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# Space Adaptation Back Pain A Retrospective Study

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# 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

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- 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

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- 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



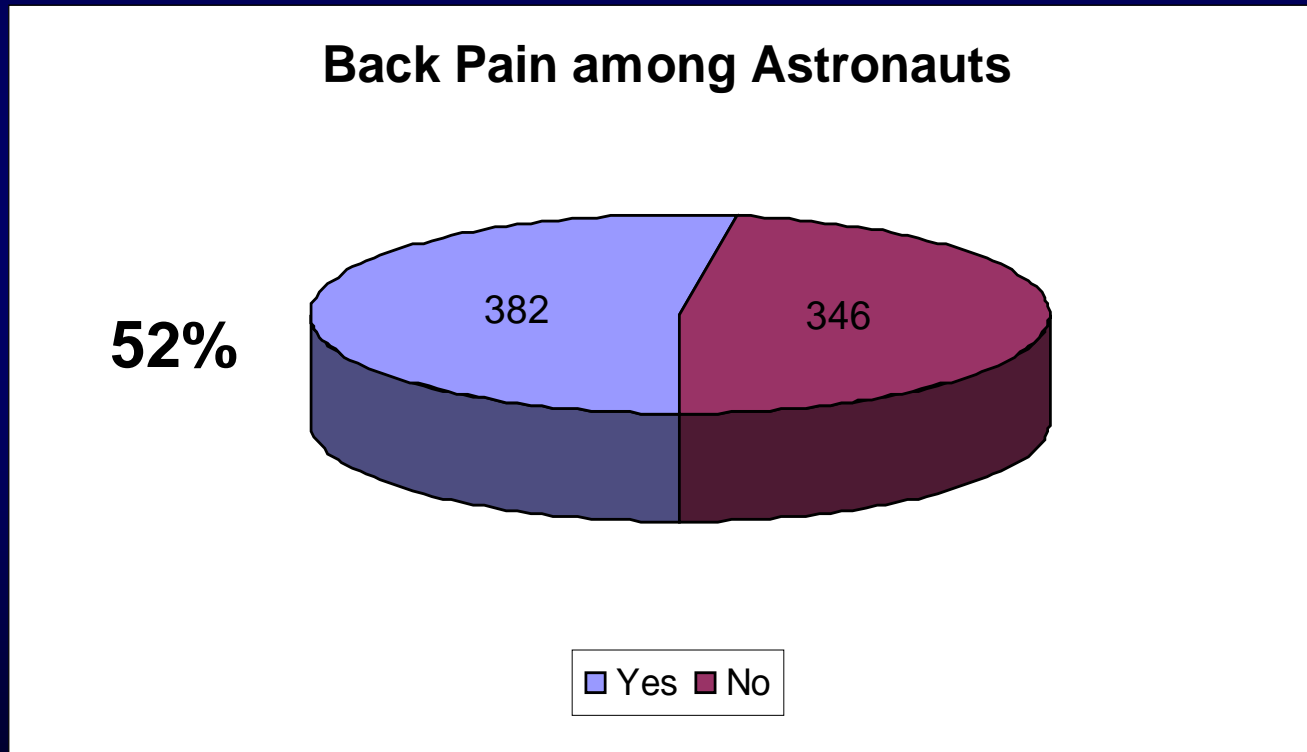
- Symptoms are not precipitated by an injury or related to prolonged recumbent sitting on the launch pad
- Symptoms develop within the first 5 days of space flight
- Multiple days of in-flight back pain were considered as one case



# Results



Incidence of SABP was 52%

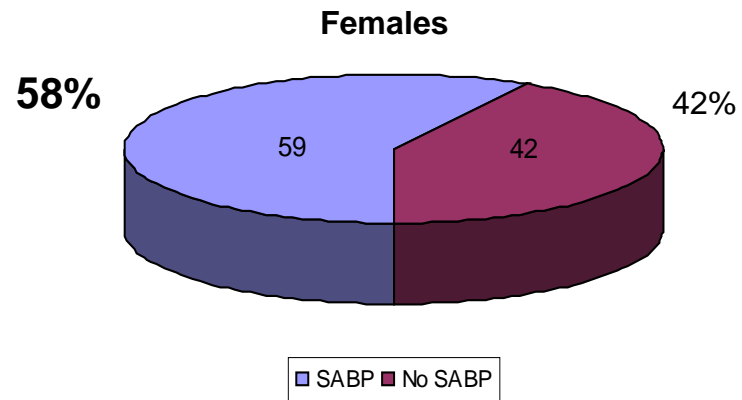
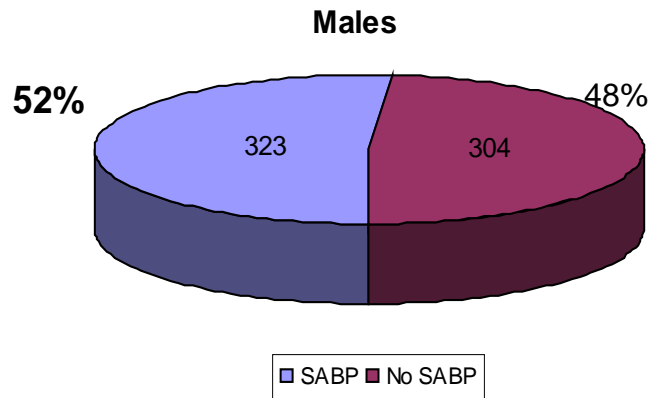




# Gender Analysis



## Comparison of Gender and Space Adaptation Back Pain



**Males**

**SABP 52%**

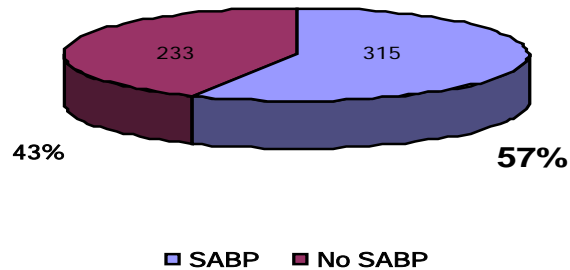
**Females**

**SABP 58%**

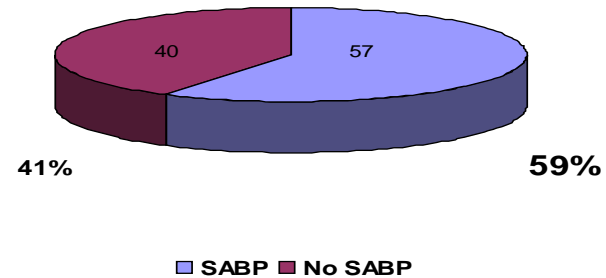
# Shuttle Gender Analysis



## Shuttle SABP Analysis Males



## Shuttle SABP Analysis Females



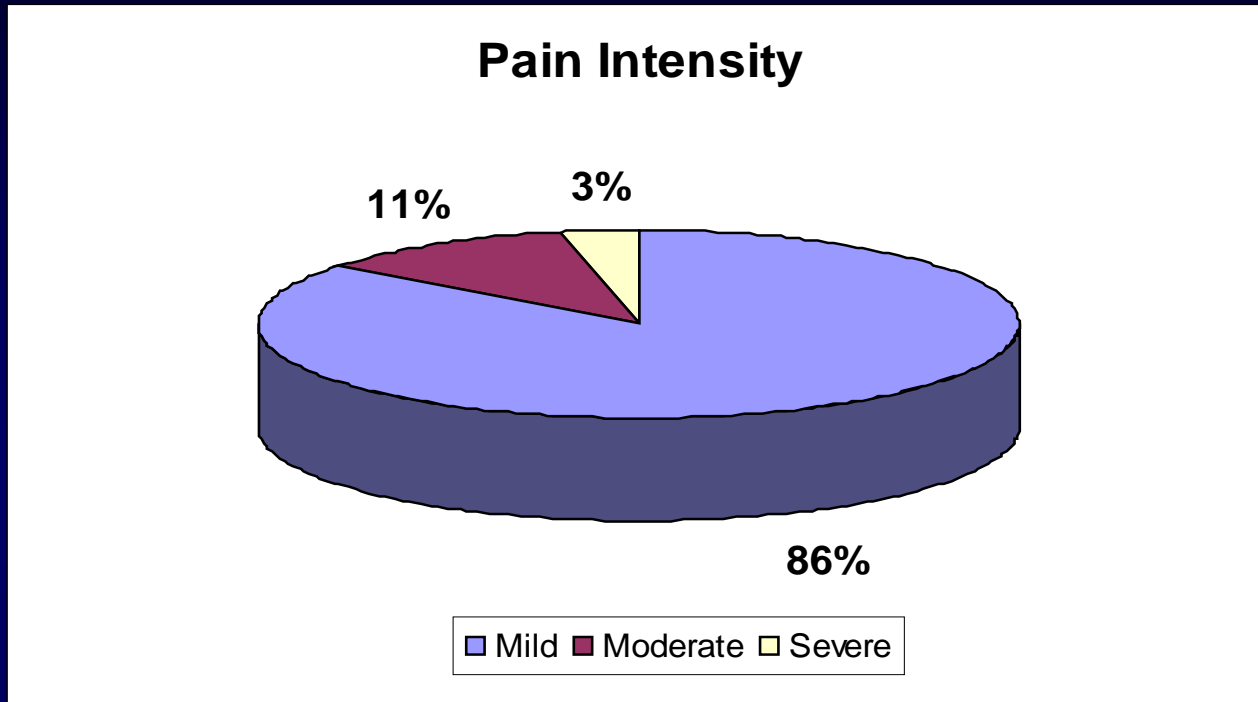
**Males**

**SABP 57%**

**Females**

**SABP 59%**

# SABP Intensity

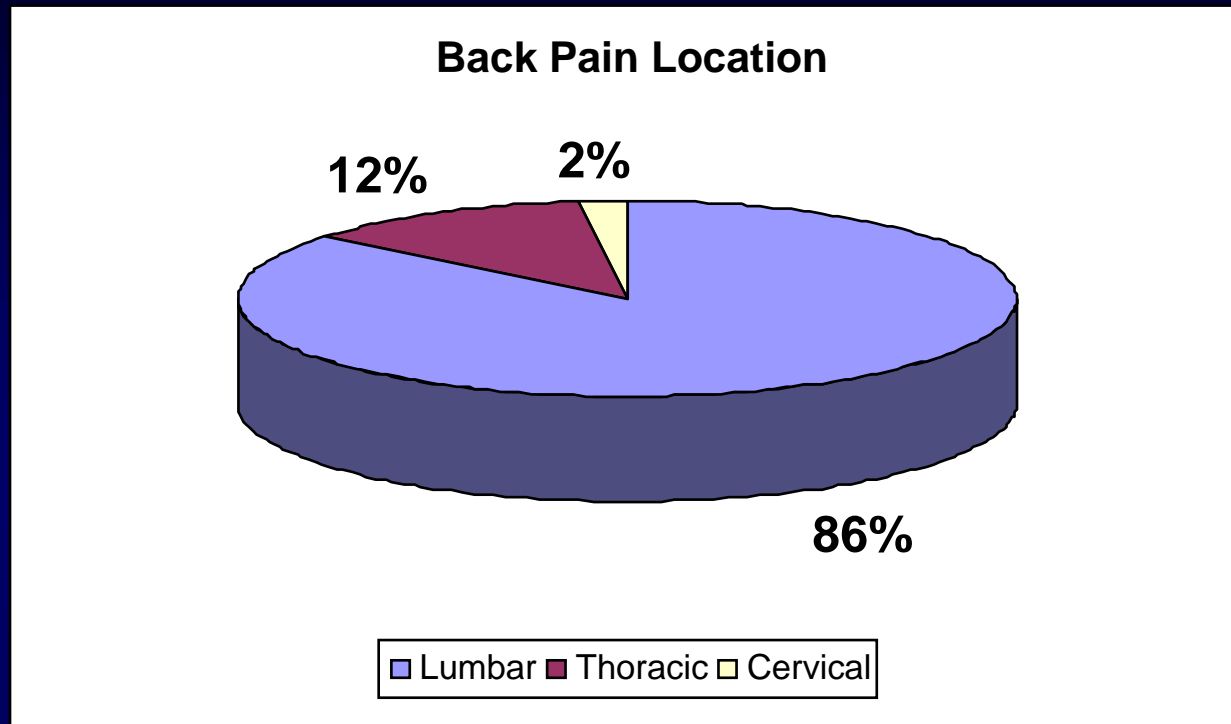


**Mild pain 86%**

**Moderate pain 11%**

**Severe pain 3%**

# SABP Location



**Lumbar 86%**

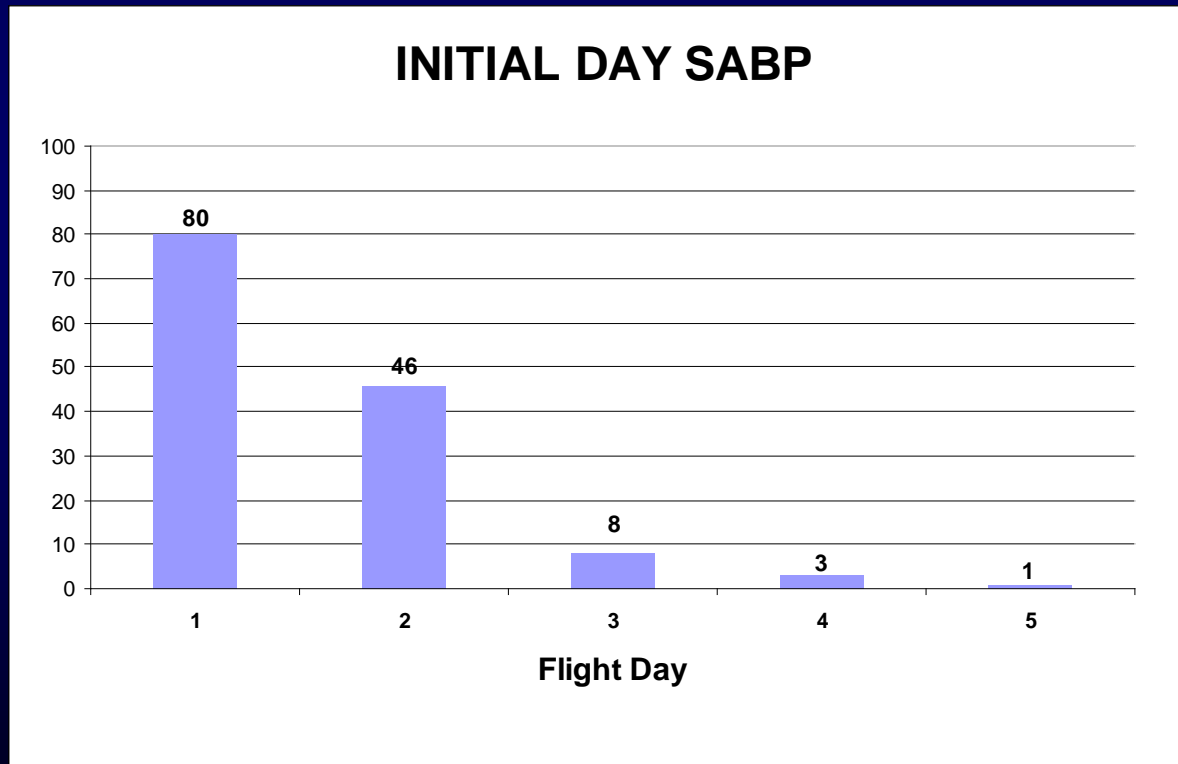
**Thoracic 12%**

**Cervical 2%**

# Onset of SABP



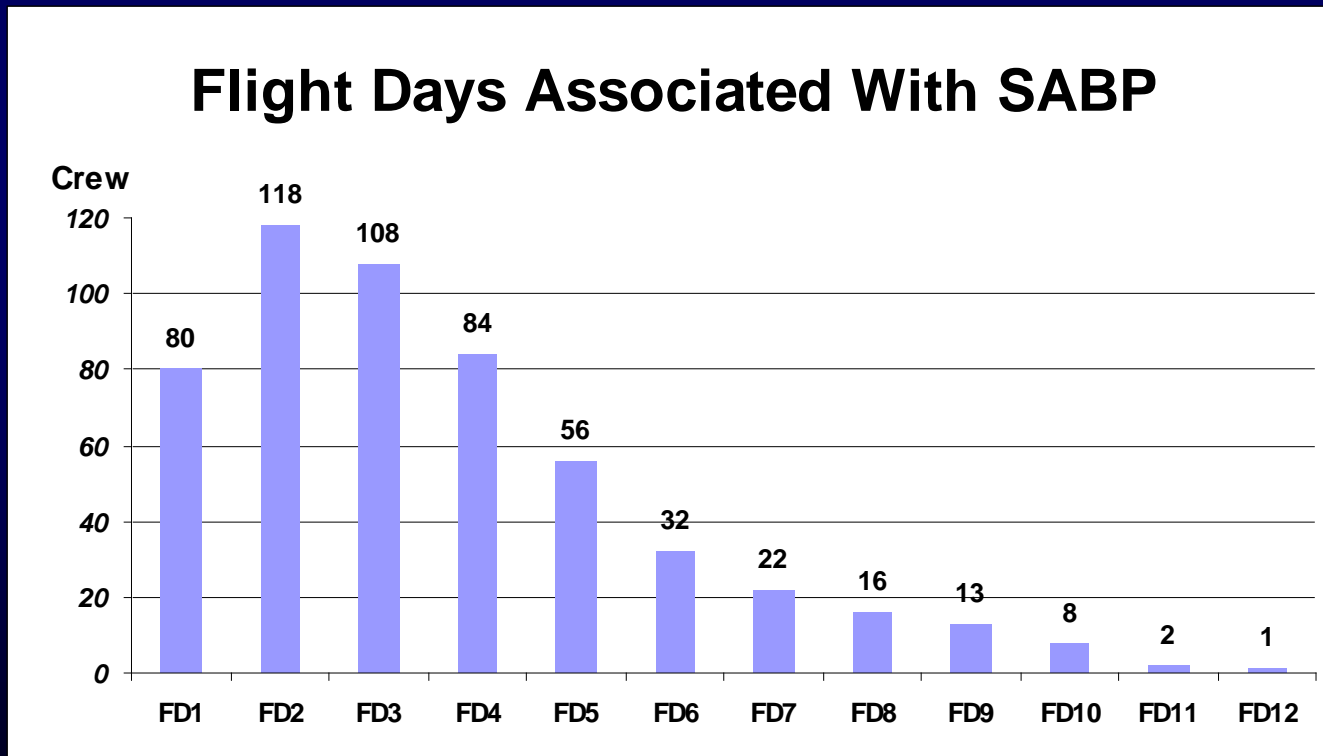
In most SABP cases, the initial onset of symptoms was within the first 2 days of space flight. Only 12 astronauts reported an onset of symptoms after flight day 2



# SABP & Flight Days



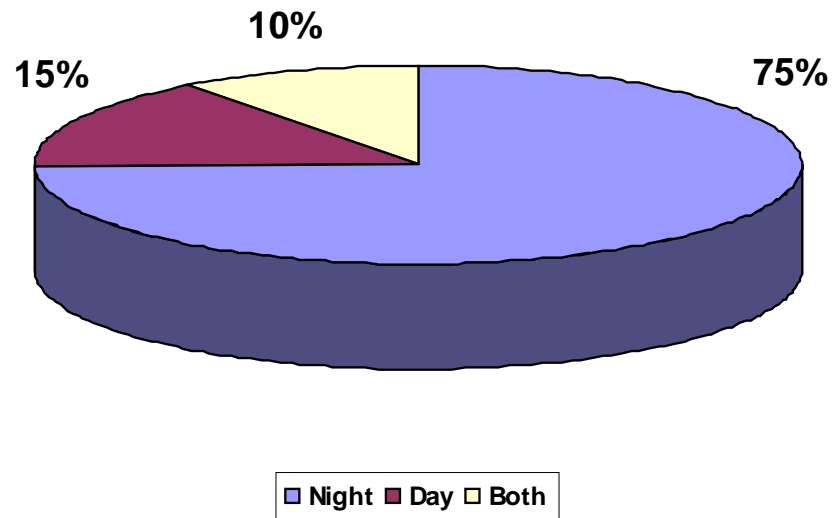
**SABP is present in the early phase of spaceflight, with a peak prevalence on flight day 2 and none reported after flight day 12**



# Temporal Component



Time of Day SABP Present



**Night**            **75%**

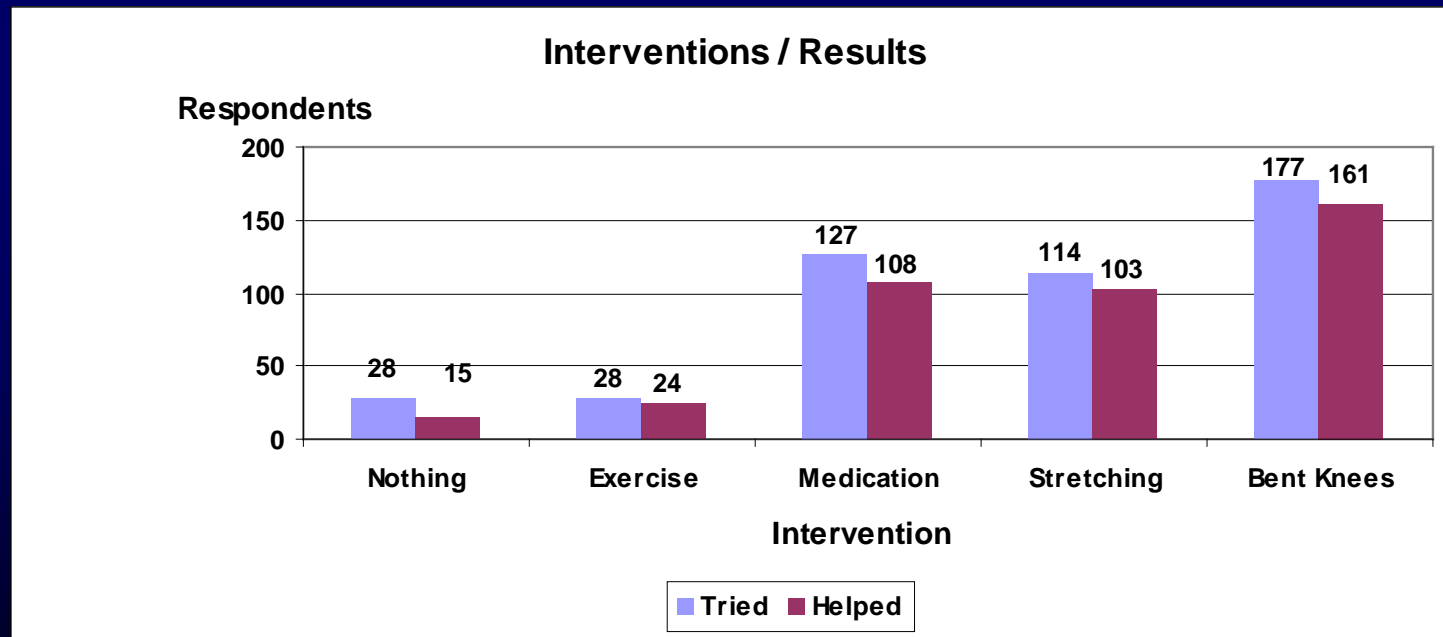
**Day**             **15%**

**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%)

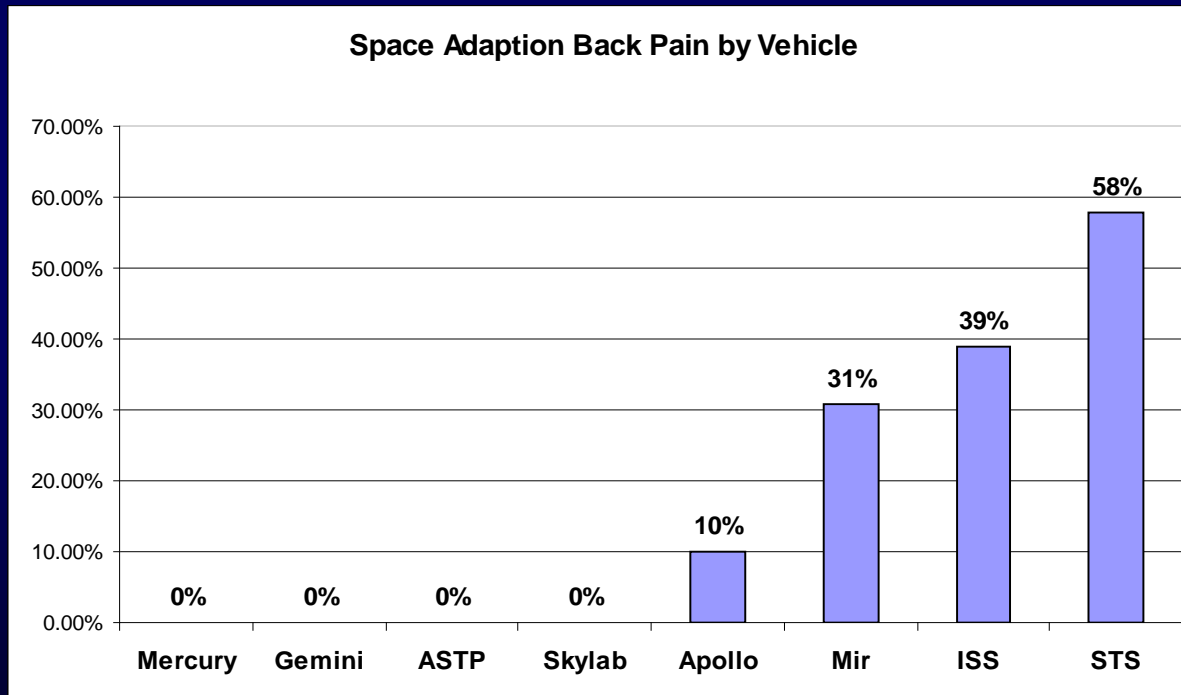




# Vehicle Analysis



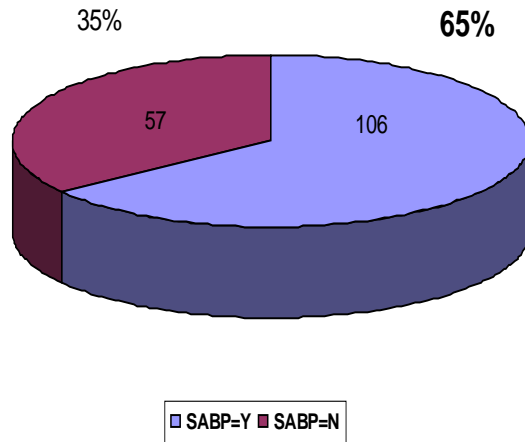
The incidence of SABP varied in relation to the space flight vehicle



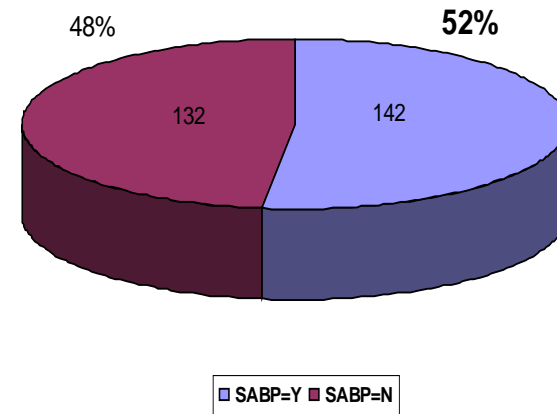
# History of Pre-flight Back Pain



Positive History of Preflight Back Pain Analysis



Negative history of Preflight Back Analysis



**Positive History**

**SABP 65%**

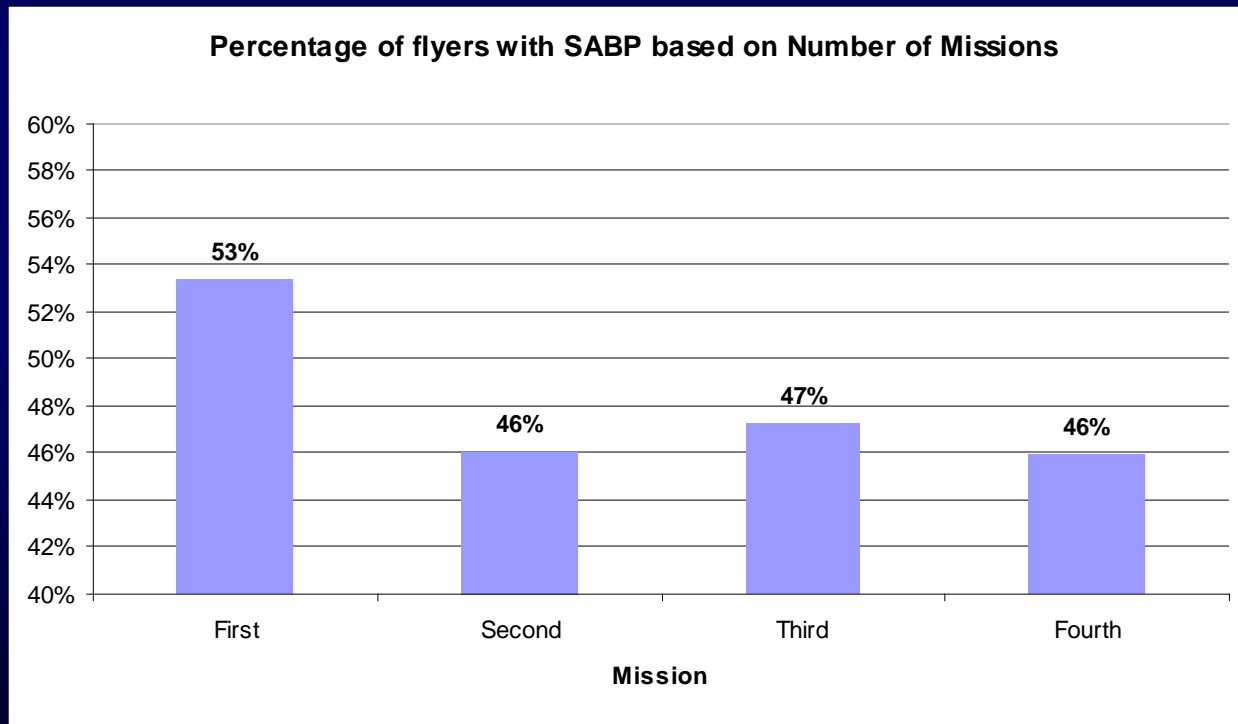
**Negative History**

**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

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- 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

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- 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

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- 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

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- 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

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# Questions

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