

Population Fetal Death Rates Predict Temperamental Characteristic and Behavior Problems

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Factors Influencing Temperamental Expression

- Temperamental characteristics have a sizeable heritability
 - From 10% to 50% of variance
- These characteristics are assumed to be influenced in their expression by environments created by caretakers (parents, teachers) or the social actors (siblings, peers)
- Still, 30% to 80% of variance remains unexplained



Prenatal Environment

- The prenatal environment has been given relatively little attention in temperament research
- A few prenatal perturbations have been studied (e.g., fetal alcohol syndrome, maternal cocaine use, fetal mercury exposure, maternal stress), and connections to temperament-like child behavior have been found (e.g., irritability, stress proneness, attention)



The Season-of-Birth Model

Annually Occurring Perturbations

Viral Infection (W)

Air Pollution (W)

Indoor Pollutants (W) →

Agricultural Chemical
Runoff (Sp)

Vitamin D Deficiency (W)

Maternal Seasonal
Affective Disorder (W)

Pregnancy Anomalies

Low Apgar Scores

Low Birth Weight

Premature Delivery

Fetal Death

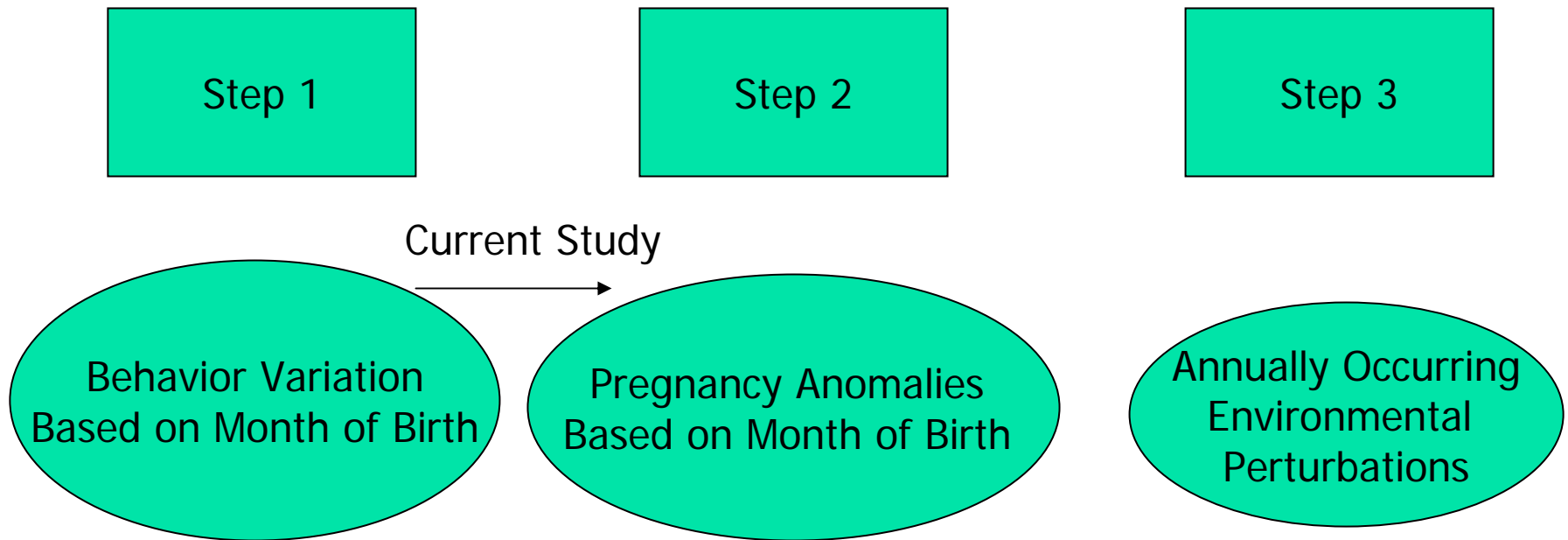
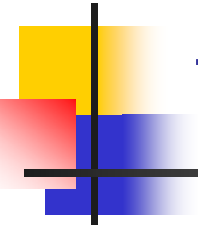
Child Behavior

Cognitively-Linked
Behavior

→ Temperament

Behavior Problems

Research Model—From Behavior to Prenatal Perturbation





Some Support for Step 1

- Adults
 - Schizophrenia (250 studies)
 - Affective Disorders (10 studies)
 - Neurological Disease (e.g., epilepsy) (20)
 - Normal Temperament or Personality (10)
- Children
 - Autism (15 studies)
 - Learning Disabilities (20)
 - Normal Temp. or Personality (1)



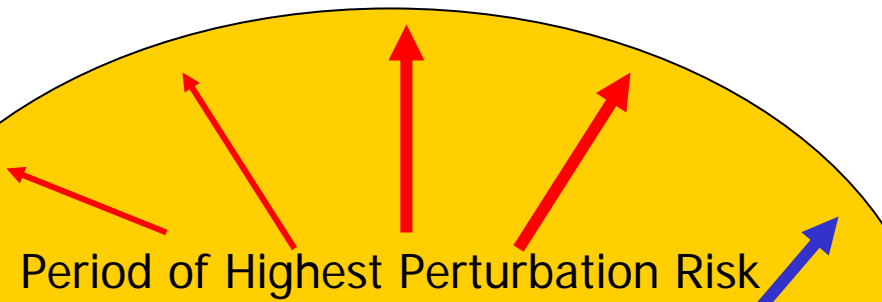
Problems of Literature

- Inconsistent literature on monthly birth patterns as related to behavior or diagnoses, particularly in children
- Very few studies connecting monthly or seasonal mediated behavioral traits or pathologies to birth anomalies, particularly for children
- Very few studies connecting monthly or seasonal mediated behavioral traits or path. to environmental risk factors, particularly for children



Summary of Interpretations of Extant Literature

January



October

April

Period of Risky Birth

A yellow oval contains six blue arrows pointing away from the bottom edge. The arrows are positioned at approximately the 8, 6, 4, 2, 1, and 3 o'clock positions, all diverging from the bottom center of the oval.

July



Current Study

- Determine if there are month-of-birth effects on extreme temperament and behavior problems
- Determine if extreme temperament and behavior problems have same birth patterns
- Determine if extreme temperament and behavior problems are related to periods of fetal death in the population (a marker for prenatal perturbation)



Sample

- Antonio Fonseca began a longitudinal data collection in early 1990's of children in 2nd grade and 4th grade born born 1981-1985
- Sample: $n = 797$ (boys = 417, girls = 380)
- Lived in central region of Portugal



Sample Demographics

- Education of Father
 - 1-4th grade education 37%
 - 5-10th grade " 37%
 - 11-12th grade " 6%
 - More than high school 9%
 - Missing data 19%



Data

- Teacher Report Form – Achenbach CBCL-2nd and 4th grade
- Martin selected items that were represented of temperament
 - Negative Emotionality (5 items, alpha .74)
 - Attention (2 items; alpha .84)
 - Impulsivity (4 items; alpha .80)
 - Sensitivity to Cues of Punishment (7 items, .67)
 - Withdrawal (3 items, .60)



Data: 2

- Pregnancy complication data
 - Obtained from Portuguese equivalent of the Bureau of Vital Statistics in U.S.
 - Monthly number of births for the five years (1981-1985)
 - Monthly number of fetal deaths (1981-1985)



Data Analyses

- Calculated number of children with high temperament scores (top 30%) separately by gender, by month of birth
- Calculated rate of fetal deaths in the population by month
- Utilized graphic presentation

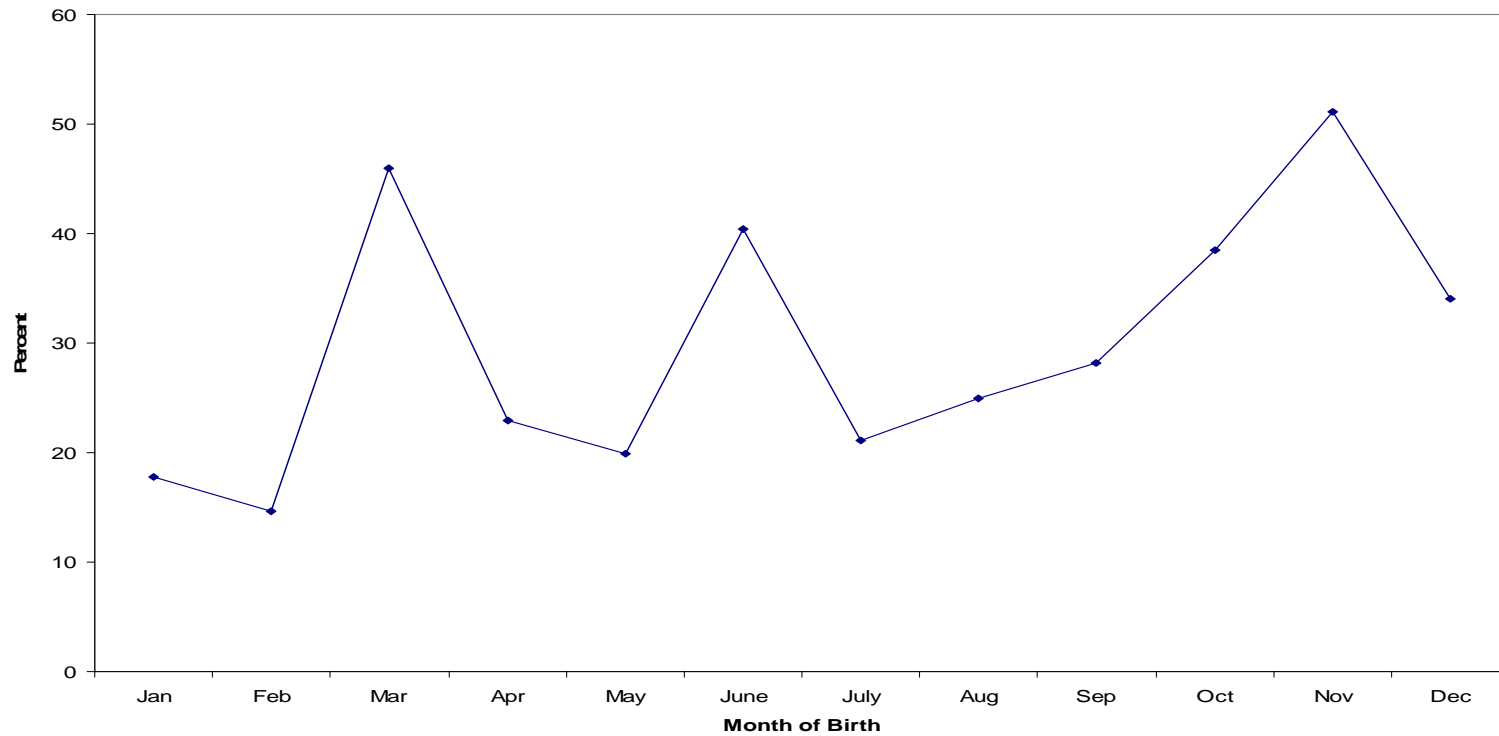


Question 1:

- Is there an association between month of birth and the temperamental characteristics of
 - Negative Emotionality
 - Attention
 - Sensitivity to Cues of Punishment
 - Impulsivity
 - Withdrawal

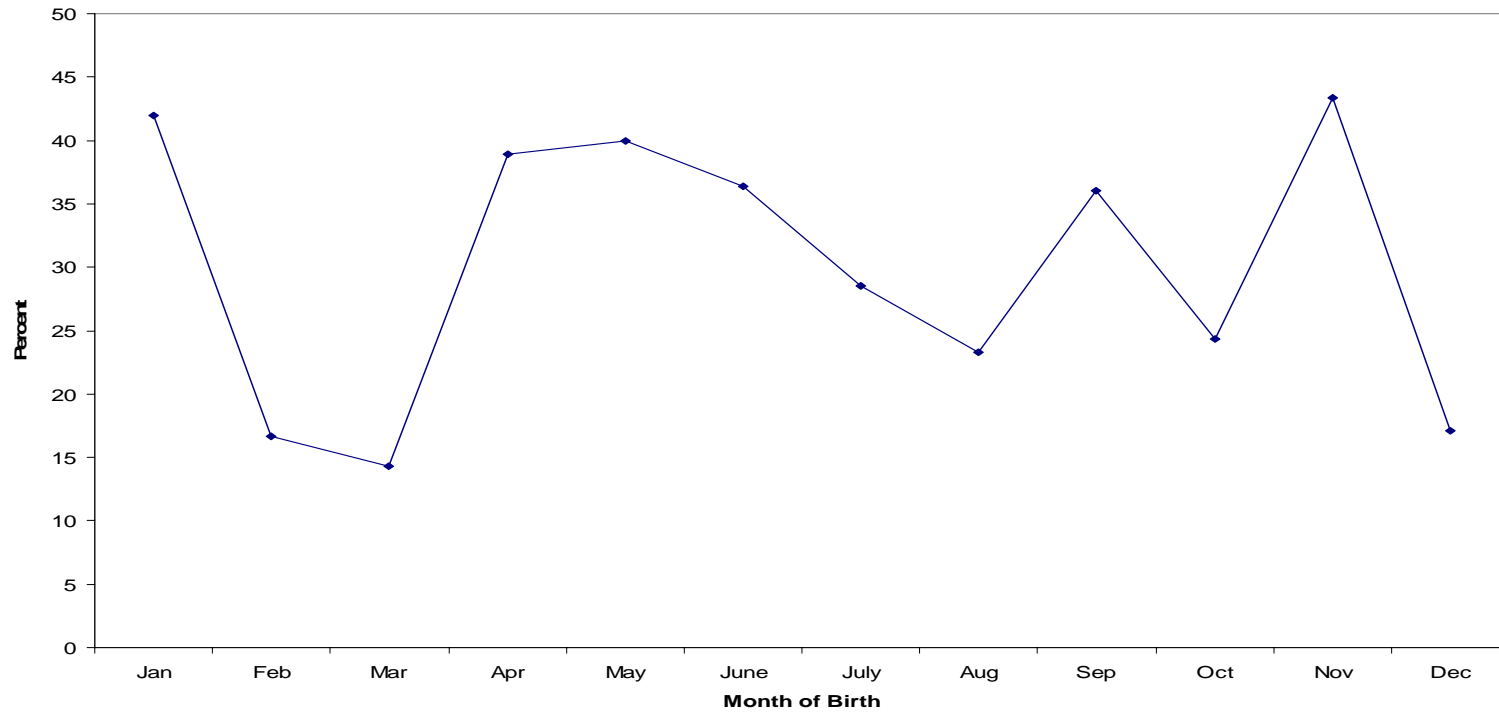
Male: Negative Emotionality

Percent of Male Students Born Each Month Who Have High (30%) Teacher-Rated Negative Emotionality Scores: Portugal, 1981-1985



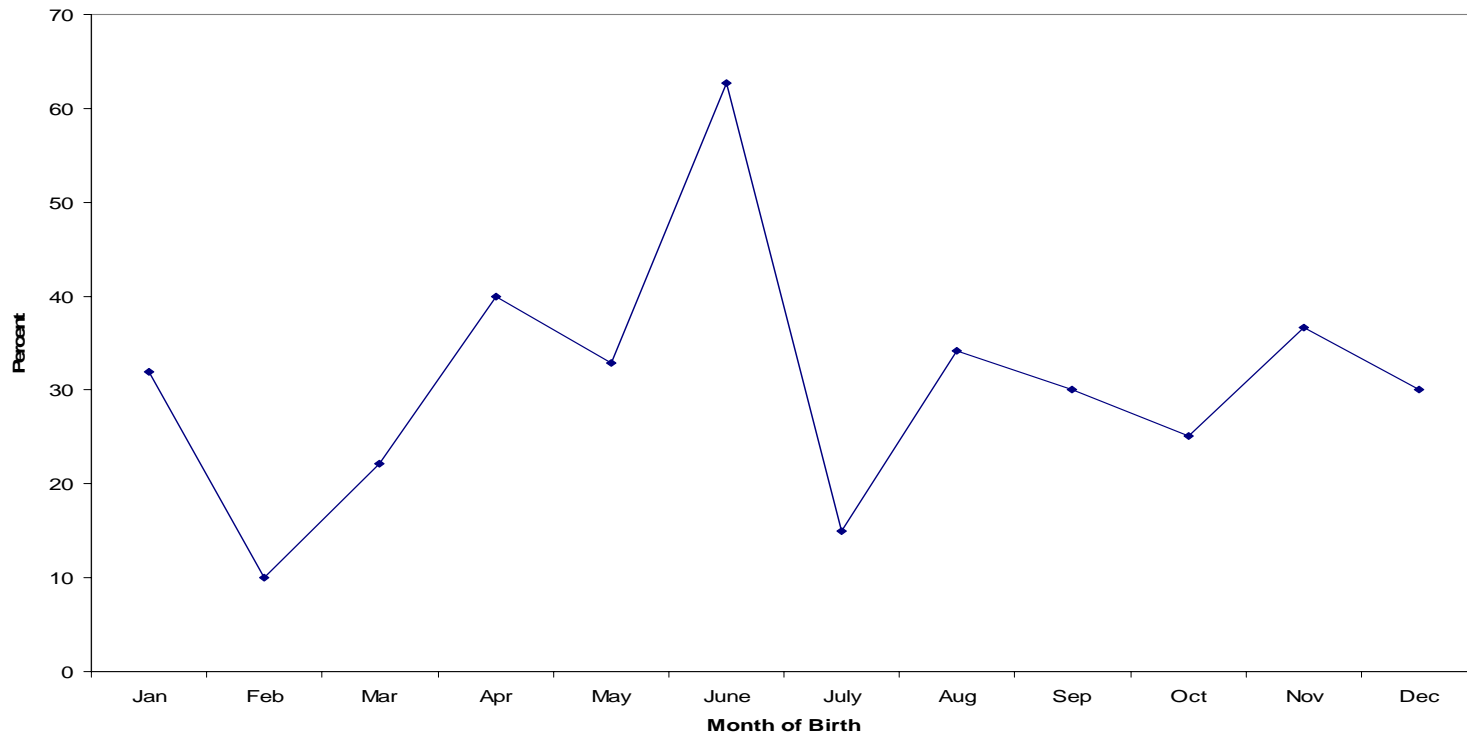
Female: Negative Emotionality

Percentage of Female Students Born Each Month With High (Top 30%) Teacher-Rated Negative Emotionality Scores:
Portugal, 1981-1985



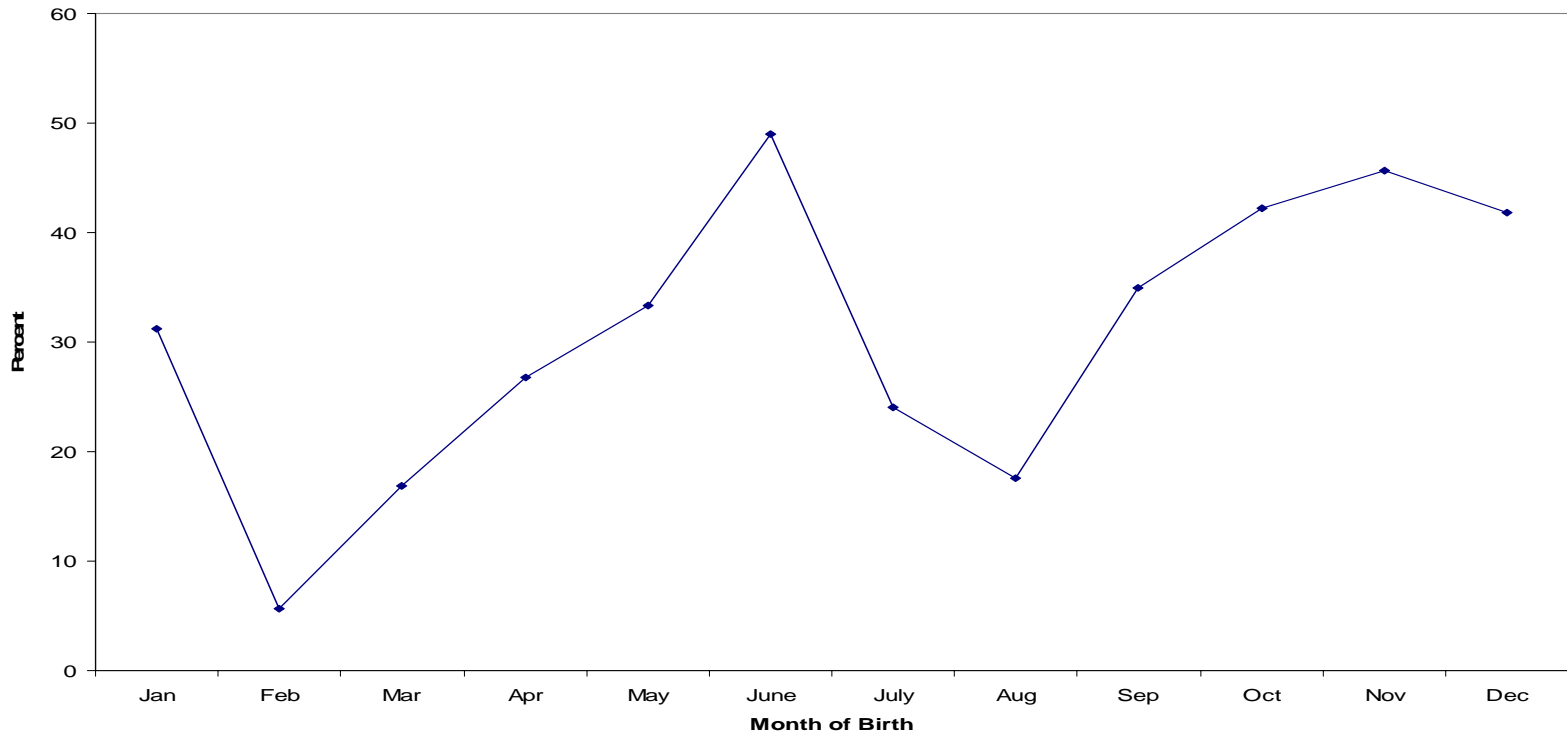
Female: Withdrawal

Percentage of Female Students Born Each Month With High (Top 30%) Temperamental Withdrawal Scores: Portugal, 1981-1985



Female: Sensitivity to Cues of Punishment

Percent of Female Students Born Each Month With High (Top 30%) Scores on Teacher-Rated Sensitivity to Cues of Punishment: Portugal, 1981-1985





Summary: Temperament Is Associated With Month-of-Birth

- Males
 - Negative Emotionality (**March, June**, Nov)
- Females
 - Negative Emotionality (January, **April- June**, Sept., Nov.)
 - Withdrawal (**June**)
 - Sensitivity to Cues of Punishment (**June**, Oct-Dec)

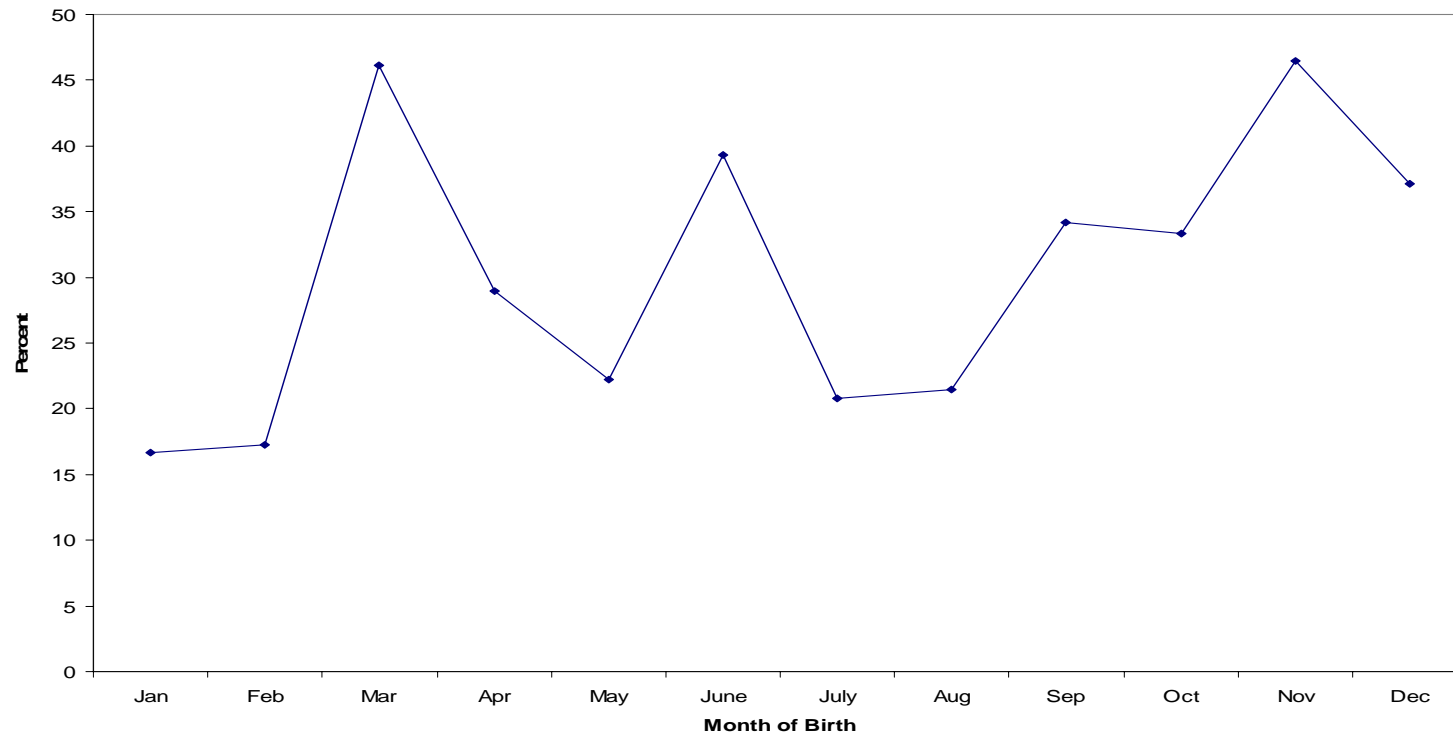


Question 2:

- Is there an association between month of birth and behavior problems as measured by the CBCL-TRF?

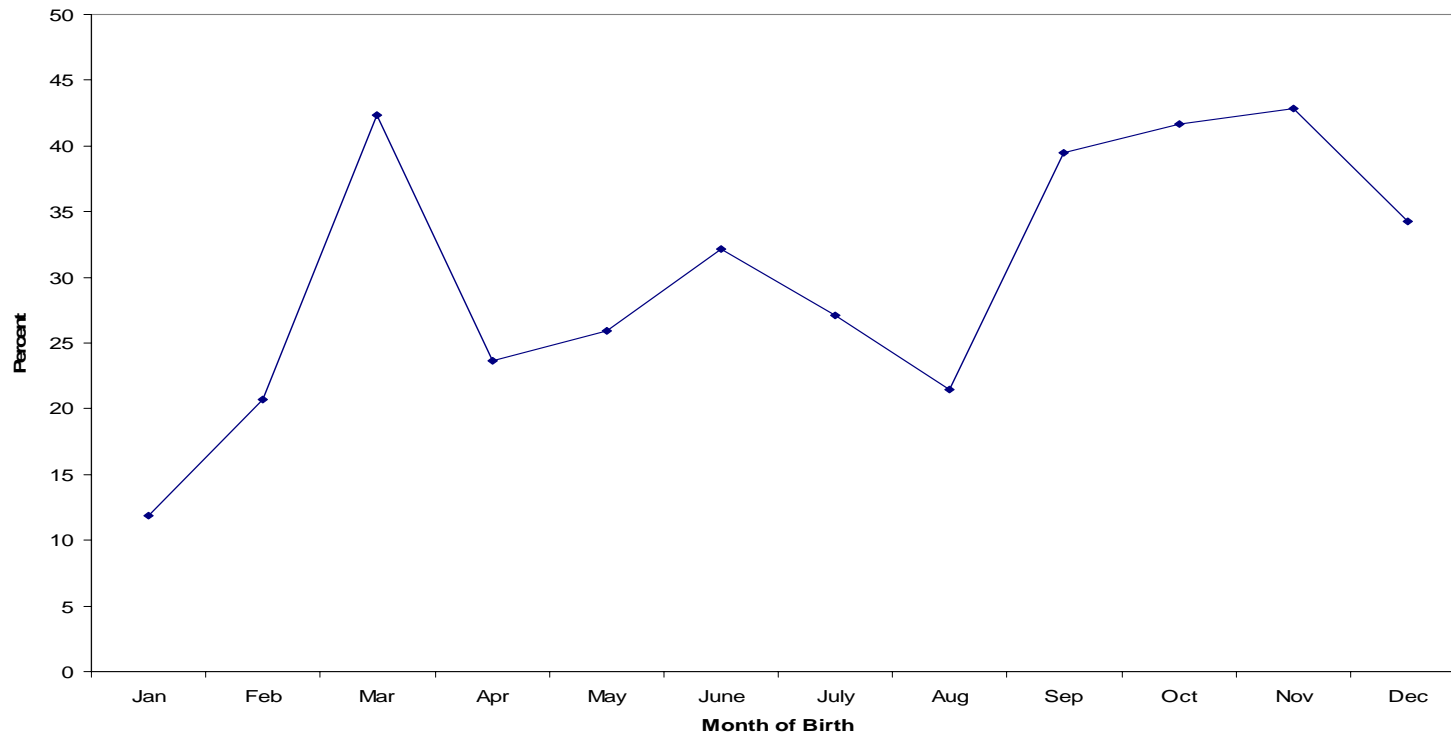
Male: Total CBCL Behavior Problem Score

Percent of Male Students Born Each Month With High (Top 30%) Teacher-Rated Behavior Problem Scores: Portugal, 1981-1985



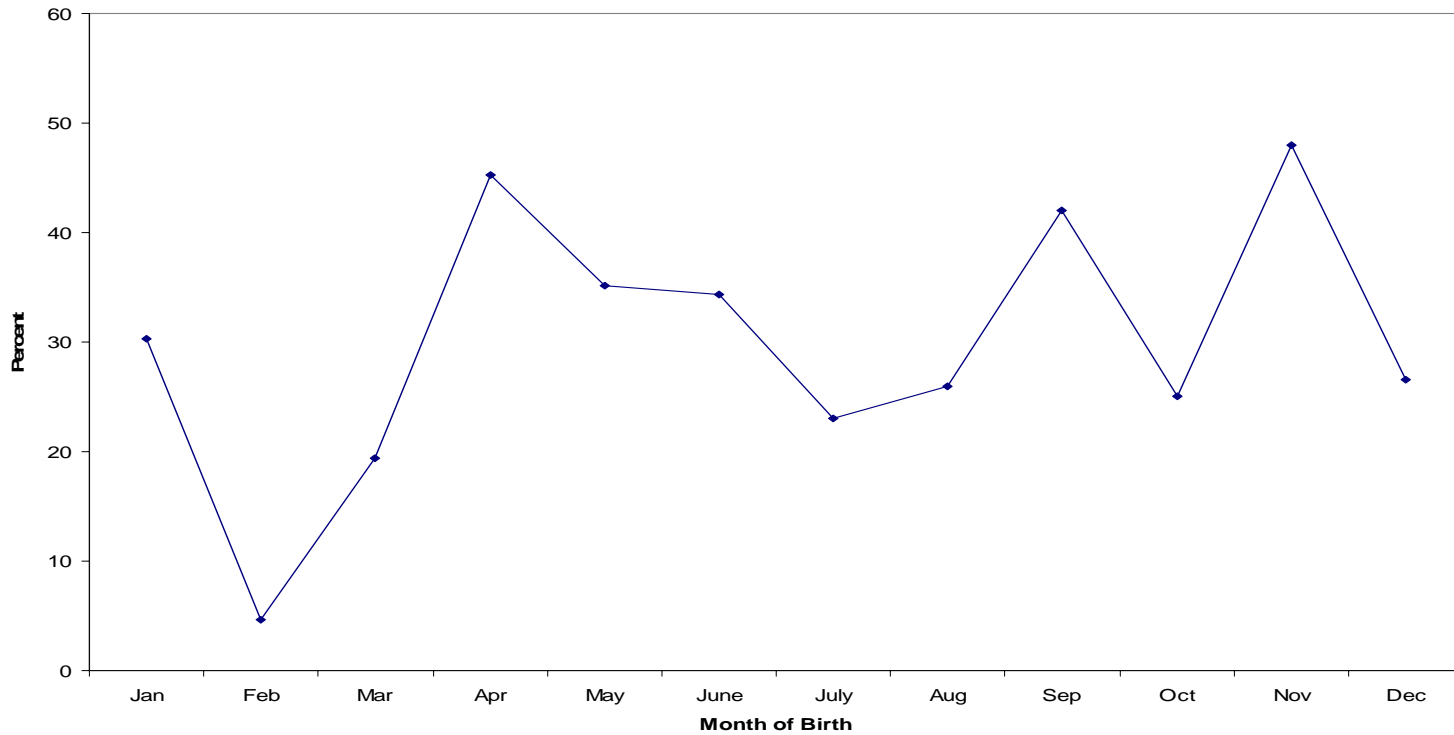
Male: Attention Problems

Percent of Male Students Born Each Month With High (Top 30%) Teacher Rated Attention Problem Scores: Portugal, 1981-1985



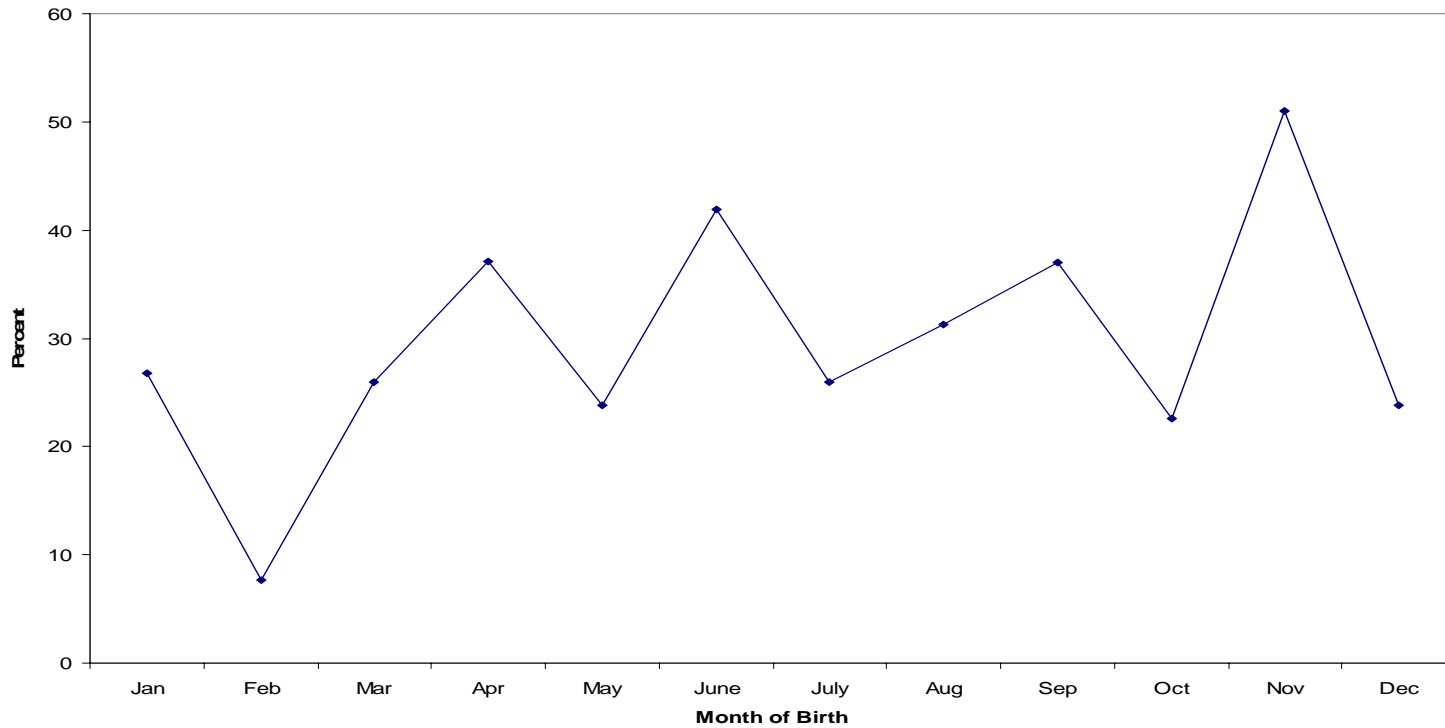
Female: Total Behavior Problem Scores: CBCL-TRF

Percent of Female Students Born Each Month With High (Top 30%) Teacher-Rated Total Behavior Problem Score: Portugal, 1981-1985



Female: Social Problems-CBCL-TRF

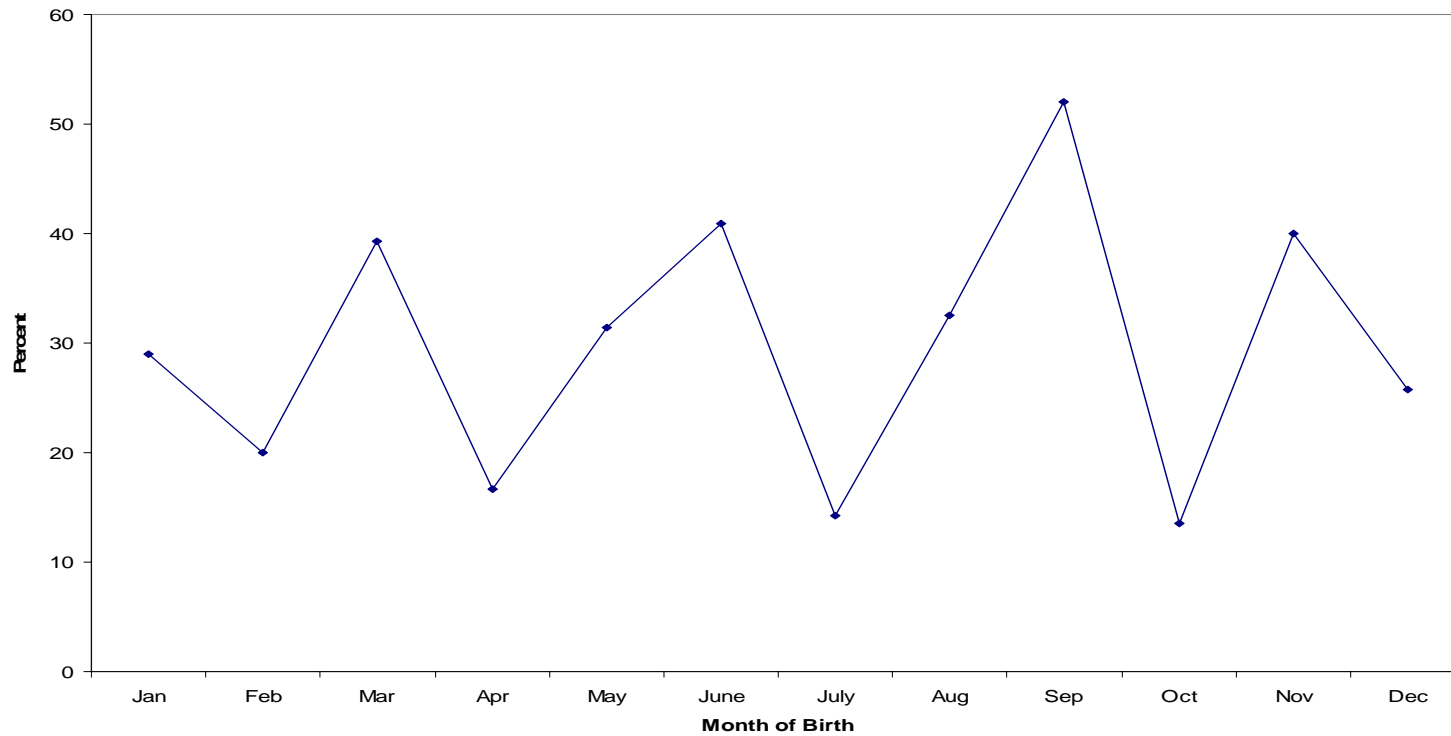
Percent of Female Student Born Each Month With High (Top 30%) Teacher-Rated Social Problem Scores: Portugal, 1981-1985





Female: Somatic Complaints

Percent of Female Students Born Each Month With High (top 30%) Teacher-Rated Scores on Somatic Complaints: Portugal, 1981-1985





Summary: There is an association of behavior problems with month of birth

■ Males

- Total Behavior Problem Score (**March, June, November**)
- Attention Problems (**March, Sept, Oct, Nov**)

■ Females

- Total Beh. Prob. Score (**April, Sept, Nov**)
- Social Problems (**June, November**)
- Somatic Complaints (**March, June, Sept, Nov**)

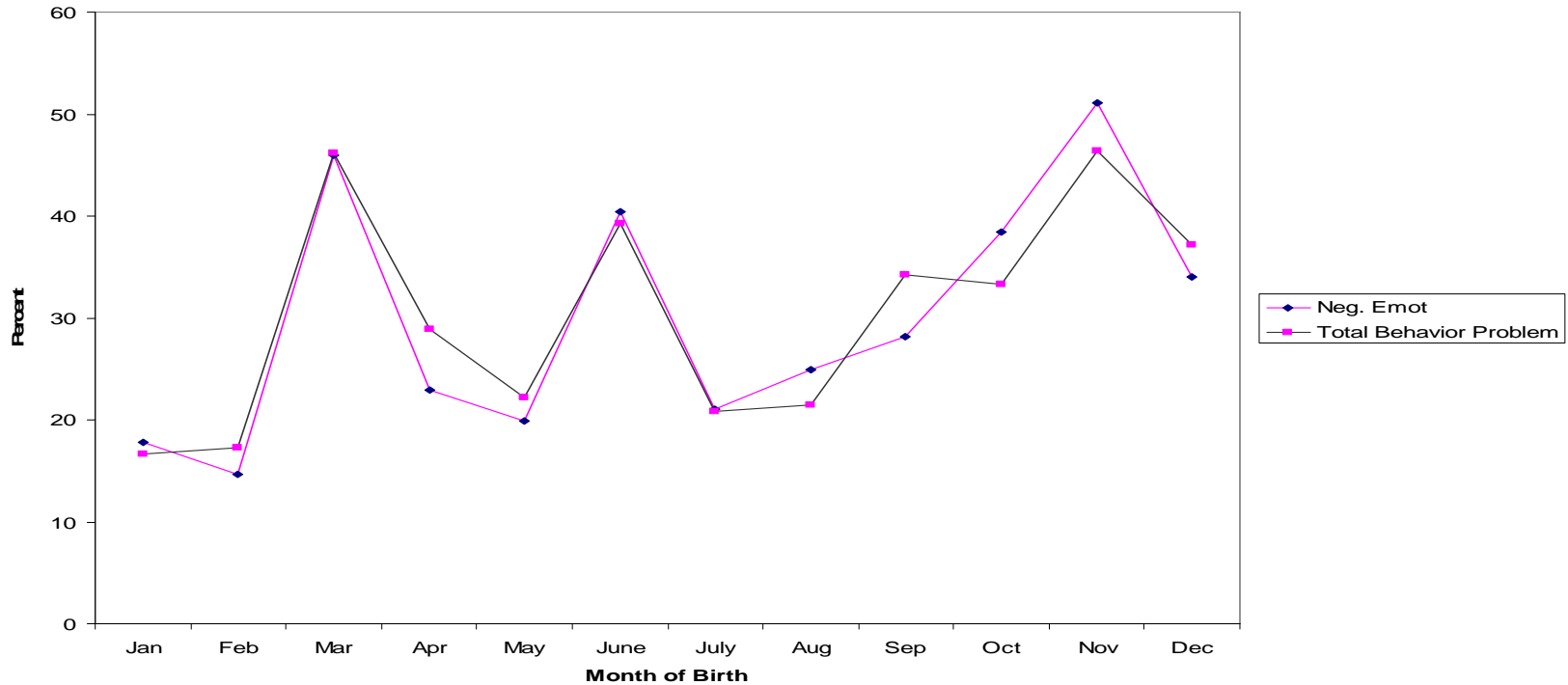


Question 3:

- Is there an association between birth patterns of children with extreme temperamental scores and birth patterns of children with behavior problems?

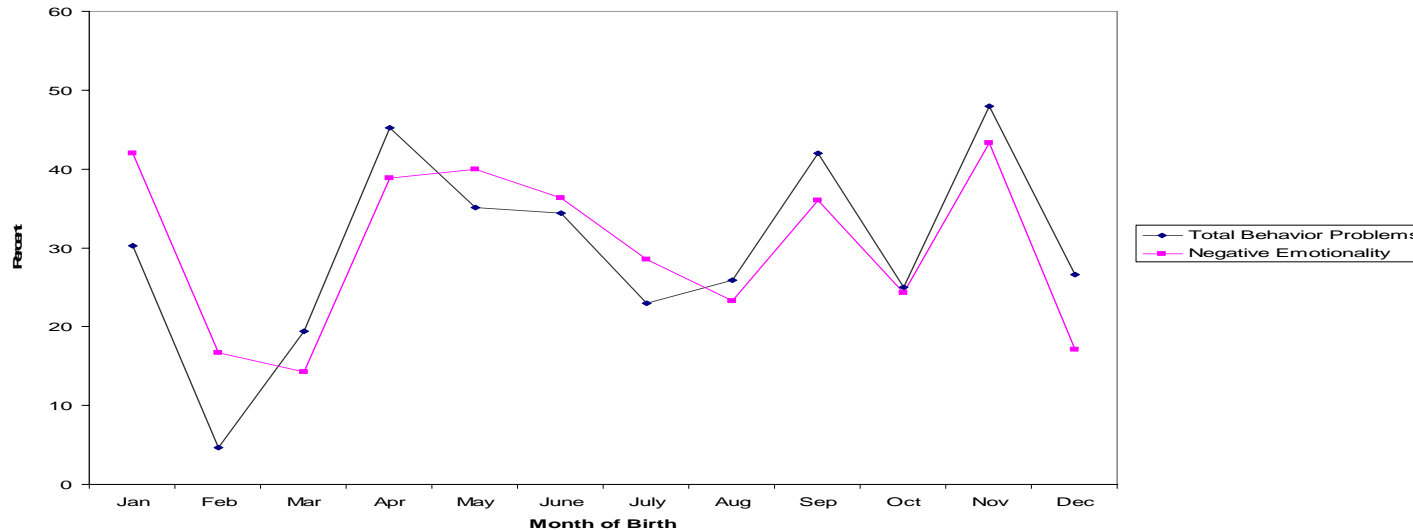
Male Negative Emotionality and Total Behavior Problems-CBCCL

Comparison of Percent of Male Students Born Each Month With High Teacher-Rated Negative Emotionality and Percent of Male Student With High Total Behavior Problem Scores: Portugal, 1981-1985



Female: Negative Emotionality and Total Behavior Problem Score-CBCL

Comparison of Percent of Female Students Born Each Month With High (Top 30%) Total Behavior Problem and High Negative Emotionality Scores: Portugal, 1981-1985





Extreme Temperament and Behavior Problems: Summary

- Very strong association between negative emotionality and total behavior problem score for these teachers (males $r = .95$; females = $.79$ across twelve months)
- No other temperamental characteristics was nearly as closely associated with month-to-month variation in behavior problems

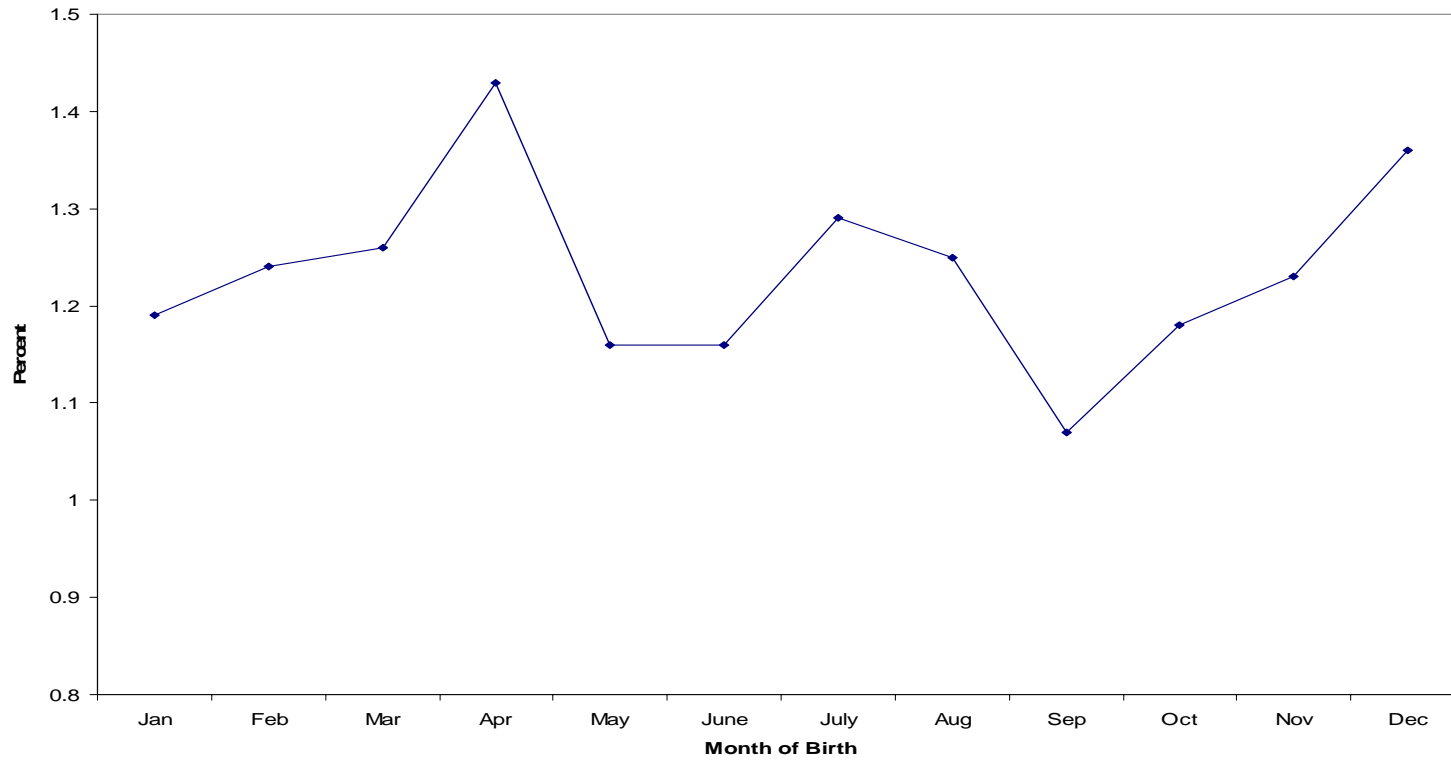


Question 4:

- Is the month-of-birth pattern of children with extreme temperamental characteristics associated with fetal death rates per month in the population?

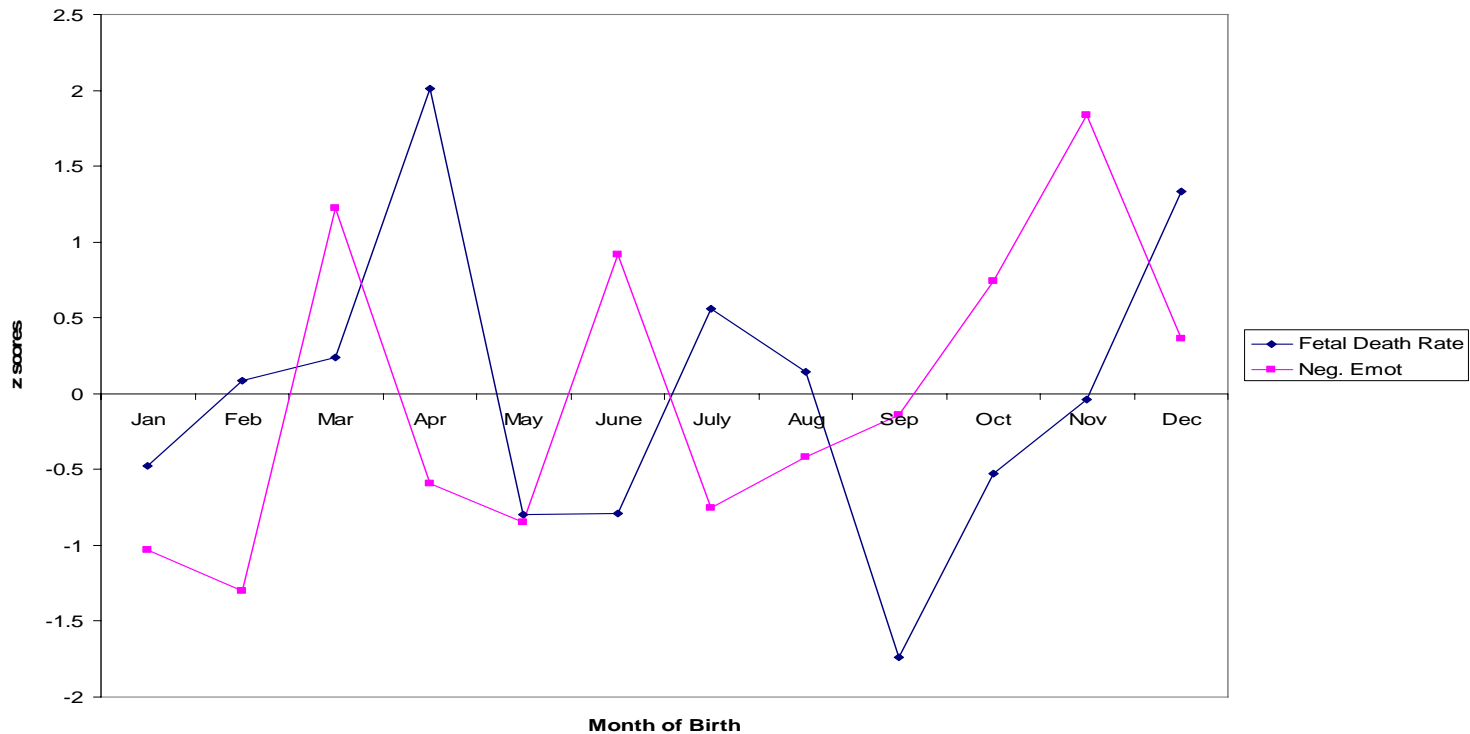
Fetal Deaths for Males

Fetal Death Rate (Fetal Deaths/Births) Per Month for Males: Portugal, 1981-1985



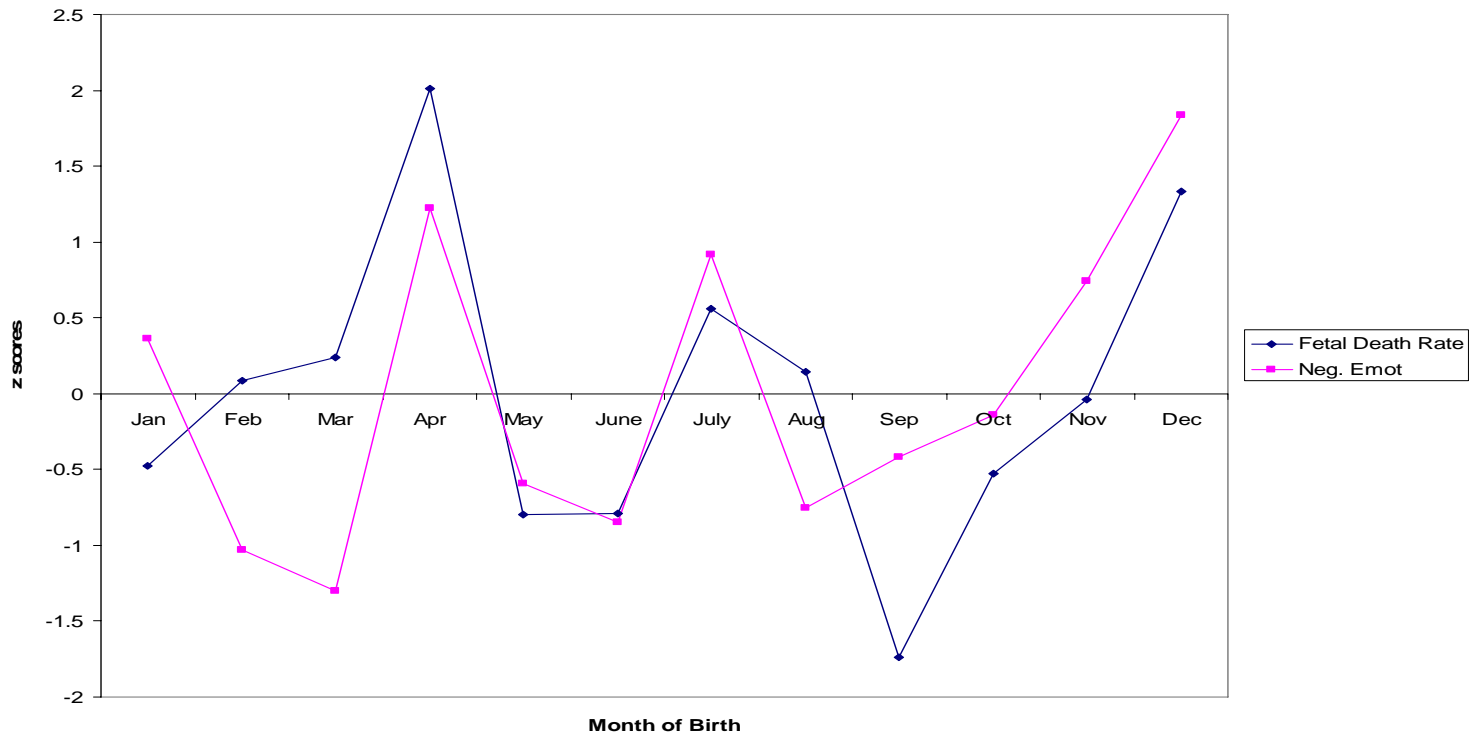
Association of Negative Emotionality and Fetal Death Rate: Males

Comparison of Fetal Death Rate Per Month and Month of Birth of Male Students With High (Top 30%) Teacher-Rated Negative Emotionality: Portugal, 1981-1985



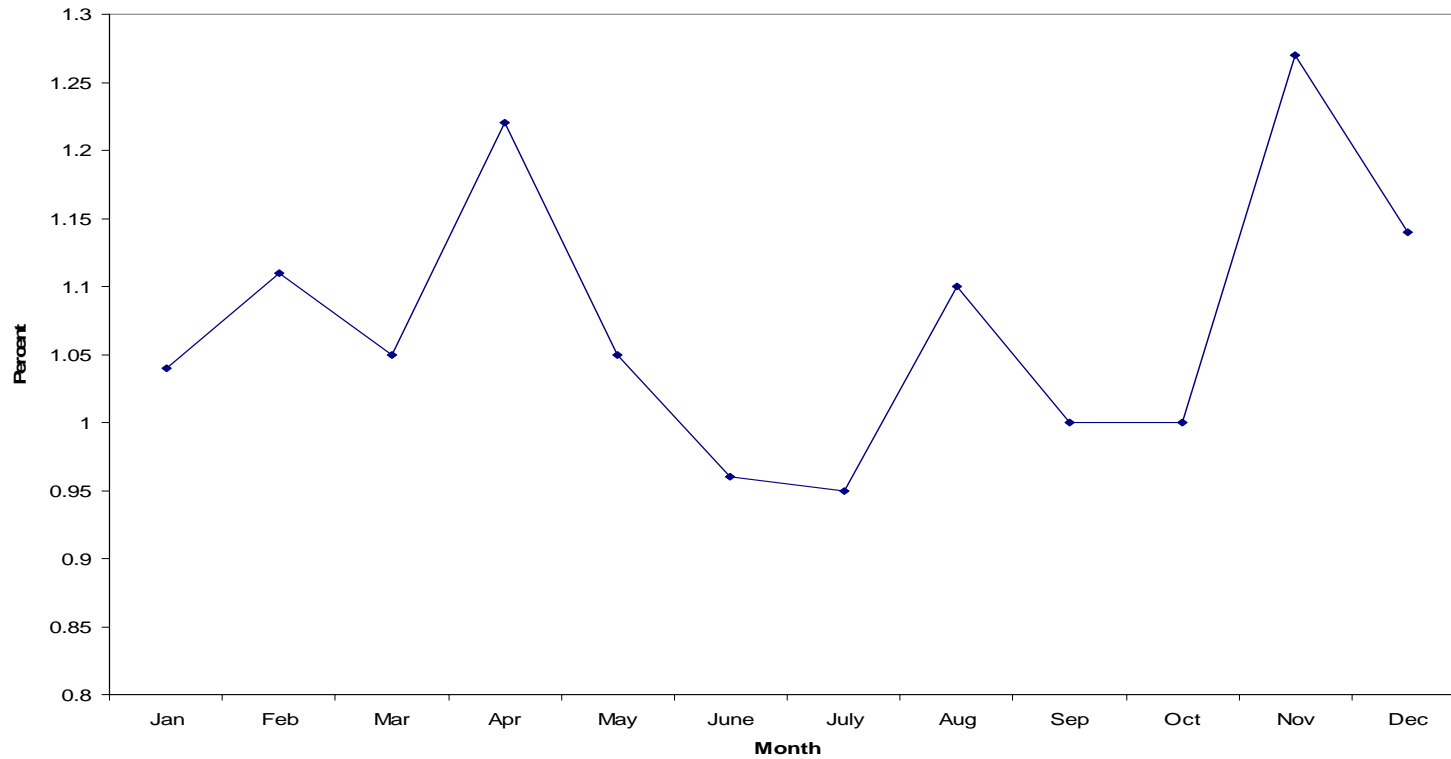
Associated of High Negative Emotionality (Advanced 1 Month) With Fetal Death Rate:

Comparison of Monthly Fetal Death Rate and Month of Birth (Advanced 1 Month) of Male Students with High (Top 30%) Negative Emotionality: Portugal, 1981-1985



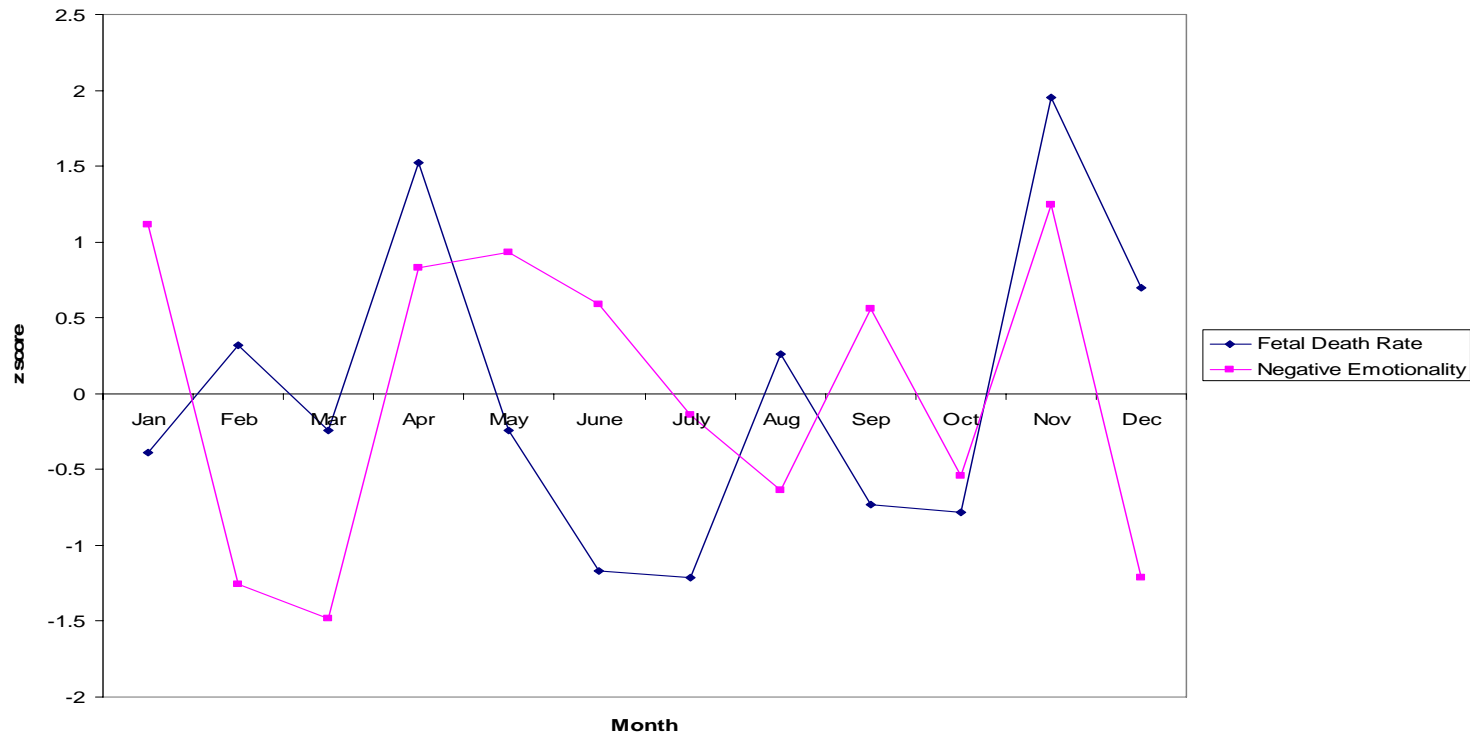
Female Fetal Death Rate

Fetal Death Rate Per Month (Fetal Deaths/Births) for Female Students: Portugal, 1981-1985



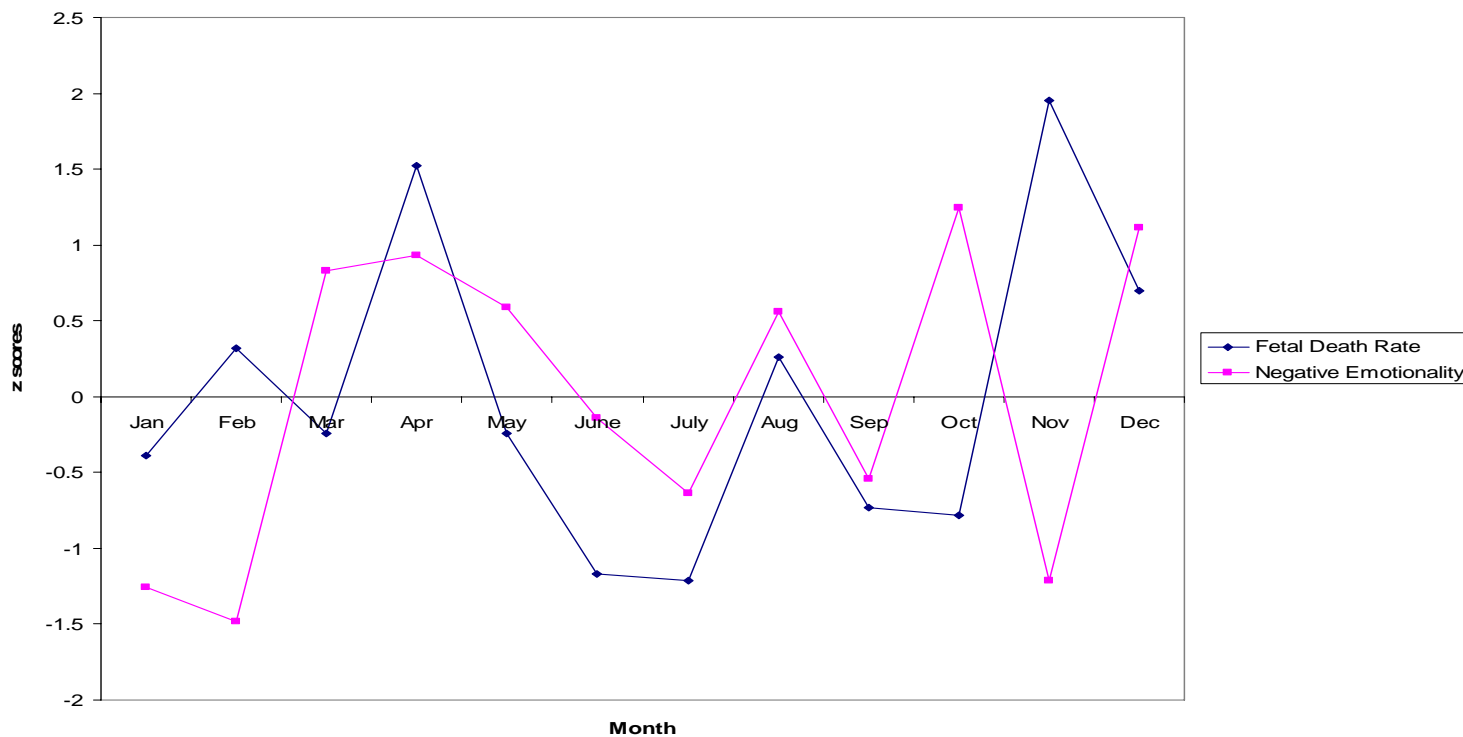
Association of High Negative Emotionality With Fetal Death Rate: Females

comparison of Monthly Fetal Death Rates and Month of Birth of Female Students With High (Top 30%) Negative Emotionality Scores: Portugal, 1981-1985



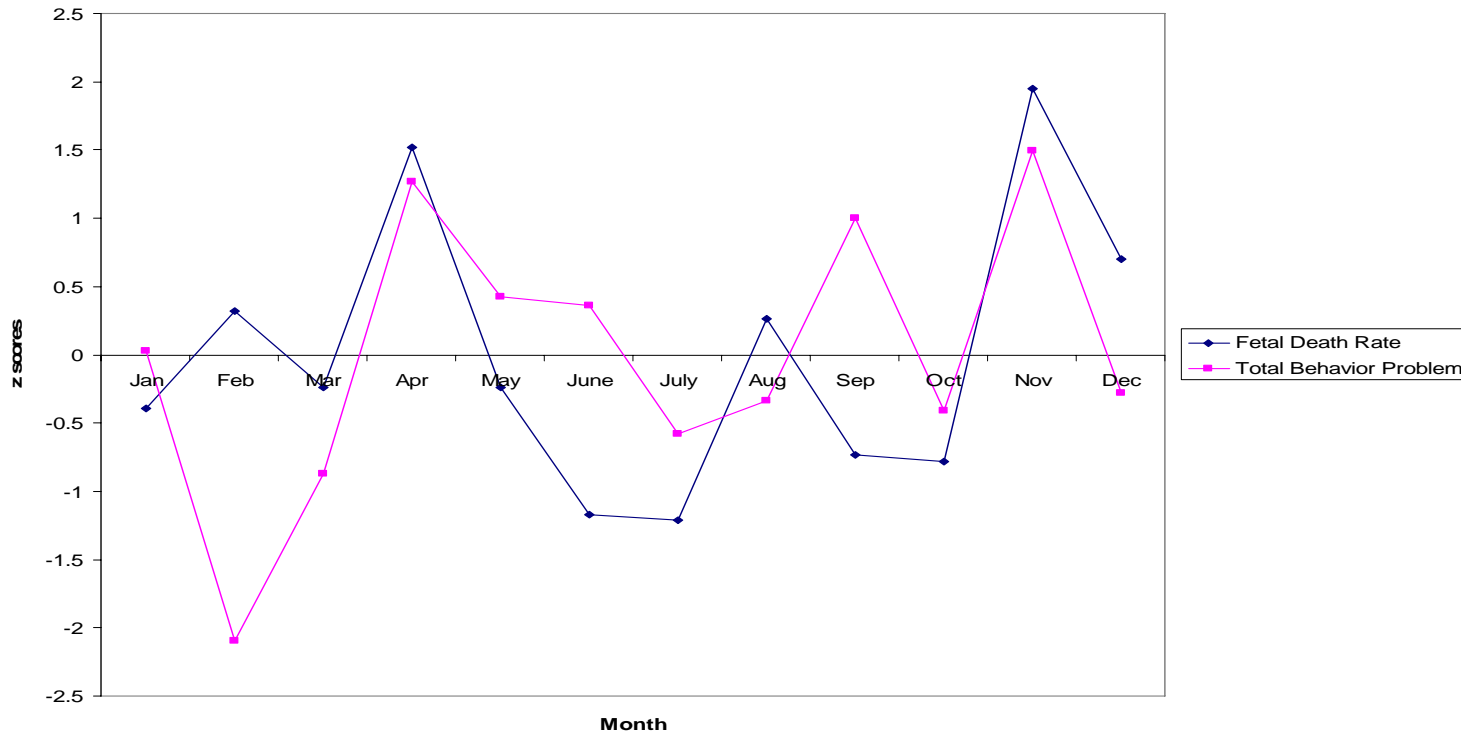
Association of Negative Emotionality (lagged 1 month) with Fetal Death Rates: Females

Comparison of Monthly Fetal Death Rates and Month of Birth of Female Students with High (Top 30%) Negative Emotionality Scores: Portugal, 1981-1985



Association of Monthly Pattern of Fetal Deaths and High Total Behavior Problems Scores – CBCL: Female

Comparison of Monthly Fetal Death Rates with Month of Birth of Female Students With High (Top 30%) Teacher-Rated Total Behavior Problems Scores - CBCL: Portugal, 1981-1985





Summary Question 4:

- Fetal death rates in population are associated with extreme temperament and behavior problems
- For males, births of high negative emotionality children precede peak fetal death peaks by one month
- For females, pattern is less clear, but appear to coincide with peak fetal death periods



Conclusions: Temperament

- There are associations between extreme temperament and month-of-birth
- Some peak periods coincide with expectations from the literature (Feb-March, June-July peaks)
- Some do not (Fall peaks)



Conclusions: Behavior Problems

- Some behavior problems are associated with month-of-birth
- Interestingly, total behavior problem scores is most strongly associated
- Total behavior problem scores were highly associated with negative emotionality



Conclusion: Relation to Fetal Death Rates

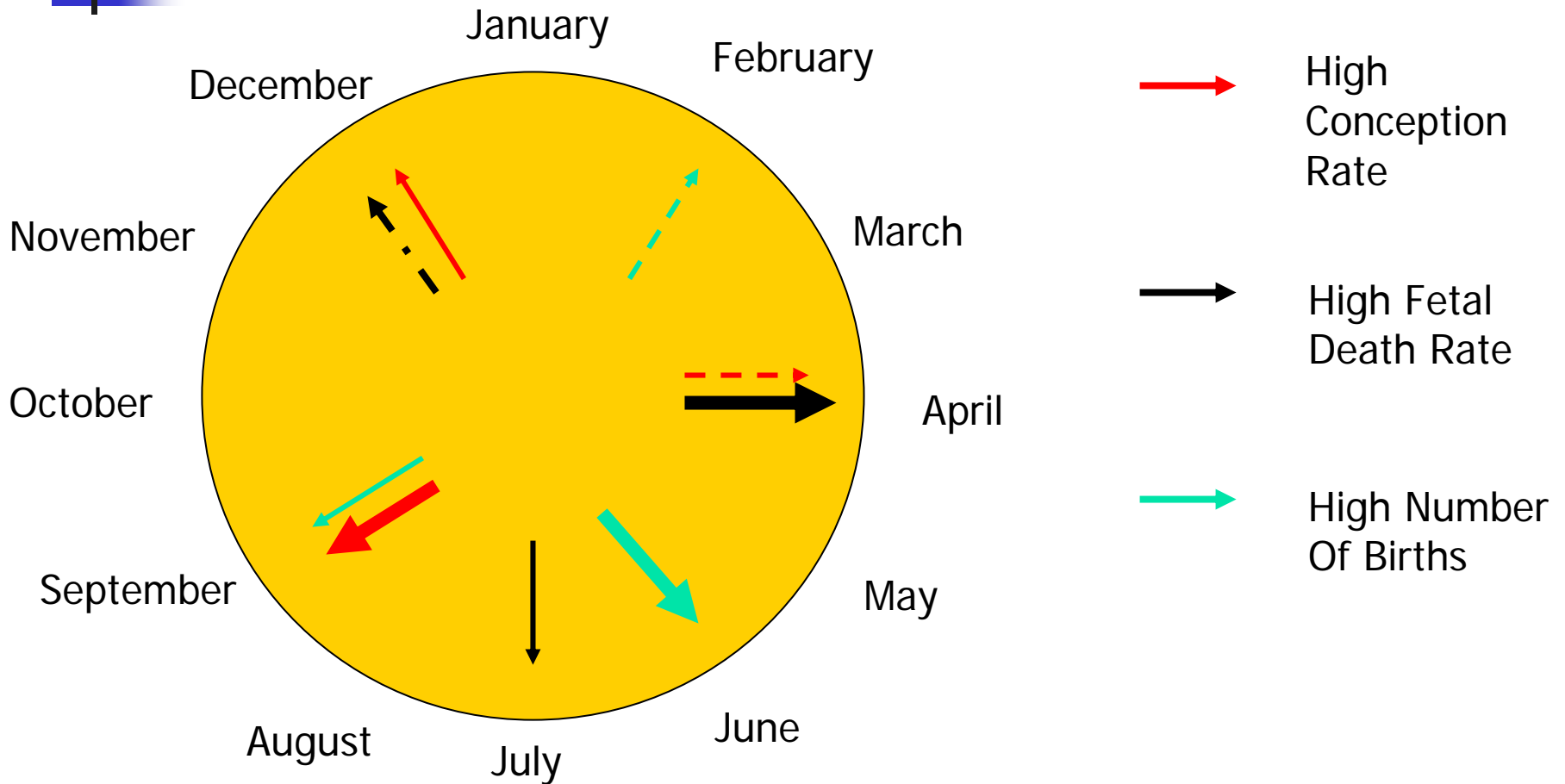
- Teachers are sensitive to behaviors that are temporally correlated with a marker of prenatal developmental disruption
- The two measurements are completely independent; teachers are most likely unaware of fetal rates in population
- Suggests that month-of-birth variation in temperamental behaviors and behavior problems is strongly influenced by prenatal factors



Theoretical Questions

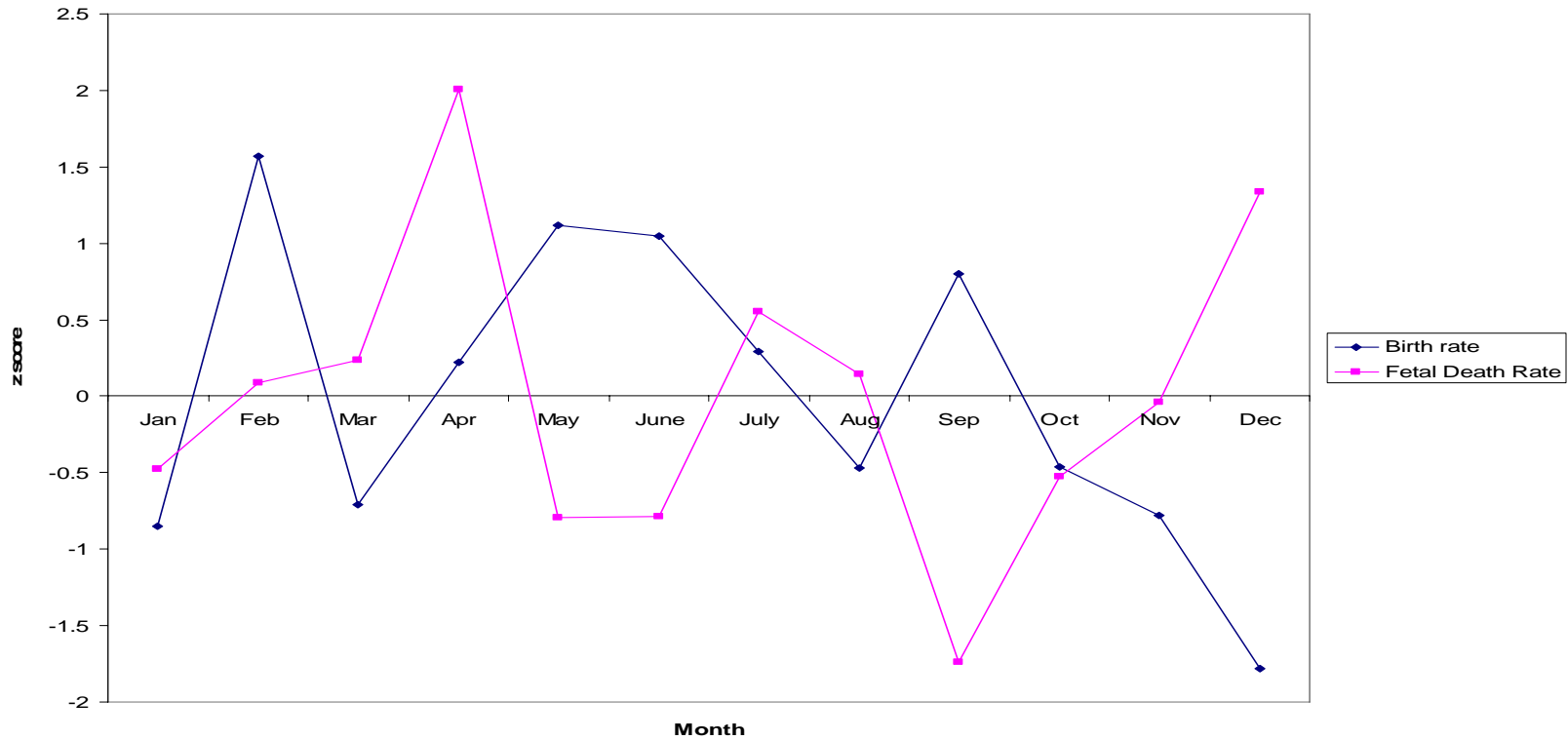
- Why is there a late fall peak in births of children with extreme temperament and behavior problems?
- Why are male and female behavioral relationships to fetal death different?
- What are primarily factors in annual cycles of fetal death?

Conception, Birth, and Fetal Death: Portugal, 1981-1985



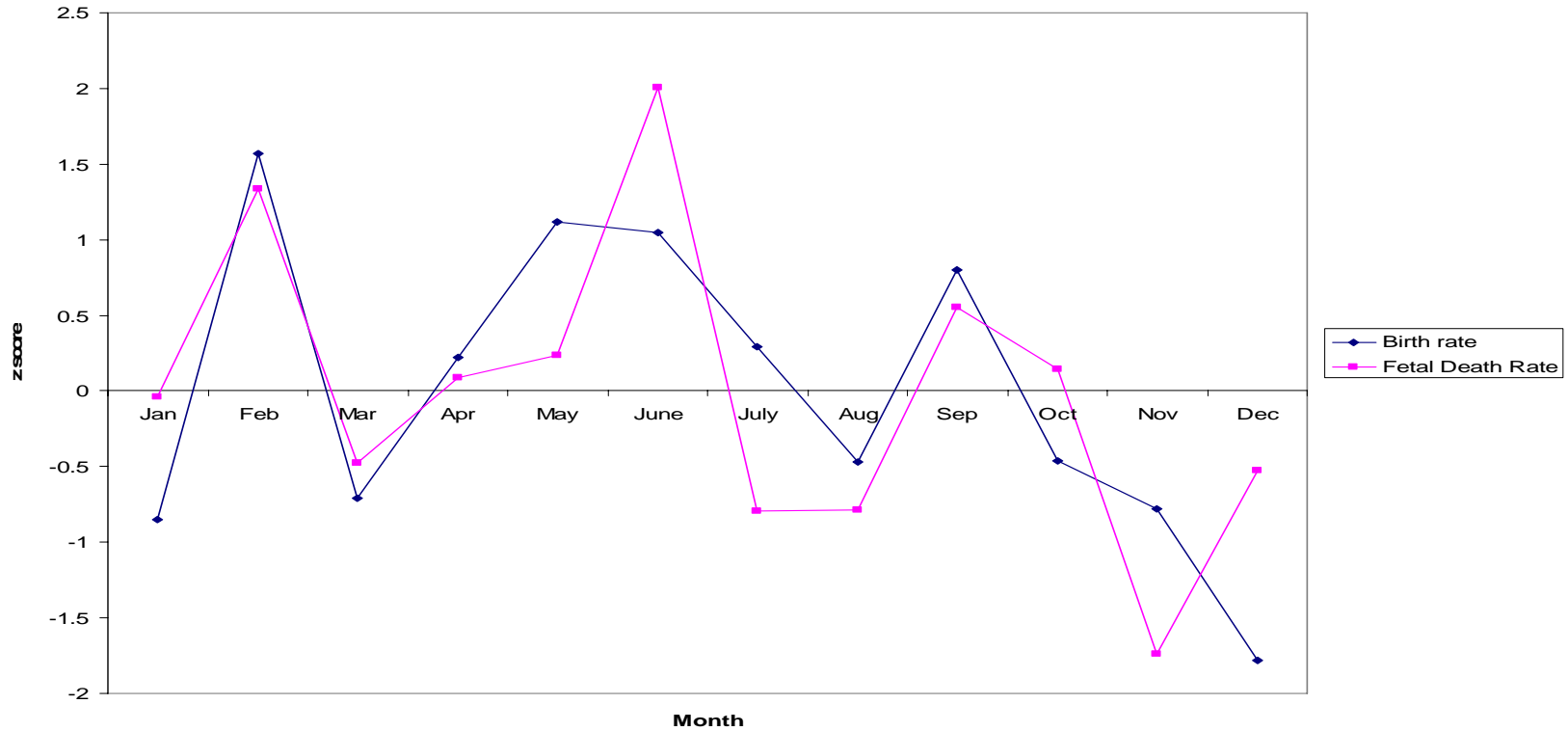
Births and Fetal Death: Males

Comparison of Births and Fetal Death Rate Per Month for Males: Portugal, 1981-1985



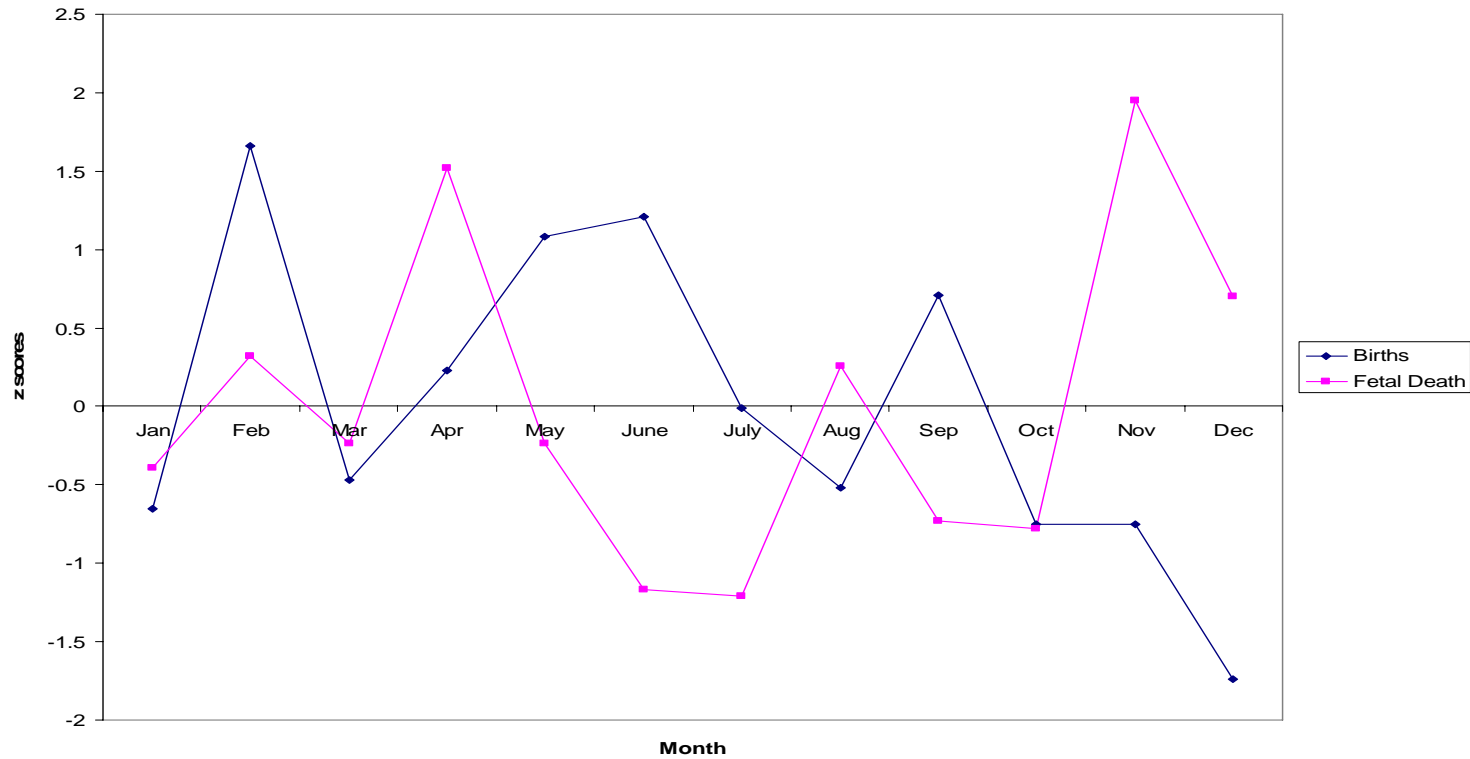
Male Births and Fetal Deaths (Advanced Two Months)

Comparison of Population Births and Fetal Deaths per Month (Advanced Two Months) for Males



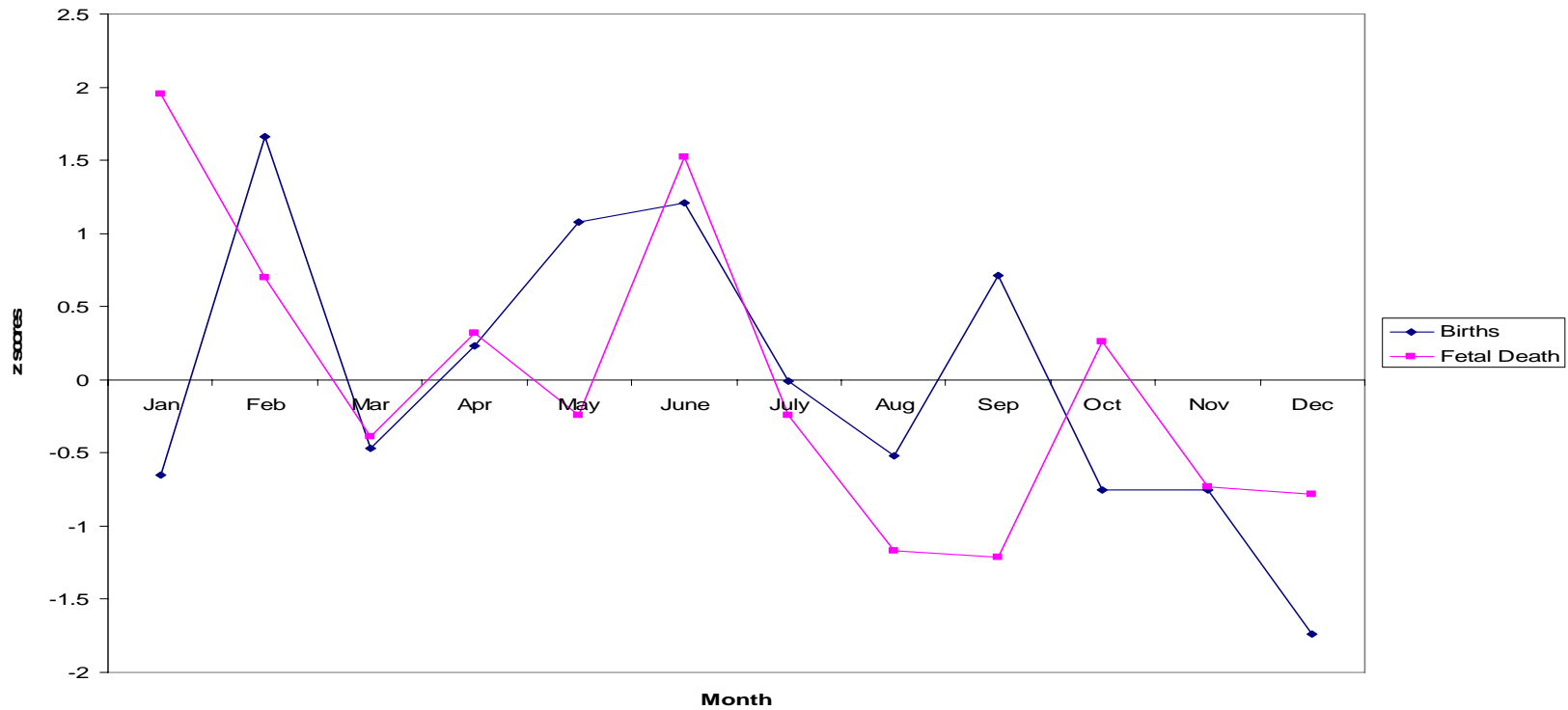
Births and Fetal Deaths: Female

Comparison of Births and Fetal Death Rates Per Month for Females: Portugal, 1981-1985



Female Births and Fetal Deaths (Advance Two Months)

Comparison of Births and Fetal Deaths Per Month (Advanced Two Months) for Females: Portugal, 1981-1985





Windward Slope (Prematurity) Model

- Fetal death peaks are simply a reflection of peaks in births displaced two or three months earlier
- Extreme negative emotionality and behavior problems are associated with births on the windward slope of birth peaks
- Does not explain male-female differences in behavior problems in association with fetal death rates
- Weakens the annually occurring prenatal perturbation hypothesis