Appendix: Risk set definition in the Cox-type models

The Proportional Intensity Model

To demonstrate how the risk set is defined in the proportional intensity model, we first need to illustrate the so-called counting process time interval that is used in the proportional intensity model (Figure 2(b)), using the same three subjects portrayed in Figure 2(a). In this formulation, the follow-up time is broken down by the occurrence of an event. For example, Subject A has three intervals, in which the subject experienced an event in the first two intervals and is censored in the last interval. The time scale is the same as in the original scale, i.e., time from the beginning of follow-up. The risk set at a particular follow-up time includes all individuals who are not yet censored at that time. Note that each individual contributes at most one record in the risk set at a particular time. For example, immediately before t=3 at which Subject B experienced an event, both Subject A and C are at risk and should be included in the risk set in addition to Subject B. An easy way to identify the risk set is to draw a vertical line at the time of an event in Figure 2(b) and include subjects who are crossed by this vertical line.

The PWP Total Time Model

The time interval that is used in the PWP total time model to define risk set is the same as in the proportional intensity model. In Figure 2(b), for example, the risk set for the first event immediately before t=3 includes Subjects B and C. Subject A is excluded, because he or she has already experienced the first event and so is not at risk for the first event anymore. An easy way to identify the risk set is to draw a vertical line at each event occurrence in Figure 2(b) and include only subjects who have the same colored time intervals that are crossed by this line.

The PWP Gap Time Model

Figure 2(c) illustrates the so-called gap time intervals for the same three hypothetical subjects illustrated in Figure 2(a). For example, the second event for Subject A occurred at t=6 in the original time scale (Figure 2(a)), while in the gap time model, it is treated as having occurred at t=5 (Figure 2(c)), which is the time since the occurrence of the previous event. The risk set definition has also changed given the newly defined time intervals. For example, in the PWP total time model, the risk set at the time immediately before the occurrence of the second event for Subject A (t=6 in Figure 2(b)) includes only Subject B because he or she has experienced one event in the past and is still in the study. However, in the PWP gap time model, Subject B is not at risk at the time immediately before the second event for Subject A (t=5 in Figure 2(c)), because he or she has already been censored.