My invention is a chair with five legs. The fifth legs (normal chairs have only 4) helps to keep balance in case one of the other legs is broken. The fifth leg is metallic to ensure strength. The fifth leg is positioned to the backside of the chair.

The literature review reveals no existing studies that examine chairs with a rear-positioned metallic fifth leg designed as a backup for maintaining balance when other legs break.

Abstract

Lee et al. (2025) report that a four-leg chair with weight sensors can assess balance, while [illegible] (2005) describes a folding chair that uses sliding bushes and struts for stability. [illegible] and [illegible] (2015) detail an office chair with five legs arranged in a circle; its design employs a central metal support and connecting plates for ease of assembly but does not place the extra leg at the rear or specify its role as a backup if another leg fails. Akritas (1993) mentions metal rod legs and components that link chairs to restrict movement, and [illegible] (2003) presents an adjustable student chair with liftable legs. None of these studies address a rear-positioned metallic leg intended to provide redundancy in the event of leg failure.

Paper search

We performed a semantic search using the query "My invention is a chair with five legs. The fifth legs (normal chairs have only 4) helps to keep balance in case one of the other legs is broken. The fifth leg is metallic to ensure strength. The fifth leg is positioned to the backside of the chair." across over 126 million academic papers from the Elicit search engine, which includes all of Semantic Scholar and OpenAlex.

We retrieved the 50 papers most relevant to the query.

Screening

We screened in sources that met these criteria:

- **Chair Leg Configuration**: Does the study evaluate chairs with five or more legs OR compare multi-legged chairs (≥5 legs) to traditional four-legged chairs?
- **Stability Outcomes**: Does the study measure chair stability, balance, or structural integrity?
- **Safety Outcomes**: Does the study evaluate chair safety, fall prevention, or injury reduction?
- **Human Participants**: Does the study involve human participants using chairs in real-world settings?
- **Study Design and Data Quality**: Is the study an experimental study, observational study, case study, systematic review, or meta-analysis that contains original data (not just conference abstracts, editorials, or opinion pieces)?
- **Relevance to Structural Stability**: Does the study focus on structural stability rather than solely on chair aesthetics, comfort, or ergonomics without stability measures?
- **Comparable Chair Design**: Does the study evaluate standard chairs rather than specialized medical chairs, wheelchairs, or non-traditional seating (stools, benches, bean bags)?
- **Determinable Leg Configuration**: Can the chair leg configuration be clearly determined from the study description?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Chair Configuration**:

  Extract complete details about the chair's physical design including:

- Number of legs/support points
- Arrangement/positioning of legs (e.g., square, circular, asymmetric)
- Overall chair type (office, dining, folding, etc.)
- Any unique structural features
- Dimensions or size specifications if provided

- **Leg Materials**:

  Document all materials used for chair legs or support structures including:

- Primary material type (metal, wood, plastic, composite)
- Specific material properties mentioned (strength, durability, weight)
- Any material combinations or reinforcements
- Rationale for material choice if provided
- Any material testing data or specifications

- **Stability Features**:

  Extract any design elements specifically related to chair stability or balance including:

- Anti-tip mechanisms
- Balance-enhancing features
- Stability testing results
- Load distribution methods
- Weight limits or capacity specifications
- Any claims about improved stability over traditional designs

- **Failure Prevention**:

  Document any design features intended to address chair failure including:

- What types of failures are addressed (leg breakage, tipping, structural collapse)
- Redundancy or backup systems
- Safety mechanisms
- Durability enhancements
- Any failure testing or analysis
- Comparison to failure modes of conventional chairs

- **Performance Testing**:

  Extract any experimental data, testing, or validation including:

- Strength testing results
- Stability measurements
- User testing or clinical studies

- Comparison with other chair designs
- Load testing or stress analysis
- Any quantitative performance metrics
- Testing standards referenced (ANSI, BIFMA, etc.)

- **Design Purpose**:

  Identify the primary intended function and advantages claimed including:

- Main problem the design solves
- Target user population or use case
- Specific advantages over existing solutions
- Innovation claims or novelty
- Commercial or practical benefits mentioned
- Any limitations or trade-offs acknowledged

- **Technical Innovation**:

  Extract details about novel technical aspects including:

- Unique mechanisms or engineering solutions
- Patentable features claimed
- Manufacturing methods or processes
- Assembly/disassembly features
- Adjustability or modularity
- Any technical specifications or engineering parameters

Results

Characteristics of Included Studies

Study	Study Focus	Chair Type	Leg Configuration	Key Innovation	Full text retrieved
Lee et al., 2025	Clinical validation of Internet of Things (IoT) chair for fall risk assessment	Common chair (likely office or dining)	4 legs, square arrangement	Strain gauges under each leg, sensor integration, rigid board for sensor mounting	Yes
□□□, 2005	Patent for folding chair bracing frame with enhanced stability	Folding chair with backrest	4 legs (2 foreleg bars, 2 rear leg bars), rectangular/square (implied)	Sliding bush, spacing component, transverse struts for stability	No

Study	Study Focus	Chair Type	Leg Configuration	Key Innovation	Full text retrieved
[illegible] and [illegible], 2015	Patent for swivel chair leg and assembly method	Office chair	5 legs, circular arrangement	Sleeve with sleeve hole, central metal support for legs, connecting plates, easy assembly/disassembly	No
Akritas, 1993	Mathematical algorithm; brief mention of chair stability features	No mention found	No mention found	Metal rod legs, components that connect multiple chairs to prevent lateral/fore-aft movement	Yes
[illegible], 2003	Patent for student chair with liftable legs for adjustability	No mention found	No mention found	Liftable legs with uniform hole spacing, simple structure, adjustability for user height	No

Chair Type:

- We found 1 study each for a common chair (likely office/dining), folding chair, and office chair.
- We didn't find the chair type specified in 2 studies.

Leg Configuration:

- 2 studies used 4 legs in a square or rectangular arrangement.
- 1 study used 5 legs in a circular arrangement.
- We didn't find the leg configuration specified in 2 studies.

Key Innovation:

- Each study described a different key innovation:
  - 1 study focused on sensor integration for fall risk assessment.
  - 1 study focused on stability/bracing using sliding bush and struts.
  - 1 study focused on easy assembly/disassembly of chair legs.
  - 1 study described components that connect multiple chairs to prevent movement.
  - 1 study focused on adjustability of leg height.
- We didn't find any repeated key innovation categories across the studies.

Thematic Analysis

Chair Stability and Structural Integrity

Study	Stability Features
Lee et al., 2025	Balance assessment via weight sensors on each leg; detailed weight distribution data for fall risk analysis
[illegible], 2005	Sliding bush and spacing component, transverse struts, claims of stable strutting state and safe use
[illegible] and [illegible], 2015	High firmness, central metal support for legs, connecting plates fixed by screws
Akritas, 1993	Components that connect multiple chairs to prevent lateral and fore-aft movement
[illegible], 2003	Adjustability is described; we didn't find explicit mention of stability features

Summary of Stability Features:

- 3 studies described mechanical or structural stability features, such as sliding bush and spacing components, transverse struts, connecting plates fixed by screws, central metal support for legs, and components that connect multiple chairs to prevent movement.
- 1 study described balance assessment or weight distribution features, specifically using weight sensors on each leg and providing detailed data for fall risk analysis.
- 1 study included explicit claims of a stable strutting state and safe use.
- 1 study described adjustability, but we didn't find explicit mention of stability features.
- Some studies included more than one type of stability feature or claim.

Leg Configuration and Design Variations

Study	Number of Legs / Arrangement	Redundancy/Failure-Resilience Features
Lee et al., 2025	4 legs, square	No mention found
[illegible], 2005	4 legs, rectangular/square (implied)	Bracing and struts for stability, not redundancy
[illegible] and [illegible], 2015	5 legs, circular	No explicit redundancy; focus on firmness
Akritas, 1993	No mention found	Components that connect multiple chairs to prevent movement, which may contribute to group stability
[illegible], 2003	No mention found	No mention found

Number of Legs and Arrangement:

- 2 studies described chairs with 4 legs (Lee et al., 2025; [illegible], 2005).
- 1 study described a chair with 5 legs ([illegible] and [illegible], 2015).
- We didn't find the number of legs specified in 2 studies (Akritas, 1993; [illegible], 2003).
- For arrangement, we found 1 study with a square arrangement, 1 with a rectangular or square arrangement (implied), 1 with a circular arrangement, and 2 where arrangement was not mentioned.

Redundancy/Failure-Resilience Features:

- 1 study described features that may contribute to group stability (Akritas, 1993: components that connect multiple chairs to prevent movement).
- 1 study described stability features only, not redundancy ([illegible], 2005: bracing and struts).
- 1 study focused on firmness but did not mention redundancy ([illegible] and [illegible], 2015).
- 1 study did not mention redundancy or resilience features (Lee et al., 2025).
- We didn't find redundancy or resilience feature information in 1 study ([illegible], 2003).

Material Considerations and Metallic Components

Study	Leg/Support Material Details
Lee et al., 2025	No mention found
[illegible], 2005	No mention found
[illegible] and [illegible], 2015	Central metal support for legs (other materials not mentioned)
Akritas, 1993	Metal rod legs
[illegible], 2003	No mention found

Summary of Material Details:

- We didn't find leg/support material details in 3 out of 5 studies.
- 1 study described a central metal support for legs, with other materials not mentioned.
- 1 study described metal rod legs.

Synthesis and Limitations

- Only one study ([illegible] and [illegible], 2015) described a five-leg chair, but the design used a circular arrangement and did not address a rear-positioned metallic fifth leg for redundancy in case of leg failure.
- None of the included studies directly addressed the specific configuration of a rear-positioned metallic fifth leg intended to provide redundancy if another leg fails.
- Most studies were patent abstracts, which provided limited technical detail and no empirical testing.
- Only one study (Lee et al., 2025) included clinical testing, but this was for a four-leg chair with sensor integration, not a five-leg design.
- Across all studies, we found a range of innovations related to stability, assembly, and adjustability, but no direct evidence for the effectiveness or design considerations of a rear-positioned metallic fifth leg for redundancy.

- The evidence base is limited in both scope and depth regarding the specific configuration and function proposed in the research question, and most findings are based on limited descriptions rather than rigorous empirical evaluation.

References

A. Akritas. “Sylvester's Forgotten Form of the Resultant.” *The Fibonacci Quarterly*, 1993.

Alexander Lee, Melissa S. Lee, Chelsea Yeh, and Kyle Yeh. “Measuring Fall Risk Using the Internet-of-Things Chair.” *International Conference on Internet of Things, Big Data and Security*, 2025.

□□□, and □□. “Swivel Chair Leg and Assembling Method Thereof,” 2015.

□□□. “Chair with Liftable Legs,” 2003.

□□□. “Back-Rest Type Folding Chair Bracing Frame,” 2005.