Trajectories of Adolescent Media Use and their Associations with Psychotic Experiences

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Key Points

Question: Are adolescent trajectories of higher media use associated with more psychotic experiences during early adulthood?

Findings: In this cohort study of 1226 youth followed from 5 months to 23 years of age, trajectories of higher video gaming and increasing-then-decreasing ("curved") computer use during adolescence were associated with 5-7% higher levels of psychotic experiences at 23 years. Adjusting for mental health and interpersonal difficulties at 12 years lessened the association for video gaming, but not for computer use.

Meaning: Modest associations between adolescent trajectories of media use and psychotic experiences may reflect the influence of shared risk factors.

INTRODUCTION

Psychotic experiences (PEs) range from mild suspiciousness and bizarre ideas to more severe delusions and hallucinations. Surveys generally situate the prevalence of PEs in adults at 5-7%, with some evidence of a cumulative risk as high as 13% by 24 years of age.[1,2] The first onset of PEs is typically between 13 and 17 years.[3] While most individuals with PEs do not develop a major mental illness, PEs are nonetheless associated with 2- to 30-fold increased risk of psychotic, affective, and substance use disorders, as well as suicidal ideation and attempts.[2,4,5] Because of these links, PEs have become a target for early interventions to prevent clinical psychosis and improve overall mental health among youth.[6,7]

Media use is a ubiquitous behavior of adolescence that may be associated with PEs. Media technologies have recreational, social, and academic uses that make some amount of exposure normative during adolescence.[8]

However, there is widespread concern that high use of screen-based media may increase the risk of mental health problems.[9–11] Higher media use and mental health problems appear to share risk factors, such as parental mental health problems, loneliness, bullying and parent-child relational problems.[1,12–15] Given these functional and mental health associations, media use may also be a marker of PE risk, with one recent study showing a cross-sectional association between higher digital media use and higher PEs among young adults.[16]

However, no study has yet examined the prospective associations between adolescent media use and PEs. Notably, this association may vary according to longitudinal trajectories and types of media use. Longitudinal trajectories describe how amounts of media use change over time, and are best documented in a prospective fashion to account for the duration and frequency of exposure during development.[9,10] Additionally, various types of media use may have differential correlates, with regular video gaming associated with better cognitive performance,[17] and internet use more strongly associated with depression in adolescent girls in comparison to gaming or TV viewing.[11] In a population-based cohort, we therefore aimed to examine the associations between adolescent media use trajectories and lifetime PEs at 23 years of age. We considered longitudinal trajectories of four types of media use between 12-17 years of age: TV viewing, video gaming, computer use, and reading.

METHODS

Participants

Participants were from the Québec Longitudinal Study of Child Development. This population-based cohort conducted by the Institut de la statistique du Québec includes 2120 children born in the province of Québec, Canada in 1997-1998 and followed up annually or biennially to present.[18] A stratified sampling procedure was used to randomly select families with babies born in Québec, Canada (excluding Cree and Inuit territories and Indigenous reserves) from a birth registry. The cohort represented the full range of socioeconomic status in the general population of Québec, and 90% of the cohort self-identified as White, aligning with Québec's demographic in the late nineties. The cohort protocols were approved by the ethics committees of the Institut de la statistique du Québec, Sainte-Justine Hospital Research Centre, and the Douglas Research Center. Informed written consent, assent, or both were obtained for each data collection. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.[19] Analyses were conducted between January 2023 and January 2024.

Psychotic Experiences

Lifetime PEs were reported by participants at 23 years of age using the 15-item Community Assessment of Psychic Experiences (frequency scale), which has good reliability and validity in non-clinical samples.[20,21] Its items measure persecutory ideations (e.g., “Have you ever felt as if people seem to drop hints about you or say things with a double meaning?”), bizarre experiences (e.g., “Have you ever felt as if the thoughts in your head

are not your own?"), and perceptual abnormalities (e.g., "Have you ever heard voices when you are alone?"), each rated on 4-point scale from "never" to "nearly always" and averaged into a global score (range: 1–4). Participants were instructed not to include experiences that occurred only while under the influence of substances.[16,22] Internal consistency was good: α, 0.87; ω, 0.90. An additional item asked participants to estimate their age at onset of the first PE.

Media Use

We defined media as technologies or vehicles for accessing information, whether for recreational, social, or academic purposes, and spanning screen-based and traditional media.[23] Four types of media use were assessed: TV viewing, console-based video gaming, computer use (including computer-based gaming, homework, and messaging), and reading outside of class time. Participants reported their media use at 12, 13, 15 and 17 years of age. For each media type, participants were asked "In a typical week, how much time did you usually spend on […]?". Response options were: None, <1h, 1-2h, 3-5h, 6-10h, 11-14h, 15-20h, or >20h per week. To capture unequal distance between these categories, we recoded them as numeric values according to their midpoints. In other cohorts, similar self-report items for digital media use were moderately correlated with device-based estimates of screen time[24] but were similarly or more predictive of mental health outcomes.[25–27]

Family and Childhood Characteristics

Measures of family and childhood characteristics are detailed in eMethods in the Supplement. Parents reported on sociodemographic characteristics (sex, racialized groups, and household income) and parental mental health (history of depression, any vs. none, and antisocial behaviors in adolescence, range 0–5) when children were 5 months or 2.5 years old. At 8 years, mothers reported weekly hours spent by their children on TV, computers, and video games. At 12 years, teachers reported on depression (5 items; range 5–15), anxiety (4 items; range 4–12), hyperactivity-inattention (9 items; range 9–27), and oppositional or defiant behaviors (4 items; range 4–12) of participants. Participants self-reported their exposure to bullying (6 items; range 6–18), the quality of their best friendship (6 items; range 6–30), and the monitoring and supportive behaviors of their parents (6 items; range 6–30). For exploratory purposes, we also included the polygenic score for schizophrenia, recognizing however that it explains only a fraction of schizophrenia heritability. Polygenic scores were derived from blood samples collected at 10 years and standardized to mean, 0; SD, 1.

Statistical Analysis

Analyses were conducted in R, version 4.2.3 (R Foundation for Statistical Computing) and included participants with data on PEs at 23 years of age and at least one assessment of media use during adolescence. Early-life characteristics of the analytic sample were compared to those of participants removed because of missing data; for these comparisons, we examined effect sizes rather than p-values.[19]

To identify group-based trajectories of media use, we used latent class linear mixed models, which are robust to missingness at random.[28] Each type of media use was regressed on age, including a quadratic term for curvilinear trajectories, and sex (female, male). Models with 1- to 4-trajectory groups with various structures were estimated. The best-fitting models were selected according to the Bayesian Information Criterion, model adequacy, and interpretability following a 4-step process (eMethods in the Supplement).[29]

To evaluate the associations of family and childhood characteristics with trajectory groups, we used multinomial logistic regressions. Missing data on family and child characteristics, including genetic variables, was replaced with multiple imputations over 40 datasets using chained equations. For each variable to impute, predictors were selected procedurally from a large set of variables based on a criterion of $r>0.15$ with the imputed variable.[30,31] All analyses were adjusted for sex. To identify pathways of associations independent of prior media use, models of childhood characteristics as predictors of adolescent media use trajectories were additionally adjusted for media use at 8 years of age. To account for the testing of multiple predictors at the level of each trajectory group, statistical significance was defined as $p<.05$ after correction for false discovery rate using the Benjamini & Hochberg method.[32]

To evaluate the associations between adolescent trajectory groups and PEs at 23 years of age, we used generalized linear models with Gamma distributions and log-link functions to accommodate the skewed distribution of PEs.[33] We alternately adjusted for each set of family and childhood characteristics to examine their confounding influences. We expressed effect sizes as the relative difference (%) in PE scores between trajectory groups. For example, +5% corresponds to the difference between mean PE scores of 1.05 and 1.00, or between 2.10 and 2.00. This is approximately equivalent to one additional point on the scale, e.g., endorsing one item as “Sometimes” instead of “Never”, yielding a raw score difference of +0.07. We used the trajectory groups that comprised the most participants as comparators for the other trajectories.

RESULTS

Sample Characteristics

Of 2120 participants at inception of the cohort, 1226 (57.8%) completed the assessment of PEs at 23 years of age and at least one assessment of media use during adolescence. These participants (including 713 [58.2%] female) constitute the analytic sample (Table 1). Relative to participants excluded from analyses due to missing information, the analytic sample featured greater proportions of female participants and households with sufficient income, had mothers who were more educated, and under-represented racialized minority groups (effect sizes > 0.1). In the analytic sample, genetic data was available for 589 participants (48%) before imputation. Data availability in the analytic sample was 100% for PEs, 77.7%–93.4% for adolescent media use at each time point, and 62.5%–100% for family and childhood characteristics.

Adolescent Media Use Trajectories

Best-fitting models of media use trajectories (eTable 1, eFigures 1–3 in the Supplement) included 3 trajectory groups for each type of media use (Figure 1). Across media types, most participants followed trajectories of lower use between 12 and 17 years of age (684 [55.8%]–894 [72.9%] participants), whereas curved and higher trajectories of use comprised fewer participants (128 [10.4%]–353 [28.8%]).

Higher parent-reported levels of children's TV viewing at 8 years of age were associated with greater odds of the higher vs. lower trajectory of TV viewing between 12–17 years (Figure 2). Other factors were not significantly associated with TV viewing trajectories. For video gaming, factors associated with greater odds of the higher vs. lower trajectory of use included male sex, household income insufficiency, higher levels of computer and video game use at 8 years, higher levels of depression, anxiety, hyperactivity-inattention and bullying, and lower levels of friendship quality and monitoring-supportive parenting at 12 years. For computer use, the only association was between higher levels of bullying at 12 years and greater odds of the higher vs. lower trajectory of use. There were no statistically significant associations with reading trajectories.

Associations with Psychotic Experiences

The distribution, age at onset, and correlates of PEs are presented in eTables 2-4 in the Supplement. Most participants reported a first onset of PE during adolescence (median, 15 years; Q_1-Q_3, 12-17 years). There were no interactions between sex and trajectories of media use (data not shown). Associations between media use trajectories and PEs are reported relative to the lower trajectories of media use (Figure 3). For TV viewing, the medium and higher trajectories were not associated with PEs. For video gaming, the higher trajectory was associated with more PEs in the unadjusted model. However, after adjusting for the participants' mental health or relationships at 12 years, the association was no longer statistically significant. For computer use, the curved trajectory was associated with more PEs in unadjusted and adjusted models. For reading, the medium and higher trajectories were not associated with PEs.

DISCUSSION

To our knowledge, this is the first study to examine prospective associations between adolescent media use and PEs. Previous research has identified concurrent associations between higher levels of PEs and higher levels of TV viewing, social media use, video gaming, and internet addiction in U.S. and Canadian convenience samples of adults.[16,34] Another study among college students from Taiwan found that higher paranoid ideas were associated with incident internet addiction, a proxy for high and impairing internet use, at 1-year follow-up.[35] Examining these associations in a population-based cohort and across adolescence, we found that 10.4–28.8% of children followed higher or curved trajectories of media use between 12–17 years of age. The curved trajectory of computer use, indicating increasing then decreasing levels of use, was associated with 4% to 5% more PEs by 23 years of age. Higher video gaming during adolescence was associated with 3% to 7% more PEs, and this difference was explained by mental health and interpersonal difficulties at 12 years. These

associations, which correspond to adding approximately 0.5–1.0 point on one of the 15 PE items, are arguably modest, and therefore do not provide evidence that adolescent media use is a cause for concern in the risk of PEs. Rather, the results underscore the importance of considering context – specifically psychosocial antecedents and time-sensitive factors during adolescence – to appropriately interpret the clinical significance of media use for adolescent mental health.

The curved trajectory of computer use was characterized by a sharp decline in use by mid-adolescence, which arguably stood in contrast with growing societal trends regarding technological connectedness: adolescents between 2010–2015 experienced a period of increasing expectations to use digital media for social purposes, leisure, or school work.[36] According to the Goldilocks hypothesis,[8] the relationship between media use and well-being is not linear: a certain amount of media use is adaptive or necessary to meet societal demands, whereas very low or very high levels of use may interfere with functioning. However, what defines this middle range may vastly differ between individuals: for example, both the higher and lower trajectories may represent adequate amounts of computer use for the adolescents in each group, thus explaining why they did not subsequently differ on their levels of PEs. In contrast, adolescents in the curved trajectory experienced a decline in computer use relative to their own antecedents, suggesting a shift in some aspect of their functioning. This disjunction of computer use with prior habits, as well as with the historical trends of increasing technological connectedness, could explain why the trajectory was associated with more PEs.

Other time-sensitive factors may have contributed to the association between the curved trajectory of computer use and PEs. These factors could include, for example, environmental exposures after 12 years of age (e.g., substance use, interpersonal problems) or the effect of PEs themselves. The fact that most participants reported a first onset of PEs during adolescence (consistently with the epidemiological literature[3]) makes it possible that emerging or intensifying PEs during this critical period interfered with computer use for the curved trajectory group. Indeed, PEs have been associated with a range of mental health and functioning difficulties,[1,5] which could hypothetically impact a person's technological behaviors. Future research should prospectively consider whether the occurrence or progression of PEs during adolescence results in, or is concurrent with, a decrease in digital media use.

It is notable that higher video gaming was associated with many indicators of adversity, including household income insufficiency, as well as mental health and interpersonal difficulties at 12 years of age. Elsewhere, lower socio-economic status, male sex, and interpersonal and mental health problems have similarly been associated with higher levels of video gaming in children and adolescents.[12,37,38] In some individuals, video gaming has been proposed to support emotion regulation and the development of social relationships, perhaps to a greater extent than more "passive" forms of media such as TV.[39,40] Children and adolescents may find that the psychological and interpersonal possibilities of video games help them to cope with loneliness and social exclusion.[41] Conversely, socio-economic precarity, mental health problems, and interpersonal difficulties may be associated with lower accessibility of other activities within the person's environment, thus reinforcing the

preference for video games.[42,43] This understanding of higher video gaming as a response to adversity is consistent with the present observation that mental health and interpersonal problems at 12 years confounded the association of higher video gaming with PEs.

Overall, media use trajectories during adolescence were modestly associated with PEs, likely in part because of shared risk factors during childhood or adolescence. Higher video game use may emerge in response to adversity that potentially underlies the subsequent association of gaming with PEs, and a late-adolescence decrease in computer use may reflect the onset of functional impairments from PEs or other time-sensitive exposures. Therefore, in the assessment of youth with higher PEs and higher media use, clinicians may need to consider the socio-environmental determinants of media use before drawing conclusions on its risks and benefits. The present findings may also be relevant in context of current efforts to develop digital mental health interventions for youth, such as therapeutic video games addressing the first episode of psychosis.[44,45] Given the greater uptake of video games among adolescents who eventually develop PEs, as the results suggest, it is worthwhile to consider whether leveraging video games as therapeutic tools can increase the reach and accessibility of early intervention services.[46]

Strengths and Limitations

Strengths of the study include detailed data on family and childhood characteristics from multiple informants, as well as prospective measurement of four types of media use over 5 years. However, generalizability may be limited due to the evolving landscape of media favored by young people: since the present participants' teenage years, smartphones and social media have risen in popularity, and the average screen time of Canadian adolescents has increased.[47] Other limitations include attrition, the self-reported nature of the data, as well as the lack of information regarding the contents, motivations, and experiences related to media use. We did not measure symptoms of gaming disorder or other forms of internet addiction, which may confer stronger associations with PEs given their inclusion of distress and functional impairments in their definitions.[48] We lacked data on PE-related distress and prospective recording of their age at onset. Residual confounding is likely: we adjusted for covariables in separate sets (to avoid overfitting the models) and our statistical approach could not account for time-varying confounders during adolescence.

CONCLUSION

Longitudinal trajectories of media use during adolescence were differentially associated with PEs at 23 years of age. Prior mental health and relationship difficulties explained this association for the higher trajectory of video gaming, whereas a curved (increasing-then-decreasing) trajectory of computer use retained a modest association with more PEs. Understanding the environmental determinants and psychosocial functions of media use during adolescence may help better integrate digital technologies in the prevention and management of PEs.

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Access to Data and Data Analysis: Dr Paquin and Dr Geoffroy had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Data Sharing Statement: Researchers can access data from the Québec Longitudinal Study of Child Development by making a request to the Institut de la statistique du Québec (https://statistique.quebec.ca/en/institut/services-for-researchers).

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TABLES

Table 1. Early-Life Characteristics of Participants Included in and Excluded From Analyses

	Participant, No. (%)		**Effect size**
	Included **N=1226**	**Excluded** **N=894**	
Sex assigned at birth			0.213
Male	513 (41.8%)	567 (63.4%)	
	713 (58.2%)	327 (36.6%)	
Racialized minority group[a]			0.121
Yes	88 (7.19%)	131 (14.7%)	
No	1136 (92.8%)	762 (85.3%)	
Household income insufficiency at 5 months[b]			0.139
Yes	237 (19.5%)	274 (31.6%)	
No	978 (80.5%)	593 (68.4%)	
Single parent household at 5 months			0.067
Yes	80 (6.54%)	91 (10.2%)	
No	1144 (93.5%)	797 (89.8%)	

Maternal age in years at child's birth, Mean (SD)	29.1 (5.10)	28.5 (5.37)	0.056
Maternal educational attainment at 5 months			0.109
No high school diploma	276 (22.5%)	288 (32.3%)	
High school diploma or higher	949 (77.5%)	604 (67.7%)	
Maternal depressive symptoms at 5 months, Mean (SD)[c]	1.31 (1.28)	1.53 (1.41)	0.080
Internalizing behaviors at 29 months, Mean (SD)[d]	1.15 (0.20)	1.15 (0.21)	0.004
Externalizing behaviors at 29 months, Mean (SD)[d]	1.50 (0.29)	1.51 (0.31)	0.010

Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec. Effect sizes for comparing included and excluded participants are Cramer's V and absolute Spearman correlations (range 0.000–1.000).

[a] Defined as parental identification of the children to any of 11 non-White racialized categories.

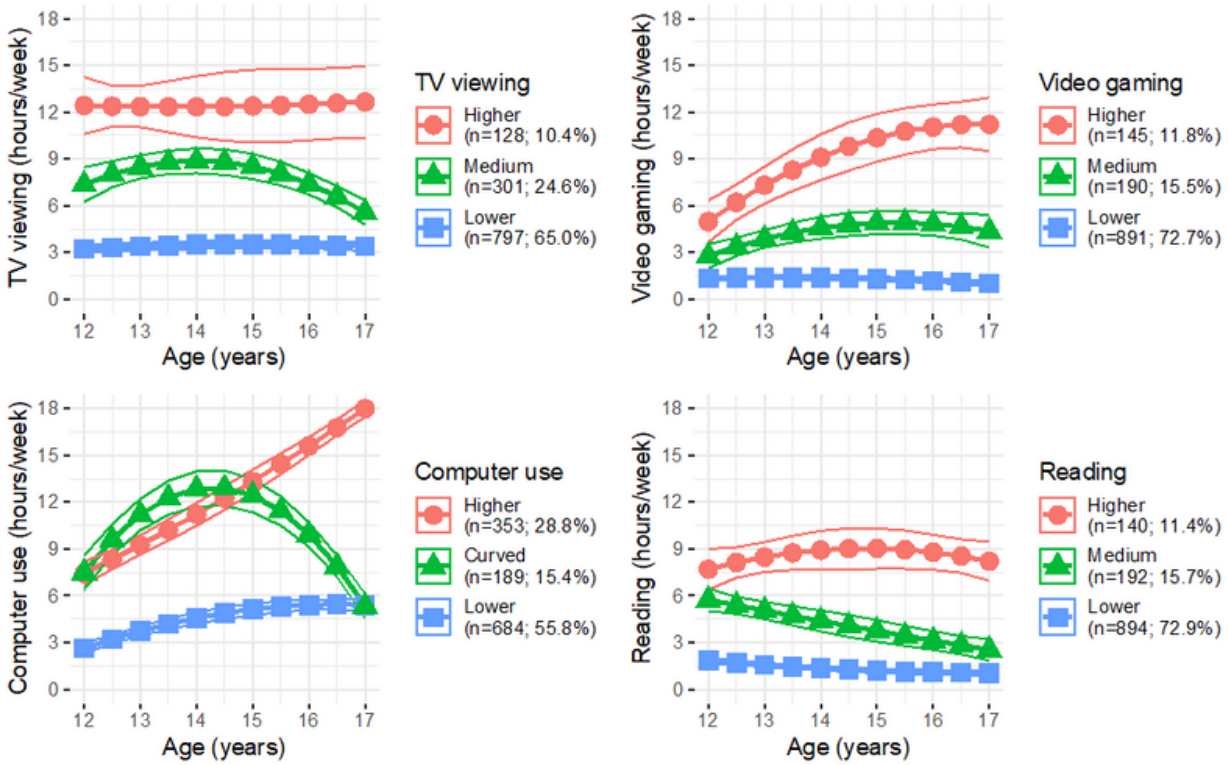
[b] Insufficiency defined as spending more than 20% of the annual income for basic needs, in addition to the average proportion spent by households of similar size and regional population density.

[c] 12-item version of the Center for Epidemiologic Studies-Depression,[49] rescaled to range 0–10.

[d] From the Behavior Questionnaire;[50] mean scores (range 1-3) of 6 items for internalizing and 10 items for externalizing behaviors; missing values replaced with 17 months.

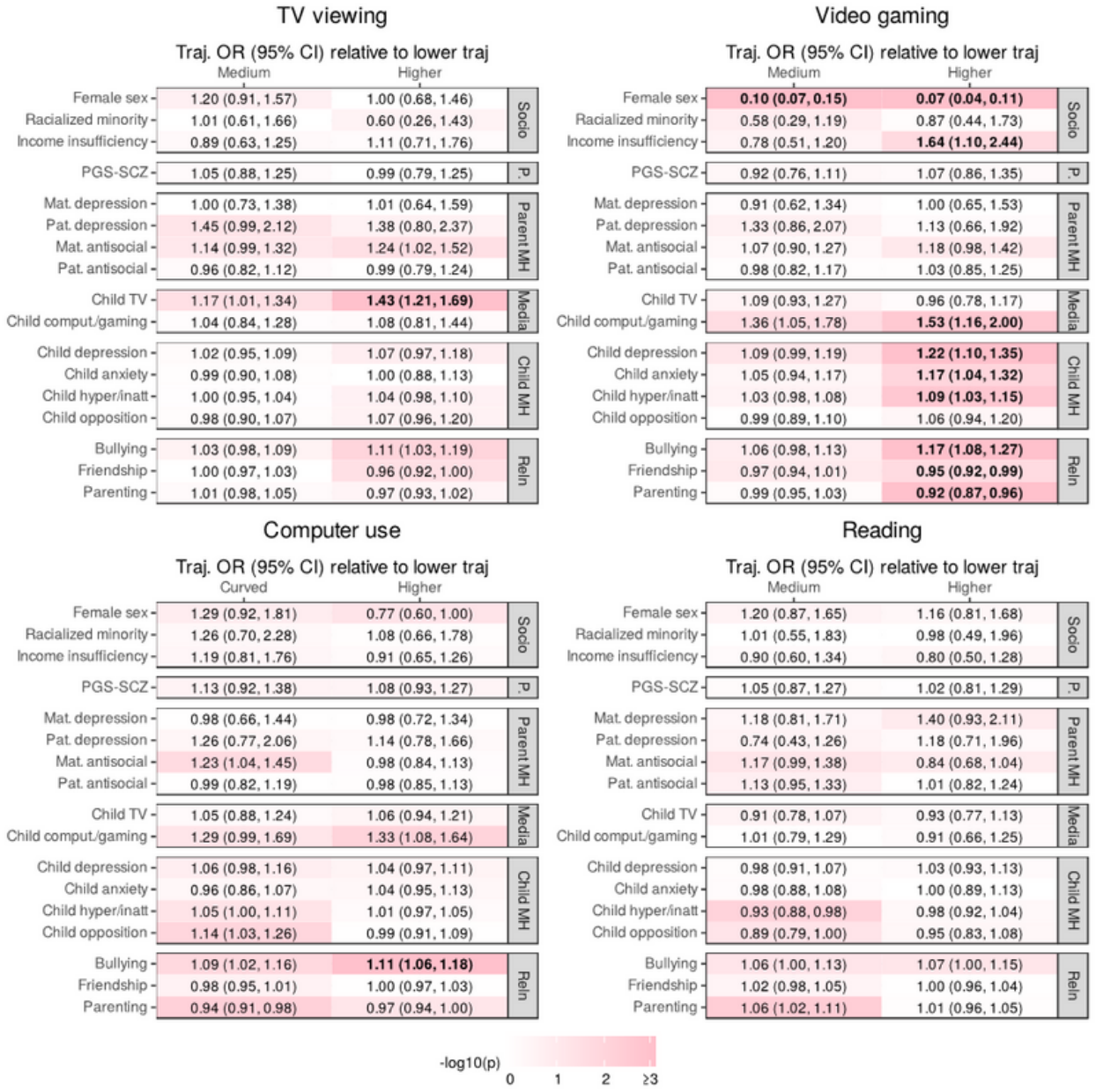
FIGURES

Figure 1. Group-Based Trajectories of Media Use Between 12 and 17 Years of Age



Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec. Latent class linear mixed models (n=1226). Media use was reported by participants at ages 12, 13, 15, and 17 as weekly hours spent on TV viewing, video gaming, computer use, and reading. Each type of media use was separately regressed on sex and age (quadratic), with mixture modeling to identify groups of participants with similar trajectories of media use. Best-fitting models among various configurations were selected using a 4-step procedure (eMethods in Supplement).

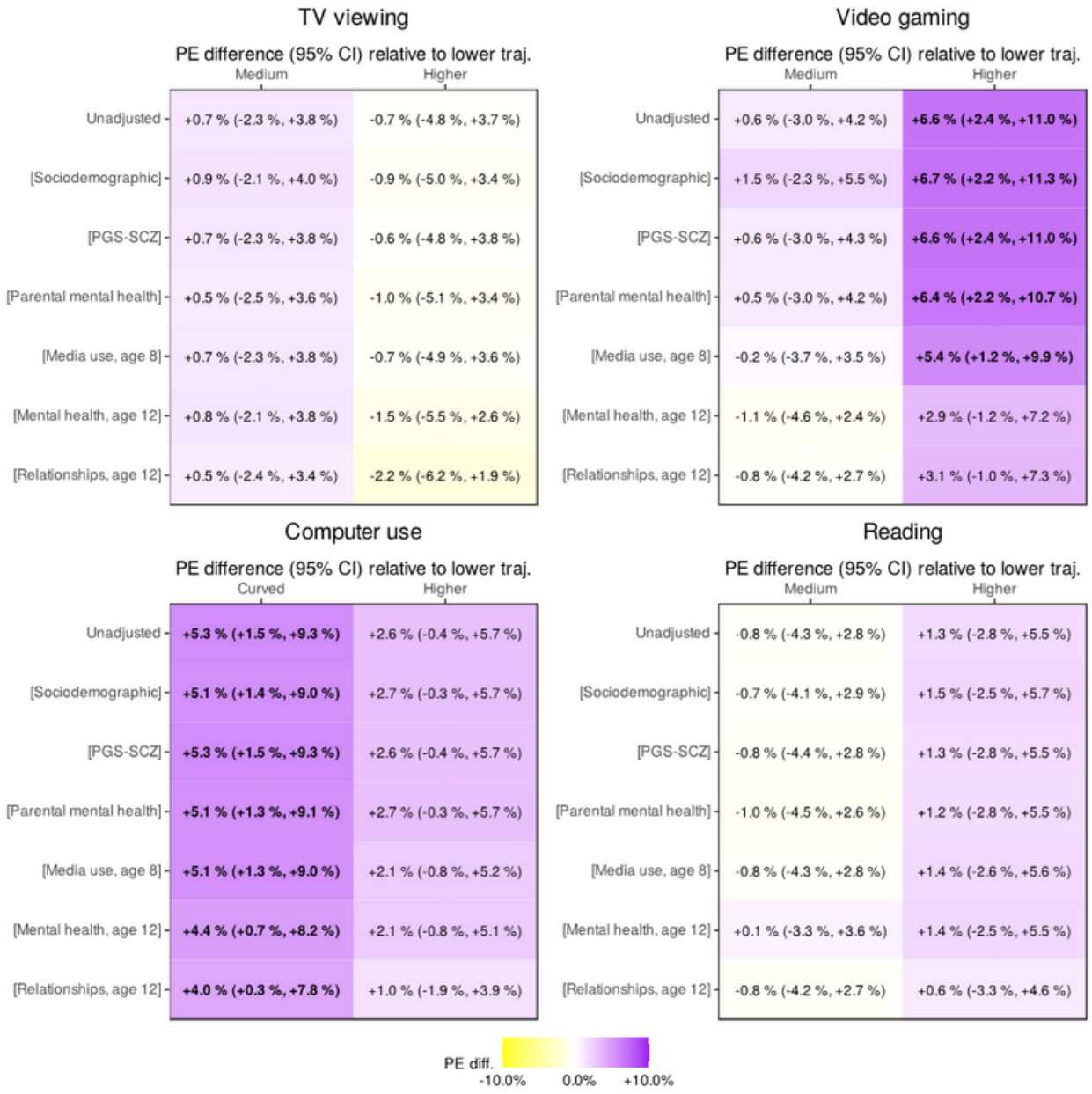
Figure 2. Odds Ratio of Adolescent Media Use Trajectories as a Function of Family and Childhood Characteristics



Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec. Odds ratio (95% CI) for trajectory groups are in comparison to the trajectory groups of low use pooled over 40 multiply datasets (n=1226). Values in bold are significant (p<.05) after adjustment for false discovery rate. Predictors from top to bottom are female vs. male sex; racialized minority group; polygenic score for schizophrenia (PGS-SCZ) adjusted for the first 3 ancestry components; maternal and paternal history of depression and antisocial behaviors; TV viewing, computer use and video gaming at age 8 (hours/week); depression, anxiety, hyperactivity-inattention, and opposition at age 12; bullying, relationship with best friend, and parenting behaviors at age 12. All models are adjusted for sex, and

models from “Child depression” to “Parenting” are also adjusted for TV viewing, computer use and video gaming at age 8.

Figure 3. Relative Difference in Psychotic Experiences at 23 Years as a Function of Adolescent Media Use Trajectories



Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec. Relative difference, % (95% CI) in psychotic experiences as a function of trajectory groups (comparator: low trajectory). Values in bold are significant at $p<.05$. Bracketed terms indicate the sets of control variables, with each set incorporated in a separate model: sociodemographic

(sex, racialized minority, income insufficiency), PGS-SCZ (polygenic score for schizophrenia and the first 3 ancestry components), parental mental health (maternal and paternal history of depression and adolescent antisocial behaviors), media use at age 8 (TV viewing, computer use and video gaming), mental health at age 12 (depression, anxiety, hyperactivity-inattention, and opposition), and relationships at age 12 (bullying, relationship with best friend, and parenting behaviors).

Supplementary Material

Table of Contents

eMethods

Measures of Family and Childhood Characteristics

The study questionnaires can be found at: https://www.jesuisjeserai.stat.gouv.qc.ca/.

Sociodemographic Characteristics. Sex assigned at birth (female, male) was identified from medical records at recruitment. Racialized groups (12 categories including White, Black or African American, Indigenous, etc.) were reported by parents at age 5 months, and racialized minority group was defined as identification to any of the categories other than White. Household income insufficiency was measured at age 5 months and was

defined as spending more than 20% of the annual income for basic needs, in addition to the average proportion spent by households of similar size and regional population density.[1] Participants also self-reported their gender identity at age 23, and we initially planned to include this variable in the analyses but did not due to few participants identifying as transgender or non-binary (26 [2.1%] participants in the analytic sample); considering that some trajectory groups comprised as little as 10% of the analytic sample, their intersections would have led to insufficient numbers of observations for statistical inference.

Polygenic Score for Schizophrenia (PGS-SCZ). See next section below.

Parental Mental Health. At 2.5 years of age, parental lifetime history of depression (any vs. none) was assessed with 16 items from the Diagnostic Interview Schedule.[2] At 5 months of age, parental history of antisocial behaviors was assessed with 5 items from the Diagnostic Interview Schedule (range: 0–5).

Media Use at Age 8. At 8 years of age, mothers reported their children's daily time spent on (1) TV viewing and (2) computer use or video gaming. Response options for each of these two items were "none", "less than 1 hour", "between 1 hour and less than 3 hours", "between 3 hours and less than 5 hours", "between 5 hours and less than 7 hours", and "7 hours or more" per day. Mothers were asked to estimate daily exposure separately for weekdays and week-end days. Responses were recoded as numeric values and were combined to estimate the total weekly time spent on these two media categories.

Mental Health Problems at Age 12. Four measures of the mental health of participants at age 12 were collected using teacher reports on the Social Behavior Questionnaire:[3] depression (5 items; e.g., child seems sad, not as happy as peers), anxiety (4 items; e.g., fearful, worried), hyperactivity and inattention (9 items; e.g., could not sit still), and oppositional and defiant behavior (4 items; e.g., defiant or refused to comply). The items were derived from the Canadian National Longitudinal Study of Children and Youth,[4] which incorporates items from the Child Behavior Checklist.[5] Each item is on a 3-point scale (1="Never or not true", 2="Sometimes or somewhat true", and 3="Often or very true") and the items were summed to produce total scores.

Interpersonal Problems at Age 12. Participants reported their exposure to bullying since the start of the school year using a 6-item measure adapted from the Self-Report Victimization Scale (e.g., being called names, getting pushed, hit or kicked).[6] Each item is a 3-point scale (1="Never", 2= "Once or twice", 3= "More often") and the items were summed to produce a total score (range 6–18). Participants also reported the quality of their relationship with their best friend in their class using a 6-item measure adapted from the Network of Relationships Inventory (e.g., feeling liked and appreciated by the friend, the friend helps understand and resolve things).[7] Each item is on a 5-point scale (1= "Little or not at all" to 5= "Most of the time") and the items are summed to produce a total score (range: 6–30). Lastly, participants reported on the behaviors of their parents in the past 6 months using 6 items adapted from the Parenting Questionnaire.[8] These items assess monitoring (e.g., "my parents find out about my misbehavior") and nurturance (e.g., "my parents make sure I

know I am appreciated") behaviors on a 5-point scale (1="Never" to 5="Always") and are summed to produce a total score (range: 6–30).

Polygenic Score for Schizophrenia (PGS-SCZ)

Blood samples were provided by 992 participants at 10 years of age. DNA extraction and testing (concentration and purity) were respectively done with the Qiagen FlexiGene DNA kit Cat#51206 and PicoGreen DNA assay (Invitrogen Quant-iT™ PicoGreen™ dsDNA Assay Kit Cat#P7589). The Infinium PsychArray-24 version 1.3 BeadChip was used for genotyping (n=978). The quality control (QC) of genetic data was conducted in PLINK version 1.90b5.2[9] and R version 3.4.3. Pre-imputation QC was conducted using two samples, the Quebec Longitudinal Study of Child Development and the Quebec Newborn Twin Study.[10] SNPs with call rates <98% or a minor allele frequency (MAF) <1%, with genotyping rates <98%, or with ambiguous strand information were removed. Additional filters included sex mismatches, relatedness, and genetic duplicates.

Ancestry components were calculated to determine genetic outliers and for inclusion as covariates in the article. Multidimensional scaling analysis with 10 components was performed on the IBS matrix using the eigen decomposition-based algorithm in PLINK version 1.90b6.7. At this step, genotype data from the Quebec Newborn Twin Study was also included. Additional filters included removal of variants with a MAF <0.05 or HWE *p*-value $<10^{-3}$ and linkage disequilibrium (LD) pruning (command --*indep-pairwise* 200 100 0.2).

Imputation was conducted using SHAPEIT version 2 (r837),[11] IMPUTE2 version 2.3.2,[12] and the 1000 Genomes Phase 3 reference panel. SNPs were imputed in 5 mega-basepair chunks and with 500 kilobase buffers. After imputation, variants with a MAF <1%, HWE test $p<1\times10^{-6}$, and INFO metric <0.8 were removed. After quality control and imputation, data on 8 407 807 SNPs and 816 participants was retained.

Summary statistics of the genome-wide association study of schizophrenia[13] (primary analyses, combined ancestry sample) were downloaded from the Psychiatric Genomics Consortium: https://www.med.unc.edu/pgc/results-and-downloads/. The polygenic score for schizophrenia (PGS) was calculated using the PRS-CS package for Python.[14] PRS-CS employs a Bayesian approach that places a continuous shrinkage (CS) prior on SNP effect sizes, allowing the inclusion of all SNPs while robustly accommodating various genetic architectures.

Statistical Procedure for the Selection of Group-Based Trajectory Models

The process of selecting group-based trajectory models involves several decisions pertaining to model structure that influence the number and shape of trajectory groups. To identify best-fitting models in a systematic and transparent manner for each type of media use (TV viewing, video gaming, computer use, and reading), we applied a 4-step procedure adapted from the recommendations of Lennon et al.[15]

Step 1: Number of Groups. For each type of media use, we compared models comprising 1 to 4 trajectory groups to identify what number of groups provided the best fit. Best fit was defined as the lowest Bayesian Information Criterion. Models with groups comprising less than 5% of the total sample were excluded to avoid the constraints of small group sizes on interpretability and statistical inference. In all models of this step, we included random quadratic terms for year and allowed the variance-covariance matrix to differ between groups according to a multiplicative factor; we selected this model structure *a priori* given the assumed heterogeneity within and between groups.[16]

Step 2: Model Structure. Using the number of groups identified in Step 1, we compared different model structures to identify what model structure provided the best fit. Again, best fit was defined as the lowest Bayesian Information Criterion, while models with groups comprising less than 5% of the total sample were excluded. We examined 7 model structures that differed in their configuration of random effect terms and of the variance-covariance matrix:

1. Fixed effects only
2. Random intercepts, equal matrices
3. Random intercepts, proportional matrices
4. Random slopes, equal matrices
5. Random slopes, proportional matrices
6. Random quadratic, equal matrices
7. Random quadratic, proportional matrices

We tested two configurations for variance-covariance matrices: a common variance-covariance matrix over all trajectory groups (“equal matrices”) vs. a group-specific parameter that multiplies the variance-covariance matrix in each group (“proportional matrices”).

Step 3: Adequacy of the Model. To examine the adequacy of the model identified in Step 2, we applied the following three criteria described by Lennon et al.:[15] (1) posterior probability of assignments (APPA) > 0.7 in each group; (2) odds of correct classification (OCC) > 5 in each group; and (3) relative entropy > 0.5. When these criteria were not satisfied, we examined the adequacy of the next best-fitting models from previous steps.

Step 4: Graphical Presentation. We examined the interpretability of the graphical presentation of the groups, with an attention to the degree of differentiation between them. For example, having two groups that followed a similar trajectory of media use with only 1 hour/week of difference at each time point could be considering as lacking interpretability, given the low plausibility that this difference would be large enough to produce distinct correlates in terms of family and childhood correlates or subsequent psychotic experiences.

eTable 1. Identification of Media Use Trajectory Models Following a 4-Step Procedure

Step	**Type of media use**			
	TV viewing	***Video gaming***	***Computer use***	***Reading***
1. Number of groups, lowest BIC				
1 group	25422.63	23779.80	27348.51	22429.25
2 groups	24777.13	21312.93	26922.40	20791.20
3 groups	24754.81	21251.01	26828.76	20723.55
4 groups	24772.08	21244.38	26859.42	20766.22
Selected model	3 groups	3 groups[a]	3 groups	3 groups
2. Model structure, lowest BIC				
Fixed effects only	25074.31	22609.73	27150.00	21589.90
Random intercepts, equal	25003.63	22602.35	27129.15	21584.54
Random intercepts, proportional	24934.65	22268.06	27083.23	21446.26
Random slopes, equal	25215.60[b]	22561.15	27132.68	21931.52[b]
Random slopes, proportional	24805.48	21561.82	26950.19	20890.43
Random quadratic, equal	25234.33[b]	22511.56	27164.28[b]	21951.69[b]
Random quadratic, proportional	24754.81	21251.01	26828.76	20723.55
Selected model	Random quadratic, proportional	Random quadratic, proportional	Random quadratic, proportional	Random quadratic, proportional
3. Model adequacy (APPA > 0.7, OCC > 5, and relative entropy > 0.5)				

APPA	High, 0.841 Medium, 0.784 Low, 0.892	High, 0.937, Medium, 0.777 Low, 0.959	High, 0.886 Curved, 0.826 Low, 0.868	High, 0.925 Medium, 0.772 Low, 0.937
OCC	High, 40.54 Medium, 9.54 Low, 5.30	High, 96.18 Medium, 18.98 Low, 9.42	High, 19.27 Curved, 19.05 Low, 6.25	High, 85.04 Medium, 16.38 Low, 6.28
Relative entropy	0.686	0.812	0.690	0.775
Interpretation	Meets criteria	Meets criteria	Meets criteria	Meets criteria
4. Graphical presentation, interpretability of trajectories (see Figure 1)				
Interpretation	Meets criteria	Meets criteria	Meets criteria	Meets criteria

Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

APPA, Average Posterior Probability Assignment. BIC, Bayesian Information Criterion. OCC, Odds of Correct Classification.

[a]The 4-group model was initially identified as best fitting based on its lower Bayesian Information Criterion. However, with 4 groups, the models subsequently identified in Step 2 did not satisfy the criteria for model adequacy (across the first, second, and third best-fitting models). Given that the 3-group model came close to the 4-group model at Step 1, we ultimately selected it for subsequent steps.

[b]Models with groups comprising less than 5% of the sample. These models were excluded.

eTable 2. Item-Wise Frequency of Psychotic Experiences

Item #	Question	Frequency (%)[a]
1	felt as if people seem to drop hints about you or say things with a double meaning	56.6
2	felt as if some people are not what they seem to be	65.4

3	felt that you are being persecuted in anyway	34.6
4	felt as if there is a conspiracy against you	16.1
5	felt that people look at you oddly because of your appearance	34.8
6	felt as if electrical devices such as computers can influence the way you think	18.6
7	felt as if the thoughts in your head are being taken away from you	9.1
8	felt as if the thoughts in your head are not your own	14.1
9	your thoughts been so vivid that you were worried other people would hear them	12.6
10	heard your thoughts being echoed back at you	10.7
11	felt as if you are under the control of some force or power other than yourself	6.3
12	felt as if a double has taken place of a family member, friend or acquaintance	<5.0
13	heard voices when you are alone	6.3
14	heard voices talking to each other when you are alone	<5.0
15	seen objects, people or animals that other people can't see	<5.0

Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

[a] Frequency was calculated as the proportion of participants in the analytic sample (n=1226) who rated the item as 2="Sometimes", 3="Often", or 4="Nearly always" (i.e., above 1="Never").

eTable 3. Distribution and Age at Onset of Psychotic Experiences by Trajectory Groups

Group	Psychotic experience score (range: 1-4)			Age at onset of first psychotic experience[a]		
	N	Mean (SD)	Median (Q_1, Q_3)	N	Mean (SD)	Median (Q1, Q3)
Total sample (n=1226)	1226	1.25 (0.29)	1.20 (1.07, 1.33)	932	14.58 (4.24)	15.00 (12.00, 17.00)
TV viewing						
Lower (n=797)	797	1.25 (0.30)	1.20 (1.07, 1.33)	601	14.81 (4.28)	15.00 (12.00, 17.00)
Medium (n=301)	301	1.26 (0.27)	1.20 (1.07, 1.40)	234	14.09 (3.93)	14.00 (12.00, 17.00)
Higher (n=128)	128	1.24 (0.27)	1.17 (1.07, 1.33)	97	14.33 (4.61)	15.00 (12.00, 18.00)
Video gaming						
Lower (n=891)	891	1.24 (0.27)	1.20 (1.07, 1.33)	668	14.67 (4.12)	15.00 (12.00, 17.00)
Medium (n=190)	190	1.25 (0.32)	1.13 (1.00 (1.33)	141	14.77 (4.71)	15.00 (12.00, 18.00)
Higher (n=145)	145	1.32 (0.36)	1.20 (1.13, 1.47)	123	13.89 (4.28)	15.00 (12.00, 17.00)
Computer use						
Lower (n=684)	684	1.23 (0.29)	1.13 (1.00, 1.33)	497	14.82 (4.39)	15.00 (12.00, 18.00)

Curved (n=189)	189	1.30 (0.26)	1.27 (1.13, 1.40)	154	14.83 (3.81)	15.00 (13.00, 17.00)
Higher (n=353)	353	1.26 (0.30)	1.20 (1.07, 1.40)	281	14.01 (4.14)	15.00 (12.00, 16.00)
Reading						
Lower (n=894)	894	1.25 (0.28)	1.20 (1.07, 1.33)	676	14.88 (4.22)	15.00 (12.00, 18.00)
Medium (n=192)	192	1.24 (0.33)	1.13 (1.00, 1.33)	142	14.39 (4.05)	14.00 (12.00, 17.00)
Higher (n=140)	140	1.27 (0.29)	1.20 (1.07, 1.40)	114	13.01 (4.25)	14.00 (10.00, 16.00)

Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

SD: standard deviation.

Q_1, Q_3: lower and upper quartiles.

[a]Age at onset of the first psychotic experience was self-reported with 1 ad-hoc item appended to the 15-item Community Assessment of Psychic Experiences at 23 years of age: “Approximately how old do you think you were when you had one of these experiences for the first time?” Responses were limited to a range of 5 to 23 years of age.

eTable 4. Associations of Family and Childhood Characteristics with Psychotic Experiences

Variable	**Relative difference in PEs, % (95% CI)**
Sociodemographic characteristics (parent report)	
Sex assigned at birth (0=male, 1=female)	-0.3 % (-2.8 %, +2.4 %)
Racialized minority status (0=no, 1=yes)	+1.5 % (-3.4 %, +6.7 %)

Household income insufficiency (0=no, 1=yes)	+8.6 % (+5.2 %, +12.1 %)
Genetic risk	
Polygenic score for schizophrenia (standardized to mean=0, SD=1)	+0.5 % (-1.1 %, +2.2 %)
Parental mental health (parent report)	
Maternal history of depression (0=no, 1=yes)	+2.8 % (-0.4 %, +6.0 %)
Paternal history of depression (0=no, 1=yes)	+3.2 % (-0.8 %, +7.3 %)
Maternal antisocial behaviors in adolescence (range: 0-5)	+1.5 % (+0.1 %, +3.0 %)
Paternal antisocial behaviors in adolescence (range: 0-5)	+1.7 % (+0.2 %, +3.2 %)
Media use at 8 years of age (parent report)	
TV viewing (hours/week)	+0.3 % (-1.0 %, +1.6 %)
Computer and video game use (hours/week)	+2.9 % (+0.9 %, +4.8 %)
Mental health problems at 12 years of age (teacher report)	
Depression symptoms (range: 5-15)	+2.0 % (+1.3 %, +2.8 %)
Anxiety symptoms (range: 4-12)	+1.7 % (+0.8 %, +2.6 %)
Hyperactivity and inattention symptoms (range: 9-27)	+1.2 % (+0.8 %, +1.5 %)
Oppositional and defiant behaviors (range: 4-12)	+2.0 % (+1.1 %, +2.8 %)
Interpersonal problems at 12 years of age (self-report)	
Exposure to bullying (range: 6-18)	+1.9 % (+1.4 %, +2.4 %)
Quality of relationship with best friend (range: 6-30)[a]	-0.3 % (-0.5 %, -0.0 %)
Parental monitoring and nurturance behaviors (range: 6-30)[b]	-0.7 % (-1.0 %, -0.4 %)

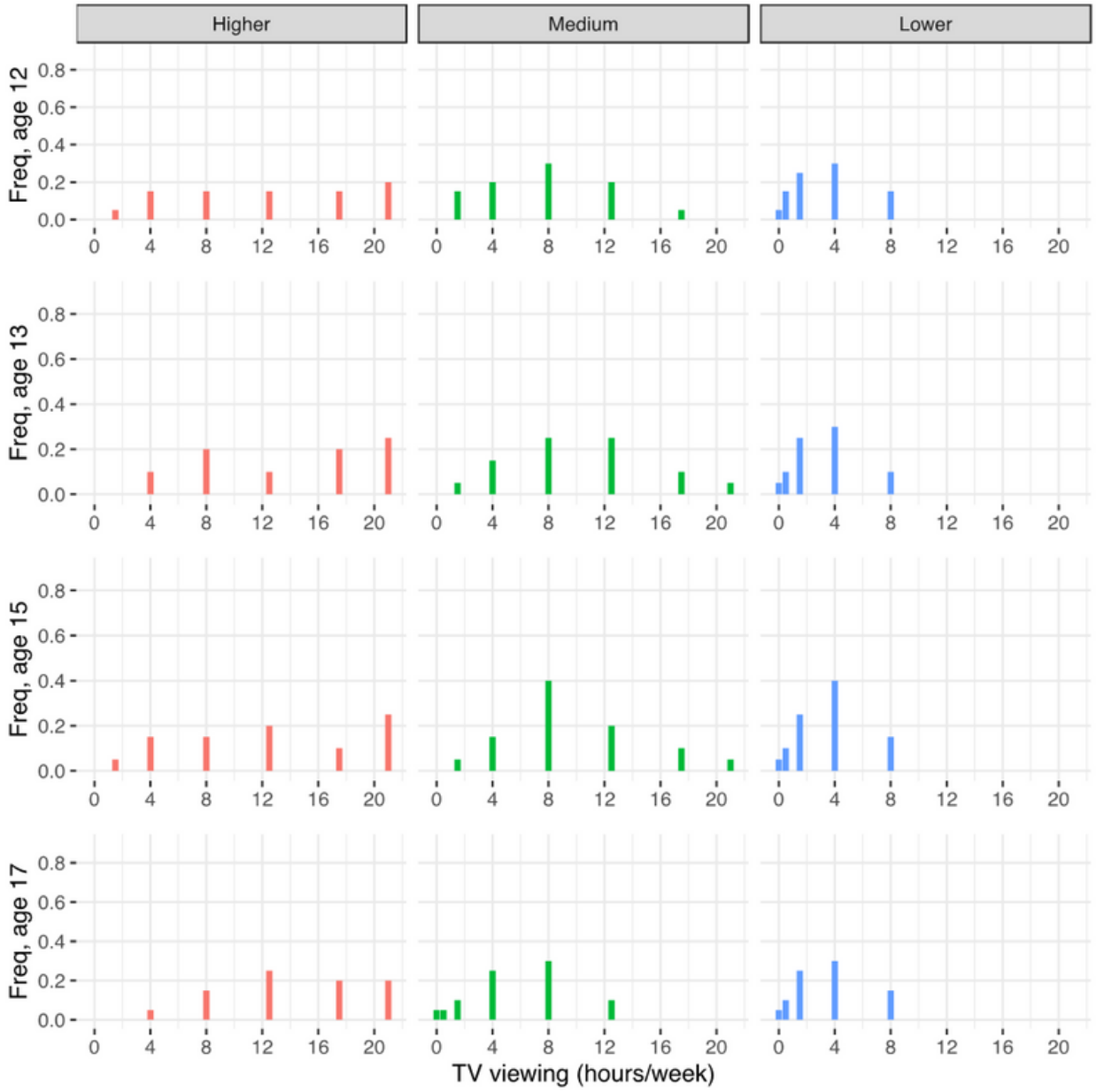
Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

Pooled from multiply imputed datasets (n=1226). The relative difference (%) in psychotic experiences (PEs; range 1-4) was estimated by examining each predictor variable in a separate Gamma model with PEs as the outcome. The polygenic score for schizophrenia was adjusted for the first three ancestry components. Other models did not include covariables. A relative difference of +1% indicates that for each additional unit of the predictor variable, the score for PEs was higher by approximately +1%.

[a]A higher score indicates a better quality of friendship.

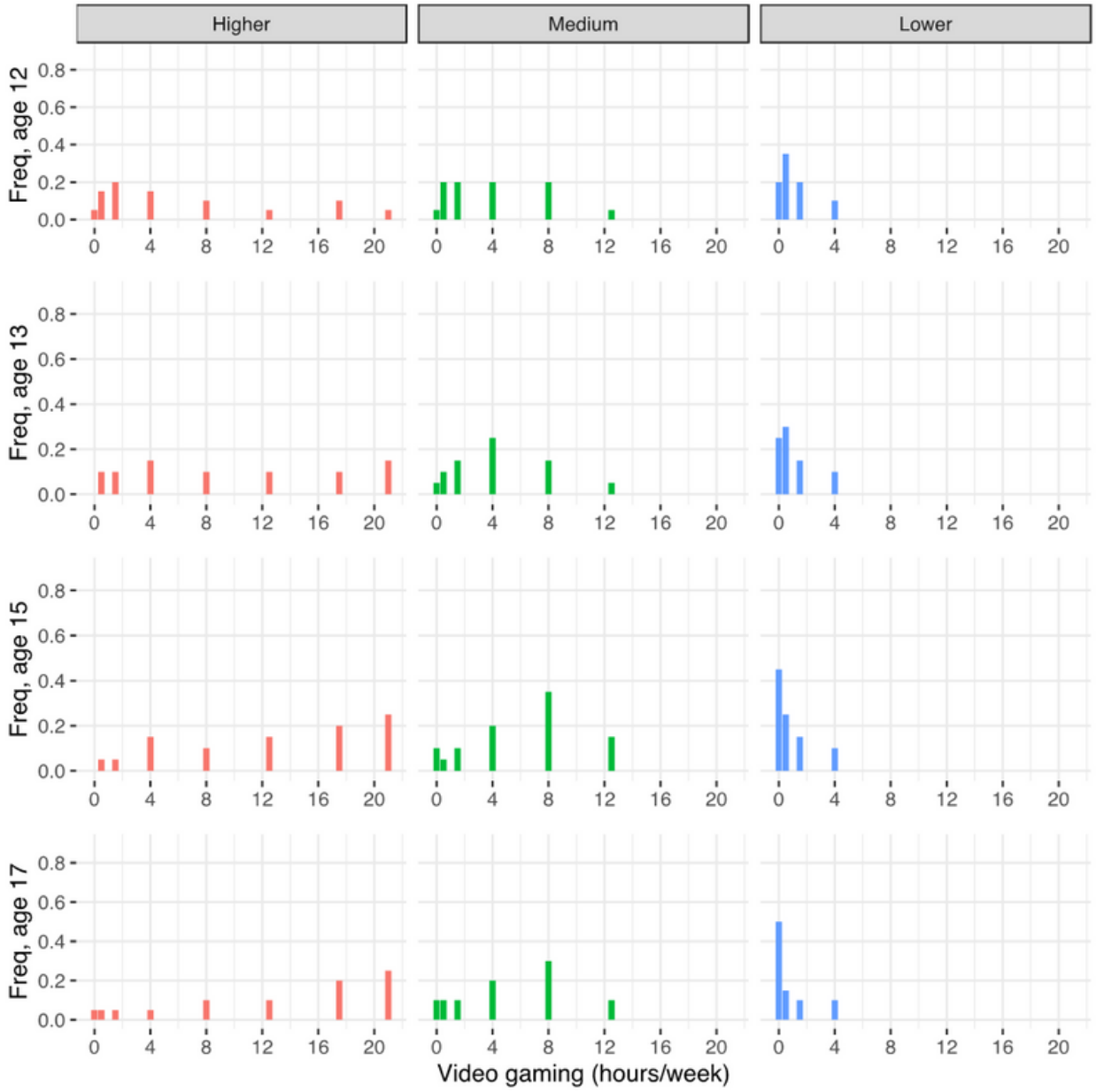
[b]A higher score indicates higher levels of monitoring and nurturance behaviors of the parents.

eFigure 1. Distribution of TV Viewing by Age and Trajectory Groups



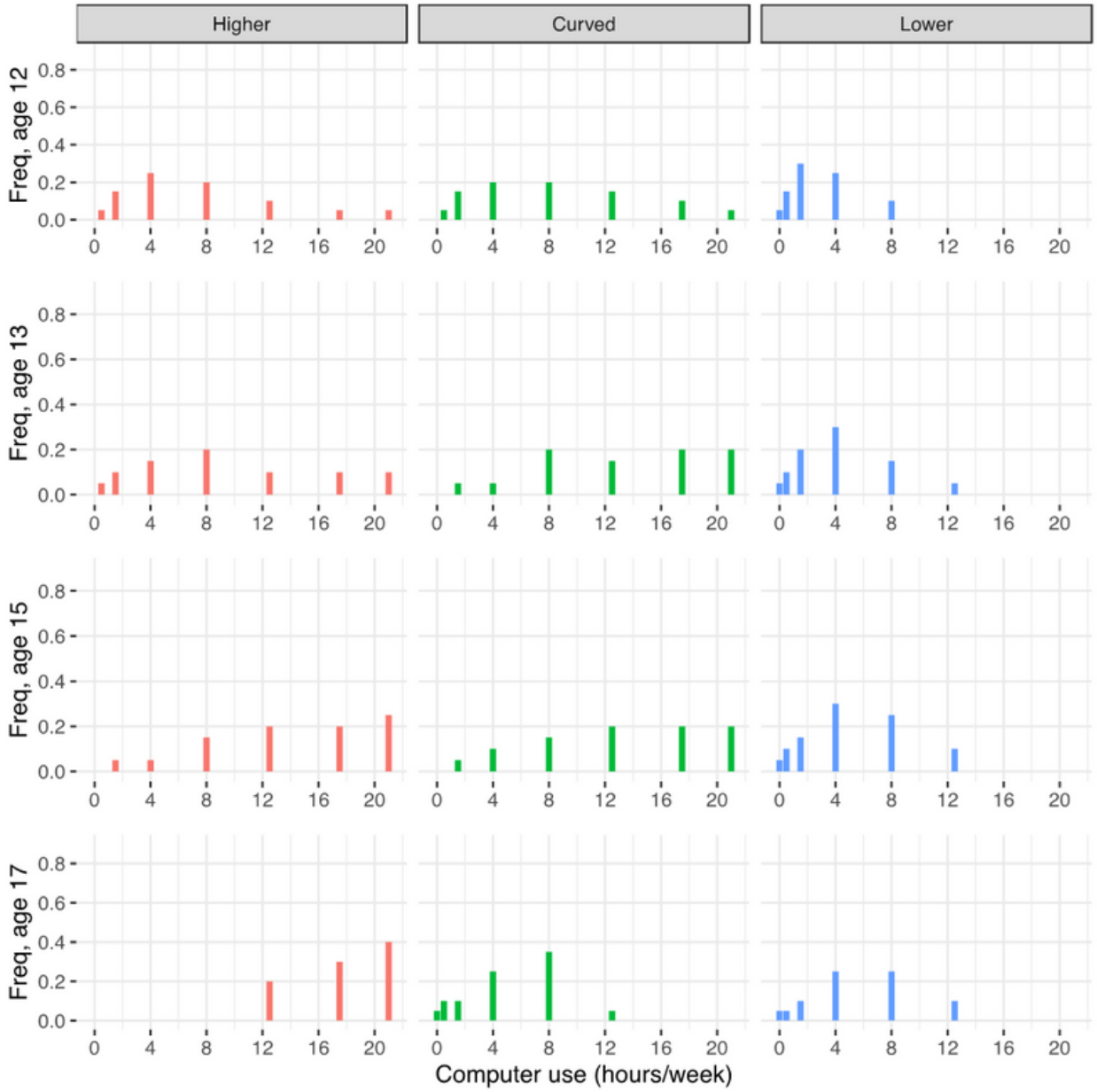
Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

eFigure 2. Distribution of Video Gaming by Age and Trajectory Groups



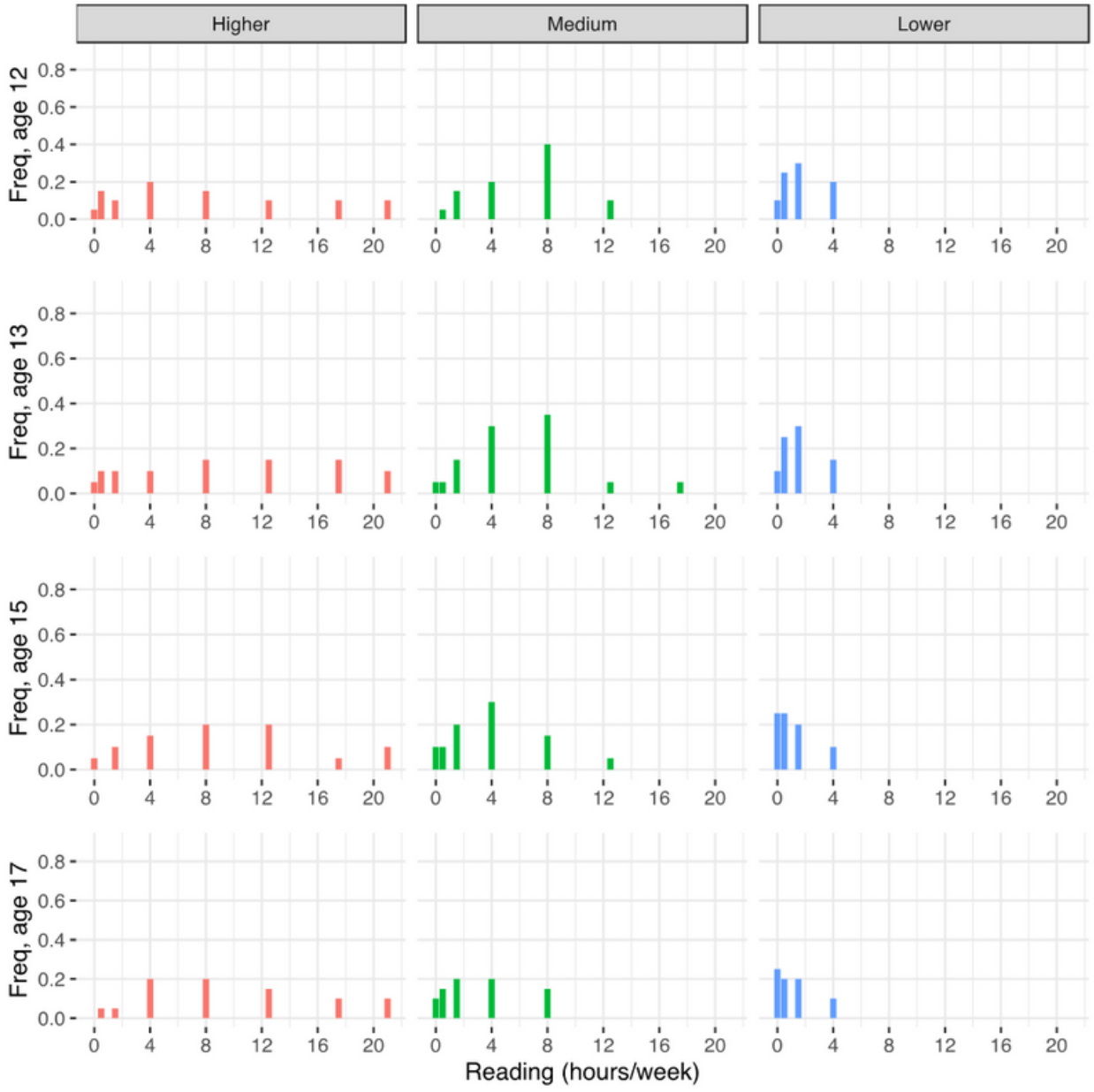
Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

eFigure 3. Distribution of Computer Use by Age and Trajectory Groups



Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

eFigure 4. Distribution of Reading by Age and Trajectory Groups



Data compiled from the Québec Longitudinal Study of Child Development (1998–2021), Gouvernement du Québec, Institut de la statistique du Québec.

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