social sciences

Supplementary Materials

Correct, Incorrect, or Uncertain? Factual Science Knowledge, Conspiratorial Anti-Science Beliefs, and Do-Not-Know Responses in Post-Pandemic Romania

All estimates derive from the clean Romania 2025 analytic sample. Calibration weights are used for descriptive estimates, and normalized weights with HC1 robust standard errors are used for the regression and threshold models. The exploratory factor analysis in S3b is unweighted.

S1. Sample and Weight Diagnostics

Table S1. Clean analytic sample and weight diagnostics.

Quantity	Value
Raw survey cases	1,012
Excluded invalid science-code cases	5
Science analytic N	1,007
Sum of analytic weights	999.288
Weight-based effective N	562.8
Approximate weighting design effect	1.789

S2. Aggregate Invalid-Code Audit

Table S2. Aggregate audit of cases excluded because at least one science item contained an out-of-range code.

Audit quantity	Value	Analysis action
Cases with any out-of-range science-battery code	5	Excluded from all science-battery analyses
Cases containing code 4	2	Observed among the affected science items
Cases containing code 5	3	Observed among the affected science items

S3. Reliability and Parallel Analysis

Table S3. Reliability and retained components from parallel analysis.

Matrix	Complete N	Alpha	Components retained
Correct 10, substantive complete, unweighted	481	.533	1
Correct 10, substantive complete, weighted	481	.471	1
Correct 10, DK = 0, unweighted	1,007	.767	2
Correct 10, DK = 0, weighted	1,007	.726	2
Incorrect 10, DK = 0, weighted	1,007	.605	2

Matrix	Complete N	Alpha	Components retained
Correct non-CAS eight, substantive complete, unweighted	518	.300	1
Correct core six, substantive complete, unweighted	547	.434	2
DK 10, unweighted	1,007	.944	1
DK 10, weighted	1,007	.926	1
GCB 15, unweighted	586	.981	not tested

Parallel-analysis observed eigenvalues (first four): correct 10 substantive complete, 3.25, 1.17, 1.06, and 1.01; correct 10 with DK scored zero, 3.36, 1.71, 1.01, and .86; incorrect 10 with DK scored zero, 3.11, 1.31, 1.03, and .97; non-CAS eight substantive complete, 2.46, 1.15, 1.04, and .97; core six substantive complete, 1.89, 1.18, .98, and .82; and DK 10, 6.72, .82, .65, and .38. Components were retained when the observed eigenvalue exceeded the 95th percentile from 500 random replications.

S3a. DK-Matrix Internal Consistency by Response Regime

The ten DK indicators were re-examined after separating respondents who used DK selectively from those who answered DK to every item. Reported alphas are weighted; eigenvalues are from the unweighted correlation matrix of the same cases.

Table S3a. Internal consistency and first eigenvalues of the DK matrix under response-regime restrictions.

Sample	N	Weighted alpha	Eigenvalue 1	Eigenvalue 2	PC1 variance
All clean cases	1,007	.926	6.72	0.82	67.2%
Excluding all-DK cases	872	.803	3.77	1.44	37.7%
Excluding all-DK on both batteries	896	.860	4.77	1.25	47.7%
Selective DK only (1-9 DK items)	391	.631	2.37	1.79	23.7%

Of the 135 respondents answering DK to all ten science items, 82.2% also answered DK to all fifteen Generic Conspiracist Beliefs items. They are 85.9% urban against 75.0% of the clean sample, and their non-missingness on the institutional trust items is 64% against 98% for other respondents. Some decline in alpha is arithmetically expected when a large block of identical responses is removed; the series is reported as evidence that the full-sample figure is not sample-general, not as proof of a response process.

S3b. Tetrachoric Exploratory Factor Analysis of the Ten Scored Items

Because the scored items are binary, dimensionality was examined on the matrix of tetrachoric correlations using principal-axis factoring with iterated communalities. The analysis is UNWEIGHTED. DK responses were treated as missing, so correlations were computed pairwise among substantive answers, and the estimation sample is the 865 cases with at least two substantive answers. Observed eigenvalues were 4.2, 1.38, and 1.04 against 95th-percentile random values of 1.51, 1.35, and 1.23 from 200 replications in which tetrachoric correlations were estimated for the simulated data as well; replications preserved each item's substantive count and marginal proportion, with missing locations assigned independently by item rather than reproducing respondents' joint missingness pattern. Parallel analysis retained two factors. The Kaiser–Meyer–Olkin measure was .599. Varimax-rotated loadings are shown for presentation. The promax solution gives a

correlation of -0.50 between the two factors of the two-factor solution, and of -0.29, +0.50 and -0.26 among the three factors of the three-factor solution. Two three-factor communalities reach .99, at the Heywood boundary, so the three-factor solution is reported as a sensitivity check only and should not be interpreted as a stable structure.

Table S3b. Varimax-rotated factor loadings and principal-axis factoring on tetrachoric correlations (unweighted; the 865 cases with at least two substantive answers).

Item	Domain	2F F1	2F F2	2F communality	3F F1	3F F2	3F F3	3F communality
Humans and dinosaurs	Core	+.197	-.141	.059	+.155	-.105	+.150	.058
Continental drift	Core	-.141	+.607	.388	-.079	+.991	-.118	.995
Antibiotics kill viruses	Core	+.472	-.398	.381	+.182	-.120	+.986	.995
Oxygen comes from plants	Core	-.057	+.589	.350	-.020	+.330	-.261	.177
Lasers focus sound waves	Core	+.728	-.310	.626	+.589	-.094	+.559	.669
World population	Core	+.814	+.029	.664	+.733	+.044	+.299	.629
Human evolution	Worldview	-.547	+.243	.359	-.615	+.367	-.004	.513
Climate change	Worldview	+.681	-.073	.470	+.625	-.064	+.250	.457
Cancer cures hidden	CAS	+.822	-.142	.696	+.814	-.138	+.217	.729
Lab-made viruses	CAS	+.730	-.063	.537	+.741	-.065	+.151	.576

The two CAS items load on the first factor, but so do several conventional items, notably world population, lasers and climate change; the second factor is carried mainly by continental drift and oxygen. The factors correlate -.50 and several items cross-load. The pattern therefore shows that the ten items are not indicators of one homogeneous construct, but it does not establish a clean two-way separation between factual knowledge and conspiratorial endorsement. Among the 547 respondents substantive on all six core items, the internal consistency of the core set is .379 weighted and .434 unweighted; both are too low to treat that subset as a reliable scale. Table 2 in the manuscript and Table S3 report the unweighted value; the weighted value is given here and in Section 4.2 of the manuscript. Both are labeled accordingly throughout.

S3c. Multiple Correspondence Analysis: Inertias and Category Coordinates

Raw MCA inertia percentages understate leading dimensions because indicator-matrix coding introduces artificial dimensionality; Greenacre-adjusted percentages are therefore reported alongside them. Total raw inertia is 2.000 for Q = 10 variables and J = 30 categories.

Table S3c. Principal inertias, raw and adjusted percentages, and mean category coordinates.

Dimension	Principal inertia	Raw %	Greenacre-adjusted %
1	0.611	30.6%	88.4%
2	0.242	12.1%	6.8%
3	0.134	6.7%	0.4%
4	0.128	6.4%	0.3%

Table S3c (continued). Mean first- and second-dimension coordinates by response type.

Sample	Response type	Dimension 1	Dimension 2
All clean cases (n = 1,007)	DK	-1.371	+0.022
	Correct	+0.492	-0.451
	Incorrect	+0.426	+0.228
Excluding all-DK cases (n = 872)	DK	-1.406	-
	Correct	+0.320	-
	Incorrect	+0.214	-

On the sample excluding the fully non-substantive cases the first dimension accounts for 18.7% of raw inertia against 30.6% on all clean cases, while the second is unchanged at 12.2%. The ordering of category coordinates is preserved. The answering-versus-DK axis is therefore genuine but substantially less dominant than the full-sample solution suggests.

S4. Full Primary Regression Coefficients

Table S4. Weighted coefficients with HC1 robust standard errors in parentheses.

Predictor	DK count	Core correct share	Worldview correct share	CAS endorsement share
Female	+0.158 (0.081)*	+0.029 (0.094)	-0.029 (0.100)	-0.040 (0.093)
Age (z)	-0.061 (0.049)	+0.083 (0.061)	+0.008 (0.067)	+0.018 (0.057)
Upper secondary	-0.856 (0.187)***	-0.337 (0.214)	+0.334 (0.201)	+0.177 (0.243)
Tertiary	-1.057 (0.198)***	-0.148 (0.207)	+0.496 (0.215)*	+0.058 (0.252)
Rural	-0.212 (0.075)**	-0.243 (0.092)**	-0.097 (0.096)	+0.079 (0.090)
Religiosity (z)	-0.102 (0.054)	-0.021 (0.052)	-0.066 (0.051)	+0.075 (0.051)
Economic security (z)	+0.015 (0.051)	+0.181 (0.056)**	-0.054 (0.053)	-0.255 (0.049)***
Internet less than daily	+0.381 (0.138)**	-0.488 (0.168)**	+0.002 (0.171)	-0.364 (0.154)*
Internet never	+0.490 (0.182)**	-0.360 (0.213)	-0.217 (0.218)	-0.270 (0.192)
Democracy satisfaction (z)	-0.057 (0.041)	-0.130 (0.047)**	+0.045 (0.052)	-0.301 (0.050)***

Model N/R2: DK count, N = 902, R2 = .214; core correct share, N = 822, R2 = .111; worldview correct share, N = 798, R2 = .061; CAS endorsement share, N = 723, R2 = .135. * p < .05, ** p < .01, *** p < .001. Continuous outcomes and continuous predictors are standardized.

S4b. DK-Count Model by Response Regime

Table S4b. Weighted DK-count model with HC1 robust standard errors, full clean sample and sample excluding the fully non-substantive cases.

Predictor	All clean cases (n = 902)	Excluding all-DK (n = 826)
Female	+0.158 (0.081)*	+0.129 (0.094)
Age (z)	-0.061 (0.049)	-0.037 (0.056)
Upper secondary	-0.856 (0.187)***	-0.870 (0.219)***

Predictor	All clean cases (n = 902)	Excluding all-DK (n = 826)
Tertiary	-1.057 (0.198)***	-1.008 (0.222)***
Rural	-0.212 (0.075)**	+0.027 (0.082)
Religiosity (z)	-0.102 (0.054)	+0.036 (0.057)
Economic security (z)	+0.015 (0.051)	+0.040 (0.063)
Internet less than daily	+0.381 (0.138)**	+0.338 (0.175)
Internet never	+0.490 (0.182)**	+0.414 (0.186)*
Democracy satisfaction (z)	-0.057 (0.041)	-0.182 (0.043)***
R-squared	.214	.274

Standard errors in parentheses. * p < .05, ** p < .01, *** p < .001. Outcome standardized; continuous predictors standardized. The apparent negative rural coefficient does not survive the restriction. The education coefficients are essentially unchanged and remain significant at p < .001; the internet coefficients attenuate, with never-use still significant (p = .026) and less-than-daily use falling just short of significance in the smaller sample (p = .054). Model fit improves. Weighted mean DK counts on the sample excluding the fully non-substantive cases are 1.96 in rural and 1.31 in urban areas.

S4c. Count Models Against Answered-Only Shares

The manuscript argues that scoring DK as zero makes education appear positively associated with substantive error because better-educated respondents attempt more items. The two model pairs below make that argument visible.

Table S4c. Weighted regressions: counts with DK scored zero against shares among answered items.

Predictor	Core correct COUNT (DK = 0)	Core correct SHARE (answered)	CAS endorsement COUNT (DK = 0)	CAS endorsement SHARE (answered)
Female	-0.115	+0.029	-0.138	-0.040
Age (z)	+0.094	+0.083	+0.072	+0.018
Upper secondary	+0.371	-0.337	+0.735***	+0.177
Tertiary	+0.665***	-0.148	+0.757***	+0.058
Rural	+0.002	-0.243**	+0.186*	+0.079
Religiosity (z)	+0.074	-0.021	+0.052	+0.075
Economic security (z)	+0.107	+0.181**	-0.217***	-0.255***
Internet less than daily	-0.604***	-0.488**	-0.312*	-0.364*
Internet never	-0.574***	-0.360	-0.294	-0.270
Democracy satisfaction (z)	-0.058	-0.130**	-0.145**	-0.301***
n	902	822	902	723
R-squared	.164	.111	.111	.135

Education predicts both count outcomes and neither share outcome. The apparent finding that better-educated respondents endorse more conspiratorial claims is an artifact of the denominator.

S5. DK-Threshold Sensitivity

Table S5. Weighted high-DK prevalence and selected adjusted odds ratios.

Definition	Prevalence	Upper secondary OR	Tertiary OR	Internet less OR	Internet never OR
DK >= 5	23.4%	.164***	.098***	5.49***	7.09***
DK >= 6	18.1%	.161***	.095***	4.54***	4.18**
All 10 DK	11.4%	-	-	-	-

S6. Convergent and Discriminant Correlations

Table S6. Weighted correlations.

Association	r
Core correct count x GCB belief	-.196
Core correct share x GCB belief	-.214
Worldview correct count x GCB belief	-.023
Worldview correct share x GCB belief	-.040
CAS endorsement count x GCB belief	.237
CAS endorsement share x GCB belief	.182
CAS endorsement share x GCB science-information facet	.162
CAS endorsement share x GCB health/technology facet	.177
Science DK count x GCB DK count	.763
Science DK count x GCB belief	-.052

S6b. Institutional Trust and the Three Substantive Domains

The survey carries an eleven-item institutional trust battery alongside interpersonal trust items. If the conspiratorial items index mistrust rather than absence of knowledge, they should move with these measures while conventional factual items do not.

Table S6b. Weighted correlations between trust measures and the three substantive domains.

Trust measure	CAS endorsement (all clean)	Core accuracy (all clean)	CAS endorsement (restricted)	Core accuracy (restricted)
Political/institutional trust	-.227	+.015	-.311	+.192
Broad institutional distrust	+.206	-.003	+.290	-.189
Media trust	-.143	-.069	-.166	+.025
Trust in universities	-.088	+.061	-.084	+.207
Interpersonal trust	-.131	-.010	-.126	+.137
Church distrust	-.087	+.202	-.159	+.193

The restricted columns exclude respondents who answered DK to every science item and those who gave an invariant response to the Generic Conspiracist Beliefs battery (n = 623). Not every retained respondent used DK selectively; the restriction removes two specific response patterns rather than defining a selective-DK group. CAS endorsement is associated with institutional trust in both the full clean sample and the restricted one. Conventional factual accuracy is unrelated to institutional trust in the full clean sample and acquires an association of the opposite sign only under the restriction. The opposite-sign contrast is therefore specific to the restricted comparison and is not presented as a sample-general result; what holds throughout is that the two item types do not behave alike.

Table S6b (continued). Convergent validity by invariant responding on the GCB battery.

Sample	n (correlations)	CAS share x GCB belief	Core share x GCB belief	GCB alpha
Complete-GCB respondents with a defined CAS share	564	+.181	-.179	.974
Excluding invariant GCB patterns	319	+.359	-.241	.921

Of the 586 respondents with complete GCB data, 252 (43.0%) gave the identical answer to all fifteen items and 206 chose 'definitely true' throughout. The alpha column is computed

on all 586 complete-GCB respondents and, excluding invariant patterns, on the remaining 334. The correlation columns use the 564 and 319 of those respondents who also have a defined CAS endorsement share; Table 3 in the manuscript uses the wider set with a defined GCB mean, which is why the core-accuracy figure differs. The convergent-validity correlation is suppressed rather than produced by invariant responding, and the alpha excluding these respondents falls within the range reported for the instrument elsewhere.

S7. Reproducibility Notes

All valid science-item responses were reconstructed from the raw true/false/DK variables and matched the saved derived correct, incorrect, and DK scores for the 1,007 clean records.

The analysis used the final calibration weight. The three candidate weight variables in the 2025 subset were numerically identical. No cluster or stratum variables were available.

The main manuscript uses theory-led domains and answered-only shares to avoid treating DK as error and to avoid treating CAS endorsement as ordinary factual ignorance.