



Space Adaptation Back Pain A Retrospective Study

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Aerospace Medical Association

80th Annual Scientific Meeting

Los Angeles, CA

May 2009

Space Adaption Back Pain



- Astronauts frequently report back pain in the early phase of space flight as they adapt to microgravity
- The epidemiology of space adaptation back pain (SABP) has not been well established



Objectives



- Determine the exact incidence of SABP among astronauts
- Develop a case definition of SABP
- Delineate the nature and pattern of SABP
- Review available treatments and their effectiveness in relieving SABP
- Identify any operational impact of SABP

Retrospective review of all available mission medical records of astronauts in the U.S. space program, which included:

- Preflight medical exams
- Flight surgeon logs
- Postflight medical exams
- Postflight medical debriefs
- Standardized back pain questionnaire
- Private Medical Conference (PMC) Tool

Missions



- Mercury
- Gemini
- Apollo
- Apollo-Soyuz Test Project (ASTP)
- Mir (U.S. Astronauts only)
- Skylab
- International Space Station (ISS) missions (Expedition 1 through 15)
- Shuttle missions STS-1 through STS-122 (Except STS-51L Challenger and STS-107 Columbia)

Study Size



A total of 772 astronaut flights were reviewed



Case Definition of SABP



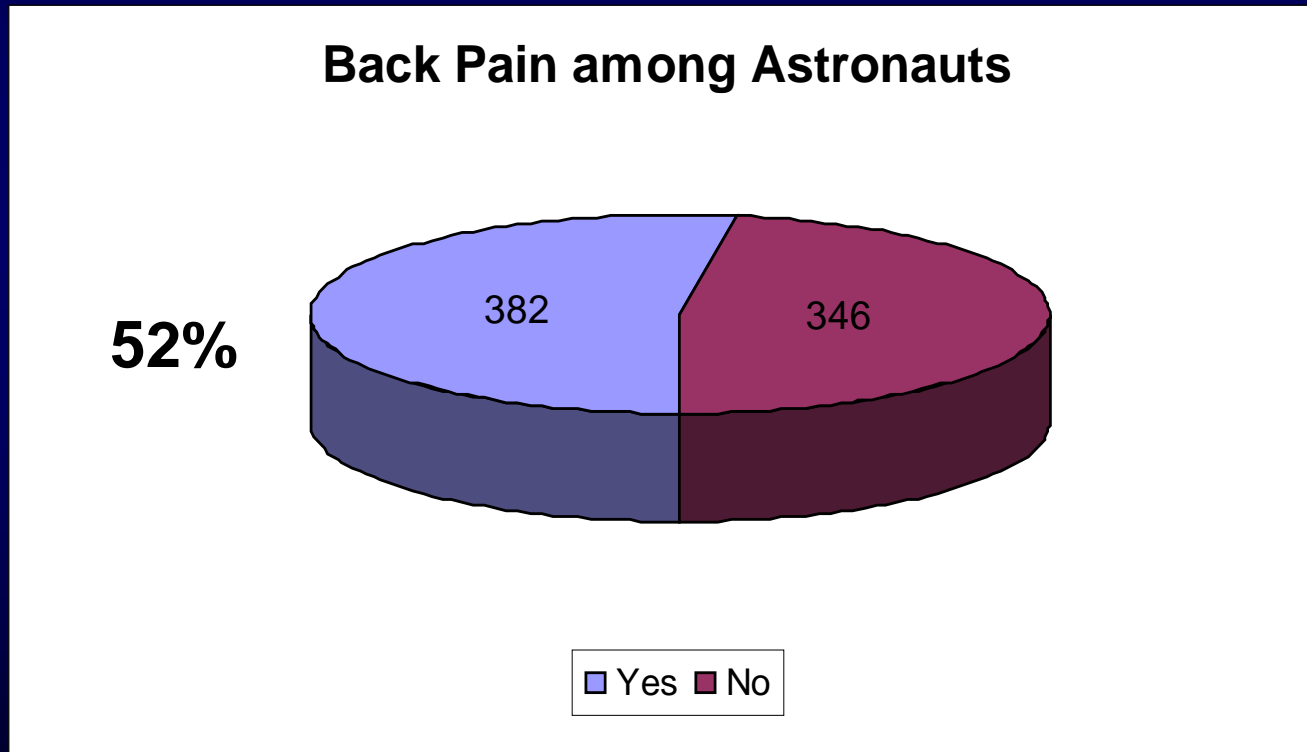
- Symptoms are not precipitated by an injury or related to prolonged recumbent sitting on the launch pad
- Symptoms develop within the first 5 days of space flight
- Multiple days of in-flight back pain were considered as one case



Results



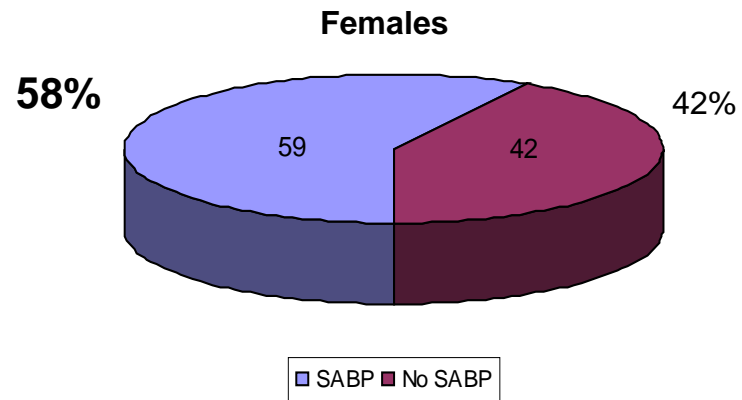
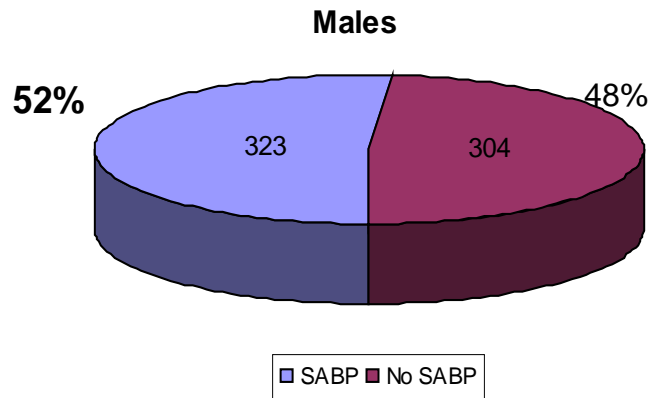
Incidence of SABP was 52%



Gender Analysis



Comparison of Gender and Space Adaptation Back Pain



Males

SABP 52%

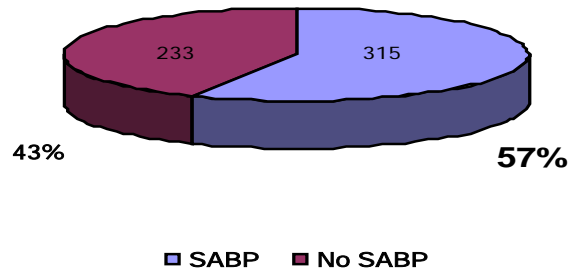
Females

SABP 58%

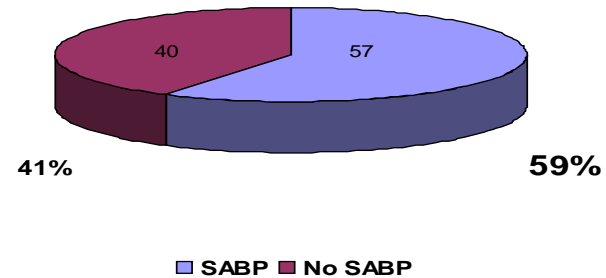
Shuttle Gender Analysis



Shuttle SABP Analysis Males



Shuttle SABP Analysis Females



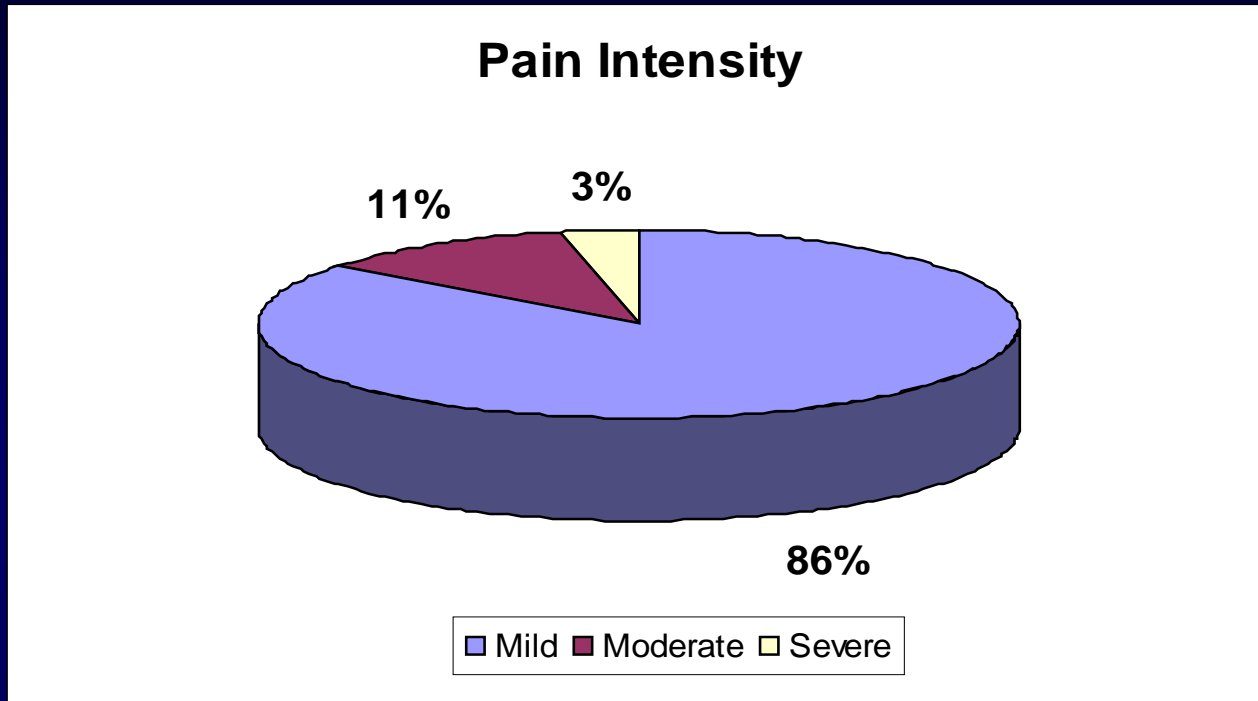
Males

SABP 57%

Females

SABP 59%

SABP Intensity

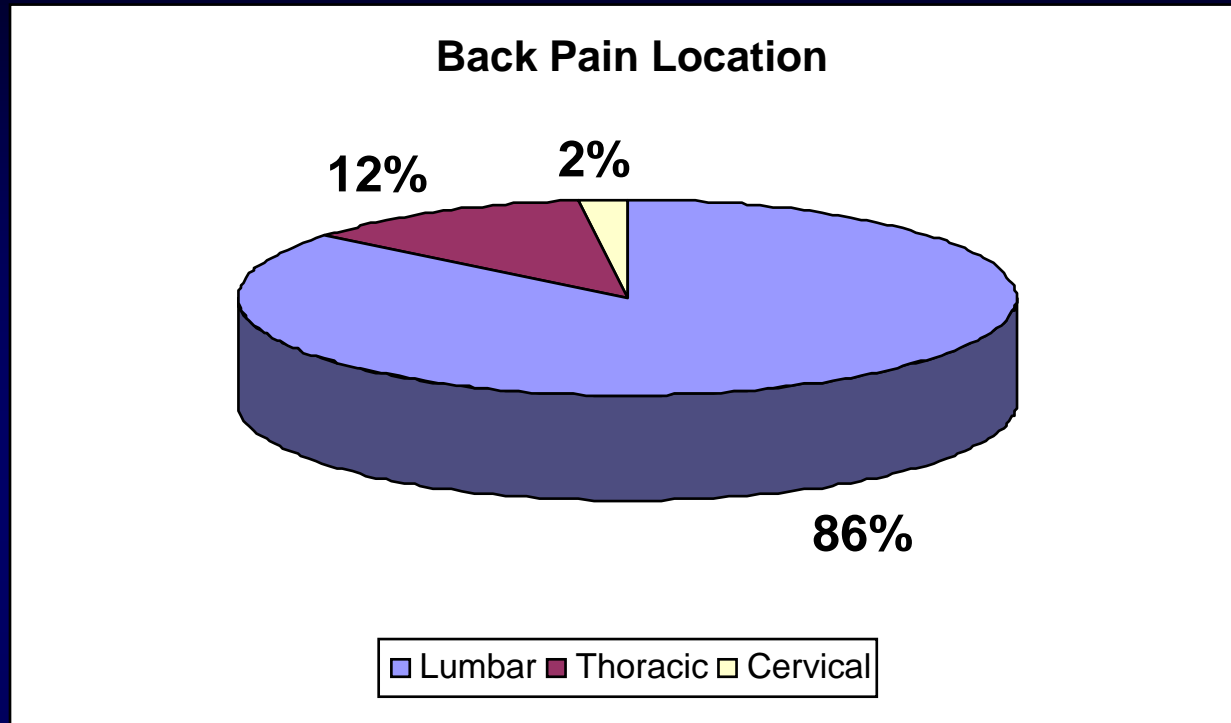


Mild pain 86%

Moderate pain 11%

Severe pain 3%

SABP Location



Lumbar 86%

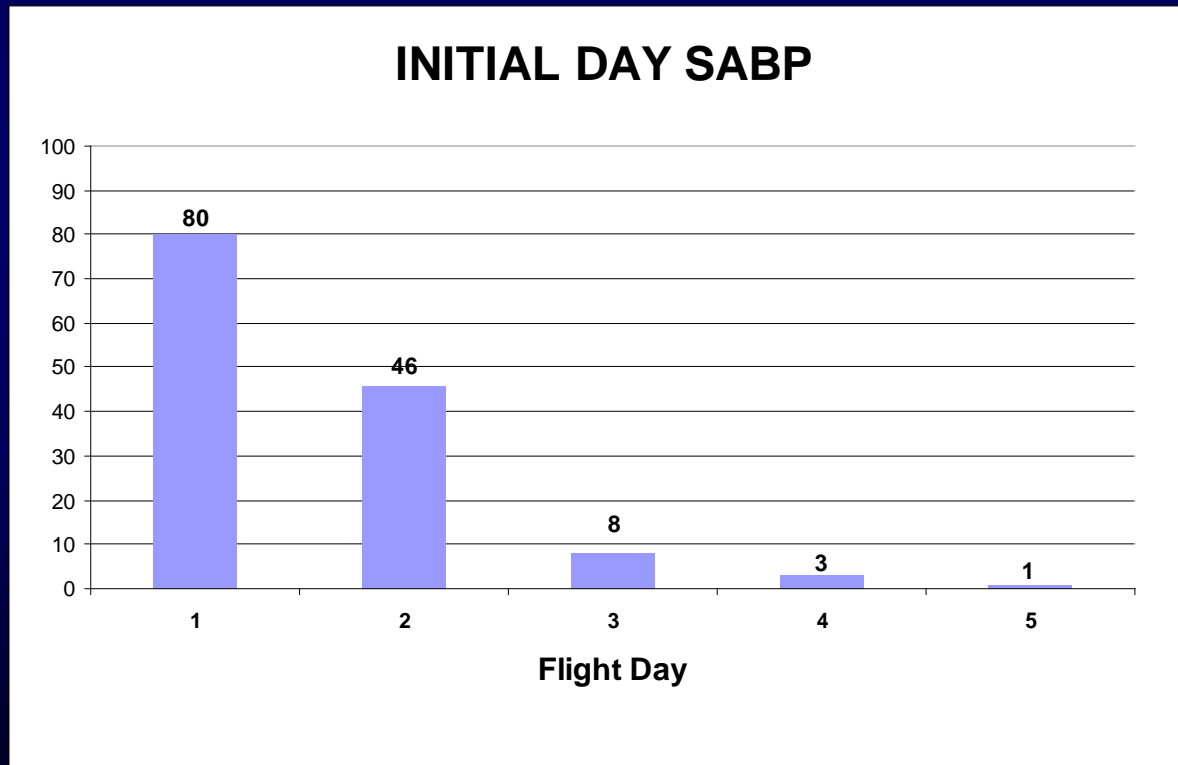
Thoracic 12%

Cervical 2%

Onset of SABP



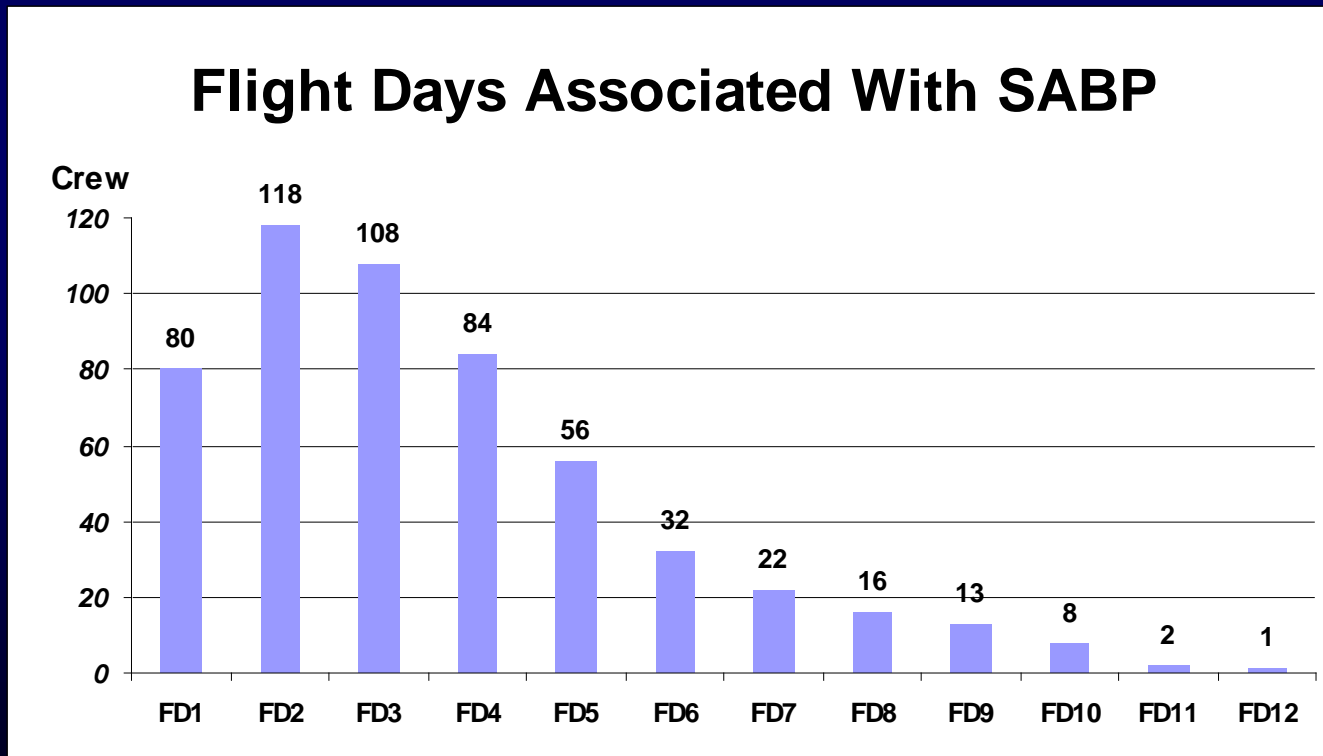
In most SABP cases, the initial onset of symptoms was within the first 2 days of space flight. Only 12 astronauts reported an onset of symptoms after flight day 2



SABP & Flight Days



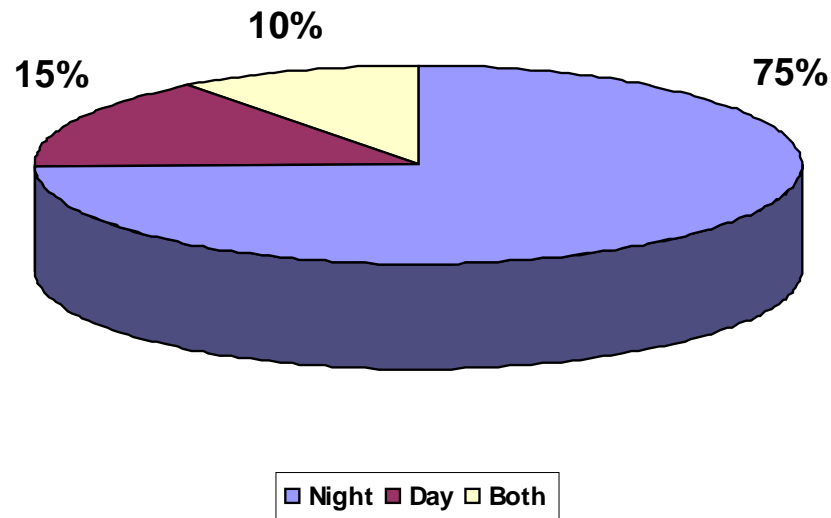
SABP is present in the early phase of spaceflight, with a peak prevalence on flight day 2 and none reported after flight day 12



Temporal Component



Time of Day SABP Present



Night **75%**

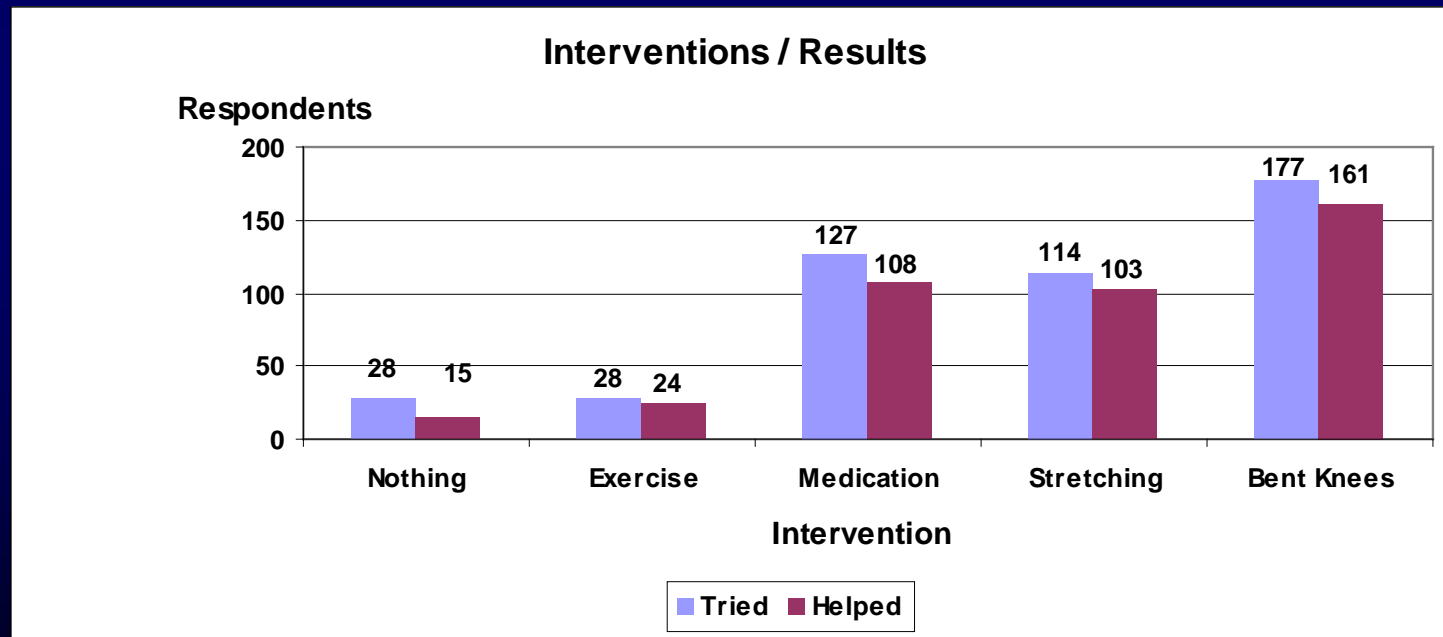
Day **15%**

Both **10%**

Effectiveness of Treatments



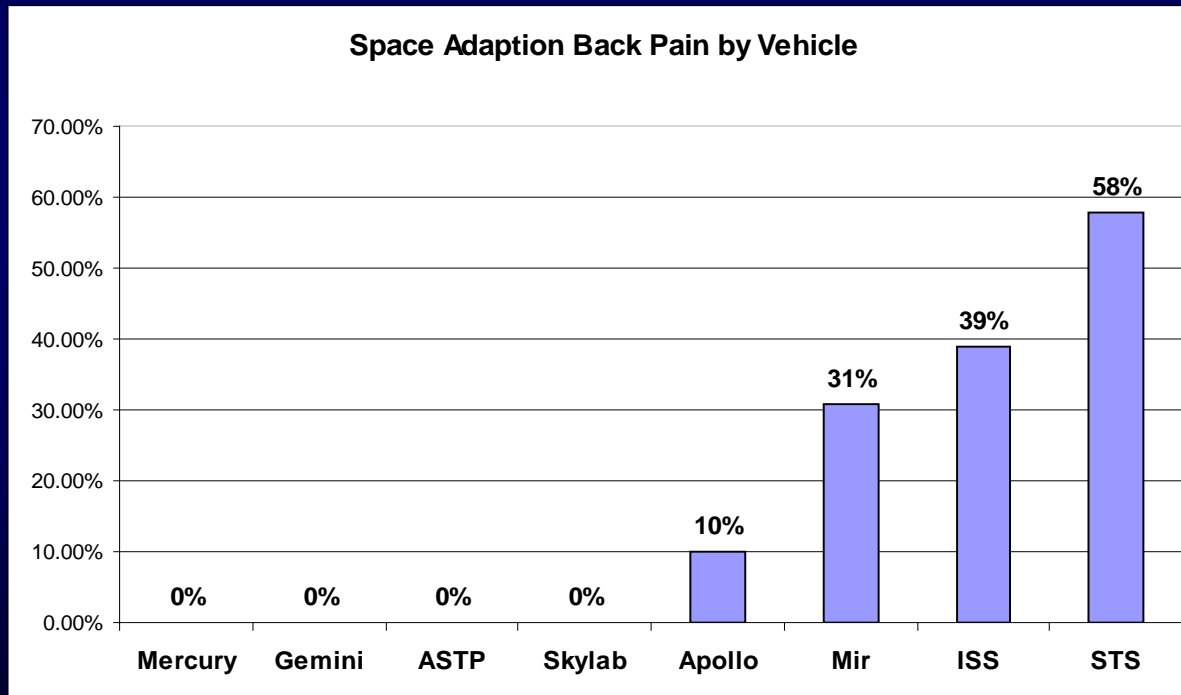
The most effective treatments were bending the knees to the chest (91%), stretching the lumbar spine (90%) and anti-inflammatory medication (85%)



Vehicle Analysis



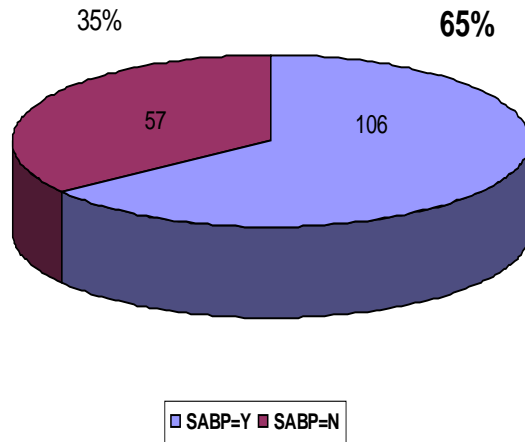
The incidence of SABP varied in relation to the space flight vehicle



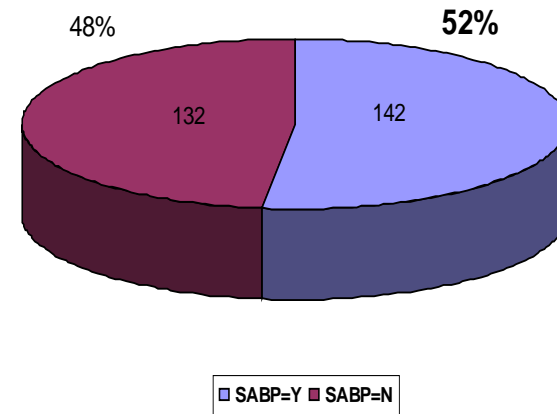
History of Pre-flight Back Pain



Positive History of Preflight Back Pain Analysis



Negative history of Preflight Back Analysis



Positive History

SABP 65%

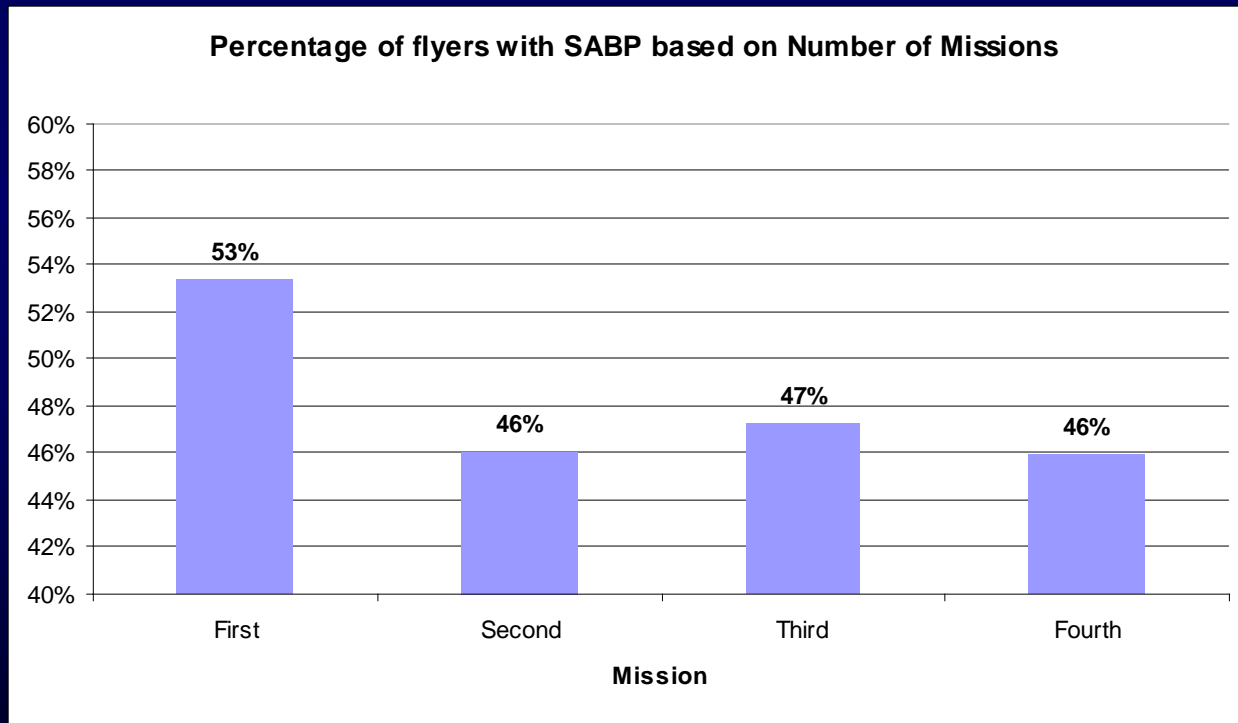
Negative History

SABP 52%

SABP Based on Number of Missions



Among astronauts who flew more than one mission; they had a higher incidence of SABP on their first mission than on subsequent missions



SABP Characteristics



- Symptoms are usually mild to moderate
- Symptoms are usually localized to the lumbar region
- Symptoms are described as an ache or stiffness
- Symptoms typically occur during the sleep period
- Neurological symptoms (radicular pain, numbness, tingling) are absent
- Symptoms tend to improve or resolve with the use of bending the knees to the chest, stretching of the lumbar spine, or anti-inflammatory medication

Conclusions



- The incidence of SABP has been determined to be 53% among astronauts in the U.S. space program
- Most cases of SABP are mild, self-limited, or respond to available treatments
- There are no currently accepted preventive measures for SABP
- It is difficult to predict who will develop SABP
- The precise mechanism and spinal structures responsible for SABP are uncertain
- There was no documented evidence of direct operational mission impact related to SABP
- There is *potential* mission impact related to uncontrolled pain, sleep disturbance, or the adverse side effects of anti-inflammatory medications

Limitations



- Retrospective study
 - Missing data
 - Misinterpretation of existing data
- Standardized back pain questionnaire only used on Shuttle missions
- Reluctance among astronauts to report in-flight back pain

Recommendations



- Promote the most effective treatments of SABP with the least potential for adverse side effects
- Sleep accommodations on all space flight vehicles should allow for crewmembers to bend their knees to the chest
- The precise mechanism, spinal structures and causative factors associated with SABP should be further investigated in order to facilitate the development of preventive measures, as well as additional effective treatments

Acknowledgements



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Questions



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