Long-term Cognitive and Health Outcomes of School-Aged Children Who Were Born Late-Term vs Full-Term

David N. Figlio, PhD; Jonathan Guryan, PhD; Krzysztof Karbownik, PhD; Jeffrey Roth, PhD

**IMPORTANCE** Late-term gestation (defined as the 41st week of pregnancy) is associated with increased risk of perinatal health complications. It is not known to what extent late-term gestation is associated with long-term cognitive and physical outcomes. Information about long-term outcomes may influence physician and patient decisions regarding optimal pregnancy length.

**OBJECTIVE** To compare the cognitive and physical outcomes of school-aged children who were born full term or late term.

**DESIGN, SETTING, AND PARTICIPANTS** We analyzed Florida birth certificates from 1994 to 2002 linked to Florida public school records from 1998 to 2013 and found 1,442,590 singleton births with 37 to 41 weeks' gestation in the Florida Bureau of Vital Statistics. Of these, 1,153,716 children (80.0%) were subsequently located in Florida public schools. Linear and logistic regression models were used to assess the association of gestational age with cognitive and physical outcomes at school age. Data analysis took place between April 2013 and January 2016.

**EXPOSURES** Late-term (born at 41 weeks) vs full-term (born at 39 or 40 weeks) gestation.

**MAIN OUTCOMES AND MEASURES** There were a number of measures used, including the average Florida Comprehensive Assessment Test mathematics and reading scores at ages 8 through 15 years; whether a child was classified as gifted, defined as a student with superior intellectual development and capable of high performance; poor cognitive outcome, defined as a child scoring in the fifth percentile of test takers or having a disability that exempted him or her from taking the Florida Comprehensive Assessment Test; and Exceptional Student Education placement owing to orthopedic, speech, or sensory impairment or being hospitalbound or homebound.

**RESULTS** Of 1,536,482 children born in Florida from singleton births from 1994 to 2002 with complete demographic information, 787,105 (51.2%) were male; 338,894 (22.1%) of mothers were black and 999,684 (65.1%) were married at time of birth, and the mean (SD) age for mothers at time of birth was 27.2 (6.2) years. Late-term infants had 0.7% of an SD (95% CI, 0.001-0.013; \( P = .02 \)) higher average test scores in elementary and middle school, 2.8% (95% CI, 0.4-5.2; \( P = .02 \)) higher probability of being gifted, and 3.1% (95% CI, 0.0-6.1; \( P = .05 \)) reduced probability of poor cognitive outcomes compared with full-term infants. These cognitive benefits appeared strongest for children with disadvantaged family background characteristics. Late-term infants were also 2.1% (95% CI, −0.3 to 4.5; \( P = .08 \)) more likely to be physically impaired.

**CONCLUSIONS AND RELEVANCE** There appears to be a tradeoff between cognitive and physical outcomes associated with late-term gestation. Children born late-term performed better on 3 measures of school-based cognitive functioning but worse on 1 measure of physical functioning relative to children born full term. Our findings provide longer-run information for expectant parents and physicians who are considering delivery at full term vs late term. These findings are most relevant to uncomplicated, low-risk pregnancies.
Considerable evidence has accumulated suggesting that full-term infants (born at 39 or 40 weeks’ gestation) have better health and cognitive outcomes in childhood and into adulthood than early-term infants (born at 37 or 38 weeks’ gestation), though many articles are limited by missing data. This evidence was the basis for the 1999 recommendation of the American College of Obstetricians and Gynecologists (ACOG) against elective induction before 39 weeks of gestation and the subsequent 2013 recommendation of the ACOG Defining “Term” Pregnancy Workgroup. Because term infants after 40 weeks face elevated risks (especially delivery and respiratory complications), the ACOG workgroup cited a U-shaped association between weeks of gestation and probability of risk, with optimal birth outcomes at 39 and 40 weeks, and recommended that the 41st week of gestation be labeled late term.

Current standards of care have been based primarily on outcomes observed immediately after birth. This U-shaped gestational age-risk probability association noted in birth outcomes may not capture trajectories seen later in life and adulthood. Specifically, there is reason to believe that cognitive outcomes continue to improve with increased gestation beyond full term. Because fetal maturation continues between full term and late term (for example, birth weight increases by an average of 106 g between full term and late term) and is associated with higher test scores, educational attainment, and wages, also P Bharadwaj, PhD, J Eberhard, PhD, C Neilson, PhD, unpublished data, 2013), children born late term may subsequently demonstrate higher cognitive functioning, even if they initially face greater risks of health complications during the perinatal period. Indeed, recent evidence indicates that late-term gestation is associated with mental and psychomotor development at 3, 6, and 12 months. In addition, social scientists have established that effects not seen on average may still be present in the extremes of the distribution; therefore, increased gestation could have particularly strong effects on the likelihood that a child will be intellectually gifted or, alternatively, cognitively impaired. We therefore hypothesized that late-term infants may have worse perinatal outcomes but may exhibit better cognitive outcomes later in childhood. We also investigated whether worse physical health observed at birth persisted later in childhood.

Data

Our study sample was composed of all singleton children born in Florida between 1994 and 2002 and educated in Florida public schools. After rigorous review of Family Educational Rights and Privacy Act and Health Insurance Portability and Accountability Act regulations, as well as institutional review board approval from Northwestern University, the University of Florida, and Florida’s education and health agencies, the Florida agencies matched children by first and last names, date of birth, and Social Security number. Informed consent was waived because data were deidentified for analysis. Common variables excluded from the match were used as checks of match quality.

Between 1994 and 2002, 1442590 singleton births with gestations between 37 and 41 weeks were recorded by the Florida Bureau of Vital Statistics. Of these children, 1153716 (80.0%) were subsequently located in Florida public school student records maintained in the Florida Department of Education Education Data Warehouse and matched. Children were...
matched if they were born in Florida, remained in the state until school age, attended a Florida public school, and had school records indicating their performance on the FCAT and their Exceptional Student Education classification. Our calculations from the American Community Survey, a 1% representative sample of the US population, indicated that 80.9% of 5-year-olds born in Florida remained in Florida and attended public school.30 Because this match rate is nearly identical to the 80.0% rate at which school records were matched to data from the Florida Bureau of Vital Statistics, we concluded that virtually all potentially matchable children were matched. Among matched children, 963,368 of 1,153,716 (83.5%) had math and reading scores on the FCAT, 171,903 (14.9%) left Florida public schools before the first tested grade, and 18,445 (1.6%) were ineligible to take the FCAT, missed the test for some other unspecified reason, or had not yet reached the third grade by the 2012-2013 school year. We matched 320,559 of 398,559 (80.4%) of early-term infants, 716,085 of 896,301 (79.9%) of full-term infants, and 117,072 of 147,690 (79.3%) of late-term infants.

Differences in covariates between the Florida population of births and those matched to Florida public school records are reported in Table 1. Compared with the overall population of children born in Florida, children observed in Florida public schools were more likely to be black (25.1% vs 22.1%), have younger mothers (13.5% vs 12.0%) with lower education levels (22.4% below high school education vs 20.0%), and have unmarried mothers (38.9% vs 34.9%).

Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Florida-Born Children (N = 1,536,482)</td>
</tr>
<tr>
<td></td>
<td>Matched Sample</td>
</tr>
<tr>
<td></td>
<td>All Gestation Lengths (n = 1,009,006)</td>
</tr>
<tr>
<td></td>
<td>Early Term (n = 255,056)</td>
</tr>
<tr>
<td></td>
<td>Full Term (n = 566,292)</td>
</tr>
<tr>
<td></td>
<td>Late Term (n = 91,438)</td>
</tr>
<tr>
<td>Gestation length categories</td>
<td></td>
</tr>
<tr>
<td>Early term</td>
<td>385,589 (25.1)</td>
</tr>
<tr>
<td>Full term</td>
<td>864,246 (56.2)</td>
</tr>
<tr>
<td>Late term</td>
<td>142,189 (9.3)</td>
</tr>
<tr>
<td>Not a term birth</td>
<td>144,458 (9.4)</td>
</tr>
<tr>
<td>Outcome variables</td>
<td></td>
</tr>
<tr>
<td>Average test scores, z score</td>
<td>0.000</td>
</tr>
<tr>
<td>Gifted status</td>
<td>97,105 (9.6)</td>
</tr>
<tr>
<td>Poor cognitive outcomes</td>
<td>50,451 (5.0)</td>
</tr>
<tr>
<td>Abnormal conditions at birth</td>
<td>84,513 (5.5)</td>
</tr>
<tr>
<td>Physical disability</td>
<td>102,310 (10.1)</td>
</tr>
<tr>
<td>Control variables</td>
<td></td>
</tr>
<tr>
<td>Maternal characteristics</td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>338,894 (22.1)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>368,343 (24.0)</td>
</tr>
<tr>
<td>Immigrant</td>
<td>370,799 (24.1)</td>
</tr>
<tr>
<td>Married at time of birth</td>
<td>999,684 (65.1)</td>
</tr>
<tr>
<td>Education status</td>
<td></td>
</tr>
<tr>
<td>Did not complete high school</td>
<td>307,297 (20.0)</td>
</tr>
<tr>
<td>Completed high school or attended college</td>
<td>1,229,185 (80.0)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>184,637 (12.0)</td>
</tr>
<tr>
<td>20-35</td>
<td>1,196,110 (77.8)</td>
</tr>
<tr>
<td>&gt;35</td>
<td>155,735 (10.1)</td>
</tr>
<tr>
<td>Infant female sex</td>
<td>749,377 (48.8)</td>
</tr>
</tbody>
</table>

Abbreviation: NA, not applicable.

* Includes singleton births from 1994 to 2002 with complete demographic information and known zip code of residence at birth.

Methods

We examined 3 cognitive outcome variables: (1) average FCAT score at ages 8 through 15 years, standardized at the grade and year level for the entire population and matched to school records to have a mean (SD) of 0 (1) to facilitate interpretation of effect sizes; (2) whether a child was classified as gifted, defined by the Florida Department of Education as “one who has superior intellectual development and is capable of high
performance\textsuperscript{31}; and (3) whether a child had a poor cognitive outcome, defined as either scoring within the lowest 5% of performers in the state or having a disability that prevented the child from taking the FCAT. These latter 2 variables, representing high or low cognitive outcomes, were expressed in terms of probability. We also examined 2 physical outcomes: (1) whether abnormal conditions of the newborn were observed in the birth record (most commonly, assisted ventilation, meconium aspiration syndrome, and respiratory distress), and (2) whether physical disabilities (an orthopedic, sensory, or cognitive impairment) were observed in the student’s record. These variables were also expressed in terms of probability.

We used linear and logistic regression methods with gestational age categorical variables to assess the association between the 3 gestational age groups (early term, full term, and late term) and the 5 outcome variables. We set the mean value of each outcome to 0 for the full-term infant group so that the results represented differences relative to a full-term reference group. Because family background characteristics influence gestational age, we controlled for maternal race/ethnicity, age at birth, educational level, neighborhood income level via zip code at time of birth, marital and immigration statuses, and number of previous births as well as child’s sex and birth month and year to disentangle the effects of gestational age from socioeconomic conditions. Thus, the estimates of the association between gestational age and the 5 outcomes are independent of observed family background characteristics. We further stratified by maternal education to gauge differences in associations by 1 measure of socioeconomic status. All analyses were performed using Stata version 12 (StataCorp).\textsuperscript{32}

Results

Gestational Age Groups

Table 2 displays the association between gestational age and test scores, gifted status, and poor cognitive outcomes, as well as abnormal conditions recorded on the birth records and physical disabilities in school. Late-term infants outperformed full-term infants along all 3 cognitive dimensions. Late-term infants scored 0.7% of a standard deviation (95% CI, 0.001-0.013; \( P = .02 \)) higher on standardized tests than did full-term infants and were 2.8% more likely to be gifted (95% CI, 0.4-5.2; \( P = .02 \)) and 3.1% less likely to have poor cognitive outcomes (95% CI, 0.0-6.1; \( P = .05 \)) relative to full-term infants. While modest in magnitude, these differences are not trivial; all cognitive differences between late-term and full-term infants were about one-half the difference observed between full-term and early-term infants (2.1% higher rate of physical disability vs 6.7%).

High cognitive outcomes and physical disabilities frequently overlapped. There was no difference between children with and without physical disabilities in the probability of high test scores, although children with physical disabilities tended to have a higher rate of very low test scores.

Potential Biases Due to Gestational Age Mismeasurement

One might be concerned that these results are due to mismeasurement of gestational age. There exists considerable evidence that gestational age is often mismeasured.\textsuperscript{33-35} We have no way of knowing precisely what factors clinicians used when determining the clinical estimate of gestational age that appears on the birth certificates, but we conducted sensitivity analyses to identify 2 groups of families where we expected measurement to be better. First, we limited the analysis to the 94.5% of mothers who spoke English or Spanish at home according to school records (Table 2). We believe that these individuals were more likely to have fewer language barriers when interacting with clinicians. Second, we limited the analysis to the 83.7% of pregnancies in which prenatal care began in the first trimester, as we suspected that gestation was more likely to be correctly dated when prenatal care began early (Table 2). In both cases, the cognitive advantage for late-term gestations is stronger than those observed in the overall population, suggesting that mismeasurement of gestational age biases the estimated cognitive advantage for late-term gestation toward 0.

Potential Biases Due to Selection

One might also be concerned that there is selection into gestational age groups for some groups of pregnancies that are expectedly managed. Table 2 excludes observations with a high degree of pregnancy risk,\textsuperscript{36} specifically children with congenital anomalies (most commonly, cleft lip or palate; polydactyly, syndactyly, or adactyly heart malformations; clubfoot; and Down syndrome) regardless of whether there were recorded maternal health or previous pregnancy problems. Table 2 additionally excludes observations in which the mother was older than 35 years and those in which there was an observed labor or delivery complication (most commonly, moderate or heavy meconium, breech or malpresentation, and fetal distress), which often led to planned deliveries. While estimates vary across specification for abnormal conditions and physical disabilities, they remain very stable with regard to the 3 cognitive outcomes.

Table 2 presents results from the subset (41.6%) of cases in which all of the selection conditions were met (ie, pregnancies in which mismeasurement was lower because prenatal care commenced in the first trimester and because the mother spoke English or Spanish and in which selection was less likely to be an issue because none of the risk factors considered were present). We continue to find that children born late term have higher test scores and higher rates of being labeled gifted as well as higher rates of physical disability than children born full term. The estimated reduction in poor cognitive outcomes is no longer statistically significant at conventional levels.
Long-term Cognitive and Health Outcomes of Late-Term Infants

Table 2. Associations Between Early-Term or Late-Term Gestation and Cognitive and Physical Outcomes*

<table>
<thead>
<tr>
<th>Gestational Age Group</th>
<th>Test Scores, Coefficient Estimate (95% CIs)*</th>
<th>Odds Ratio (95% CIs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gifted</td>
<td>Poor Cognitive</td>
</tr>
<tr>
<td>All children, No.</td>
<td>912 786</td>
<td>947 486</td>
</tr>
<tr>
<td>Early term</td>
<td>-0.015 (0.019 to -0.011)</td>
<td>0.955 (0.939 to 0.970)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.007 (0.001 to 0.013)</td>
<td>1.028 (1.004 to 1.052)</td>
</tr>
<tr>
<td>Only those with English- and Spanish-speaking mothers, No.</td>
<td>862 449</td>
<td>893 821</td>
</tr>
<tr>
<td>Early term</td>
<td>-0.014 (-0.019 to -0.010)</td>
<td>0.953 (0.937 to 0.969)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.008 (0.002 to 0.014)</td>
<td>1.035 (1.010 to 1.060)</td>
</tr>
<tr>
<td>Excluding children with congenital anomalies or maternal health problems, No.</td>
<td>699 089</td>
<td>725 066</td>
</tr>
<tr>
<td>Early term</td>
<td>-0.009 (-0.013 to -0.004)</td>
<td>0.971 (0.953 to 0.989)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.008 (0.001 to 0.015)</td>
<td>1.030 (1.003 to 1.057)</td>
</tr>
<tr>
<td>Excluding children with congenital anomalies or maternal health problems, complications with labor or delivery, and mothers ≥35, No.</td>
<td>477 671</td>
<td>495 119</td>
</tr>
<tr>
<td>Early term</td>
<td>-0.008 (-0.014 to -0.003)</td>
<td>0.973 (0.950 to 0.995)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.003 (0.002 to 0.019)</td>
<td>1.037 (1.009 to 1.079)</td>
</tr>
<tr>
<td>Excluding children with congenital anomalies or maternal health problems, complications with labor and delivery, and mothers ≥35; maintaining only those who began prenatal care in first trimester and who speak English or Spanish, No.</td>
<td>379 450</td>
<td>392 303</td>
</tr>
<tr>
<td>Early term</td>
<td>-0.008 (-0.015 to -0.002)</td>
<td>0.971 (0.947 to 0.996)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.012 (0.002 to 0.021)</td>
<td>1.061 (1.024 to 1.100)</td>
</tr>
</tbody>
</table>

* All regressions control for infant sex, maternal race/ethnicity, maternal marital and immigration statuses, month and year of birth, 4 maternal age group variables (≤19, 20-29, 30-35, and ≥35 years), 3 maternal education group variables (<high school, high school, and >high school), 3 neighborhood income levels at birth variables, and birth order.

Coefficients are relative to full-term gestation. Standard errors used to calculate 95% CIs are corrected for heteroscedasticity.

because of the higher standard errors (4% lower; \( P = .12 \)), and the estimated increase in abnormal conditions seen in the full population is not observed in this “cleanest” subset (0.5% higher; \( P = .90 \)).

Heterogeneity by Family Background

We investigated the degree to which the different gestational age results in childhood cognition and health were similar across maternal education groups. Table 3 stratifies the data by maternal education groups and by pregnancies in which prenatal care started in the first trimester, when gestational dating is more likely to be accurate. Both the estimated cognitive gains as well as the estimated physical disabilities associated with late-term gestation were particularly pronounced for children of less-educated mothers (ie, did not complete high school) relative to highly educated mothers (ie, graduated from high school or college).

In summary, these findings suggest there may be a tradeoff between physical and cognitive outcomes associated with late-term gestation. While late-term gestation was associated with an increase in the rate of abnormal conditions at birth and with worse physical outcomes during childhood, it was also associated with better performance on all 3 measures of school-based cognitive functioning measures during childhood. Differences in outcomes between full-term and late-term infants appeared greater for low-education vs high-education families. These pat-


terms of findings are present in cases in which we restrict analysis to low-risk, uncomplicated pregnancies (and less chance of selection into gestational age group) and to pregnancies in which gestational age is less likely to be misclassified.

Discussion

The present study has several limitations. While we controlled for a wide range of covariates to reduce the risk of selection bias and performed sensitivity analyses on the subset of the population that had low-risk and uncomplicated pregnancies, which are less likely to have planned deliveries, it is possible that our results may not accurately represent the study population. It may be the case that families with some unmeasured advantage were more likely to continue their pregnancies to late term and that the findings reported herein reflect this unmeasured characteristic of advantaged families. We also do not know which births were induced or performed with scheduled cesarean sections. In addition, while we attempted in several ways to identify pregnancies in which gestational age was more likely to be correctly measured, our results may be driven in part by mismeasurement of gestational age. For instance, if clinical estimates of gestation were based on ultrasound estimates, then these estimates could in part be a proxy for measures of infant size. An ideal study would be able to make use of hospital- or other institution-specific practice differences to have an exogenous source of variation to ascertain the causal consequences of gestation and more precise measurement of conception dates. However, we know of no data that can provide these ideal features at present.

There are other possible selection issues that we cannot directly address with the matched health-education data. First, children who died prematurely could not be included into the matched dataset. However, we observed from linked birth and infant death data from the Centers for Disease Control and Prevention for Florida births between 1995 and 2002 that while early-term infants were more likely to die as a neonate or in infancy than full-term infants, there was no observed difference between late-term and full-term infants (and in fact, late-term infants are slightly less likely to die in infancy). Second, it is possible that our results could be affected by differential rates of antepartum stillbirth. However, we do not have access to data that allow us to determine the extent, if any, of this potential bias.

Conclusions

Our findings that cognitive and physical outcomes are better for full-term infants than early-term infants provide further confirmation of the recommendation by ACOG and other groups to avoid scheduling elective, nonmedically indicated inductions of labor before 39 weeks' gestation, using more thorough and complete data than have generally been available in the extant literature. Our linkage of birth data to school records suggests that there may be a previously undocumented benefit to continuing pregnancy beyond 40 weeks, especially in the case of poorly educated mothers. We are com-

<table>
<thead>
<tr>
<th>Gestational Age Group</th>
<th>Test Scores, Coefficient Estimate (95% CIs)*</th>
<th>Odds Ratio (95% CIs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gifted</td>
<td>Poor Cognitive Outcome</td>
</tr>
<tr>
<td>High school dropouts, No.</td>
<td>200 917</td>
<td>208 881</td>
</tr>
<tr>
<td>Early term</td>
<td>−0.014 (-0.023 to -0.005)</td>
<td>0.974 (0.920 to 1.031)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.010 (-0.003 to 0.022)</td>
<td>1.074 (0.995 to 1.160)</td>
</tr>
<tr>
<td>High school or college graduate, No.</td>
<td>711 869</td>
<td>738 605</td>
</tr>
<tr>
<td>Early term</td>
<td>−0.018 (-0.023 to -0.014)</td>
<td>0.947 (0.931 to 0.963)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.005 (-0.002 to 0.012)</td>
<td>1.019 (0.994 to 1.044)</td>
</tr>
<tr>
<td>High school dropouts; prenatal care started in first trimester, No.</td>
<td>138 788</td>
<td>144 259</td>
</tr>
<tr>
<td>Early term</td>
<td>−0.013 (-0.024 to -0.003)</td>
<td>0.975 (0.912 to 1.042)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.012 (-0.003 to 0.028)</td>
<td>1.078 (0.985 to 1.180)</td>
</tr>
<tr>
<td>High school or college graduate; prenatal care started in first trimester, No.</td>
<td>625 469</td>
<td>648 579</td>
</tr>
<tr>
<td>Early term</td>
<td>−0.018 (-0.023 to -0.013)</td>
<td>0.947 (0.930 to 0.964)</td>
</tr>
<tr>
<td>Late term</td>
<td>0.006 (-0.002 to 0.014)</td>
<td>1.027 (1.001 to 1.053)</td>
</tr>
</tbody>
</table>

*All regressions control for infant sex, maternal race/ethnicity, maternal marital and immigration statuses, month and year of birth, 4 maternal age-group variables (<19, 20-29, 30-35, and >35 years), 3 neighborhood income levels at birth variables, and birth order.

*Coefficients are relative to full-term gestation. Standard errors used to calculate 95% CIs are corrected for heteroscedasticity.
paratively confident that our findings pertain primarily to uncomplicated, low-risk pregnancies, which are less likely to have planned deliveries. While this article does not constitute a course of action for clinicians, our findings provide useful long-term information to complement the extant short-term data for expectant parents and physicians who are considering whether to induce delivery at full term or wait another week until late term.

**ARTICLE INFORMATION**

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**Author Contributions:** Dr Figlio had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.  

**Study concept and design:** Figlio, Guryan, Karbownik.  

**Acquisition, analysis, or interpretation of data:** All authors.  

**Drafting of the manuscript:** All authors.  

**Critical revision of the manuscript for important intellectual content:** All authors.  

**Statistical analysis:** Figlio, Guryan, Karbownik.  

**Obtained funding:** Figlio.  

**Administrative, technical, or material support:** Figlio, Roth.  

**Study supervision:** Figlio.  

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**REFERENCES**


