D. PANEL COMMENTARY ON DISCUSSION GROUP REPORTS

"Comment on Fatigue Drivers"

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DR. STEVEN R. HURSH: My focus this morning is to talk about the fatigue drivers. Taking the perspective of a scientist, many of the particular fatigue factors, such as the environmental, personal, and organizational factors that were described today can be lumped into conceptual categories that translate into scientific principles related to fatigue. I will organize the discussion group findings using this kind of scientific perspective.

I propose that there are five categories that encompass the majority of the particular fatigue drivers that were mentioned.

The five categories are, from my perspective at least:

- inadequate restorative sleep, for whatever reason;
- long hours of wakefulness, again, for whatever reason;
- circadian timing of critical tasks – aviation is a 24/7 operation, and sometimes critical tasks occur at bad times of the day from the point of view of a person's physiology;
- workload and the demands of the job itself; and
- personal factors.

I will discuss each of those in detail to illustrate some points. In the area of inadequate restorative sleep, that really breaks down into two subcategories: one is insufficient time for sleep, and the other one is that the opportunities to sleep are at less than optimal circadian times.

Inadequate time to sleep may be broken down into inadequate planned time to sleep - the schedule simply did not permit it; or it could be that the time was available but it wasn't utilized as it should have been.

And often times inadequate sleep time has to do with the shift work scheme, for example, from our last two presenters looking at aviation shift work schedules, the shift work scheme itself simply does not have enough time between shifts to permit adequate restorative sleep. Under other conditions the environment in which the sleep is going to be taken, be it on board the aircraft or during a layover, is a poor sleep environment, so

the sleep that is taken is not restorative. In addition, the schedule may not consider the time it takes to transport to rest, be that transport provided by the airline or transport arranged by the individual, erodes the time available for sleep. Finally, there are competing activities - organizationally arranged activities or personal choices of activities – and these competing activities erode the opportunities to sleep.

There are also schedule extensions: the schedule looked good on paper, but given weather, given equipment problems, given other kinds of considerations, the schedule itself is not what was planned for in the first place.

There may be a lack of napping opportunities. Inadequate sleep can be sometimes addressed by opportunities to take naps, but the regulations often don't permit it.

Corporate fatigue policies may not allow a person to opt out of a work assignment to get restorative sleep, or there is the perception, at least, that the policy doesn't permit that.

Individual trips themselves may not erode opportunities for sleep, but when one constructs a monthly trip line or bid package, they may have done a clever job of preventing themselves from getting enough restorative sleep between trips. And some of this relates to economics and lifestyle decisions that drive these decisions.

The second category is long hours of wakefulness. And long hours of wakefulness is not just because of ULR or long hours of duty, but when you combine long hours of duty with a long period of wakefulness prior to duty that may be created by a long commute, then we have long hours of wakefulness, and that is a shared responsibility of both the operator and the individual to arrange commuting such that when the person has commuted to their place of departure, they have allowed themselves enough time for pre-trip rest. However, often times provisions for pre-trip rest isn't self selected, and education might help to restore that.

Reserves and delays can cause long hours of wakefulness. When a person is on reserve, the trip may be repeatedly delayed so that the time for them to report is also constantly delayed. If called off reserve, then all of a sudden they have a long time of wakefulness prior to actually having to report, and that creates problems.

The problem of rolling delays relates to predictability. If you don't have a predictable schedule, it's often very difficult to get restorative sleep, and that then creates long hours of wakefulness by the time the shift is over.

Finally, outside activities can create long hours of wakefulness because the person has opted to do a military task or some other work assignment that is combined with the actual aviation work assignment.

The circadian timing of tasks is another critical fatigue factor. Many commercial transportation operations in this country economically require us to work the back side of the clock. That is a fact of life, and we are going to have to mitigate that risk, not by eliminating those jobs, but by dealing with the reality of working at those times of the day.

Shift work requires that we work at odd times of the day. So we must develop strategies to mitigate the potential erosion of our performance and build in barriers to error that would take into account the degradations of performance.

We should consider the timing of critical tasks. We don't do a very good job of thinking about when critical tasks are going to occur with respect to our physiological time. Sometimes, if we had planned ahead and had the option of moving the task to a different time, then we would have changed the schedule and reduced the fatigue risk.

Delays and diversions can move block times. The take off or land would have been perfectly fine from a circadian perspective, but owing to a delay or diversion, all of a sudden, critical tasks are now scheduled at a time that wasn't anticipated to be a bad time, but now is. And some of that problem is created by marketing.

Workload is another key factor. We have heard a lot today about how many takeoffs and landings in a work duty period can create additional fatigue, and we need to take that into account. But again in the area of the shift workers, congestion of our airports and reduced staffing, and the stress of work demands creates additional workload.

Personal factors include age, sleep disorders, and self-medication. Sometimes because of a lack of education, people self-medicate in ways that are actually counterproductive to getting restorative sleep.

There are also trait differences in sleep need that are often not considered, either by the individual or by the organization. For example, there are differences between individuals in their ability to sleep on board an aircraft. If we are counting on those on-board sleep opportunities to make the schedule feasible, we need to consider that some people just simply can't do that, and we must consider how to accommodate that problem without creating economic disadvantage for those individuals.

As a fatigue modeler, I have a personal responsibility to make it clear that many of these factors that I just mentioned are not easily considered by modeling. Fatigue modeling, especially in the hands of the operator, often assumes a nominal sequence of events. And many of the things I just mentioned would not be considered by modeling. So the modeling ends up being a best case scenario.

Transport to rest usually is not considered by modeling, especially if that transport is delayed by traffic or some other unforeseen event.

Competing activities are not visible to the operator, and can't be modeled. Commute times that are self-selected by the individual from their domicile to their place of reporting often are not considered in the modeling.

Predictability is very difficult for modeling to consider. All the model sees is that there is a rest opportunity, and the model doesn't consider that the rest opportunity could not be utilized because of the unpredictability of the report time.

And delays and diversions are often ad hoc changes that the modeling doesn't consider because the model was fed the nominal schedule, not the actual schedule.

So these are some of the limitations of modeling - not to mention many of the personal factors that modeling currently does not consider. We have to be very rational and realistic about what modeling can do for us. It is oftentimes the best case scenario.

One way to mitigate that limitation is to think, not only of the modeling results as a nominal prediction, but consider also the variance around that prediction. If we know that in a particular season of the year schedules are going to be disrupted very frequently because of weather, consider that factor in the modeling, and say, well, this is what the nominal schedule is, but we know that 30 percent of the time it is not going to be this way, it is going to be this way, then the modeling should start to reflect the variance, not only the mean, in the realistic forecast.

And finally we can often use, since this is a shared responsibility, and many of the things that I describe to you that erode our opportunities for restorative sleep or create long periods of wakefulness are choices of the individual, then

one way to address that, at least from an educational perspective, is to put modeling in the hands of the operators themselves: the pilot, the shift worker, the flight attendant. If crewmembers had an opportunity to access a model of their own schedule, then they could exercise some discipline in considering the consequences of their own choices and the impact of their choices on their expected performance at the end of that next duty assignment.

So I see an opportunity here for shared responsibility to create schedules that are workable, and to give employees the tools they need to evaluate their own actions and how lifestyle decisions impact on their fatigue and state of rest.

A copy of Dr. Steven Hursh's biographical information is provided in Appendix B.