Advancing Astropharmacy and Sports Pharmacy

Guest Editors: Ashley Anderson R.Ph., IOC-Drugs in Sport, Ahmer Raza R.Ph., PharmD., MPharm, Shireen Aziz R.Ph., PharmD., MS Pharmacology, Misbah Noreen R.Ph., PharmD., MS Pharmacology

Ashley Anderson R.Ph., IOC-Drugs in Sport, (sportspharmacists@gmail.com)
Ashley Anderson, B.S.Pharm, MBA, International Olympic Committee-Drugs in Sport Certificate is a clinical pharmacist at an acute care hospital, working in general practice and also specializes in Clincal Sports Pharmacy. Ms. Anderson received her pharmacy degree from Butler University and completed studies in herbal medicine in Zhejiang China during and after pharmacy school. From 2006 until 2021, Ms. Anderson worked for the US Anti-Doping Agency, answering calls on the Drug Reference Line, creating drug information materials for elite athletes and the public, and leading the ingredient management for the search engine called Global DRO. Ms. Anderson has been a thought leader in Sports Pharmacy Integrity and is the founder of the International Sports Pharmacists Network, creator of the University of Southern California Sports Pharmacy curriculum, and was the lead content contributor and editor for the FIP global report on Sports Pharmacy.

Ahmer Raza R.Ph., (ahmerraza313@yahoo.com**)**
Ahmer Raza, Pharm.D., MPharm., is a Ph.D. student in Clinical Pharmacy, actively contributing to the I-CARE4OLD project—an EU-funded initiative. His research focuses on developing an innovative decision-support AI tool for personalized care aimed at optimizing treatments, enhancing the quality of life for individuals with chronic complex conditions, improving the overall quality of care, and reducing societal healthcare costs. In addition to his work in clinical pharmacy, Ahmer is passionately advancing the concept of Astropharmacy in collaboration with experts from the University of Minnesota, exploring the unique challenges and opportunities of pharmaceutical care in space exploration. He is dedicated to pushing the boundaries of pharmacy science by bridging clinical innovations with futuristic domains like Astropharmacy, while also advocating for the establishment of specialized Space Pharmacy Council and research frameworks to support these emerging fields.

Shireen Aziz R.Ph., (shireenaziz1994@yahoo.com)
Shireen Aziz, Pharm.D., MS Pharmacology, is a Ph.D. student in Clinical Pharmacy actively contributing to the I-CARE4OLD project. Her research interest are on pharmacokinetic and pharmacodynamic (PKPD) changes in space, drug stability under space conditions, and the effects of the space environment on human physiopharmacology. In addition to her clinical pharmacy research, Shireen is actively working on advancing the concept of Astropharmacy, exploring innovative pharmaceutical solutions for long-duration space missions and extraterrestrial environments. Her work aims to bridge the gap between terrestrial pharmacology and space medicine, contributing to the development of specialized guidelines and frameworks for pharmaceutical care in space exploration. With a vision for groundbreaking advancements, she collaborates with international experts to establish Astropharmacy as a transformative field in pharmacy and space research.

Misbah Noreen R.Ph., (misbahshah101@gmail.com)
Misbah Noreen is a pharmacist with a strong foundation in Biomedicine. Her research interests focus on understanding PKPD changes in extreme environments, such as space, and exploring how these changes influence drug efficacy and safety. She is actively working on addressing the challenges of medication stability in space and investigating the physiological effects of the space environment on drug metabolism and action. Misbah is also contributing to the advancement of the emerging field of Astropharmacy, collaborating with global experts to explore innovative pharmaceutical practices and regulatory frameworks for space missions. With her strong interdisciplinary approach, she is passionate about bridging gaps between clinical pharmacy and novel frontiers like space medicine. She aims to contribute to the global pharmacy profession by shaping innovative pharmaceutical practices that can adapt to diverse and challenging environments.

Keywords: Astropharmacy, Sports Pharmacy, Space Pharmacy Council, Pharmacist

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Dear Editor:
We invite pharmacists, researchers, academicians, and professionals to contribute to advancing the emerging field of **Astropharmacy** and **Sports Pharmacy** through innovative and thought-provoking research papers.

Introduction:
Pharmacists have a vital role to play in shaping the future of space exploration. As humanity ventures into space, the challenges of ensuring the safe and effective use of medications in extreme environments, along with pre-launch conditioning and re-acclimating upon return to Earth, become increasingly complex. Astropharmacy is an emerging discipline dedicated to addressing these challenges by leveraging the expertise of pharmacy professionals. With the challenges of microgravity, radiation exposure, limited resources, and the physiological changes experienced by astronauts, preserving health and ensuring safe and effective drug therapy in space is vital.

Astropharmacy and sports pharmacy can be complementary to each other, as astronauts can be considered the ultimate athletes. Like elite athletes, astronauts undergo intense physical conditioning, experience extreme physiological demands, and require precise health management to optimize performance and recovery. Both fields focus on addressing issues such as muscle atrophy, bone density loss, hydration, nutritional supplementation, and medication use in challenging conditions. By integrating insights from Sports Pharmacy into Astropharmacy, innovative strategies for managing health, performance, and recovery in space can be developed. Similarly, advancements in space medicine can contribute to enhancing care for athletes, particularly in areas such as drug stability under extreme conditions, precision dosing, and novel delivery systems. This synergy highlights the potential for cross-disciplinary innovation, advancing pharmaceutical practices in both terrestrial and extraterrestrial settings.

This call for papers seeks to explore the evolving role of pharmacists and the discipline of pharmacy in supporting space exploration and Sports Pharmacy. From logistical concerns of pharmaceutics to sports pharmacy and remote drug information services, pharmacists improve systems and advance astronaut safety. 3D printing of drugs, developing stable formulations for medications or utilizing

DOI: https://doi.org/10.24926/iip.v16i1.6548

pharmacogenomic insights for personalized treatments, pharmacists have the expertise to address the unique medical needs of recreational space travelers and career astronauts. The integration of pharmacological research with advancements in space technology offers an unparalleled opportunity to pioneer solutions for long-duration missions to the Moon, Mars, and beyond.

We invite pharmacists, researchers, clinicians, and industry professionals to contribute original research, reviews, commentary, idea papers, case studies, experiences, student projects, notes, and perspectives that advance the fields of Astropharmacy and Sports Pharmacy. These fields share a unique synergy, particularly in their focus on optimizing human performance and health under extreme conditions. Contributions could address a variety of topics, including but not limited to:

- **Developing strategies for medicine storage and stability** under conditions of microgravity, radiation exposure, extreme temperatures, and during high-intensity sports training or events.
- **Designing and implementing emergency preparedness frameworks** to ensure timely pharmaceutical interventions during space missions and in competitive sports settings.
- **Innovating on-site pharmaceutical preparation methods** to ensure astronauts' and athletes' health and safety during extended spaceflights or high-demand sports tournaments.
- **Exploring the role of sports pharmacology and clinical sports pharmacy practices** in pre-launch training and rehabilitation for astronauts, highlighting the parallels between astronaut health and elite athletic performance.
- **Conducting research on pharmacokinetics and pharmacodynamics (PKPD)** in zero gravity, and applying these insights to better understand the effects of physical exertion and environmental stressors on drug efficacy and safety in athletes.
- **Developing prevention or treatment protocols** for health conditions such as muscle atrophy, bone density loss, and oxidative stress—common to both astronauts and athletes.
- **Advancing sports pharmacy practices** by integrating findings from space medicine, including innovative drug delivery systems, performance enhancement strategies, and recovery protocols.
- **Leading efforts to establish specialized curricula** for Space and Sports Pharmacy, training future pharmacists to address unique challenges in microgravity environments and high-performance sports.

Potential topics include, but are not limited to:

Astropharmacy

- PKPD modeling and simulation in microgravity environments.
- Long-term medication stability under extreme space conditions.
- Innovations in drug delivery systems for space missions.
- Innovations in human performance and endurance for space travel.
- Establishment of personalized drug information technology.
- Occupational health and pharmacy.
- Health, training, medication use of military personnel
- Drug-mediated immunotherapy or innate healing technology.
- Development of a specialized **Space Pharmacy Curriculum**.
- Ethical, regulatory, and logistical considerations for pharmaceutical care in space.
- Pharmacogenomics in space.

Sports Pharmacy

- Innovations in drug testing and anti-doping strategies in professional sports.
- Role of pharmacists in managing injury recovery and rehabilitation in athletes.
- Astronauts and military personnel as athletes.
- PKPD of medications used in athletes during high-performance sports activities.
- Development of personalized sports pharmacology protocols to optimize athletic performance.
- Nutritional supplements and their pharmaceutical implications in enhancing endurance and recovery.
- Management of medication use in athletes with chronic medical conditions.
- Integration of technology in monitoring drug effects and health parameters in athletes.
- Collaborative role of sports pharmacists in multidisciplinary teams for athlete care.
- Drug safety and adverse effect management in sports pharmacy practice.
- Ethical and regulatory aspects of medication use in professional and recreational sports.

We aim to raise awareness and establish a foundation for this emerging field by bringing together the pharmacy community to explore these critical challenges. Accepted papers will provide valuable insights for advancing Astropharmacy and Sport Pharmacy as a specialty, paving the way for the creation of a **Space Pharmacy Council** and the integration of Astropharmacy and Sports Pharmacy into academic and professional domains.

DOI: https://doi.org/10.24926/iip.v16i1.6548

Submission information:
Information about submitting a paper to **INNOVATIONS in pharmacy** can be found at:
https://pubs.lib.umn.edu/index.php/innovations/about/submissions
https://pubs.lib.umn.edu/index.php/innovations/aimsandscope

Editor's Note: When responding to this Call for Papers, select the PHARMACY PRACTICE & PRACTICE-BASED RESEARCH section of this journal, Jon Schommer, Editor. The Guest Editors will serve as part of the review team for all submissions.

Key deadlines: There are no fixed deadlines for submission. Manuscripts will be reviewed on a rolling basis as they are received. We encourage authors to submit their work at their earliest convenience to ensure timely consideration and feedback.

Disclaimer: The statements, opinions, and data contained in all publications are those of the authors.

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DOI: https://doi.org/10.24926/iip.v16i1.6548