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Making space for the older adventure traveller: The dawn of commercial space tourism

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'Galloping about the cosmos is a game for the young, Doctor.'
Captain James T Kirk
Star Trek II: The Wrath of Khan

Adventure tourism, including sojourns to high-altitude destinations, is no longer the preserve of younger travellers.[1] The recent completion of suborbital flights to the edge of space by 82-year-old American aviator, Wally Funk, and 90-year-old Star Trek actor, William Shatner, has heralded a new era in commercial space tourism, with 'Captain Kirk' (Shatner) becoming the oldest person to travel to space,[2] eclipsing Funk's short-lived record and the longstanding record held previously by John Glenn. Glenn returned to space in 1998 at the age of 77, nearly four decades after becoming the first American to orbit the Earth.

With global life expectancy projected to increase beyond 75 years by 2040, and the costs associated with space tourism expected to drop as the market inevitably expands,[3] the opportunity to engage in space tourism may become an appealing life goal for many older individuals. The ethical and environmental arguments against commercial space tourism are being actively debated.[3] Physicians who care for older patients, however, should have a basic familiarity with the unique physiologic challenges of space travel in this population.

Space tourists are likely to be older than the average astronaut and to have multiple medical comorbidities. The world's first space tourist was aged 60 years when he spent eight days orbiting the Earth as part of a mission to the International Space Station (ISS). His documented medical history was remarkable for the presence of moderately severe bullous emphysema, a spontaneous pneumothorax requiring pleurodesis, a lung parenchymal mass that was biopsied, and atrial and ventricular ectopy. His visit to the ISS passed off without medical complications, however.[4]

While suborbital space flights involve only minutes of weightlessness at altitudes of approximately 100 km above the Earth's surface, they do present significant vertical and horizontal acceleration *g* forces, which can reach 5*g* during launch. Most individuals with well-controlled medical conditions can tolerate these forces during the take-off and landing phases. Age-related blunting of baroreceptor reflexes, however, means that the older space tourist is more likely to experience syncope. The prolonged stasis associated with travel to low Earth orbit (200-400 km above the Earth) exposes the older traveller to a higher risk of thromboembolism. A centrifuge study commissioned by the Federal Aviation Administration reported a low incidence of cardiac symptoms and arrhythmias in older subjects with controlled medical comorbidities. Implanted cardiac devices performed well and were not damaged during the experimental exposure to suborbital spaceflight conditions.[5]

The well-established microgravity-induced changes in body composition, reduced bone density, muscle atrophy, and back pain are more likely to be an issue for older orbital tourists who spend protracted periods in a microgravity environment. Other clinical syndromes to which orbital tourists are susceptible include neurovestibular dysfunction, space intracranial hypertension, and an increased risk of cancer resulting from the effects of immunosuppression.[3] Table I summarises the most important effects of microgravity on cardiovascular and neuromuscular function.

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Table I: Physiologic effects of microgravity in older travellers (modified from Flaherty *et al.*[3])

Body System	Physiologic Effects
Musculoskeletal	• Replacement of skeletal muscle by adipose tissue • Transient decrease in limb volume • Decreased bone density • Decreased skeletal muscle mass • Bone loss-related hypercalciuria causing kidney stones
Neurological	• Impaired visuo-motor tracking • Impaired vestibulo-ocular reflex • Reduced visual acuity • Motion sickness
Cardiovascular	• Decreased plasma volume • Cephalad fluid redistribution • Increased heart rate, maximum at launch and re-entry • Decreased peripheral resistance • Orthostatic hypotension • Increased stroke volume and cardiac output • Increased central venous pressure during launch • Minimal decrease in exercise capacity • Post-flight anaemia caused by reduced haematopoiesis

While guidance exists to assist physicians in providing medical clearance for suborbital space tourists,[6] we believe that clinical recommendations need to be adapted to accommodate the needs of an older space tourist clientele. It would be of interest to seek the views of older individuals on this subject. To the best of our knowledge, no research exploring the views of the older generation towards the prospect of personal space flight participation has been undertaken. Whether space flight participation will remain the preserve of high net worth individuals or become more democratised in the future remains to be observed. Although there is a stringent process in place for the selection of astronauts for space missions, we anticipate that physicians who specialise in the care of older patients may be involved in counselling them about the biomedical challenges of space travel, particularly orbital travel in a microgravity environment. It seems likely in the near future that space travel will no longer be "a game for the young".

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