Xylitol Gum and Tooth Caries
Literature Activity

The goal of this activity is to practice interpreting the results of survival analyses in the literature.

The abstract for "A Practice-Based Study on the Effect of a Short Sucrose/Xylitol Exposure on Survival of Primary Teeth Caries Free" by Anttonen et al. (2011) is presented below.

Background. In a randomized double-blinded clinical trial, preschool children used sucrose or xylitol chewing gum regularly for 2 months to study the preventive effect of xylitol on acute otitis media (AOM). Salivary *mutans streptococci (sm)* levels of the children were measured before the exposure. Those with $\geq 10^5$ sm CFU in 1 mL saliva were considered to have high sm levels *(sm+)*; and those with $<10^5$ CFU low sm levels *(sm–)*.

Aim. This practice-based study aims to evaluate long-term dental effects of the sucrose/xylitol exposure on primary teeth.

Design. For analyses, individuals were divided into sub groups according to their study group in the original AOM trial and baseline *sm* levels. Outcome events owing to dental caries of their all primary teeth were followed from dental records up to 12 years. Survival of teeth caries free was determined by Kaplan–Meier method and analyzed statistically by Wilcoxon testing.

Results. Survival of primary teeth caries free of children with high *sm* levels in the sucrose group was significantly shorter compared with all other groups when followed until shedding.

Conclusions. Two months' regular exposure to sucrose was sufficient to induce dental caries in primary teeth of children with elevated sm levels at baseline.

Use the abstract to answer the following questions.

RESEARCH QUESTION AND FINDINGS

1. State in your own words the authors' primary scientific question.

   What are the long-term effects of sucrose or xylitol exposure on caries rates in primary teeth?

2. State in your own words the authors' primary finding.

   The group with high SM levels in the sucrose group report dental caries in primary teeth faster than the rest of the study population.

METHODS

3. What sampling method and study design was used for this study? (e.g., Was it observational or experimental? Random sample? Control group? Randomized? Blinded?)

   The study design was a double-blind, randomized, clinical intervention trial. The sampling method was a form of non-random sampling. The paper mentions their study sample was composed of individuals who had participated in a previous AOM study conducted, in which the participants were from day-care centers.

4. What were the treatments used in this study?

5. *Exactly* how is the event of interest defined?

   Outcomes owing to dental caries in primary teeth.

6. Is the event determined at the person-level or the individual tooth-level? How do you know?

   The event is considered at the individual tooth-level in the statistical analysis

7. How is time zero defined for a given child (e.g., starting date)?

   (Note, this answer is not provided in the abstract.) At birth.

8. If a tooth survived to shedding without getting a caries (i.e., cavity), would it be denoted as having the event of interest or as being censored?

RESULTS

Use Figure 2 to answer questions 9 and 10:

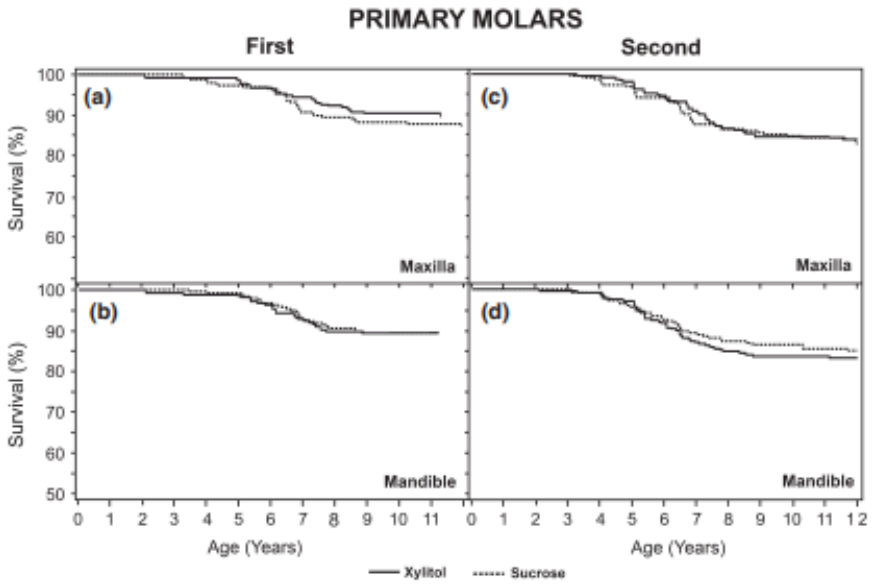

Fig. 2. Kaplan–Meier survival functions of first (a, b) and second (c, d) primary molars of participants in the sucrose and xylitol groups in a chewing gum trial studying the effect of xylitol on preschool children's acute otitis media incidence.

9. What do the two curves represent?

10. Why do the curves not drop to 0% by age 12 years?

11. Based on the plots, are the differences in survival in the two treatment groups large enough to convince you that the xylitol gum treatment really works better than the sucrose gum control? Explain your reasoning.

Use Figure 3 to answer questions 12 and 13:

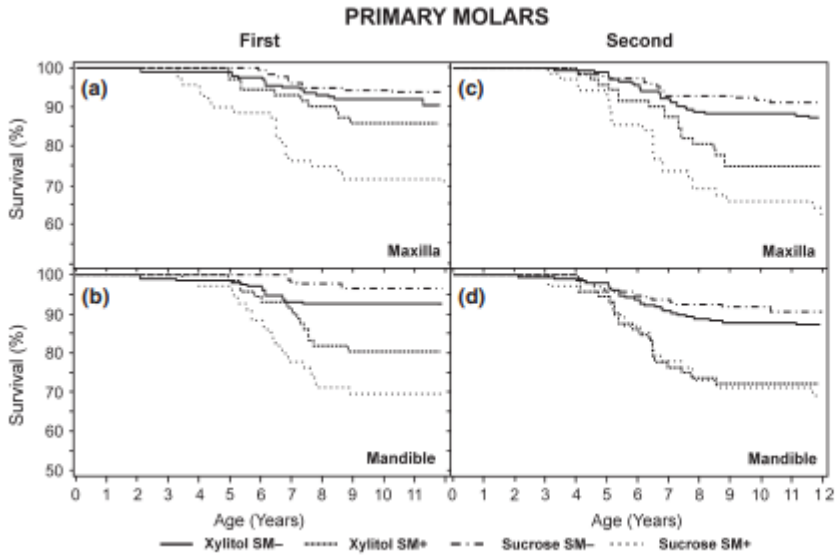

Fig. 3. Kaplan–Meier survival functions of first (a, b) and second (c, d) primary molars of participants in the xylitol-sucrose chewing gum trial, when the groups were divided into subgroups according to participants' salivary *mutans streptococci* levels (*sm*+: $\geq 10^5$ CFU/mL and *sm*–: $<10^5$ CFU/mL).

12. What do the four curves represent? Which group, in general, has the best survival? Which group, in general, has the worst? In the *sm*- group, does xylitol improve survival compared to sucrose? Similar question for the *sm*+ group.

13. The authors tested whether the sucrose *sm*+ group differed from the other three groups put together and found *p*-values less than 0.05 (Figure 3a: $p = 0.01$, Figure 3b: $p < 0.001$, Figure 3c: $p < 0.001$, Figure 3d: $p = 0.001$). Why do you think they made this comparison? Do you think that if they had tested whether xylitol *sm*+ differed from sucrose *sm*+, they would have come to the same conclusions (especially for Figure 3d)? Which comparison do you think is more appropriate?

DISCUSSION

14. Xylitol gum may have a beneficial effect relative to sucrose gum. Does this study give us any indication about whether xylitol gum is beneficial relative to doing nothing at all (no gum)?