Developmental Changes in Secrecy during Middle Adolescence: Links with Alcohol Use and Perceived Controlling Parenting

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Abstract

Adolescence is a developmental period characterized by fundamental transformations in parent-child communication. Although a normative shift in adolescents' secrecy seems to occur in parallel to changes in their drinking behaviors and in their perceptions of the relationship with their parents, relatively little attention has been paid to their associations over time. The present longitudinal study examined the associations between developmental changes in adolescents' secrecy, alcohol use, and perceptions of controlling parenting during middle adolescence, using a latent growth curve approach. At biannual intervals for two consecutive years, a sample of 473 Swiss adolescents (64.7% girls) beginning their last year of mandatory school (mean age at Time 1 = 14.96) completed self-report questionnaires about secrecy, alcohol use, and perceived controlling parenting. The results of the univariate models showed mean level increases in secrecy and alcohol use, but stable levels in controlling parenting over time. The results of a parallel-process model indicated that higher initial levels of secrecy were associated with higher initial levels of alcohol use and perceived controlling parenting, while an increase in secrecy was associated with an increase in alcohol use and an increase in perceived controlling parenting over time. In addition, adolescents who reported the lowest initial levels of perceived controlling parenting showed a greater increase in secrecy over time and those with high initial levels of secrecy reported a relative decrease in perceived controlling parenting. Finally, adolescents with the lowest initial levels of alcohol use experienced a greater increase in secrecy. Overall, these results indicate that the development of adolescents' secrecy is associated with the development of their drinking habits and perceptions of family relationships in dynamic ways.

Keywords: adolescent secrecy, alcohol use, controlling parenting, latent growth curve modeling

Introduction

As adolescents grow up and spend an increasing amount of unsupervised time with their peers (Lam et al., 2014), they have more opportunities to engage in risky behavior, with alcohol use being one of the most common behaviors in Western countries (Inchley et al., 2020). These drinking habits are a major concern for parents who wonder how best to prevent their child's involvement in these risky behaviors. While parents have often been held responsible for the development of their children's alcohol use and misuse (for a review, see Ryan et al., 2010), evidence from the literature suggests that adolescents play an active role in shaping their own development as well. Ever since Stattin and Kerr (2000)'s reconceptualization of the construct of "parental monitoring", the active and deliberate withholding of information (i.e., keeping secrets from parents), has been considered as an important determinant of externalizing problems (e.g., Frijns et al., 2010). Although a normative increase in adolescents' secrecy seems to occur in parallel with changes in their drinking habits and in their perceptions of their parents' rearing style, relatively little attention has been paid to the associations between these processes over time. Hence, this study used a latent growth curve modeling approach to longitudinally examine how the development of secrecy is related to changes in their alcohol use and perceptions of controlling parenting during middle adolescence.

Keeping Secrets From Parents During Adolescence: A Developmental Increase

As adolescents spend more time with their peers (Lam et al., 2014), a larger proportion of their life becomes unknown to their parents as they particularly have to rely upon the information shared by their children (Kerr et al., 2010). At the same time, adolescents' needs for privacy and autonomy typically increase during this developmental transition. According to the Communication Privacy Management theory (CPM; Petronio, 2002, 2010), information is managed in such a way as to balance two paradoxical needs in close relationships: disclosing private information would help to give a sense of *intimacy* within a relationship, whereas concealing would contribute to a sense of *privacy* and jurisdiction over personal information. Thus, keeping secrets, which involves intentionally withholding information from parents (e.g., about friends or activities), is particularly important for adolescents to assert their autonomy and privacy within their family (Finkenauer et al., 2008).

In accordance with these considerations, changes in parent-child patterns of communication during adolescence have been documented in the literature (for a meta-analysis, see Lionetti et al., 2018). Specifically, previous studies revealed a linear increase in adolescents' secrecy during early and middle adolescence, which is stronger for boys than for girls (Keijsers et al., 2010; Laird et al., 2013). Although secrets potentially fulfill positive developmental functions for adolescents' sense of autonomy and privacy, the implications of this

concealment strategy are more complex. Indeed, when adolescents frequently withhold information (e.g., about their unsupervised activities), their parents are likely to have fewer opportunities to provide support and guidance (Marshall et al., 2005).

Adolescents' Secrecy and Drinking Behaviors

Much like the documented increases in adolescent secrecy, a number of previous longitudinal studies aimed at examining how drinking behaviors change throughout the adolescent years. In general, these studies revealed a linear increase in the frequency of alcohol use (Zehe & Colder, 2014), binge drinking (Mutti-Packer et al., 2017) and alcohol intoxication (Dickson et al., 2015) from early to late adolescence. Although girls are likely to have higher levels of alcohol use in early adolescence, the increase over time is especially pronounced among boys (Chen & Jacobson, 2012). In addition, the prevalence of alcohol use seems to increase when adolescents pass the legal age for drinking (Gmel et al., 2017). Despite the fact that both secrecy and drinking-related behaviors tend to increase over time, little attention has been paid to the potential interplay between these processes. Instead, scholars primarily examined the relation between the propensity to withhold information (e.g., keeping secrets, lying) at a given year and the level of alcohol use one or two years later, and vice versa. These studies demonstrated that higher levels of secrecy (McCann et al., 2016) and lies (Lushin et al., 2017) were associated with more frequent subsequent alcohol use among middle-aged adolescents. Reciprocally, more frequent alcohol use was also predictive of subsequent higher levels of secrecy in mid-adolescence (McCann et al., 2016), underlining that the involvement of adolescents in risky behaviors also shapes the way they regulate the information communicated to their parents.

To date, there is only indirect evidence suggesting that changes in secrecy and alcohol use are related processes throughout adolescence. Indeed, existing studies mainly focused on the developmental associations between disclosure and substance use over time, showing that adolescents who experienced a greater increase in disclosure also reported a greater decrease in substance use (e.g., Micalizzi et al., 2019). In addition, reciprocal associations have also been shown, with lower levels of disclosure at age 14 predicting a greater increase in substance use over time (Barnes et al., 2000) and, conversely, low and stable levels of disclosure throughout adolescence being associated with higher levels of substance use at age 18 (Padilla-Walker et al., 2018).

Overall, the literature suggests that adolescents' frequent use of secrecy is not only a risk factor for their development, but may also be an attempt to hide certain types of misconduct from their parents, often to avoid potential negative parental actions or reactions to the information provided (e.g., Tokić & Pećnik, 2010). Indeed, adolescents are likely to share information with confidants who are less likely to be intrusive and

pressuring with them (e.g., a controlling parenting style; Baudat et al., 2020). To better understand the development of secrecy, it is therefore important to consider the general context within which adolescents communicate with their parents.

Secrecy within the Parent-Child Relationship: The Case of Controlling Parenting

In 2000, Stattin and Kerr already maintained that parents may facilitate (vs. hinder) the communication with their adolescent by creating a climate in which their child's point of view is taken into consideration. This idea was confirmed in subsequent studies, revealing that a controlling parenting context has negative implications for adolescents' willingness to share information (e.g., Soenens et al., 2006). Within the Self-Determination Theory framework (Ryan & Deci, 2017), controlling parents are described as pressuring their child to act, think and feel in specific ways through the use of intrusive and manipulative techniques (e.g., guilt induction, love withdrawal, shame; Soenens & Vansteenkiste, 2010). From a developmental perspective, adolescents' perceptions of controlling parenting have been described as increasing slightly from early to late adolescence (Rogers et al., 2020). However, it remains unknown whether secrecy and controlling parenting are developmentally linked. Despite the lack of empirical studies addressing the associations between changes in secrecy and controlling parenting, there are theoretical arguments and empirical research suggesting that both are likely interrelated.

According to Self-Determination Theory, controlling parenting behaviors thwart adolescents' basic psychological needs which, in turn, may lead them to preserve a sense of autonomy, for example through compensatory behaviors (Vansteenkiste & Ryan, 2013). In this context, keeping secrets may be particularly helpful for adolescents as a means of expressing resistance to their parents (Parkin & Kuczynski, 2012). In line with these propositions, controlling parenting behaviors have been cross-sectionally associated with lower levels of disclosure (through lower levels of need satisfaction; Tokić Milaković et al., 2017) and greater secrecy among middle adolescents (Baudat et al., 2020). Similarly, it has been longitudinally shown that when parents reacted in a controlling manner to their child's disclosure (e.g., by being cold and rejecting the child's feelings), adolescents felt more controlled, which, in turn, triggered them to keep more secrets (Tilton-Weaver et al., 2010). Together, these results suggest that adolescents would respond to their parents' controlling parenting behaviors by restricting their access to private information.

Beyond the conventional perspective of children as being merely passive recipients of their parents' socialization practices, literature also stated that adolescents play an active role in shaping their parents' rearing styles and practices (Soenens et al., 2019). Engaging in covert behaviors, for example, creates a distance

between the adolescents and their parents (Finkenauer et al., 2009). In turn, parents who suspect their adolescents to keep secrets may either negatively perceive their children's concealment behaviors (e.g., a sign of distrust or social exclusion), which would be translated into poor parenting behaviors (Finkenauer et al., 2005), or feel compelled to engage in controlling behaviors in an attempt to continue to alter their child's behavior (Soenens et al., 2019). In line with this, previous studies demonstrated that the propensity of adolescents to keep secrets predicted lower levels of responsiveness, acceptance or involvement (e.g., Finkenauer et al., 2005; Keijsers et al., 2010), but no study so far examined whether adolescents' secrecy elicits controlling parenting.

The Present Study

Despite the documented developmental changes in secrecy, alcohol use and perceptions of controlling parenting throughout adolescence, relatively little attention has been paid to their associations over time. In the present study, the first aim was to describe mean developmental changes in secrecy, alcohol use and perceived controlling parenting across middle adolescence. It was expected that secrecy, alcohol use and perceptions of controlling parenting would increase on average, as previous research provided evidence for increases in adolescents' secrecy (Keijsers et al., 2010), drinking behaviors (Zehe & Colder, 2014) and perceptions of controlling parenting (Rogers et al., 2020) during adolescence. The second objective was to examine how developmental changes in secrecy, alcohol use and perceptions of controlling parenting are associated with each other across middle adolescence. Based on past research documenting positive associations between secrecy and alcohol use (McCann et al., 2016) as well as between secrecy and controlling parenting (Baudat et al., 2020), several pathways were hypothesized. First, simultaneous changes across middle adolescence were expected; that is, adolescents who would experience a greater increase in secrecy would also report a stronger increase in alcohol use and in controlling parenting, respectively. Moreover, the intercepts and slopes of each construct were expected to be reciprocally linked, such that baseline levels of secrecy would be predictive of an increase in both alcohol use and controlling parenting and, conversely, baseline levels of alcohol use and controlling parenting would be predictive of an increase in secrecy. As previous research offered evidence for differences in terms of gender and age, gender and age differences were controlled throughout the analyses.

Methods

Participants and Procedure

For the present study, data were collected as part of a larger longitudinal study examining the development of identity, family relationships and risk-taking during middle adolescence. This study was conducted in compliance with the Ethics Code of the Swiss Society of Psychology (SSP). Adolescents in their

last year of mandatory school (i.e., 9th grade) were recruited from eleven public schools in the French-speaking part of Switzerland. A few weeks before data collection, participants were informed about the purpose of the study and the confidential treatment of the data. A total of 1,105 adolescents (51% girls, M_{age} = 15.08, *SD* = .64) agreed to be involved in the study at Time 1. All adolescents voluntarily participated and were free to withdraw at any time. At four points in time, each separated by half of a year, participants completed the same set of questionnaires. At Time 1 and Time 2, adolescents completed a series of self-report questionnaires at school during a class period, under the supervision of two research team members. At Time 3 and Time 4, when adolescents had finished their mandatory school, they were invited to complete questionnaires at home and to send them back to the research team. To encourage their participation, those who returned their questionnaire received a gift card with 15 CHF (US$ 15) value redeemable at a nationwide department store.

For the purpose of the present study, the sample comprised only adolescents (*n* = 473; 64.7% girls) who participated during the two parts of the study, that is, at least once during their last year of mandatory school (i.e., Time 1 and/or Time 2) and at least once the year after leaving school (i.e., Time 3 and/or Time 4). At Time 1, adolescents' age ranged between 13 and 17 years (M_{age} = 14.96; *SD* = .56). Of the participants, 31.9% followed a general-oriented education and 68.1% followed an academic-oriented education. Most of them were Swiss citizens (81.1%) and they came from an intact family structure (i.e., biological parents who live together; 75.7%). When comparing the financial situation of their family with other families in Switzerland, 61.3% perceived their personal situation as average, 33.6% perceived it as below, and 5.1% perceived it as above.

Attrition analyses were conducted to compare the characteristics of the sample of adolescents who completed the questionnaires of the variables of interest (i.e., secrecy, alcohol use and perceived controlling parenting) during the two parts of the study (*n* = 473) with those of the sample of adolescents who participated only in the first part of the study (*n* = 632). Chi-square tests revealed that, compared with adolescents who dropped out, adolescents who participated in the two parts of the study were statistically significantly more likely to be girls, $\chi^2(1) = 58.12$, adjusted $p < .001$, more likely to follow an academic-oriented education, $\chi^2(1) = 69.52$, adjusted $p < .001$, and more likely to come from an intact family structure, $\chi^2(1) = 5.92$, adjusted $p = .015$. Chi-square tests revealed no differences in the financial situation of the families, $\chi^2(1) = 0.49$, adjusted $p = .482$. The results of a series of independent *t*-tests with adjusted *p*-value (Benjamini-Hochberg's method) also indicated that, compared with participants who dropped out, participants enrolled in the whole study reported less secrecy at Time 1 ($M = 2.04$, $SD = 1.07$ vs. $M = 2.35$, $SD = 1.22$), $t(1018.2) = 4.33$, adjusted $p <$

.001, and at Time 2 (M = 2.13, SD = 1.03 vs. M = 2.39, SD = 1.12), t(1012.5) = 3.91, adjusted p < .001, less controlling parenting at Time 1 (M = 1.99, SD = 0.66 vs. M = 2.17, SD = 0.72), t(952.56) = 4.24, adjusted p < .001, and at Time 2 (M = 1.94, SD = 0.65 vs. M = 2.14, SD = 0.71), t(978.2) = 4.67, adjusted p < .001, and less alcohol use at Time 1 (M = 1.51, SD = 0.70 vs. M = 1.81, SD = 0.86), t(1029.2) = 6.21, adjusted p < .001, and at Time 2 (M = 1.74, SD = 0.81 vs. M = 1.97, SD = 0.94), t(1025.40) = 4.18, adjusted p < .001. Overall, these results indicate that adolescents involved in the whole study differ statistically significantly on a number of dimensions from those who dropped out.

Overall, 14.5% of the data were missing among the repeated measures of the study variables. Specifically, 445 (94%) participants completed the measure of secrecy at Time 1, 455 (94%) at Time 2, 414 (88%) at Time 3 and 320 (68%) at Time 4. For the measure of alcohol use, 441 (93%) participants provided complete data at Time 1, 454 (96%) at Time 2, 415 (88%) at Time 3 and 324 (68%) at Time 4. Finally, complete data for the measure of perceived controlling parenting were obtained for 425 (90%) participants at Time 1, 442 (93%) at Time 2, 402 (85%) at Time 3, and 317 (67%) at Time 4.

Measures

All measures were either already available in French or translated through a back-translation procedure.

Perceived controlling parenting. Perceptions of controlling parenting were assessed through the French version of the Dependency-oriented and Achievement-oriented Psychological Control Scale (DAPCS; Mantzouranis et al., 2012; Soenens et al., 2010). This 17-item questionnaire measures two domain-specific types of parental psychological control. Specifically, the Dependency-oriented Psychological Control subscale (DPC; 8 items) evaluates the degree to which parents use psychological control to keep their child within close physical and emotional boundaries (e.g., “My parents are only friendly with me if I rely on them instead of on my friends”), whereas the Achievement-oriented Psychological Control subscale (APC; 9 items) evaluates the degree to which parents use psychological control to make children comply with excessive parental demands for performance (e.g., “My parents make me feel guilty if my performance is inferior”). Participants responded on a 5-point Likert scale (1 = *completely disagree,* 5 = *completely agree*). As was done in previous research (e.g., Lo Cascio et al., 2016), the two scales were combined in the analyses in order to assess a general controlling parenting style as perceived by adolescents. Internal reliability of the scale (including both DPC and APC items) across waves was excellent (α = .90-.94).

Secrecy. Two secrecy items from the Child Disclosure scale (Stattin & Kerr, 2000) were used to measure adolescents' propensity to keep secrets. These items evaluate the extent to which adolescents conceal information about their leisure-time activities from their parents (e.g., "I keep much of what I do in my free time secret from my parents"). Responses were rated on a 5-point Likert scale (1 = *never* or *not at all*, 5 = *always* or *very much*). This scale has been used in numerous studies and demonstrated good reliability (e.g., Frijns et al., 2010; Keijsers & Poulin, 2013). In the present study, internal consistency across waves was good (α = .71-.77).

Alcohol use. Individual alcohol use was assessed through a French version of the modified Risk Involvement and Perception Scale (RIPS-R; Ben-Zur & Reshef-Kfir, 2003; Shapiro et al., 1998; Zimmermann, 2010). This questionnaire evaluates the frequency of adolescent involvement in a variety of risky activities within the last 12 months. In the present study, two statements related to alcohol use were used, thereby assessing drinking ("Drinking") and drunkenness ("Getting drunk"). Items were measured on a 5-point Likert scale (1 = *never*, 5 = *every day*). In line with previous research using similar measures (e.g., Smith et al., 1995), items were combined to form a composite score. Internal reliability across waves was good (α = 0.73-0.83).

Plan of Analysis

Statistical analyses were performed using R Statistical Software (R Core Team, 2018).

Growth curve analysis. In order to investigate changes over time, a latent growth curve modeling approach was used (Bollen & Curran, 2006; Duncan, 2006; Preacher et al., 2008). This method has the advantage of (1) considering both intraindividual (within-person) change over time and interindividual (between-person) differences in this change; and (2) allowing the examination of antecedents (and consequences) of change (Preacher et al., 2008). Models were estimated with a robust maximum likelihood estimation method (equivalent to the Yuan-Bentler T2-star test statistic; Yuan & Bentler, 2000) as the distribution of the Time 1 alcohol measure was somewhat skewed and leptokurtic (skewness = 1.68; kurtosis = 2.80).

As a first step, to examine mean developmental changes in secrecy, alcohol use, and perceptions of controlling parenting, three separate univariate latent growth curve models were estimated, examining whether average scores for each of these dimensions increase, decrease, or remain constant over time. In latent growth curve models, two latent growth factors represent aspects of change in one repeated measure: the *intercept*, which refers to the average initial level of the variable, and the *slope*, which refers to the average rate of change over time in this variable (Bollen & Curran, 2006; Preacher et al., 2008). These factors are defined by setting their loadings to specific a priori values. That is, for the intercept factor, each repeated measure has been set to 1. For the slope factor, linear models (0, 1, 2, 3) were tested, with the starting point fixed at 0 and the equally

spaced units (0, 1, 2, 3) corresponding to the 6 months between waves (see Figure 1). In addition, covariances among these growth factors were also specified. Following Bollen and Curran (2006)'s recommendations, quadratic (0, 1, 4, 9) and unspecified (i.e., except for the first and last loading, the loadings are freely estimated) shape of growth were also tested. Linear and nonlinear models were compared using a robust chi-square difference test to choose the best-fitting model (Satorra & Bentler, 2001). Once the best-fitting model was selected, the mean intercept and the mean slope of the chosen model were examined to describe the average initial level and the average rate of change in the variable over time, whereas the variance in the intercept and the variance in the slope were examined to assess interindividual differences (or heterogeneity) in the initial levels and rates of changes. In addition, the covariance among these aspects of change were examined to interpret the degree to which initial levels were associated with rates of change over time.

In a second step, to examine associations between mean developmental changes in secrecy, alcohol use and perceptions of controlling parenting, a parallel process latent growth curve model (Preacher et al., 2008; also referred as multivariate latent curve models [Bollen & Curran, 2006] or as associative latent growth curve [Duncan, 2006]) was performed. In parallel process models, the optimal univariate latent growth curve models of each repeated-measure variable are combined within one parallel process model (Bollen & Curran, 2006). Overlapping developmental changes were examined by estimating correlations between growth factors of secrecy, alcohol use and perceived controlling parenting. Moreover, the question of whether initial levels of one construct predicted later changes in another construct was examined by estimating structural paths among growth factors. Specifically, the slope of secrecy was regressed on the intercepts of both controlling parenting and alcohol use, the slope of controlling parenting was regressed on the intercepts of both secrecy and for alcohol use, and the slope of alcohol use was regressed on the intercepts of both secrecy and controlling parenting.

In a final step, the role of adolescent gender and age was considered. To do so, a conditional parallel process latent growth curve model, including gender as a time-invariant covariate and the legal age for drinking beer and wine (i.e., 16 years old in Switzerland) as a time-varying covariate, was tested. Specifically, the latent intercept and slope factors of secrecy, alcohol use and controlling parenting were regressed on gender (0 = girls, 1 = boys). The repeated measures of alcohol use were also directly regressed on the legal drinking age variable, which was dummy coded (0 = < 16 years old, 1 = ≥ 16 years old).

Model fit was assessed using the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Values are generally

regarded as indicative of a good fit when CFI is greater than .95, RMSEA is under .06, and its associated intervals confidence are smaller than 0.05 and 0.10, respectively, and SRMR is under .08 (Hu & Bentler, 1999).

Sensitivity analysis. As Little's MCAR test (Little, 1988) was not statistically significant, χ^2 (251) = 280.17, p = .100, all growth models were fitted with Full Information Maximum Likelihood estimation. Although likelihood-based methods (i.e., assuming a missing at random [MAR] mechanism) are in most cases reasonable, there are situations where this assumption may potentially not hold (Enders, 2010). For this reason, a series of sensitivity analysis in the form of pattern-mixture models were conducted to test the influence of missing data on the main findings (Enders, 2011; Hedeker & Gibbons, 1997). In the current pattern-mixture model analyses, the sample was first stratified into subgroups that share a similar pattern of missing data, and variables based on these groups were then included as predictors of the intercepts and slopes in growth models.

Results

Descriptive Statistics and Correlations

Descriptive statistics and correlations among manifest variables are presented in Table 1. Overall, higher levels of secrecy were moderately correlated with higher levels of both alcohol use and perceptions of controlling parenting across time. There were also small and positive correlations between alcohol use and controlling parenting, but only at Time 2 and Time 3.

Changes in Adolescents' Secrecy, Alcohol Use and Perceptions of Controlling Parenting

The first objective of the present study was to examine the mean developmental changes in adolescents' secrecy, alcohol use and perceptions of controlling parenting during middle adolescence, using univariate latent growth curve models. First, linear and nonlinear growth models were tested and compared for each of the three variables of interest. None of the nonlinear growth models lead to a statistically significant improvement in model fit according to the chi-square statistic. Specifically, the quadratic and unspecified shape models of secrecy did not improve model fit, $\chi^2(4) = 4.87$, $p = .301$ and $\chi^2(2) = 0.32$, $p = .852$, respectively. The same results were found for the quadratic and unspecified shape models of controlling parenting, $\chi^2(4) = 4.84$, $p = .304$ and $\chi^2(2) = 1.69$, $p = .429$, respectively. Finally, the unspecified shape model of alcohol use did not improve model fit, $\chi^2(2) = 3.44$, $p = .179$, while the quadratic model of alcohol use had estimation issues (i.e., negative variance estimates), suggesting that this model was a poor representation of the data (Bollen & Curran, 2006). Parameter estimates for the three linear univariate growth models are presented in Table 2.

Model fit for the linear growth model of secrecy was excellent, χ^2 (5) = 6.79, p = .236, robust CFI = .99, robust RMSEA = .030, 90% CI [.000, .080], SRMR = .030. As hypothesized, the mean for the slope factor of secrecy was significant and positive, suggesting that the overall sample reported a linear increase in secrecy across middle adolescence. A significant variance in both the intercept and the slope indicated that adolescents differed with respect to their baseline levels and trajectories of change in secrecy over time. Moreover, the statistically significant and negative correlation between the intercept and slope factors suggested that the initial levels of secrecy were inversely related to the rates of change over time. As depicted in Figure 2, adolescents with the lowest levels of secrecy at Time 1 (i.e., the 1st quartile) reported on average a relatively greater increase in secrecy over time (slope estimate = 0.09, 95% CI [0.07, 0.10]), whereas adolescents with the highest initial levels of secrecy (i.e., the 4th quartile) had more stable levels of secrecy over time (slope estimate = -0.02, 95% CI [-0.05, 0.02]). This result may potentially represent a ceiling effect (Kaplan, 2009); that is, adolescents who already scored high in secrecy at the beginning of middle adolescence can increase relatively less in this construct over time.

Model fit for the linear growth model of alcohol use was almost acceptable, χ^2 (5) = 30.25, p < .001, CFI = .96, RMSEA = .114, 90% CI [.077, .155], SRMR = .046. Modification indices demonstrated a statistically significant improvement in the model if Time 2 and Time 3 alcohol use errors were allowed to correlate, $\Delta\chi^2$ = 19.58, p < .001. The final model including this modification produced an excellent fit, χ^2(4) = 6.84, p = .145, robust CFI = .99, robust RMSEA = .042 [90% CI: .000, .093], SRMR = .031. As hypothesized, the mean for the slope factor of alcohol use was significant and positive, suggesting that the overall group reported a linear increase in alcohol during middle adolescence. A significant variance in both the intercept and slope indicated that adolescents differed with respect to their baseline levels and trajectories of change in alcohol use over time. Moreover, the statistically significant and negative correlation between the intercept and slope factors suggested that the baseline levels of alcohol use were inversely related to the rates of change over time. As illustrated in Figure 2, adolescents with the lowest initial levels of alcohol use (i.e., the 1st quartile) experienced a greater increase in their drinking behaviors during middle adolescence (slope estimate = 0.14, 95% CI [0.10, 0.18]), whereas adolescents with the highest initial levels of alcohol use (i.e., the 4th quartile) reported a relatively smaller increase (slope estimate = 0.09, 95% CI [.03, .15]).

Finally, the linear growth model for perceived controlling parenting demonstrated an excellent fit, χ^2 (5) = 5.08, p = .406, robust CFI = 1.000, robust RMSEA = .007, 90% CI [.000, .073], SRMR = .021. Contrary to the hypothesis, the mean for the slope factor of perceived controlling parenting was not statistically

significant, meaning that, on average, there was no systematic change in perceived controlling parenting during middle adolescence. Although there was no systematic change in perceived controlling parenting over time, there was a significant variance in the slope, suggesting that the participants in this study do not follow the same trajectory over time: some of them increase in perceived controlling parenting, whereas others remain stable or decrease during middle adolescence. Moreover, the statistically significant and negative correlation between the intercept and slope factors suggested that the initial levels of perceived controlling parenting were inversely related to the rates of change over time. As depicted in Figure 2, adolescents with the lowest initial levels of perceived controlling parenting (i.e., the 1st quartile) reported a relatively greater decrease over time (slope estimate = -0.03, 95% CI [-0.04, -0.02]), whereas adolescents with the highest initial levels (i.e., the 4th quartile) had more stable levels of perceived controlling parenting over time (slope estimate = -0.02, 95% CI [-0.05, 0.01]).

Associations between Developmental Changes in Secrecy, Alcohol Use and Controlling Parenting

The second goal of the present study was to examine associations between mean developmental changes in adolescents' secrecy, alcohol use and perceptions of controlling parenting, using a parallel process model. For doing so, the best-fitting univariate growth curve models of each repeated measure were first combined within one parallel process latent growth curve model, which yielded an excellent fit χ^2 (50) = 93.16, $p < .001$, robust CFI = .97, robust RMSEA = .05, 90% CI [.033, .065], SRMR = .035. Then, a conditional parallel process latent growth curve model, including gender as a time-invariant covariate and the legal age for drinking beers and wine (i.e., < 16 years old vs. ≥ 16 years old) as a time-varying covariate, was tested. This final model fits the data well, χ^2 (100) = 173.36, $p < .001$, robust CFI = .96, robust RMSEA = .043, 90% CI [.032, .053], SRMR = .045. Parameter estimates for secrecy, alcohol use and controlling parenting are presented in Table 2. Results presented in Table 3 and Figure 3 revealed significant associations between mean developmental changes in secrecy, alcohol use and perceived controlling parenting, as is discussed below.

Secrecy-alcohol use links. When considering the associations between adolescents' secrecy and alcohol use, there was, as hypothesized, a statistically significant and positive association between the intercepts of secrecy and alcohol use, meaning that a higher initial level of secrecy related to a higher initial level of alcohol use. Results also revealed a significant and positive link between the slopes of secrecy and alcohol use, indicating that a greater increase in secrecy was concurrently associated with a greater increase in alcohol use. Regarding the structural paths among growth factors, contrary to what was hypothesized, the intercept of adolescent secrecy was not statistically significantly predictive of later increases in adolescent alcohol use. However, as

expected, the intercept of adolescent alcohol use was negatively predictive of the slope of secrecy. Given that the overall sample reported an increasing level of secrecy over time, this indicates that a lower initial level of alcohol use was associated with a greater increase in secrecy. As depicted in Figure 4, adolescents who reported the lowest levels of alcohol use (i.e., the 1st quartile) experienced a greater increase in secrecy (slope estimate = 0.09, 95% CI [0.07, 0.12]), whereas those with the highest initial levels of alcohol use (i.e., 4th quartile) had a relative decrease in secrecy (slope estimate = -0.05, 95% CI [-0.08, -0.01]). As higher initial levels of alcohol use were already strongly related to higher initial levels of secrecy at baseline (i.e., $r = .54$, $p < .001$), this may reflect a ceiling effect (Kaplan, 2009). As can be seen in Figure 4, adolescents reporting the highest initial levels of alcohol use (i.e., adolescents in the fourth quartile) still reported the highest level of secrecy at Time 4.

Secrecy-controlling parenting links. When considering the associations between adolescents' secrecy and perceptions of controlling parenting, as expected, the intercepts of secrecy and controlling parenting were positively related, indicating that a higher initial level of secrecy related to a higher initial level of perceived controlling parenting. There was also a significant positive association between the slopes of secrecy and controlling parenting. This result may be interpreted as an association between a greater increase in secrecy and a greater increase in controlling parenting. Furthermore, in line with what was hypothesized, the results revealed reciprocal associations between the intercepts and slopes of secrecy and perceived controlling parenting. Specifically, the intercept of secrecy was statistically significantly and negatively predictive of the slope of perceived controlling parenting. Figure 5 provides further insight into this link: adolescents with the lowest initial levels of secrecy (i.e., the 1st quartile) had more stable levels of perceived controlling parenting (slope estimate = 0.01, 95% CI [-0.01, 0.03]), whereas those with the highest initial levels of secrecy (i.e., 4th quartile) reported a relative decrease in perceived controlling parenting over time (slope estimate = -0.06, 95% CI [-0.09, -0.04]). Nevertheless, adolescents from the 1st (vs. 4th) quartile still reported the lowest (vs. highest) levels of controlling parenting at Time 4. Conversely, the intercept of perceived controlling parenting was statistically significantly and negatively predictive of the slope of secrecy. As illustrated in Figure 5, this result suggests that adolescents with the lowest initial levels of perceived controlling parenting (i.e., the 1st quartile) experienced a greater increase in secrecy over time (slope estimate = 0.10, 95% CI [0.07, 0.12]), whereas those with the highest initial levels of controlling parenting (i.e., the 4th quartile) had more stable levels of secrecy (slope estimate = -0.01, 95% CI [-0.05, 0.02]). Again, these results could be explained by the fact that higher initial levels of controlling parenting were related to higher initial levels of secrecy (i.e., $r = .54$, $p < .001$); hence, adolescents initially scoring high on controlling parenting still reported the highest levels of secrecy at Time 4.

Alcohol use-controlling parenting links. Even though it was beyond the main scope of the present study, the associations between adolescents' alcohol use and perceptions of controlling parenting were examined as exploratory analyses. Results indicated that the intercepts of alcohol use and controlling parenting were positively correlated, meaning that a higher initial level of alcohol use was related to a higher initial level of controlling parenting. A significant positive correlation between the slopes of alcohol use and controlling parenting, suggesting that, as adolescents increasingly perceive their parents as controlling, they are also more likely to increasingly consume alcohol. In addition, the results revealed reciprocal associations between aspects of change in alcohol use and controlling parenting. On the one hand, the intercept of controlling parenting was statistically significantly and negatively predictive of the slope of alcohol use; that is, adolescents who perceived the lowest initial levels of controlling parenting reported a greater increase in alcohol use. By contrast, the intercept of adolescent alcohol use was statistically significantly and positively predictive of the slope in controlling parenting; that is, adolescents with the lowest initial levels of alcohol use reported a smaller increase in perceived controlling parenting.

Age and gender as covariates. There were no statistically significant differences by gender in the initial levels or rates of change in secrecy, alcohol use and controlling parenting. However, age positively predicted adolescents' reports of alcohol use at Time 1, at Time 2 and at Time 3, respectively, meaning that adolescents over the age of 16 at Time 1, at Time 2 and at Time 3 reported higher levels of alcohol use.

Sensitivity Analyses

In order to examine the influence of missing data on the main findings, a series of sensitivity analyses in the form of pattern-mixture models (Enders, 2011; Hedeker & Gibbons, 1997) was conducted. First, the influence of missing data in each measure (i.e., secrecy, alcohol use and controlling parenting) on the results of each corresponding univariate model was examined. The patterns of missing data are summarized in Table 4. As it is reasonable to assume that intermittent missing observations are randomly missing in longitudinal studies (Hedeker & Gibbons, 1997), patterns were recoded into groups based on the last available wave of measures for secrecy, alcohol use, and perceived controlling parenting, respectively; that is, participants were classified as completers (i.e., those for whom data were available at Time 4) or dropouts (i.e., those with missing data at Time 4). Completion rates of 68% (320 out of 473 participants), 69% (324 participants) and 67% (317 participants) were observed for secrecy, alcohol use and perceived controlling parenting, respectively. Next, the previously estimated univariate models were re-estimated by including the dummy indicator of missing data (0 = completers, 1 = dropouts) as a predictor of the intercept and slope. Results of the re-estimated univariate

model of secrecy indicated that the effects of the dummy indicator of missing data for this measure on the intercept and slope were not statistically significant, B = 0.01, p = .902 and B = -0.02, p = .698, respectively. Similarly, according to the results of the re-estimated univariate model of alcohol use, no statistically significant effects of the dummy indicator of missing data for this measure were found on the intercept and slope, B = 0.03, p = .715 and B = -0.01, p = .832, respectively. Finally, results of the re-estimated univariate model of controlling parenting showed a significant effect of the dummy indicator of missing data for this measure on the intercept, B = 0.14, p = .027, but not on the slope, B = -0.02, p = .420. This result suggests that baseline levels of perceived controlling parenting varied depending on the status of missing data on this measure. Specifically, participants with missing data at Time 4 had slightly higher baseline levels of controlling parenting (intercept estimate = 2.05, SE = 0.05) than those with complete data (intercept estimate = 1.94, SE = 0.04). However, the parameter estimates of the intercept were very similar to that obtained in the previously estimated univariate model of controlling parenting (intercept estimate = 1.99, SE = 0.03). In other words, although the initial levels of perceived controlling parenting varied slightly with the status of missing data, the pattern-mixture model provided similar results, showing that adolescents generally perceived their parents as relatively little controlling at the beginning of middle adolescence.

In a second step, the influence of missing data on the results of the parallel process model was examined. Participants were classified as completers (i.e., those for whom data were available at Time 4 for secrecy, alcohol use and perceived controlling parenting) or dropouts (i.e., those with missing data at Time 4). Next, the previously estimated parallel process model was re-estimated by including the dummy indicator of missing data as a predictor of the intercepts and slopes of secrecy, alcohol use and perceived controlling parenting. Results indicated no statistically significant effects of the dummy indicator on the intercept of secrecy, B = 0.01, p = .920, on the intercept of alcohol use, B = 0.04, p = 616, on the slope of secrecy, B = 0.01, p = .870, on the slope of alcohol use, B = 0.01, p = .852, and on the slope of controlling parenting, B = -0.04, p = .175. However, there was again a significant effect of the dummy indicator on the intercept of perceived controlling parenting, B = 0.16, p = .016, suggesting that baseline levels of perceived controlling parenting varied according to the status of missing data on the measures of secrecy, alcohol use and controlling parenting. Specifically, participants with missing data at Time 4 had slightly higher baseline levels of perceived controlling parenting (intercept estimate = 2.05, SE = 0.05) than those with complete data (intercept estimate = 1.94, SE = 0.04). However, parameter estimates were again very similar to that obtained in the previously estimated

parallel process model (intercept estimate = 1.96, SE = 0.04). Taken together, the results of the sensitivity analyses suggest that the missing data generally did not bias the main findings.

Discussion

Adolescence is a developmental period during which the parent-child relationship transforms fundamentally, bringing about changes in communication patterns and parental concerns about their adolescents' risk-taking behaviors. Previous longitudinal studies provided evidence for a linear increase in adolescents' secrecy from parents during middle adolescence (Keijsers et al., 2010). Although this shift in parent-adolescent communication seems to occur in parallel to previously described increase in adolescents' alcohol consumption (e.g., Zehe & Colder, 2014) and in their perceptions of controlling parenting (e.g., Rogers et al., 2020), relatively little attention has been paid to their associations over time. The main goal of the present study was thus to examine the associations between mean developmental changes in adolescents' secrecy, alcohol use and perceptions of controlling parenting throughout middle adolescence, using a latent growth curve modeling approach. Overall, the results of univariate latent growth curve models revealed that, on average, adolescents' secrecy and alcohol use increased linearly during middle adolescence, whereas their perceptions of controlling parenting remained constant over time. The results of the parallel process latent growth curve model also revealed linkages between the development of adolescent secrecy, alcohol use and perceptions of controlling parenting.

Changes in Adolescents' Secrecy from Parents, Drinking Behaviors and Perceptions of Controlling Parenting

In a developmental period during which adolescents' needs for autonomy and privacy increase, adolescents are inclined to establish boundaries around their private information (Finkenauer et al., 2008). These changes in parent-child communication have been documented in previous studies which revealed that adolescents increasingly limit their parents' access to private information during middle adolescence (Keijsers et al., 2010). The present study provides additional support to this literature by showing that, on average, adolescents' use of secrecy increased linearly throughout this specific period of adolescence. Although adolescents' tendency to keep secrets increased slightly, it should be noted that the overall level of secrecy remained rather moderate over time, suggesting that the communication between parents and adolescents does not completely shut down throughout adolescence. Indeed, consistent with the CPM theory (Petronio, 2010), adolescents are actually inclined to use concealment as a means of claiming their privacy, but they are also trying to maintain close relationships and strong bonds with their parents who remain important source of

support and guidance (Finkenauer et al., 2008). At the same time, corroborating the results of previous research (e.g., Zehe & Colder, 2014), this study showed that adolescents more often engage in alcohol drinking behaviors throughout mid-adolescence.

Along with this shift in adolescents' concealment and drinking behaviors, developmental changes in adolescents' perceptions of the relationship with their parents have been documented in the literature (e.g., Mastrotheodoros et al., 2019). Contrary to previous works examining changes in adolescents' perceptions of controlling parenting (e.g., Rogers et al., 2020), results indicated, however, that perceived controlling parenting remain on average stable across middle adolescence. This finding is consistent with previous studies which found stable levels of parents' perceptions of their own controlling style over time (Meter et al., 2019). Moreover, the low level of perceived controlling parenting suggests that, on average, adolescents in the sample perceived the climate of interaction with their parents as respectful of their autonomy throughout middle adolescence. It is, however, important to underline that variability among individuals have been observed in both initial levels and rates of change, suggesting that adolescents in the sample perceived their relationships with their parents differently. This variability has been confirmed in previous studies (Rogers et al., 2020; Van Petegem et al., 2017), which described distinct developmental trajectories of controlling parenting style. The concept of stage-environment fit (Eccles et al., 1993) is relevant for understanding the heterogeneity in how adolescents' perceptions of parenting styles develop throughout adolescence. Indeed, some parents may manage to adapt well to the new reality of adolescence and, consequently, grant appropriate freedom when the adolescent needs it, which would translate into stability or a decrease in controlling parenting. On the other hand, other parents may have difficulty adapting to the needs of their developing adolescent and may even respond by increasing control as a means of maintaining influence over their child's behaviors (Soenens et al., 2019).

Associations Between Changes in Secrecy and Alcohol Use

In line with previous studies (e.g., Keijsers et al., 2009), results provided evidence for linkages between the development of adolescents' secrecy and drinking behaviors. As hypothesized, adolescents who reported high levels of secrecy at the beginning of middle adolescence also reported more drinking behaviors. In line with previous studies that showed that a stronger increase in adolescent disclosure goes hand in hand with a stronger decrease in delinquency (Keijsers et al., 2009), findings also suggest that there was a continuous interplay between adolescents' secrecy and alcohol use, with a greater increase in secrecy being associated with a stronger increase in alcohol use. Consistent with previous studies (e.g., McCann et al., 2016), when

adolescents frequently kept secrets, their parents have fewer opportunities to provide support and guidance to their child (Marshall et al., 2005). Reciprocally, adolescents who are involved in risky behaviors also have more reasons to hide their conducts from their parents (e.g., McCann et al., 2016).

In addition to these simultaneous increases, results indicated that initial levels of alcohol use at the beginning of middle adolescence were predictive of an increase in their concealment behaviors over time. Previous longitudinal studies found that adolescents' involvement in alcohol use predicted higher levels of subsequent secrecy (e.g., McCann et al., 2016). The present study adds to this existing literature by showing that adolescents who reported the lowest levels of alcohol use at the beginning of middle adolescence were those who experienced a greater increase in secrecy over time, compared to those with the highest levels of alcohol use. This result is probably due to the fact that adolescents' use of secrecy and alcohol were already highly and positively related to each other at the beginning of middle adolescence: adolescents reporting a high initial level of alcohol use still reported the highest level of secrecy at the end of middle adolescence. Contrary to expectations, however, adolescents' use of secrecy at the beginning of adolescence was not related to an increase in their alcohol consumption over time. Consistent with previous studies that noted that adolescents' use of secrets is likely to follow rather than precede risky conducts (Laird et al., 2013), it can be assumed that the increase in secrecy may be partly driven by the initial level of drinking at the beginning of middle adolescence but that, conversely, the increase in alcohol use is not explained by the initial level of secrecy.

Associations Between Changes in Secrecy and Controlling Parenting

As shown in previous work (Baudat et al., 2020), adolescents keeping the highest levels of secrets from their parents at the beginning of middle adolescence also perceived more controlling parenting. Moreover, adolescents who reported a greater increase in secrecy experienced a greater increase in controlling parenting. One of the reasons for this positive association between the development of secrecy and the development of controlling parenting may be that when adolescents perceived their parents as intrusive, they may feel controlled and, in turn, react in an oppositional way to what is expected of them (e.g., Van Petegem et al., 2015), keeping secrets here. Alternatively, when parents suspect their adolescents of withholding information from them, they may feel disappointed, which would result in poor parenting styles (Finkenauer et al., 2005). Parents may also try to continue to exert their influence over their children through the use of controlling techniques (Soenens et al., 2019).

In addition to these simultaneous increases, there were both parent- and child-driven effects between adolescents' secrecy and their perceptions of controlling parenting. On the one hand, adolescents' perceptions of

controlling parenting at the beginning of mid-adolescence predicted an increase in secrecy, such that adolescents who perceived their parents as little controlling reported a greater increase in secrecy, compared to those who perceived their parents as highly controlling. As with the association between secrecy and alcohol use, supplementary analyses suggest that this is likely due to the fact that secrecy and perceptions of controlling parenting were already strongly and positively interrelated at the beginning of middle adolescence. On the other hand, adolescents also appear to play an agentic role in shaping their parents' rearing style, as adolescents who reported the highest levels of secrecy at the beginning of mid-adolescence perceived a decrease in controlling parenting.

Limitations and Future Directions

Although the present study adds to the knowledge about the associations between the development of secrecy, alcohol use and controlling parenting over time, a number of shortcomings should be addressed in future studies. First, there are several limits regarding the design of the study. Specifically, adolescents who participated in the whole study differ from those who dropped out in terms of sociodemographic characteristics and family dynamics. Another limitation is attrition in the study sample (as is often the case in longitudinal studies), as it appears to be slightly related to the level of perceived controlling parenting at the baseline. Furthermore, in order to limit the time required to complete the questionnaire of the largest study, the measures of secrecy and alcohol use included only two items. In addition, only the child-parent relationship was considered in the questionnaire, without differentiating the adolescent-mother dyad and the adolescent-father dyad. However, past research showed that mothers' and fathers' parenting style differ from each other (e.g., Lansford et al., 2014). Future studies would thus benefit from using extended scales for assessing information management and alcohol use, and by allowing adolescents to report on both their mother's and father's rearing style.

Additionally, there were significant variations in the development of adolescents' secrecy, alcohol use and perceptions of controlling parenting, suggesting individual differences in trajectories of change. Supporting this idea, studies using growth mixture modeling identified distinct trajectories in adolescents' disclosure (e.g., Padilla-Walker et al., 2018) and in their perceptions of controlling parenting (e.g., Van Petegem et al., 2017). Moreover, although the present study assessed change in secrecy across mid-adolescence by involving adolescents at four times during this specific developmental period, no conclusions can be drawn about changes that occur throughout either early or late adolescence. Further research could investigate the associations

between different developmental trajectories of secrecy, alcohol and perceptions of controlling parenting throughout adolescence.

Future studies could also consider both the topics (e.g., school, unsupervised activities) and the type of secret that one is keeping. Indeed, drawing upon the Social Domain Theory (Turiel, 1983), previous studies revealed that adolescents are likely to regulate information differentially depending on the legitimacy they grant to their parents about the topic of discussion (e.g., Smetana et al., 2006). Moreover, the type of secret, namely whether it is kept private from everybody else versus shared with confidants (e.g., friends), moderates the intra- and inter-personal implications of secrecy (e.g., Frijns et al., 2013). Previous studies also documented a variety of other concealment strategies that adolescents use to hide information from their parents, such as lies (e.g., Engels et al., 2006) and topic avoidance (e.g., Mazur & Ebesu Hubbard, 2004). Finally, future research could aim at distinguishing different profiles of information management, as adolescents are assumed to simultaneously use a mixture of concealment and disclosure strategies, in order to assert their privacy and autonomy while remaining connected with their parents (Finkenauer et al., 2008). Another potential direction for future studies would thus to address patterns of adolescents' information and their associations with risky behaviors and perceived parenting style.

Conclusion

Adolescence is a developmental period characterized by fundamental transformations in parent-child communication patterns. Although this process seems to occur in parallel with changes in adolescents' drinking behaviors and in their perception of their parents' rearing style, less is known about their associations over time. The present study highlighted that adolescents' secrecy about unsupervised activities increased linearly during middle adolescence, along with their drinking behaviors, while their perceptions of their parents' controlling rearing style remained constant. Moreover, adolescents are likely to develop boundaries around information about their unsupervised activities after being involved in drinking behaviors. Finally, parents' rearing style has a role to play in the increase of adolescents' secrecy; and, conversely, through their covert behaviors, adolescents' also shape their parents' rearing style. Overall, this study points out that the development of adolescents' secrecy is associated with the development of their drinking behaviors and perceptions of family relationships in dynamic ways.

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Authors' Contributions

SB helped in the design and collection of data, analyzed and interpreted the data, and wrote the manuscript; SVP helped in the design and collection of data, helped in the interpretation, and contributed to the writing of the manuscript; JPA participated in the conception and design of the study, supervised and performed the statistical analysis, and helped in the interpretation and writing the manuscript; GAS participated in the design, coordination and collection of data, and helped in the writing the manuscript; GZ conceived and designed the study, coordinated the project and helped in the writing of the manuscript. All authors have read, edited and approved the final manuscript.

Data Sharing Declaration

This manuscript's data will not be deposited.

Conflicts of Interest

The authors report no conflict of interests.

Compliance with Ethical Standards

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Ethical approval

The study was conducted in accordance with the ethical standards of the Swiss Society of Psychology (SSP).

Informed Consent

Informed consent was obtained from all participants included in the study.

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Table 1

Means, Standard Deviations and Correlations of Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Secrecy T1	–											
2. Secrecy T2	.53***	–										
3. Secrecy T3	.38***	.47***	–									
4. Secrecy T4	.33***	.43***	.59***	–								
5. Alcohol Use T1	.42***	.27**	.22*	.21**	–							
6. Alcohol Use T2	.37***	.42***	.22*	.24***	.71***	–						
7. Alcohol Use T3	.29***	.40***	.30***	.27***	.47***	.72***	–					
8. Alcohol Use T4	.29***	.32***	.36***	.40***	.42***	.63***	.75***	–				
9. Controlling Parenting T1	.33***	.32***	.22*	.28*	.15	.21*	.21*	.05	–			
10. Controlling Parenting T2	.31***	.37***	.30***	.30*	.18	.26**	.28**	.15	.63***	–		
11. Controlling Parenting T3	.12	.26**	.34***	.30**	.09	.19	.21*	.13	.46***	.60***	–	
12. Controlling Parenting T4	.11	.18	.20	.34***	.17	.22*	.15	.16	.42***	.54***	.69***	–
M	2.04	2.13	2.13	2.24	1.51	1.74	1.99	2.22	1.99	1.94	1.94	1.94
SD	1.07	1.03	1.04	1.03	0.70	0.81	0.87	0.92	0.66	0.65	0.74	0.74

*$p < .05$. **$p < .01$. ***$p < .001$. (adjusted p-values according to Holm's method)

Table 2

Parameter Estimates (Standard Errors) for Latent Growth Curve Models of Adolescents' Reports of Secrecy, Alcohol Use and Perceived Controlling Parenting

Variable	Univariate models	Conditional parallel process model
Secrecy		
Intercept estimate	2.06 (0.05)***	2.09 (0.06)***
Slope estimate	0.05 (0.02)**	0.46 (0.10)***
Intercept variance	0.66 (0.08)***	0.67 (0.08)***
Slope variance	0.07 (0.02)***	0.06 (0.02)***
Intercept ↔ slope	–.45**	–.19
Alcohol Use		
Intercept estimate	1.52 (0.03)***	1.47 (0.04)***
Slope estimate	0.24 (0.02)***	0.33 (0.06)***
Intercept variance	0.48 (0.05)***	0.44 (0.05)***
Slope variance	0.08 (0.01)***	0.08 (0.01)***
Intercept ↔ slope	–.38***	–.37***
Controlling parenting		
Intercept estimate	1.99 (0.03)***	1.96 (0.04)***
Slope estimate	–0.01 (0.01)	0.09 (0.05)
Intercept variance	0.33 (0.03)***	0.32 (0.03)***
Slope variance	0.03 (0.01)***	0.03 (0.01)**
Intercept ↔ slope	–.25*	–.03

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3

Associations between Growth Factors in the Conditional Parallel Process Latent Growth Curve Model of Adolescents' Reports of Secrecy, Alcohol Use and Perceived Controlling Parenting

Model Parameters	Standardized Estimates	*p*
Correlations among growth factors		
Secrecy intercept ↔ Alcohol intercept	.54	< .001
Secrecy intercept ↔ Controlling intercept	.54	< .001
Alcohol intercept ↔ Controlling intercept	.13	.022
Secrecy slope ↔ Alcohol slope	.25	.002
Secrecy slope ↔ Controlling slope	.67	< .001
Alcohol slope ↔ Controlling slope	.27	.001
Regressions on intercepts		
Alcohol intercept → Secrecy slope	–.22	.019
Secrecy intercept → Alcohol slope	.09	.348
Controlling intercept → Secrecy slope	–.31	.003
Secrecy intercept → Controlling slope	–.49	< .001
Controlling intercept → Alcohol slope	–.17	.033
Alcohol intercept → Controlling slope	.29	.004
Regressions on covariates		
Gender[1] → Secrecy intercept	–.04	.513
Gender[1] → Secrecy slope	.05	.510
Gender[1] → Alcohol intercept	.03	.544
Gender[1] → Alcohol slope	.00	.978
Gender[1] → Controlling intercept	.07	.213
Gender[1] → Controlling slope	.02	.805
Age[2] → Alcohol Time 1	.17	< .001
Age[2] → Alcohol Time 2	.14	< .001
Age[2] → Alcohol Time 3	.08	.006
Age[2] → Alcohol Time 4	.03	.210

Note. [1]0 = girl, 1 = boy. [2]Age variable was dummy coded: 0 = under 16 years old, 1 = over 16 years old.

Table 4

Missing Data Patterns, Sample Size by Patterns, and Dummy Indicator for Sensitivity Analyses

Pattern	Secrecy	Alcohol use	Controlling parenting	Dropout
OOOO	242	244	213	0
OOOM	134	128	127	1
OOMO	51	50	54	0
MOOO	13	15	23	0
MOOM	12	14	18	1
OMOM	7	7	11	1
OMOO	6	7	10	0
OMMO	5	5	10	0
MOMO	3	3	7	0

For pattern: O = observed data; M = missing data. For example, the pattern "OOOO" indicates there is no missing data at each of the four measurement times, and the pattern "OOOM" indicates that there is missing data at Time 4 but available data at Times 1, 2 and 3. For dropout: 0 = data available at Time 4, 1 = missing data at Time 4.

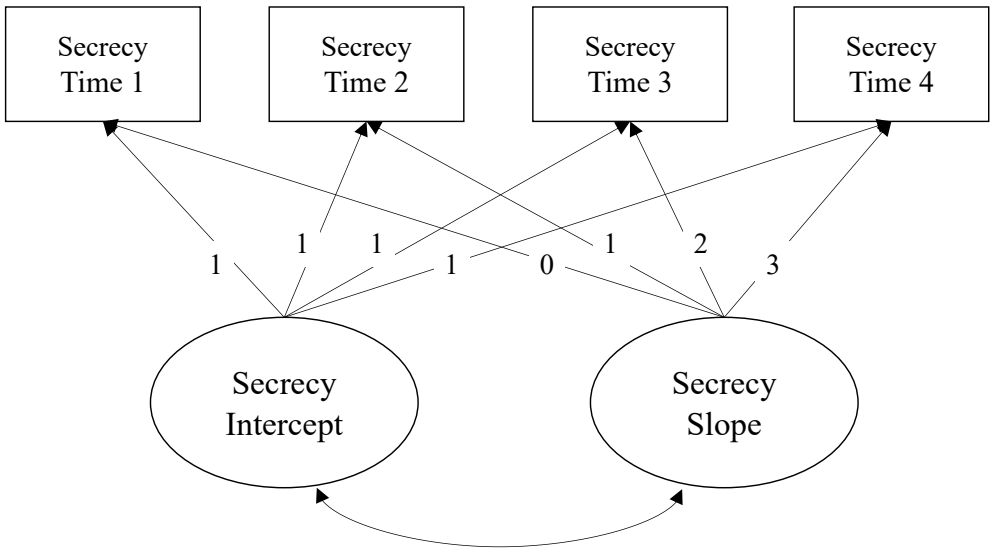

Figure 1. Theoretical univariate linear latent growth curve model for secrecy.

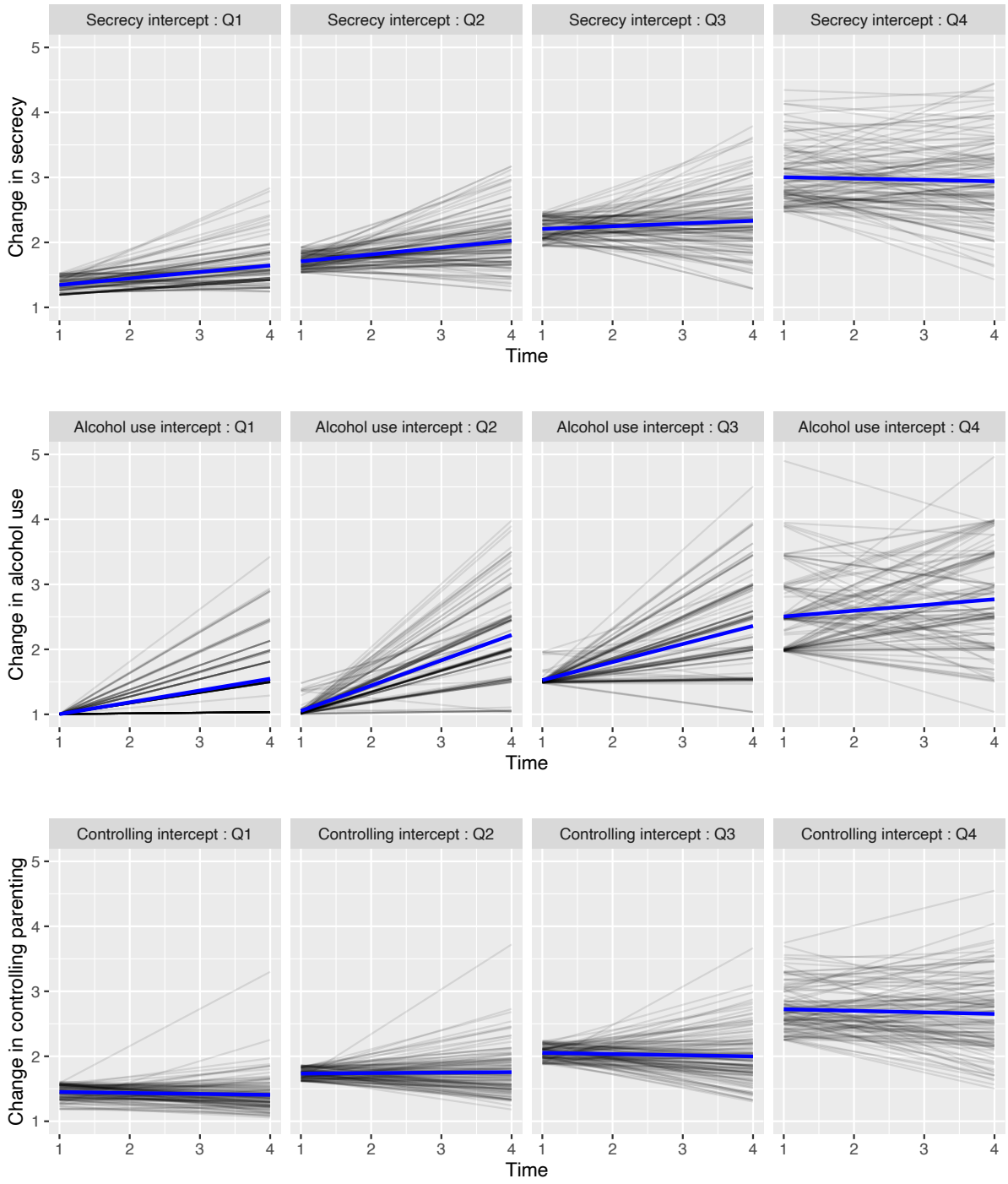

Figure 2. Mean developmental changes (in bold) in adolescents' secrecy, alcohol use and perceptions of controlling parenting, by quartiles of their initial levels, respectively.

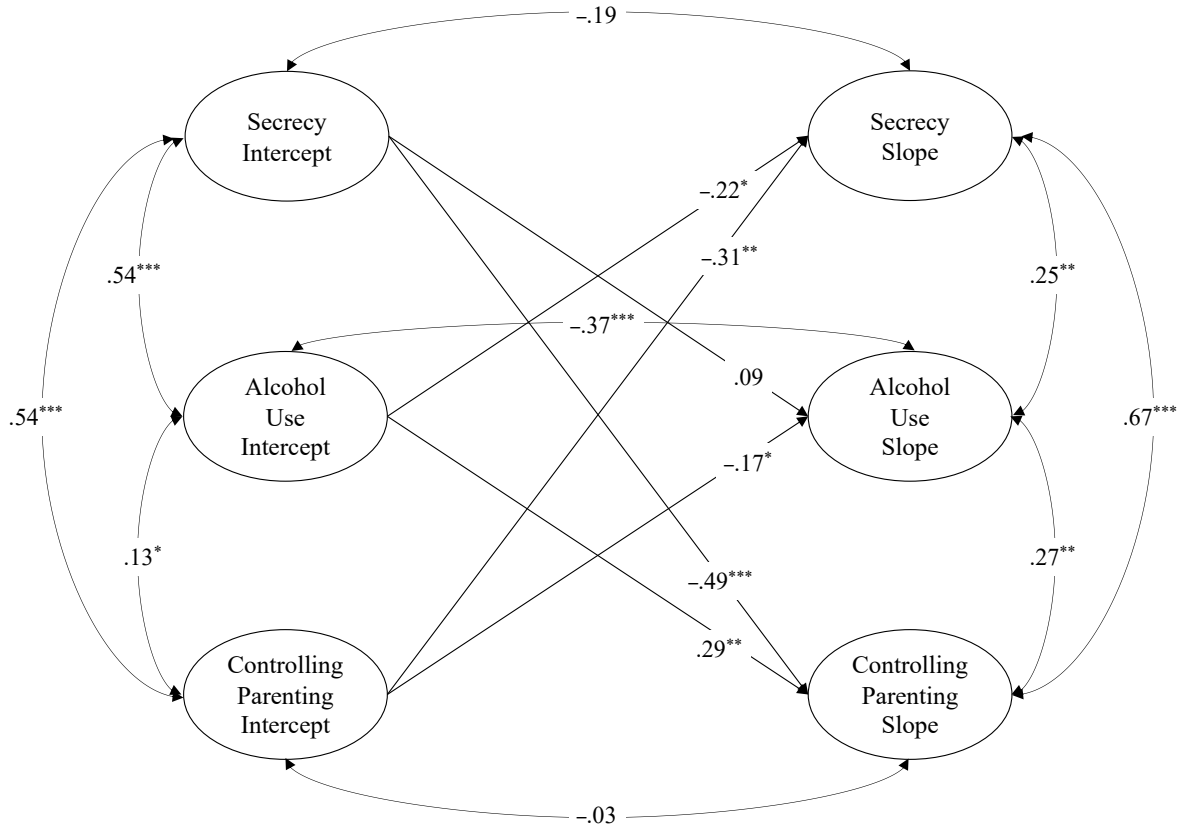

Figure 3. Results of a conditional parallel process model describing the associations between changes in adolescents' secrecy, alcohol use and perceive controlling parenting over time, including gender as a time-invariant covariate and age as a time-varying covariate (not presented here). For clarity reasons, intercept and slope factor loadings for each repeated-measure variable are not depicted.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

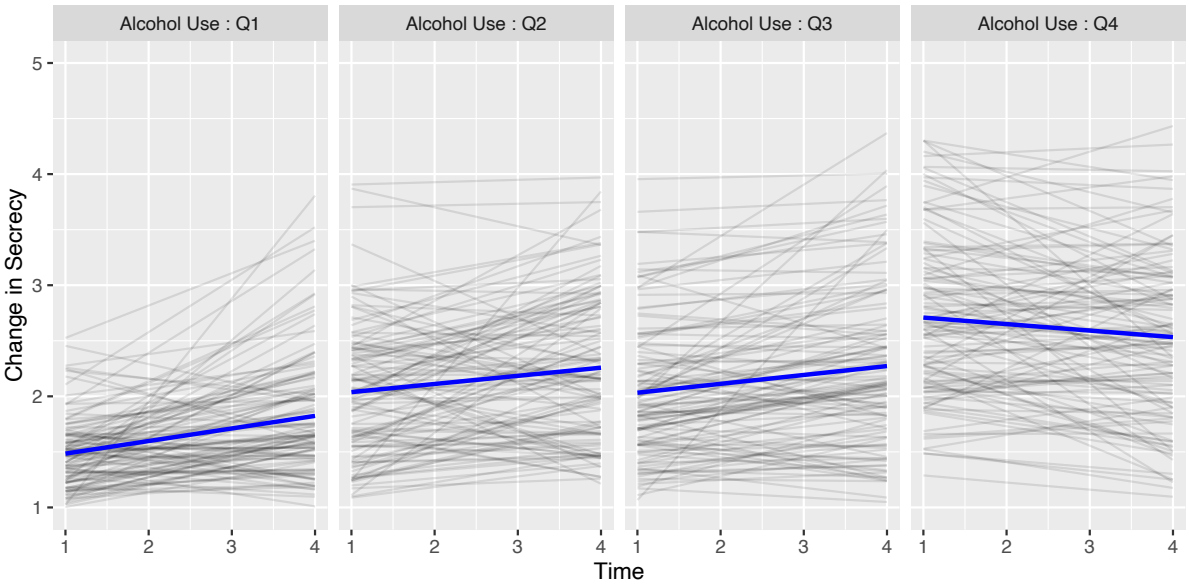

Figure 4. Mean developmental changes in adolescents' secrecy over time by quartiles of baseline levels of alcohol use.

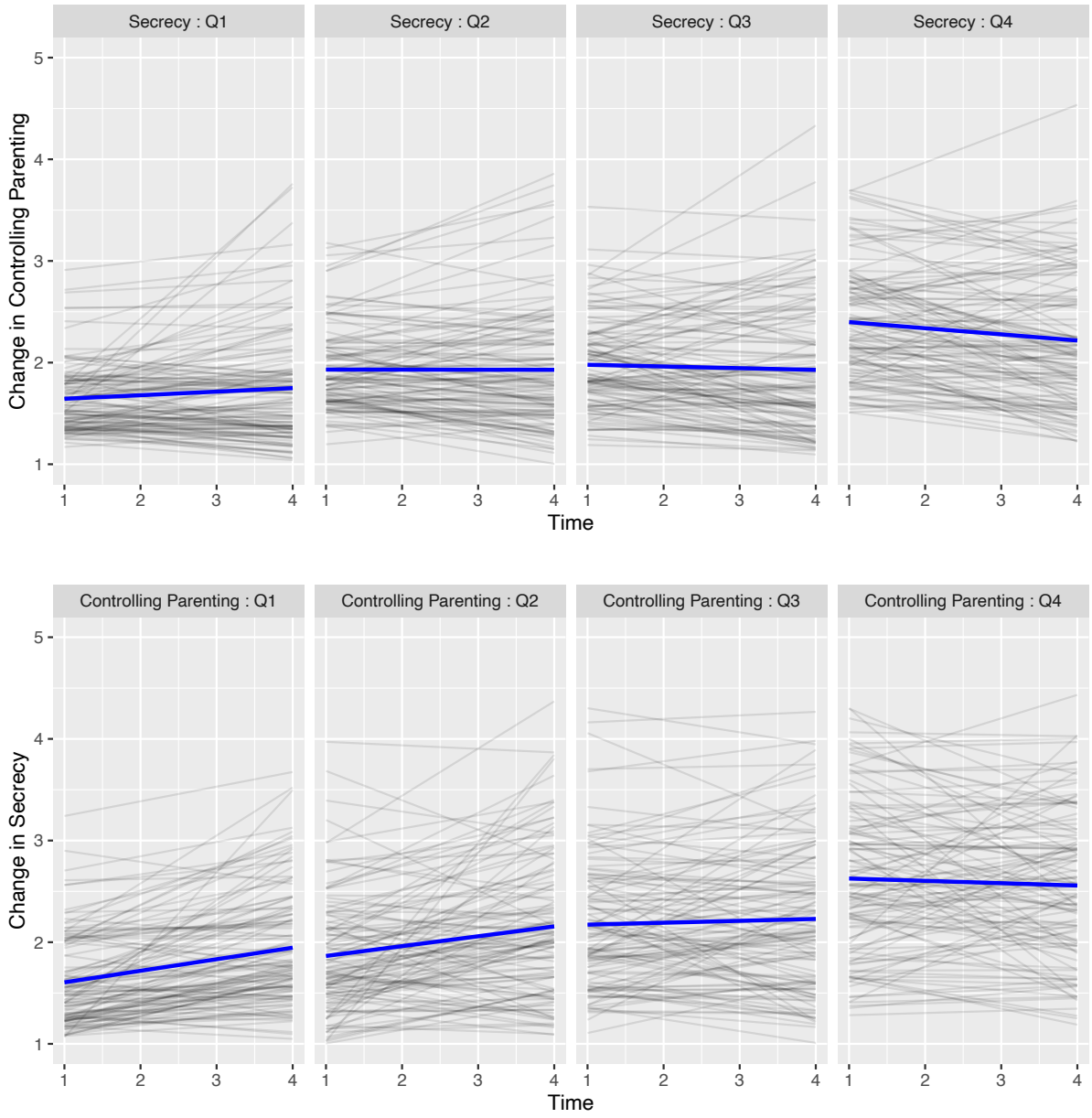

Figure 5. Mean developmental changes in adolescents' secrecy and perceptions of controlling parenting by quartiles of baseline levels of controlling parenting and secrecy, respectively.