assume a normal distribution of the data, yet it is also effective with normally distributed data, if that is the case.

CONRAD KREBS, MD, FACC
Sterling Winthrop Research Institute
Rensselaer, New York 12144

Reference

1. Benhorin J, Tzivoni D, Schuster M, Keren A, Stern S. Frequency and significance of ventricular arrhythmias in patients with reduced ejection fraction (≤30%). J Am Coll Cardiol 1987;9:225A.

Reply

In the data presented, the two main variables were not originally treated as continuous but were dichotomized (left ventricular ejection fraction at 20% and ventricular arrhythmia at several cut points of frequency and complexity) and analyzed by a chi-square test. That analysis showed that patients with an ejection fraction <20% had a significantly higher probability of having frequent ventricular arrhythmia (>100 ventricular ectopic depolarizations/24 h) than did patients with an ejection fraction of 20 to 30% ($p < 0.01$, odds ratio = 3.0). Further analysis that treated both variables as continuous found a weak but highly significant correlation between ejection fraction and log ventricular ectopic depolarizations/24 h ($r = -0.285$, $p < 0.001$). Thus, there is a significant association between the degree of systolic dysfunction and frequent ventricular arrhythmia in patients with reduced ejection fraction; obviously, this association cannot be interpreted as a cause and effect relation.

JESAIA BENHORIN, MD
DAN TZIVONI, MD
Bikur Cholim Hospital
Jerusalem, Israel

Fighter Pilots Are World Class Athletes

Because both auto racing and motorcycling were included in the classification of sports (1) included in the 16th Bethesda Conference report, it would seem appropriate to include flying in the classification scheme. The rigors of both civilian and military flying of high performance aircraft during severely stressful aerobatic or aerial combat maneuvering require maximal *specific* physical conditioning to tolerate very high onset sustained $+G_z$ (head to foot) acceleration forces. The $+G_z$ environment requires both strength and endurance to prevent $+G_z$-induced loss of consciousness (G-LOC) and ensure maximal performance while flying. The competitive environment of the aviator is unique, requiring maximal performance of exhaustive anti-G straining maneuvers, which enhance the driving pressure to the central nervous system, counteracting the downward bodily displacement of blood induced by the $+G_z$ forces. Military fighter pilots experience sustained exposure to levels as high as $+9G_z$. Marked alterations in the autonomic nervous system occur from the baroreceptor stimulation resulting from performing the anti-G straining maneuver and the abrupt offset after high sustained $+G_z$. In addition, civilian aerobatic pilots are exposed to $-G_z$ (foot to head) stress levels of $-4G_z$ to $-6G_z$ cyclically with the $+G_z$ stress (2). Both tachyarrhythmias and bradyarrhythmias result from these $+G_z$ exposures. Interestingly, intense aerobic conditioning has been associated with an increased incidence of rhythm disturbances with compromise of the tolerance to $+G_z$ stress and predisposition to G-LOC (3–5).

Civilian aerobatic pilots compete in meets on a regular basis. Military fighter pilots compete almost daily and in a wartime situation are required to compete for their lives (and country). The emotional and psychologic stress levels are exceptionally intense. Classification of flying within the scheme proposed would seem to be reasonable if considered in a high static demand category. Dynamic demands during $+G_z$ stress are probably moderate to low; however, military flyers are required to remain in optimal physical condition to enhance performance and minimize cardiovascular risk factors. Aerobic conditioning is required for these aircrew, with the proviso that it should not be carried to unusual extremes. Optimal physical conditioning programs have yet to be thoroughly investigated and validated to ensure aerospace safety, enhance performance and provide cardiovascular fitness. Weight lifting to enhance specific muscle groups used to combat high $+G_z$ forces is currently recommended to be integrated with an aerobic fitness program. Flying should also be included in the group for which syncope ($+G_z$-induced loss of consciousness) represents a tremendously increased risk. It does not fall into the category of (resulting from) danger of body collision.

In every way these aircrew represent the equivalent of the world class athlete in terms of regular competition, a high premium (life itself) on excellence and achievement and vigorous systematic training. In addition, these unique individuals (military) may not have the luxury of using proper judgment in extricating themselves from the competitive event because of the unique circumstances, even if they wish to do so.

Recognition of flying high performance aircraft within the classification scheme ensures that the unique environment and requirements of these individuals are recognized by the entire medical and research communities. It is true that both the civilian and military aviation communities have specific medical groups that are charged with aircrew safety; however, these problems and innovative answers remain within the scope of the entire spectrum of the medical and scientific worlds. It may one day mean that the only way to "freely" enjoy all of the sports listed will be through the superior performance of our finest aircrews charged with the ultimate defense of this nation.

JAMES E. WHINNERY, PhD, MD, FACC
Air University Center for Aerospace
Doctrine, Research and Education
Maxwell Air Force Base, Alabama

References

1. Mitchell JH, Blomqvist CG, Haskell WL, et al. Classification of sports. J Am Coll Cardiol 1985;6:1198–9.
2. Bloodwell RD, Whinnery JE. Acceleration exposure during competitive civilian aerobatics (abstr). Aerospace Med Assn Scientific Sessions 1982;167–8.
3. Whinnery JE, Laughlin MH, Hickman JR Jr. Concurrent loss of consciousness and sino-atrial block during $+G_z$ stress. Aviat Space Environ Med 1979;50:635–8.
4. Whinnery JE. Acceleration induced atrioventricular dissociation: hemodynamic consequences. Aviat Space Environ Med 1982;53:432–4.
5. Whinnery JE, Laughlin MH, Uhl GS. Coincident loss of consciousness and ventricular tachycardia. Aviat Space Environ Med 1980;51:827–31.