**Supporting Information S1: Supporting Tables**

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| Table S1. Epilepsy Diagnosis by Age among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **AGRE** | **SSC** | **AC** |
|  | **Never** **Diagnosed** **with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never** **Diagnosed** **with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never** **Diagnosed** **with Epilepsy** | **Diagnosed** **with Epilepsy** |  |
|  | **No. (%)** | **p-value** | **No. (%)** | **p-value** | **No. (%)** | **p-value** |
| Age (years) |  |  | <.001 |  |  | <.001 |  |  | 0.006 |
| 6 or under | 1039 (97.7) | 25 (2.4) |  | 632 (98.0) | 13 (2.0) |  | 190 (96.0) | 8 (4.0) |  |
| 7-9 | 586 (94.8) | 32 (5.2) |  | 514 (98.5) | 8 (1.5) |  | 102 (96.2) | 4 (3.8) |  |
| 10-12 | 280 (91.2) | 27 (8.8) |  | 337 (96.8) | 11 (3.2) |  | 59 (86.8) | 9 (13.2) |  |
| 13 or older | 248 (87.3) | 36 (12.7) |  | 252 (93.0) | 19 (7.0) |  | 60 (87.0) | 9 (13.0) |  |

Abbreviations: AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium.

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| Table S2. Epilepsy Diagnosis by Gender among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **AGRE** | **SSC** | **AC** |
|  | **Never Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never Diagnosed****With Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never Diagnosed****With Epilepsy** | **Diagnosed** **with Epilepsy** |  |
|  | **No. (%)** | **p-value** | **No. (%)** | **p-value** | **No. (%)** | **p-value** |
| Gender |  |  |  |  |  |  |  |  |  |
| Male | 1745 (95.5) | 83 (4.5) | .001 | 1500 (97.3) | 42 (2.7) | 0.40 | 343 (94.0) | 22 (6.0) | 0.26 |
| Female | 408 (91.7) | 37 (8.3) |  | 235 (96.3) | 9 (3.7) |  | 77 (90.6) | 8 (9.4) |  |

Abbreviations: AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium.

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| Table S3. Epilepsy Diagnosis by History of Developmental Regression among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **AGRE** | **SSC** | **AC** |
|  | **Never Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never Diagnosed****with Epilepsy** | **Diagnosed** **64093ldren from AGRE and ng data on seizures, and 61 children from with Epilepsy** |  | **Never** **Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  |
|  | **No. (%)** | **p-value** | **No. (%)** | **p-value** | **No. (%)** | **p-value** |
| Any Regression |  |  | <.001 |  |  | 0.25 |  |  | <.001 |
| No Definite Loss | 1517 (95.8) | 66 (4.2) |  | 1251 (97.4) | 33 (2.6) |  | 330 (95.7) | 15 (4.3) |  |
| Definite Loss | 636 (92.2) | 54 (7.8) |  | 484 (96.4) | 18 (3.6) |  | 90 (85.7) | 15 (14.3) |  |
| Loss of Any Language |  |  | 0.11 |  |  | 0.03 |  |  | 0.04 |
| No | 1128 (96.6) | 40 (3.4) |  | 1432 (97.6) | 35 (2.4) |  | 354 (94.4) | 21 (5.6) |  |
| Yes | 260 (94.6) | 15 (5.5) |  | 290 (95.4) | 14 (4.6) |  | 65 (87.8) | 9 (12.2) |  |
| Loss of Skills |  |  | 0.05 |  |  | 0.47 |  |  | <.001 |
| No Consistent Loss | 1007 (96.9) | 32 (3.1) |  | 1325 (97.4) | 36 (2.6) |  | 351 (96.2) | 14 (3.8) |  |
| Probable Loss | 42 (97.7) | 1 (2.3) |  | 64 (94.1) | 4 (5.9) |  | 21 (77.8) | 6 (22.2) |  |
| Definite Loss | 333 (94.1) | 21 (5.9) |  | 341 (97.2) | 10 (2.8) |  | 38 (80.8) | 9 (19.2) |  |

Abbreviations: AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium.

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| Table S4. Epilepsy Diagnosis by Language among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **AGRE** | **SSC** | **AC** |
|  | **Never** **Diagnosed****with Epilepsy** | **Diagnosed****with Epilepsy** |  | **Never Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never** **Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  |
|  | **No. (%)** | **p-value** | **No. (%)** | **p-value** | **No. (%)** | **p-value** |
| Overall Level of Language |  |  | 0.03 |  |  | 0.02 |  |  | 0.007 |
| Meaningful Use of Phrases | 1453 (95.7) | 66 (4.3) |  | 1574 (97.5) | 40 (2.5) |  | 339 (95.2) | 17 (4.8) |  |
| Fewer than 5 Words | 374 (93.0) | 28 (7.0) |  | 48 (92.3) | 4 (7.7) |  | 41 (85.4) | 7 (14.6) |  |

Abbreviations: AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium.

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| Table S5. Epilepsy Diagnosis by Cognitive Ability among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **Never Diagnosed****with Epilepsy** | **Diagnosed****with Epilepsy** |  |
|  | **No. (Mean, SD)** | **p-value** |
| **AGRE**  |  |  |  |
| Full Scale IQ (n = 469) | 456 (82.6, 23.6) | 13 (75.2, 30.4) | 0.27 |
| PPVT Standard Score (n = 1277) | 1233 (83.7, 26.7) | 44 (73.1, 32.9) | 0.04 |
| **SSC**  |  |  |  |
| Full Scale IQ (n = 1785) | 1734 (84.1, 26.5) | 51 (61.3, 26.5) | <.001 |
| PPVT Standard Score (n = 1748) | 1699 (86.8, 28.4) | 49 (64.7, 30.6) | <.001 |
| **AC** |  |  |  |
| Full Scale IQ (n = 273) | 260 (94.3, 21.1) | 13 (76.7, 16.2) | 0.003 |
| PPVT Standard Score (n = 337) | 320 (89.6, 28.9) | 17 (63.1, 27.4) | <.001 |

Abbreviations: SD, standard deviation; AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; PPVT, Peabody Picture Vocabulary Test.

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| Table S6. Epilepsy Diagnosis by Intellectual Disability among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **AGRE** | **SSC** | **AC** |
|  | **Never Diagnosed****with Epilepsy** | **Diagnosed with Epilepsy** |  | **Never Diagnosed****with Epilepsy** | **Diagnosed with Epilepsy** |  | **Never Diagnosed****with Epilepsy** | **Diagnosed with Epilepsy** |  |
|  | **No (%)** | **p-value** | **No (%)** | **p-value** | **No (%)** | **p-value** |
| Intellectual Disability (ID) |  |  | 0.08 |  |  | <.001 |  |  | 0.02 |
| Non- ID (IQ > 70) | 314 (98.1) | 6 (1.9) |  | 1259 (98.4) | 20 (1.6) |  | 224 (96.6) | 8 (3.4) |  |
| ID (IQ < 70) | 143 (95.3) | 7 (4.7) |  | 475 (93.9) | 31 (6.1) |  | 36 (87.8) | 5 (12.2) |  |

Abbreviations: AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium.

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| Table S7. Epilepsy Diagnosis by Adaptive Functioning among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **AGRE** | **SSC** | **AC** |
|  | **Never** **Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never** **Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  |
|  | **No. (Mean, SD)** | **p-value** | **No. (Mean, SD)** | **p-value** | **No. (Mean, SD)** | **p-value** |
| Adaptive Behavior Composite Score | 1439 (58.9, 19.0) | 74 (45.9, 19.9) | <.001 | 1735 (74.5, 11.5) | 51 (65.9, 12.0) | <.001 | 357 (74.5, 19.2) | 26 (61.3, 23.8) | 0.001 |
| Motor Skills Standard Score | 1369 (82.2, 20.9) | 70 (72.6, 23.6) | <.001 | 631 (82.8, 12.6) | 14 (76.5, 11.0) | 0.06 | 171 (80.7, 14.0) | 10 (70.8, 17.8) | 0.03 |

Abbreviations: SD, standard deviation; AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium.

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| Table S8. Epilepsy Diagnosis by Autism Severity among Individuals with Autism Spectrum Disorder, Genetic Collaborative Samples |
|  | **AGRE** | **SSC** | **AC** |
|  | **Never** **Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never** **Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  | **Never Diagnosed****with Epilepsy** | **Diagnosed** **with Epilepsy** |  |
|  | **No. (Mean, SD)** | **p-value** | **No. (Mean, SD)** | **p-value** | **No. (Mean, SD)** | **p-value** |
| ADOS Calibrated Severity Score | 1200 (6.8, 1.8) | 58 (7.2, 1.8) | 0.07 | 1679 (7.4, 1.7) | 50 (7.8, 1.7) | 0.08 | 274 (6.8, 2.6) | 11 (7.1, 2.3) | 0.70 |

Abbreviations: SD, standard deviation; AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium; ADOS, Autism Diagnostic Observation Schedule.

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| Table S9. Logistic Regression Modeling the Odds of an Epilepsy Diagnosis by Demographic and Clinical Characteristics, Individual Genetic Collaborative Samples |
|  | **AGRE****(n = 430)** | **SSC****(n = 1785)** | **AC****(n = 260)** |
| **Characteristic** | **OR (95% CI)** | **p-value** | **OR (95% CI)** | **p-value** | **OR (95% CI)** | **p-value** |
| Age |  |  |  |  |  |  |
|  9 years and younger | 1.00 [Reference] |  | 1.00 [Reference] |  | 1.00 [Reference] |  |
| 10 years and older | 1.70 (1.02-2.86) | 0.04 | 1.52 (1.15-2.02) | 0.004 | 2.07 (1.14-3.77) | 0.02 |
| Gender |  |  |  |  |  |  |
| Male | 1.00 [Reference] |  | 1.00 [Reference] |  | 1.00 [Reference] |  |
| Female | 3.52 (1.05-11.78) | 0.04 | 1.05 (0.49-2.23) | 0.91 | 0.75 (0.15-3.82) | 0.73 |
| Cognitive Ability |  |  |  |  |  |  |
| Full Scale IQ Score | 0.80 (0.41-1.57) | 0.53 | 0.47 (0.31-0.71) | 0.004 | 0.35 (0.16-0.74) | 0.01 |
| Adaptive Functioning |  |  |  |  |  |  |
| Adaptive Behavior Composite Score | 0.87 (0.43-1.77) | 0.70 | 0.96 (0.61-1.53) | 0.88 | 0.87 (0.40-1.90) | 0.72 |
| Language |  |  |  |  |  |  |
| Meaningful Use of Single Words, Two-Word Phrases, or Three-Word Phrases | 1.00 [Reference] |  | 1.00 [Reference] |  | 1.00 [Reference] |  |
| Fewer than 5 Words | 2.24 (0.21-24.12) | 0.51 | 0.72 (0.21-2.42) | 0.59 | *Not estimated* | 0.98 |
| Developmental Regression |  |  |  |  |  |  |
| No Loss of Language or Skills | 1.00 [Reference] |  | 1.00 [Reference] |  | 1.00 [Reference] |  |
| Loss of any Language or Skills | 1.52 (0.46-5.04) | 0.49 | 0.92 (0.49-1.71) | 0.78 | 2.39 (0.64-8.86) | 0.19 |

Abbreviations: OR, odds ratio; CI, confidence interval; FSIQ, full scale IQ score; AGRE, the Autism Genetic Resource Exchange; SSC, the Simons Simplex Collection; AC, the Autism Consortium.

Model is adjusted for all variables.

Odds ratios for full scale IQ score and adaptive behavior composite score represent the odds of epilepsy for a one standard deviation increase.

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| Table S10. Cross-Validation of Parent Report Epilepsy Diagnosis on the ADI-R with Report of Non-Febrile Seizures based on Medical History, Subset of Genetic Collaborative Study Participants (n=2,525) |
|  | **Parent Report of Epilepsy Diagnosis on ADI-R**  |
| **Parent Report of Non-Febrile Seizures on Medical History** | Never Diagnosed with Epilepsy | Diagnosed with Epilepsy |
|  | **No. (%)** |
| No Non-Febrile Seizures | 2372 (97.8) | 5 (5.0) |
| One or More Non-Febrile Seizures | 53 (2.2) | 95 (95.0) |

Abbreviations: ADI-R, Autism Diagnostic Interview- Revised (ADI-R).