoning* score. This is contrast to the observed relationship between gender and UCAT scores, for which there is a statistically significant relationship.

Other sociodemographic variables are statistically significant predictors of total UCATSEN score, such as reporting non-white ethnicity (β = -110.7, -151.4 to -70.0, p<0.001), attending a state school (β = -96.8, -138.2 to -55.4, p<0.001), and having a lower socioeconomic status (β = 111.8, -173.2 to -50.5, p<0.001). These are broadly comparable to the relationships observed for UCAT score.

Do these differences explain the difference between scores on the UCAT and UCATSEN?

Tables 11 reports the results from a series of linear regression models, where we model the relationship between test type and scores obtained. We first perform a univariable analysis, modelling the unadjusted relationship between test type (UCAT or UCATSEN) and score obtained. We then performed a multivariable regression model, controlling for the sociodemographic variables, reporting the adjusted relationship between test type and score obtained.

	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Total score	90.4 (73.8 to 105.1) p<0.001	45.2 (25.8 to 64.7) p<0.001
Abstract Reasoning score	26.1 (21.1 to 31.0) p<0.001	17.1 (10.2 to 24.0) p<0.01
Decision Making score	20.2 (15.6 to 24.8) p<0.001	4.86 (-1.31 to 11.0) p=0.12
Quantitative Reasoning score	23.9 (19.4 to 28.4) p<0.001	16.6 (10.5 to 22.8) p<0.001
Verbal Reasoning score	20.3 (16.6 to 24.0) p<0.001	6.62 (1.54 to 11.7) p=0.01
SJT score	14.2 (10.2 to 18.2) p<0.001	2.05 (-3.00 to 7.11) p=0.43
'Rebalanced' total score	43.7 (36.7 to 50.6) p<0.001	19.3 (9.92 to 28.6) p<0.001

Table 11: Results from a series or univariable and multivariable linear regression models, exploring the relationship between test type taken (UCAT or UCATSEN) and score obtained.

As can be seen in Table 11, the unadjusted relationship between taking the UCATSEN (rather than the UCAT) and total score obtained is β = 90.4 (73.8 to 105.1, p<0.001). That is candidates who took the UCATSEN, on linear regression modelling, scored 90 points higher than those who took the UCAT. However, when controlling for demographic factors, the effect size reduces to β = 45.2 (25.8 to 64.7, p<0.001).

Interestingly, when looking at the subtest scores, the effect size of test taken becomes statistically non-significant for *decision making* score and the SJT score, when controlling for the available demographic variables.

When analysing the 'rebalanced' total score, the unadjusted difference between UCATSEN performance and UCAT performance was β = 43.7 (36.7 to 50.6, p<0.001). However, when controlling for the demographic differences between UCAT and UCATSEN takers, the difference in 'total' score (if the total score were to be 'rebalanced', as outlined in the methods section) would be reduced to β = 19.3 (9.92 to 28.6, p<0.001).

The impact of removing Abstract Reasoning

	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Total score	64.4 (53.2 to 75.5) p<0.001	27.6 (12.6 to 42.6) p<0.001
'Rebalanced' total score	42.3 (35.2 to 49.5) p<0.001	17.0 (7.27 to 28.7) p<0.001

Table 12: Results from univariable and multivariable linear regression models, exploring the relationship between test type taken (UCAT or UCATSEN) and total score obtained, with abstract reasoning score excluded.

As can be seen in Table 12, the unadjusted relationship between UCAT and UCATSEN takers is 64.4 points higher on the UCATSEN (β = 64.4, 53.2 to 75.5, p<0.001). Adjusting for the demographic differences between the two populations, this difference is reduced to 27.6 points (β = 27.6, 12.6 to 42.6, p<0.001). For the 'rebalanced' total score, assuming the dimensionality of the test remains the same with the removal of *abstract reasoning* the adjusted difference between the two tests would be 17 points (β = 17.0, 7.27 to 28.7, p<0.001).

Latent profile analyses

Model fit statistics are displayed in Table A8. We thus proceeded with i) the three profile model and ii) the nine profile model.

Figures 1 and 2 display the results the three profile model and the nine profile model, respectively. The same results are displayed in supplementary tables A9 and A10.

Tables 13-15 display the results from multinomial logit models, predicting profile membership from demographic variables. This was only possible for the three-profile model.
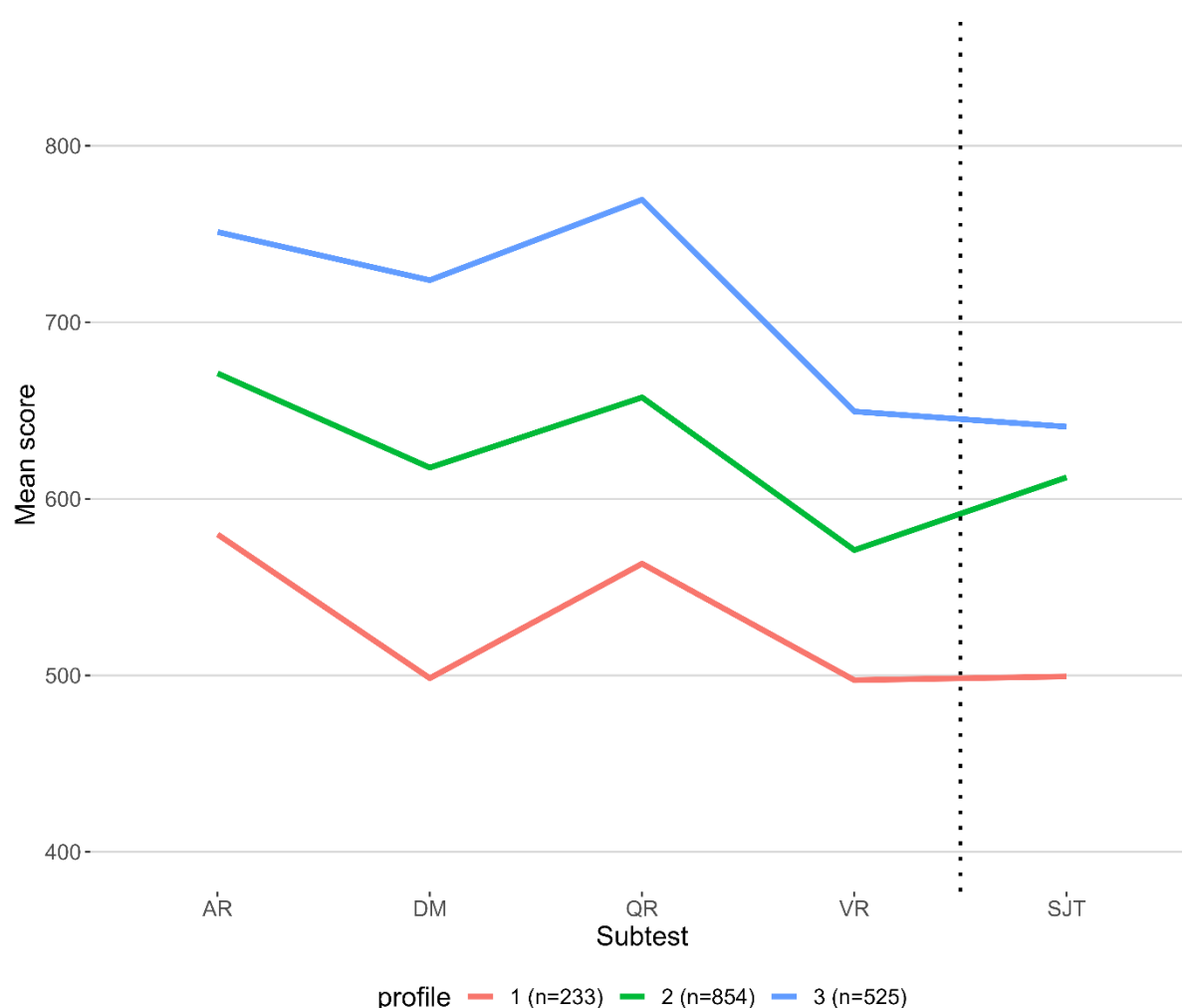

Figure 1: Results from a three profile latent model.

As can be seen in Figure 1, the three profile model separates UCATSEN takers into three broad profiles: low performers across all four cognitive subtests and the SJT (n=233, 14.5%), a large group consisting of around half of all UCATSEN candidates (n=854, 53.0%),

and a group containing the highest performers across all components of the UCATSEN (n=525, 32.6%).

Ethnicity independently predicts being in a higher profile across all comparisons. For example, those who are non-white have around 27% of the odds of being in profile 3 (the highest performers) than in profile 1 (the lowest performers) (Relative Risk Ratio [RRR] 0.27, 0.16 to 0.46).

Those who attended a state school are independently less likely to be in profile 3 than in profile 2 (RRR 0.61, 0.44 to 0.84, p<0.001) and profile 1 (RRR 0.37, 0.21 to 0.65). However, no differences were observed between profile 2 and profile 1 for school type attended. Similarly, those from a low socioeconomic background were less likely to be in profile 3 than profile 1(RRR 0.31, 0.16 to 0.65, p<0.001), but this was not a significant predictor of being in profile 3 v profile 2, or profile 2 v profile 1.

Gender was not an independent predictor of latent profile membership, and age, higher education or being a UK native were not significant univariable predictors of profile membership.

Profile 2 v Profile 1	Unadjusted RRR (95% CI) p-value	Adjusted RRR (95% CI) p-value
Male	0.87 (0.64 to 1.18) p=0.36	1.28 (0.77 to 2.12) p=0.33
Non-white ethnicity	0.40 (0.29 to 0.57) p<0.001	0.51 (0.31 to 0.83) p=0.01
20 years of age or older	1.16 (0.86 to 1.59) p=0.33	n/a
Attended state school	0.52 (0.34 to 0.77) p=0.001	0.60 (0.35 to 1.04) p=0.07
Low socioeconomic status	0.54 (0.34 to 0.87) p=0.01	0.56 (0.31 to 1.01) p=0.05
Higher education	1.25 (0.89 to 1.75) p=0.19	n/a
UK	1.61 (0.94 to 2.78) p=0.09	n/a

Table 13: Partial results from multinomial logistic regression models, displaying results comparing membership of profile 2 to profile 1.

Profile 3 v Profile 1	Unadjusted RRR (95% CI) p-value	Adjusted RRR (95% CI) p-value
Male	1.10 (0.80 to 1.52) p=0.56	1.43 (0.84 to 2.44) p=0.19
Non-white ethnicity	0.20 (0.14 to 0.28) p<0.001	0.27 (0.16 to 0.46) p<0.001
20 years of age or older	0.98 (0.71 to 1.37) p=0.92	n/a
Attended state school	0.32 (0.21 to 0.48) p<0.001	0.37 (0.21 to 0.65) p=0.001
Low socioeconomic status	0.29 (0.17 to 0.51) p<0.001	0.32 (0.16 to 0.65) p<0.01
Higher education	1.03 (0.72 to 1.48) p=0.87	n/a
UK	1.67 (0.92 to 3.02) p=0.09	n/a

Table 14: Partial results from multinomial logistic regression models, displaying results comparing membership of profile 3 to profile 1.

Profile 3 v Profile 2	Unadjusted RRR (95% CI) p-value	Adjusted RRR (95% CI) p-value
Male	1.27 (1.01 to 1.59) p=0.04	1.12 (0.80 to 1.55) p=0.52
Non-white ethnicity	0.49 (0.38 to 0.62) p<0.001	0.54 (0.38 to 0.75) p<0.001
20 years of age or older	0.84 (0.67 to 1.06) p=0.15	n/a
Attended state school	0.61 (0.47 to 0.80) p<0.001	0.61 (0.44 to 0.84) p<0.001
Low socioeconomic status	0.54 (0.36 to 0.83) p=0.01	0.57 (0.33 to 1.01) p=0.06
Higher education	0.82 (0.64 to 1.06) p=0.13	n/a
UK	1.03 (0.64 to 1.67) p=0.89	n/a

Table 15: Partial results from multinomial logistic regression models, displaying results comparing membership of profile 3 to profile 2.
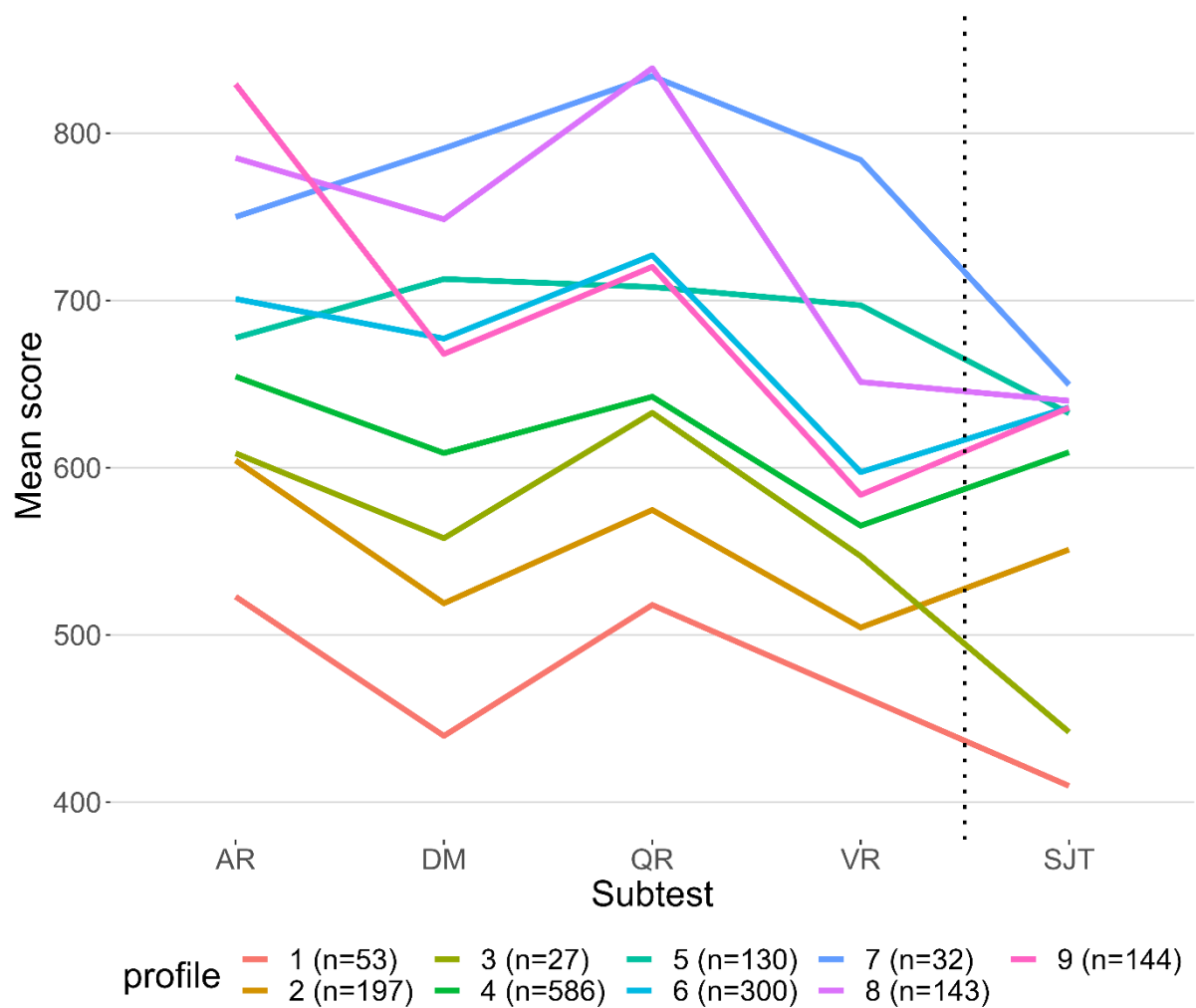
Figure 2: Results from a nine profile latent model.

Figure 2 displays the results from a nine-profile latent model. These are:

- Profile 1 (n=53, 3.29%): A small group of particularly low scoring candidates.
- Profile 2 (n=197, 12.2%): Low scoring candidates.
- Profile 3 (n=27, 1.67%): A small group of individuals who score particularly poorly on the SJT.
- Profile 4 (n=586, 36.4%): The largest group, around a third of the sample, who perform around the average
- Profile 5 (n=130, 8.1%): A group of above average candidates
- Profile 6 (n=300, 18.6%): A larger group of candidates who score similarly to profile 5, except worse on *verbal reasoning*
- Profile 7 (n=32, 1.98%): A group of higher performing candidates as in profile 8, although who perform better in *verbal reasoning*

- Profile 8 (n=143, 8.87%): A larger group of higher performing candidates, although who perform relatively worse on *verbal reasoning.*
- Profile 9 (n=144, 8.93%): A group who did similarly to Profile 6, except substantially better on *abstract reasoning*

As can be seen, there is relatively little cross-over between groups; that is, candidates generally perform relatively similar, compared to other identified profiles, across the four cognitive components. There are some exceptions, notably profile 9 (n=144, 8.93%), who perform the best overall on abstract reasoning, but do not maintain that high level of performance across the other subtests, and profile 8, who perform relatively much worse on *verbal reasoning*.

Given the number of profiles, it was not feasible to predict profile membership using regression models for the nine-profile model.

Summary

In this report, we have explored the demographic and educational profiles of those who took the UCATSEN, the most widely taken extended version of the UCAT, in 2022. When comparing with those who took the standard UCAT, we identified a number of differences in demographic profiles. Individuals identifying as non-white or who attended a state school had lower odds of taking the UCATSEN than the UCAT, controlling for other demographic variables. Older applicants (those who were 20 years of age or older when taking the test) had higher odds of taking the UCATSEN than the UCAT. Latent analyses suggested that most candidates' relative performance on each of subtest of the UCATSEN was reasonably stable. However, in a nine-profile model we identified groups of candidates who performed particularly highly on *abstract reasoning* and another who performed lower on *verbal reasoning,* relative to their performance on the other subtests.

We identified a number of statistically significant relationships between sociodemographic variables and performance on the UCATSEN. Most of these relationships were broadly in line with those observed for the UCAT. However, a notable difference was that for *total score*, *abstract reasoning* score, *decision making* score, or *verbal reasoning* score on UCATSEN, gender was not a statistically significant predictor, unlike in the UCAT.

Average score on the UCATSEN is higher than on the UCAT, and this is the same for each subtest too. On regression modelling, controlling for the sociodemographic variables

reduced the gap in total score between UCATSEN and UCAT by approximately half. Interestingly, when controlling for sociodemographic variables, we observed no difference in scores on *decision making* and the SJT between UCATSEN and UCAT test takers. It is possible that the *decision making* subtest and the SJT are less speeded, whereas those subtests for which differences remain after controlling for sociodemographic differences are more speeded. Future work could be undertaken to explore the item response timings on the UCATSEN, using methodology such as item response theory.

The potential removal of *abstract reasoning* from the test from 2025 would reduce the difference in scores between UCAT takers and UCATSEN takers, under the assumption that performance on the remaining three cognitive subtests would be unchanged. It is not clear how realistic this assumption would be, given that the time saved by removing abstract reasoning is to be redistributed to the other subtests. However, given the above conclusion that *abstract reasoning* is one of the subtests which is more speeded, it is possible that the removal of this subtest will reduce the observed average performance differences between UCAT and UCATSEN applicants. A future study could investigate this further.

Our results suggest that 'rebalancing' the total UCAT score by balancing the *verbal reasoning* score with the non-verbal components (including *abstract reasoning*) would reduce the differences between average UCAT score and UCATSEN score. Indeed, when controlling for sociodemographic differences between the two populations in the 2022 cohort, the difference between 'rebalanced' scores on the two tests is reduced to less than 20 points (β = 19.3 (9.92 to 28.6, p<0.001). This is in line with other research that suggests potential benefits of 'rebalancing' the total UCAT score in line with the dimensionality of the test.

Given the number of individuals who sit an extended version of the UCAT, and the increasing numbers of such applications, a future research programme using UKMED is likely to be feasible. This would potentially allow analyses that investigate the relationships between UCATSEN performance and prior educational attainment, or subsequent performance in medical school, as has previously been reported for the UCAT.

A number of limitations of this work should be acknowledged. There will be individuals who take the UCAT who would be eligible to sit an extended version of the UCAT. We only analysed data from the 2022 cohort, so it is possible that the results from this cohort do not generalise to other cohorts. While we could analyse the UCATSEN separately, the small populations of the other extended versions of the UCAT did not allow for any analysis. It may be possible to analyse multiple cohorts of these tests by standardising scores, in line with published research on the UCAT.

Conclusions

There are some differences in the test populations between those who take the UCAT and those who take the UCATSEN. These differences explain some of the observable differences in performance between the two tests. However, they do not explain all of the performance differences. Differences remain for some subtests, and it is possible that these are the subtests which are more speeded. Therefore, further research should be undertaken to explore the item response timings on the UCATSEN, as well as considerations of a wider programme of research using UKMED.

Appendix - Additional tables

Variable	Unadjusted odds ratio (95% CI) p-value	Adjusted odds ratio. (95% CI) p-value
Male	0.87 (0.80 to 0.96) p=0.01	0.92 (0.81 to 1.03) p=0.15
Non-white ethnicity	0.48 (0.44 to 0.53) p<0.001	0.39 (0.35 to 0.44) p<0.001
20 years of age or older	2.40 (2.19 to 2.63) p<0.001	2.39 (1.90 to 3.01) p<0.001
Attended state school	0.78 (0.70 to 0.87) p<0.001	0.70 (0.62 to 0.79) p<0.001
Low SES	0.88 (0.76 to 1.02) p=0.09	n/a
Higher education	2.18 (1.98 to 2.40) p<0.001	0.89 (0.62 to 1.27) p=0.53
Free school meals	1.37 (1.22 to 1.54) p<0.001	1.43 (1.22 to 1.68) p<0.001
Regional identity		
Northern Irish (v English)	0.73 (0.53 to 1.00) p=0.05	0.37 (0.25 to 0.54) p<0.001
Scottish (v English)	0.79 (0.64 to 0.97) p=0.03	0.70 (0.54 to 0.91) p=0.01
Welsh (v English)	0.83 (0.64 to 1.09) p=0.19	0.67 (0.47 to 0.94) p=0.02

Table A1: Results from univariable and multivariable logistic regression models, modelling the relationship between available demographic variables and whether an individual took an extended version of the UCAT or not. CI = confidence interval. SES = socioeconomic status.

UCAT: total score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	75.2 (68.8 to 81.6) p<0.001	70.4 (61.8 to 79.0) p<0.001
Non-white ethnicity	-107.0 (-114.1 to -100.0) p<0.001	-91.4 (-100.1 to -82.8) p<0.001
20 years of age or older	-56.8 (-64.7 to -48.8) p<0.001	-38.4 (-61.5 to -15.4) p=0.001
Attended state school	-189.3 (-196.6 to -182.0) p<0.001	-165.2 (-173.9 to -156.5) p<0.001
Low SES	-116.7 (-127.3 to -106.0) p<0.001	-69.1 (-80.6 to -57.6) p<0.001
Higher education	-44.7 (-53.3 to -36.1) p<0.001	-47.7 (-78.8 to -16.7) p=<0.01

Table A2: Relationship between sociodemographic variables and total score on the UCAT.

UCAT: Abstract Reasoning score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	11.0 (8.84 to 13.2) p<0.001	8.14 (5.08 to 11.2) p<0.001
Non-white ethnicity	-14.5 (-16.9 to -12.0) p<0.001	-10.8 (-13.9 to -7.68) p<0.001
20 years of age or older	-12.9 (-15.5 to -10.2) p<0.001	-7.99 (-16.2 to 0.27) p=0.06
Attended state school	-49.5 (-52.1 to -47.0) p<0.001	-43.9 (-47.0 to -40.8) p<0.001
Low SES	-29.0 (-32.7 to -25.3) p<0.001	-20.0 (-24.2 to -15.9) p<0.001
Higher education	-11.1 (-14.0 to -8.21) p<0.001	-11.5 (-22.6 to -0.43) p=0.04

Table A3: Relationship between sociodemographic variables and *abstract reasoning* score on the UCAT.

UCAT: Decision Making score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	19.7 (17.7 to 21.7) p<0.001	19.4 (16.7 to 22.1) p<0.001
Non-white ethnicity	-40.8 (-43.0 to -28.6) p<0.001	-36.8 (-29.6 to -34.1) p<0.001
20 years of age or older	-18.6 (-21.1 to -16.1) p<0.001	-12.6 (-19.9 to -5.25) p=0.001
Attended state school	-50.7 (-53.0 to -48.4) p<0.001	-43.3 (-46.2 to -40.7) p<0.001
Low SES	-34.2 (-37.6 to -30.9) p<0.001	-19.4 (-23.1 to -15.7) p<0.001
Higher education	-14.8 (-17.5 to -12.1) p<0.001	-19.0 (-28.9 to -9.16) p<0.001

Table A4: Relationship between sociodemographic variables and *decision making* score on the UCAT.

UCAT: Quantitative Reasoning score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	37.8 (32.8 to 36.7) p<0.001	33.9 (31.2 to 36.7) p<0.001
Non-white ethnicity	-20.0 (-22.2 to -17.8) p<0.001	-17.5 (-20. 2 to -14.7) p<0.001
20 years of age or older	-24.5 (-26.9 to -22.0) p<0.001	-16.7 (-24.0 to -9.43) p<0.001
Attended state school	-53.6 (-55.9 to -51.3) p<0.001	-47.4 (-50.1 to -44.7) p<0.001
Low SES	-29.0 (-32.3 to -25.6) p<0.001	-15.5 (-19.2 to -11.9) p<0.001
Higher education	-22.4 (-25.1 to -19.8) p<0.001	-12.2 (-22.1 to -2.41) p=0.02

Table A5: Relationship between sociodemographic variables and *quantitative reasoning* score on the UCAT.

UCAT: Verbal Reasoning score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	9.71 (8.10 to 11.3) p<0.001	8.92 (6.69 to 11.1) p<0.001
Non-white ethnicity	-31.7 (-33.5 to -30.0) p<0.001	-26.4 (-28.6 to -24.1) p<0.001
20 years of age or older	-0.82 (-2.81 to 1.17) p=0.42	n/a
Attended state school	-35.5 (-37.4 to -33.6) p<0.001	-30.5 (-32.7 to -28.2) p<0.001
Low SES	-24.5 (-27.2 to -21.7) p<0.001	-14.2 (-17.2 to -11.2) p<0.001
Higher education	3.62 (1.45 to 5.78) p=0.001	-5.60 (-12.9 to 1.71) p=0.13

Table A6: Relationship between sociodemographic variables and *verbal reasoning* score on the UCAT.

UCAT: SJT score	Unadjusted β (95% CI) p-value	Adjusted β (95% CI) p-value
Male	-14.8 (-16.6 to -13.1) p<0.001	-15.4 (-17.6 to -13.2) p<0.001
Non-white ethnicity	-15.0 (-16.9 to -13.2) p<0.001	-9.37 (-11.6 to -7.11) p<0.001
20 years of age or older	8.61 (6.44 to 10.7) p<0.001	3.90 (-2.11 to 9.91) p=0.20
Attended state school	-31.0 (-32.9 to -29.0) p<0.001	-26.5 (-28.8 to -24.3) p<0.001
Low SES	-17.5 (-21.2 to -14.8) p<0.001	-13.5 (-16.5 to -10.5) p<0.001
Higher education	12.0 (9.70 to 14.4) p<0.001	-7.74 (-15.8 to 0.25) p=0.06

Table A7: Relationship between sociodemographic variables and *SJT* score on the UCAT.

Profiles	AIC	BIC	Sample-size adjusted BIC	Entropy
2	92733.9	92820.1	92769.3	0.770
3	91892.5	92010.9	91941.0	0.798
4	91575.0	91725.8	91636.8	0.787
5	91424.7	91607.8	91499.8	0.780
6	91299.3	91514.7	91387.6	0.764
7	91241.7	91489.5	91343.3	0.765
8	91196.5	91476.5	91311.3	0.756
9	91151.9	91464.2	91280.0	0.762
10	91121.2	91465.9	91262.6	0.748

Table A8: Model fit statistics for the different latent profile analyses performed. AIC = Akaike Information Criterion. BIC = Bayesian Information Criterion.

Profile	n (%)	Abstract Reasoning	Decision Making	Quantitative Reasoning	Verbal Reasoning	SJT
1	233 (14.4%)	579.9	498.4	563.3	497.3	499.4
2	854 (53.0%)	671.1	617.7	657.5	571.0	612.2
3	525 (32.6%)	751.2	723.9	769.5	649.5	640.9

Table A9: Results from a three-profile latent model.

Profile	n (%)	Abstract Reasoning	Decision Making	Quantitative Reasoning	Verbal Reasoning	SJT
1	53	522.9	439.6	517.9	463.7	409.7
2	197	604.3	518.9	574.7	504.4	551.0
3	27	608.6	557.8	632.8	547.1	441.9
4	586	654.5	608.7	642.4	565.3	609.2
5	130	677.6	712.8	708.0	697.1	632.5
6	300	700.9	677.2	727.0	597.3	636.1
7	32	749.9	790.9	834.1	784.0	649.6
8	143	785.2	748.5	838.9	651.2	640.0
9	144	829.3	668.0	720.1	583.7	635.8

Table A10: Results from a nine-profile latent model.

ACKNOWLEGDMENTS

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