Objectives: To test associations between onset of formal child care (in infancy or as a toddler), high school graduation, and employment earnings from ages 18 to 35 years.

Methods: A 30-year prospective cohort follow-up study, with linkage to government administrative databases (N = 3020). Exposure included formal child care, if any, by accredited caregivers in centers or residential settings at ages 6 months and 1, 1.5, 2, 3, and 4 years. A propensity score analysis was conducted to control for social selection bias.

Results: Of 2905 participants with data on child care use, 59.4% of male participants and 78.5% of female participants completed high school by age 22 to 23. Mean income at last follow-up (n = 2860) was $47,000 (Canadian dollars) (SD = 37,700) and $32,500 (SD = 26,800), respectively. Using group-based trajectory modeling, we identified 3 groups: formal child care onset in infancy (~6 months), formal child care onset as a toddler (after 2.5 years), and never exposed. After propensity score weighting, boys with child care started in infancy had greater odds of graduating than those never exposed (odds ratio [OR] 1.39; 95% confidence interval [CI]: 1.18–1.63; P < .001). Boys attending child care had reduced odds of low income as young adults (infant onset: OR 0.60 [95% CI: 0.46–0.84; P < .001]; toddler onset: OR 0.63 [95% CI: 0.45–0.82; P < .001]). Girls’ graduation rates and incomes revealed no significant association with child care attendance.

Conclusions: For boys, formal child care was associated with higher high school completion rates and reduced risk of adult poverty. Benefits for boys may therefore extend beyond school readiness, academic performance, and parental workforce participation.

What’s known on this subject: Correlational studies suggested that early child care services with population-wide availability can potentially be effective tools for improving developmental trajectories. However, the association of child care attendance with outcomes beyond adolescence has been documented in few studies. Long-term outcomes remain to be explored.

What this study adds: With this study, we provide the first prospective evidence indicating that for boys, regulated child care services initiated in infancy may increase high school completion and prevent poverty in adulthood.
Research suggests that educational attainment and earning capacity are rooted in early childhood.1–4 Poor quality of care and inadequate learning environments in early childhood have been identified as risk factors for poor academic performance and mental health problems in children and adolescents. Adverse childhood experiences are also linked to unhealthy or risk-taking behaviors that place children at increased risk of educational underachievement, unemployment, poverty, health-related problems, or premature mortality.4–11

In line with experimental evidence,12–15 correlational studies have suggested that early child care services (ie, day care) with population-wide availability can potentially be effective tools for improving developmental trajectories.16,17 However, social selection (ie families using child care services tend to be of higher socioeconomic status because they need to send their children somewhere during working hours) has limited the conclusions that could be drawn from correlational research. Yet, over the past decade, the use of statistical methods, such as propensity score weighting, and instrumental variables have strengthened the possibility of drawing inferences on the impact of child care services. A number of outcomes then remain to be explored.

First, few studies have documented the association, if any, of child care attendance with outcomes assessed beyond middle childhood or adolescence. Correlational studies of economically and ethnically diverse populations have revealed that child care services were associated with better cognitive and academic functioning and mental health during childhood and adolescence, especially in settings with high-quality child care.16–23 These associations were shown to persist until the end of elementary school24 and into high school.20–22 However, several studies indicated that these effects may fade over time.25,26 To our knowledge, there is, as yet, no evidence that child care attendance is linked to high school completion or to future economic success.

Second, authors of few studies have examined whether starting child care at an earlier or later age is more beneficial, and none have included follow-up into adulthood. Timing studies have yielded mixed results, some reporting earlier,16,24,27,28 and others later,29,30 onset as related to positive outcomes. The question of optimal timing for starting child care has important implications for child development, mothers in the workforce, duration of parental leave, and public investment in these and other child-related services.

Third, there is limited evidence of sex differences as reported in associations between child care, academic achievement, and later economic outcomes.31 The lack of subgroups limits the application of findings to health promotion and economic equality interventions. Lastly, long-term studies that have linked early intensive child care programs to earned income in adulthood have generally relied on self-reported incomes at a single time point or for a short time frame. This has yielded mixed results.32 Self-reported outcomes potentially introduce response bias and/or measurement error; in addition, these studies failed to capture more complete information on income dynamics and fluctuations in adulthood.

In the current study, we examined the associations between attendance at child care before school entry, high school graduation (official records by age 22–23 years), and employment earnings from ages 18 to 35 years (from government tax records data) in a random sample of births in Quebec, Canada. We specifically tested for differential associations between earlier versus later age of onset of child care services and adult academic and economic outcomes, including sex differences.

**METHODS**

**Participants and Study Design**

Data were obtained from the Quebec Longitudinal Study of Kindergarten Children (QLSKC), an ongoing prospective, population-based cohort study of 3020 children (1420 girls [47.2%] and 1600 boys [52.8%]) born in 1980 and 1981.33 We conducted a database linkage study using the records of the QLSKC cohort to determine participants exposed and not exposed to child care, as originally reported by the mother. Data regarding high school graduation were provided by the Quebec Ministry of Education records for all participants at ages 22 to 23 years. Personal income data were obtained from Statistics Canada tax records for years 1998 through 2015, with 18 measurement points at ages 18 to 35 years. A description of the linkage methods was recently published.34 Participants with no information on child care attendance from 6 months to age 4 years (n = 112; 3.7%) or with no filed tax returns data from age 18 to 35 years (n = 50; 1.7%) were excluded from the trajectory analysis. Sample sizes varied thereafter for specific outcomes and predictors. The final samples included 2905 participants with complete data for both child care attendance and high school graduation and 2860 participants with data available on both child care attendance and employment earnings.

The study was approved by the Research Ethics Boards of the Sainte-Justine Research Center and the University of Montreal. Written informed consent was provided by parents.
Low-income threshold was decommissioned, excluding capital gains. Personal pretax wages, salaries, and commission (Supplemental Information). These included a well-documented source of social selection bias were selected for propensity score weighting (Supplemental Information). These included baseline indicators of family socioeconomic status and structure, perinatal child characteristics, and stimulation received at home, as measured on family survey questionnaires.

Statistical Analysis

Group-based developmental trajectory modeling was used to estimate child care attendance pattern over time, with probability of child care attendance specified as following a cubic function of age. The same analysis was performed to model employment earnings for each year from age 18 to 35 years. The aim was to identify groups that followed a distinctive low-income trajectory. Final model selection was based on the Bayesian information criterion (BIC), Akaike information criterion (AIC), model-adequacy tests, quality of classification, and parsimony.

The unadjusted association between child care trajectory and outcomes was estimated by using binary logistic regression (high school completion) or multinomial logistic regression (income trajectory). Missing data on covariates were handled by using multiple imputation by chained equations. Ten complete data sets were generated, a number generally considered sufficient. For the adjusted model, propensity score weighting was used to control for social selection bias and to isolate the putative effect of child care on high school graduation and income trajectories by using the 16 covariates mentioned earlier that were associated (P < .10) with either child care attendance trajectory or outcomes or both. Propensity score weighting was applied by using multimonial logistic regression and inverse probability of treatment weighting (IPTW) after multiple imputations. Covariance balance was assessed to obtain the standardized mean difference with and without propensity score weighting. The associations between child care onset and outcomes of interest were then reestimated. Adjusted models of each outcome were stratified by sex.

Sensitivity Analysis

To verify robustness of the results, we repeated the analyses, introducing additional covariates such as age at birth and IQ, as measured at ages 12 and 13 years, respectively (Supplemental Information). Attention deficit and IQ were shown to be crucial to the prediction of educational and economic outcomes.

All analyses were conducted by using Stata version 14 (Stata Corp, College Station, TX) and/or R for statistical computing versions 3.5.2 and 3.5.3 (64 bit). Significance was set at 0.05, and all tests were 2-tailed.

RESULTS

Child Care Attendance Trajectories

The best model identified the following 3 patterns of attendance (Fig 1): infant onset (n = 547; 18.8%) included children with a high likelihood of starting formal child care at ~6 months of age and continuing through to age 4 to 5 years; toddler onset (n = 422; 14.5%), after 2.5 years; and never exposed (n = 1936; 66.6%) included children who had never attended formal child care in their preschool years. Model fit statistics are reported in Supplemental Table 4.

In Table 1, we report baseline child and family characteristics by child care trajectory as well as statistical differences between the 3 groups before propensity score weighting. Children who started formal child care in infancy, as compared with starting as toddlers or never exposed, were less likely to come from families with low levels of education or low occupational prestige. Mothers were more likely to be working; they were also less likely to have had a teenage pregnancy. After propensity score weighting, differences between groups decreased substantially, and similarities on personal characteristics and family

Measures

Child Care Services

Child care was defined in accordance with the Act Respecting Child Day Care (Revised Statutes of Quebec c.S-4.1, 1979) (an act now replaced by the Educational Child Care Act, c.S-4.1.1, 2005) and regulations from the Quebec Office of Child Care Services (1980). For further details, see the Supplemental Information. Mothers originally reported type and quantity of child care use from 6 months to age 4 years (at 6 months and 1, 1.5, 2, 3, and 4 years). Child care types included (1) center-based care, (2) family-based care, (3) home care in the child’s home by a nonrelative, and (4) home care provided by the mother or a relative. For this study, we defined formal child care services as regulated center-based and family-based child care settings operating weekdays and required to conform to legislative provincial standards. Children were classified into the child care type, if any, in which they spent the most hours per week; quantity of use was originally coded as follows: 0, never; 1, 1 to 10 hours; 2, 10 to 20 hours; 3, 20 to 40 hours; and 4, >40 hours.

Outcomes and Control Variables

Primary outcomes were high school completion by age 22 to 23 from official records and adult income at ages 18 to 35, as measured by government tax return data. Income was defined as the total of all personal pretax wages, salaries, and commissions, excluding capital gains. Low-income threshold was defined as the 20th percentile for the study sample. A total of 16 covariates representing a well-documented source of social selection bias were selected for propensity score weighting (Supplemental Information). These included baseline indicators of family socioeconomic status and structure, perinatal child characteristics, and stimulation received at home, as measured in Supplemental Table 4.
backgrounds increased. The standardized mean difference for covariates was below the conservative threshold of 0.10, representing balanced grouping (Supplemental Tables 5 through 7, Supplemental Fig 4).

Educational, economic, and family characteristics at follow-up are shown in Table 2. When compared with male participants, female participants had higher high school graduation rates (78.5% vs 59.4%), had lower personal earnings ($32 500 vs $47 000), were more likely to be married or cohabiting, and were more likely to have children living in the household by age 35 years.

High School Completion

Bivariate association and adjusted models with IPTW propensity scoring revealed that the time of onset of formal child care was significantly associated with high school graduation in the overall study sample (Supplemental Table 8). After IPTW propensity score adjustment, boys who initiated formal child care in infancy had higher odds of high school graduation than those who were never exposed (odds ratio [OR] 1.39; 95% confidence interval [CI]: 1.18–1.63; P < .001) (Table 3) and a 7.7-point increase (ie, 14% higher) in the rate of graduation (Fig 2A). This pattern was not found in girls. Girls graduated from high school at higher rates than boys, and the rate did not differ according to child care attendance or timing thereof.

Risk of Poverty in Adulthood

Trajectories of low income from 18 to 35 years are shown in Fig 3. The best model identified the following patterns: stable, low risk of poverty (n = 1900; 64.4%), moderate risk of poverty (n = 710; 24%), and high, rapidly increasing risk of poverty (n = 360; 12%). The difference in median income at age 35 between the low- and high-risk trajectories was $44 100. Model fit indices are presented in Supplemental Table 9.

Both unadjusted and adjusted models revealed a lower risk of poverty when the participant had been enrolled in a formal child care service (Supplemental Table 10). In the sex differences analysis, however, only male participants showed a significant association between formal child care and lower likelihood of poverty (infant onset: OR 0.60 [95% CI: 0.46–0.84; P < .001]; toddler onset: OR 0.63 [95% CI: 0.45–0.82; P < .001]) (Table 3, Fig 2B).

Sensitivity Analysis

Attention deficit and IQ at ages 12 and 13 years, respectively, are significantly associated with high school graduation and earned income. After introducing these additional covariates into the main adjusted model, the association with child care attendance remained significant across outcomes. The covariate-adjusted model yielded slightly higher estimates of an association between infant onset of child care and high school completion compared with the adjusted model without the additional covariates (Supplemental Tables 8 and 11).

DISCUSSION

Little is known about the long-term outcomes of child care attendance and whether early gains translate into benefits later in life. Using a large and economically diverse population-based sample, we explored whether child care before school entry (ie, before age 5 years) was associated with educational attainment and employment earnings in young adulthood up to 3 decades later. Results were adjusted by using propensity score weighting to control for social selection bias and reduce differences in family background between children who did or did not attend child care. Adjusted results revealed that, for boys, early enrollment in formal child care was associated with higher rates of high school graduation and a lower likelihood of poverty at ages 18 to 35 years. For girls, graduation rates and incomes revealed no significant association with child care.

FIGURE 1

Trajectories of formal child care attendance before school entry. The y-axis represents the probability of attending child care services from 6 months to age 4 years. Boxes represent observed values, and lines represent the fitted regressions slopes. Fit indices for the model included the lowest BIC (−5431.01) and mean odds of correct classification (31.03) (ie, the model classified the participants 31.03 times better than classification by chance, which is adequate if >5.0). Details, including model fit statistics, are provided in Supplemental Table 4.
With an OR of 1.39 for high school graduation and a protective OR of 0.60 against the risk of poverty, male participants attending formal child care since infancy were \(\sim 8\) percentage points more likely to graduate from high school and \(\sim 4\) percentage points less likely to follow a trajectory of persistent low income in adulthood, as compared with those with no exposure to child care. Starting as a toddler also conferred protective advantages against poverty (\(\sim 4\) percentage points). Although the effect sizes were small, it is important to keep in mind, as previously noted,\(^47\) that because of the widespread use of child care, those small effects may be highly relevant at the population level.

### TABLE 1 Baseline Child and Family Characteristics by Child Care Trajectory (Before Adjustment)

<table>
<thead>
<tr>
<th>Child Care Attendance</th>
<th>Never Exposed ((n = 1936))</th>
<th>Infant Onset ((n = 547))</th>
<th>Toddler Onset ((n = 422))</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child characteristics, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male participants</td>
<td>1016 (52.5)</td>
<td>285 (52.1)</td>
<td>233 (52.2)</td>
<td>.56</td>
</tr>
<tr>
<td>Birth order</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firstborn</td>
<td>811 (42.1)</td>
<td>344 (63.8)</td>
<td>195 (47.3)</td>
<td>—</td>
</tr>
<tr>
<td>Second born</td>
<td>755 (39.2)</td>
<td>159 (29.5)</td>
<td>161 (38.1)</td>
<td>.000</td>
</tr>
<tr>
<td>Third born or higher</td>
<td>359 (18.6)</td>
<td>36 (6.7)</td>
<td>56 (13.6)</td>
<td>—</td>
</tr>
<tr>
<td>Low birth wt, &lt;2500 g</td>
<td>105 (8.0)</td>
<td>26 (7.1)</td>
<td>20 (7.8)</td>
<td>.85</td>
</tr>
<tr>
<td>Preterm birth, &lt;37 wk gestation</td>
<td>297 (23.4)</td>
<td>73 (19.9)</td>
<td>69 (25.3)</td>
<td>.24</td>
</tr>
<tr>
<td>Family characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother born in Canada, No. (%)</td>
<td>1869 (96.9)</td>
<td>517 (94.9)</td>
<td>392 (93.8)</td>
<td>.03</td>
</tr>
<tr>
<td>Father born in Canada, No. (%)</td>
<td>1658 (96.1)</td>
<td>453 (92.6)</td>
<td>335 (89.1)</td>
<td>.000</td>
</tr>
<tr>
<td>Low(^a) maternal education, No. (%)</td>
<td>610 (31.8)</td>
<td>96 (17.8)</td>
<td>70 (24.5)</td>
<td>.000</td>
</tr>
<tr>
<td>Mother employed during child’s preschool years, No. (%)</td>
<td>715 (37.4)</td>
<td>424 (78.6)</td>
<td>299 (71.9)</td>
<td>.000</td>
</tr>
<tr>
<td>Teenaged mother at child’s birth, No. (%)</td>
<td>62 (3.2)</td>
<td>8 (1.5)</td>
<td>21 (5.0)</td>
<td>.007</td>
</tr>
<tr>
<td>Low(^b) paternal education, No. (%)</td>
<td>603 (35.5)</td>
<td>127 (26.2)</td>
<td>99 (27.9)</td>
<td>.000</td>
</tr>
<tr>
<td>Family structure, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intact family unit</td>
<td>1235 (87.7)</td>
<td>308 (80.0)</td>
<td>194 (67.8)</td>
<td>—</td>
</tr>
<tr>
<td>Single-parent family</td>
<td>132 (9.4)</td>
<td>53 (13.8)</td>
<td>70 (24.5)</td>
<td>.000</td>
</tr>
<tr>
<td>Blended family</td>
<td>42 (3.0)</td>
<td>24 (6.2)</td>
<td>22 (7.7)</td>
<td>—</td>
</tr>
<tr>
<td>Maternal age at child’s birth, y, mean (SD)</td>
<td>26.6 (4.6)</td>
<td>26.6 (3.9)</td>
<td>26.5 (4.8)</td>
<td>.80</td>
</tr>
<tr>
<td>Paternal age at child’s birth, y, mean (SD)</td>
<td>29.20 (5.6)</td>
<td>28.67 (5.5)</td>
<td>29.07 (4.9)</td>
<td>.14</td>
</tr>
<tr>
<td>Maternal occupational socioeconomic index, mean (SD)</td>
<td>42.43 (12.8)</td>
<td>47.23 (12.7)</td>
<td>44.90 (12.3)</td>
<td>.000</td>
</tr>
<tr>
<td>Paternal occupational socioeconomic index, mean (SD)</td>
<td>43.06 (14.5)</td>
<td>44.54 (14.5)</td>
<td>44.60 (14.3)</td>
<td>.05</td>
</tr>
<tr>
<td>Mother-child interactions, mean (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stimulating</td>
<td>—1.82 (3.8)</td>
<td>—1.46 (3.9)</td>
<td>—1.45 (3.9)</td>
<td>.06</td>
</tr>
<tr>
<td>Pleasurable</td>
<td>14.35 (6.3)</td>
<td>13.30 (6.7)</td>
<td>13.51 (6.7)</td>
<td>.07</td>
</tr>
</tbody>
</table>

\(P\) values are based on analysis of variance for continuous variables or Pearson’s \(\chi^2\) test for categorical variables. —, not applicable.

\(^a\) No high school diploma.

\(^b\) Based on occupational prestige scale (Supplemental Information).

### TABLE 2 Education, Earnings, and Family Characteristics at Age 35 Years

<table>
<thead>
<tr>
<th>Characteristics(^a)</th>
<th>Female Participants ((n = 1370))</th>
<th>Male Participants ((n = 1530))</th>
</tr>
</thead>
<tbody>
<tr>
<td>High school completion by age 22–23 y, No. (%)</td>
<td>1080 (78.5)</td>
<td>910 (59.4)</td>
</tr>
<tr>
<td>Personal income at age 35 y, (\text{CAD, mean (SD)})</td>
<td>32500 (26800)</td>
<td>47000 (37700)</td>
</tr>
<tr>
<td>Personal income at age 35 y, (\text{CAD, median (IQR)})</td>
<td>31100 (7290–50200)</td>
<td>44500 (19300–68300)</td>
</tr>
<tr>
<td>Personal income at age 35 y, (\text{CAD, range})</td>
<td>0–190000</td>
<td>0–370300</td>
</tr>
<tr>
<td>Family characteristics at age 35 y, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married or cohabiting</td>
<td>870 (64)</td>
<td>820 (55)</td>
</tr>
<tr>
<td>Divorced, separated, or single</td>
<td>440 (32)</td>
<td>530 (35)</td>
</tr>
<tr>
<td>No. offspring in household, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 children</td>
<td>310 (23.2)</td>
<td>520 (34.3)</td>
</tr>
<tr>
<td>1–2 children</td>
<td>760 (58)</td>
<td>680 (45.4)</td>
</tr>
<tr>
<td>3+ children</td>
<td>250 (17)</td>
<td>180 (11)</td>
</tr>
</tbody>
</table>

\(\text{CAD, Canadian dollar; IQR, interquartile range.}\)

\(^a\) Up to 10% missing. In accordance with Statistics Canada data protection requirements, displayed counts are rounded to base 10, and percentages are rounded to 1 decimal point; earnings are rounded to the nearest 100, and ranges represent the mean of the 5 lowest and 5 highest scores, respectively.
Given that failure to complete a high school education carries with it substantial economic costs to individuals and society, our findings provide evidence that the provision of early child care can be a cost-effective means of increasing social development, economic opportunity, and protection against poverty.

Our results are consistent with previous experimental studies demonstrating long-term gain for children enrolled in intensive preschool intervention programs. Three studies from the Chicago Longitudinal Study on the large-scale Child-Parent Center Education Program reported higher rates of high school graduation for male participants along with higher socioeconomic levels (including income), with benefits increasing with intervention duration. It is noteworthy that these structured programs were conducted on a population from low-income inner city schools in Chicago. This limits their generalizability to community-based child care services, like ours, that cover the entire income spectrum in the population, with child care services varying from home based to center based and of varying levels of quality.

Caution should be used in generalizing the results to cohorts of participants born in other time periods. However, we note that authors of previous studies reported benefits of early formal child care up to adolescence using distinct birth cohorts separated by at least 10 years, namely the British Millennium Cohort Study, the Eunice Kennedy Shriver National Institute of Child Health and Human Development Study of Early Child Care, and the Quebec Longitudinal Study of Child Development. The US Early Childhood Longitudinal Study–Kindergarten class of 1998–1999 revealed that children

### TABLE 3 High School Graduation and Risk of Poverty at Ages 18–35 Years by Child Care Attendance

<table>
<thead>
<tr>
<th>Child Care Attendance</th>
<th>Completed High School (n = 2905)</th>
<th>Low (n = 1840)</th>
<th>High (n = 340)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td><strong>Female Participants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never exposed</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
</tr>
<tr>
<td>Onset in infancy</td>
<td>1.11 (0.91–1.35)</td>
<td>0.82 (0.64–1.06)</td>
<td>0.92 (0.71–1.18)</td>
</tr>
<tr>
<td>Onset as toddler</td>
<td>1.10 (0.91–1.35)</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
</tr>
<tr>
<td></td>
<td>.31</td>
<td>.13</td>
<td>.50</td>
</tr>
<tr>
<td><strong>Male Participants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never exposed</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
<td>1 (reference)</td>
</tr>
<tr>
<td>Onset in infancy</td>
<td>1.39 (1.18–1.63)</td>
<td>0.60 (0.46–0.84)</td>
<td>0.63 (0.45–0.82)</td>
</tr>
<tr>
<td>Onset as toddler</td>
<td>1.06 (0.90–1.24)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results were adjusted by inverse probability weighting by using propensity scores from all 16 confounders related to selection bias. —, not applicable.

### FIGURE 2

Adjusted rates for high school completion and risk of poverty in adulthood by child care attendance. A, High school completion. B, Risk of poverty. Values are adjusted by IPTW by using propensity scores. Error bars indicate 95% CIs.
who started center care programs at ages 2 to 3 years had better reading and math scores at school entry than those who started at younger or older ages.29 Methodologic differences between the current study and the Early Childhood Longitudinal Study–Kindergarten include assessment of outcomes, follow-up duration, and statistical methodology, limiting a direct comparison.

Several plausible mechanisms may account for the associations observed in this study. There is already a well-established literature documenting the association between early child care attendance, school readiness, and better academic performance in literacy and mathematics. The 2 latter are likely to mediate the association with high school graduation or later employments earnings. Early development of socioemotional competence53,54 could also function as an important mediator. Social-emotional learning and a play-centered early child care environment that includes ample opportunities for relational and active learning may be particularly effective in fostering school adaptation for boys, thereby increasing higher educational attainment and contributing to later earning capacity.

Our findings provide information about the age at which onset of child care services may be the most beneficial and to whom. In particular, our findings indicate the importance of such services for boys, who are generally at higher risk of problem behavior and school dropout.

The benefits observed for boys are not generalizable to girls. Future research that is aimed at understanding why the association between early formal child care and long-term outcomes differs for boys and girls is needed. Potential explanations include differences in the socialization process of boys and girls,55–57 with boys benefiting more from early socialization with same-aged peers.55,58,59

This study has several strengths. First, we used a large population-based sample from the French-language public school system in Quebec, Canada. Second, we used 2 independent government administrative databases for long-term 30-year follow-up. Third, we examined 2 outcomes at different developmental time points: (1) high school graduation, a key path to entry into the workforce, and (2) employment earnings during adulthood, an important indicator of economic status and well-being.

Fourth, our results were stratified by sex. Fifth, we used a robust method to address social selection bias, namely IPTW (in this case, exposure to regulated child care services) by using propensity scores. Finally, our analyses included timing of onset and type of child care, which are important for several reasons: (1) the putative combined effects on child development and total time spent in child care and (2) the impact on parental participation in the workforce and the implications thereof on social policy.

We also note some limitations. This was an observational study; causal inferences are therefore not possible. After propensity scoring, the groups were made as equivalent to each other as possible with respect to observed baseline covariates. Even if our findings were consistent with previous experimental studies, they may not be generalizable to contexts with different child care systems or to populations with different cultural and ethnic backgrounds. Studies in other contexts and populations are needed to test the generalizability of results. No differentiation between levels of child care quality and educator's level of training is also a limitation that should be addressed.
in future large-scale population-based child care studies.

CONCLUSIONS
To our knowledge, this study provides the first evidence of an association between early child care, increased rates of high school graduation, and lower risks of poverty in young adulthood, particularly for boys. The findings suggest that benefits of formal child care may extend well beyond school readiness and parental participation in the workforce, including a reduction in high school drop-out rates for boys, for long-term socioeconomic gain.

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ABBREVIATIONS
AIC: Akaike information criterion  
BIC: Bayesian information criterion  
CI: confidence interval  
IPTW: inverse probability of treatment weighting  
OR: odds ratio  
QLSKC: Quebec Longitudinal Study of Kindergarten Children

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