BSI Insight Series:

Startup Edition

Webinar #3: *How to Use Risk Mapping to Setup Your Project for Success*

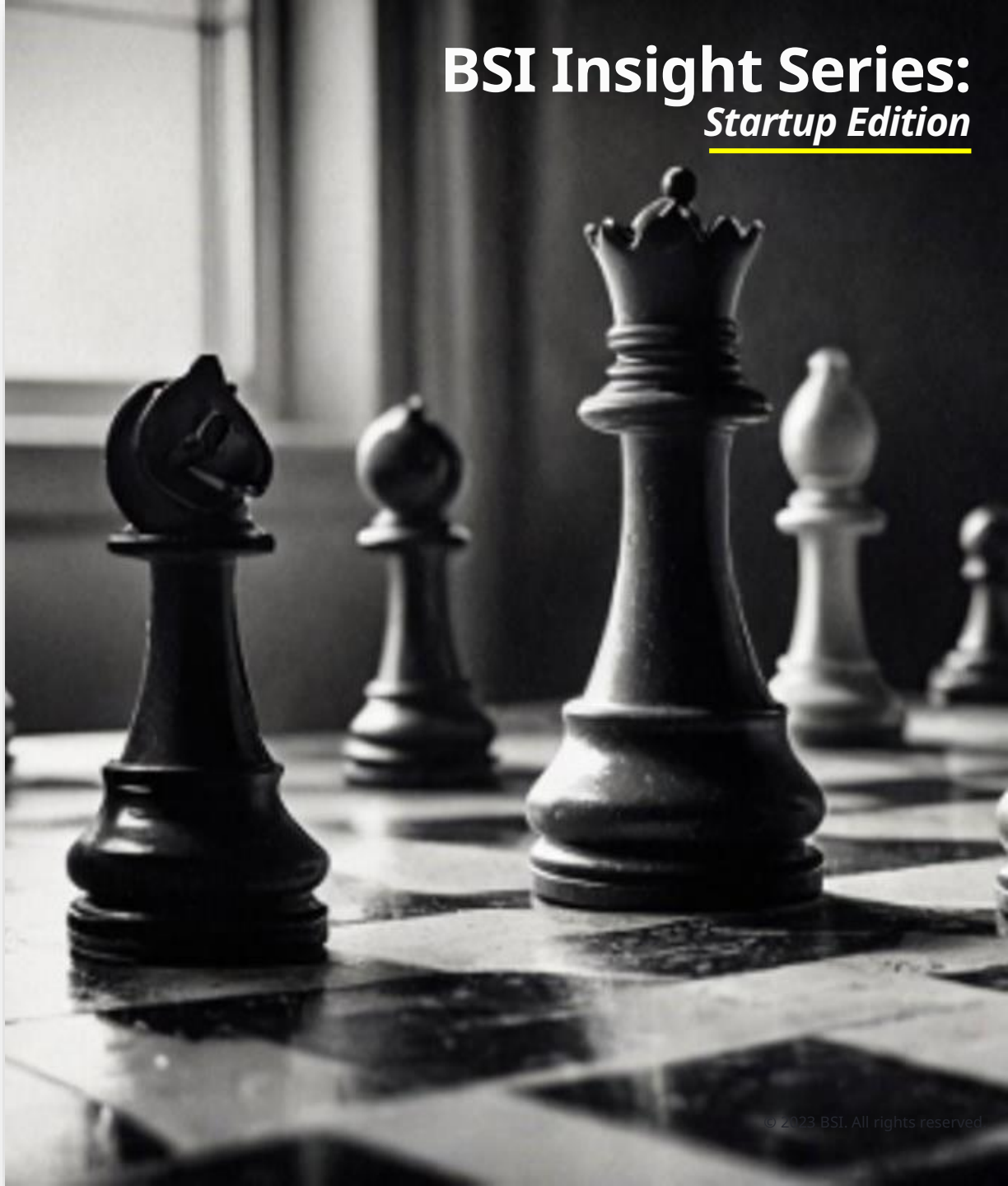
January 13, 2025

With us today…

Mariana Linck, PhD
Team Training Lead, Vascular Devices

Jason Butcher
Sr. Technical Tech Specialist
Vascular Devices

Olaf Schulz
Director Epicenter Memphis TN
Accelerator Hub (External to BSI)



EPICENTER

EPICENTER MEMPHIS OVERVIEW

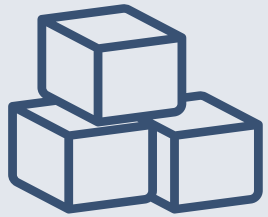
epicentermemphis.org

OUR KEY FOCUS AREAS

Epicenter is the region's leading entrepreneurial development organization.

Our mission is to build venture-backable companies and to connect founders with resources needed to build, grow, & scale their companies in the Digital Delta.

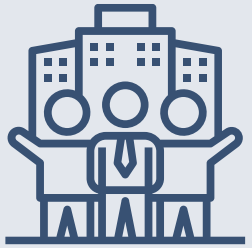
ATTRACT



BUILD COMMUNITY

CAPITAL + CUSTOMER READINESS

ACCESS TO NETWORKS/ RESOURCES



CONVENE

PROGRAMS & INITIATIVES

ZERO TO 510

MedTech Vertical

ZeroTo510 MedTech Accelerator - Nationally Recognized

- 13-week Intensive Curriculum w/ Demo Day

Alumni Stats

- 53 alumni companies
  - Known for capital efficiency
  - Lifespan - 2x national average

Since 2015

- 50% of founders raise $500K+ (2.4× national avg)
- 37.5% of women founders raise $500K+ (8× national avg)
- 41% of minority founders raise $500K+ (~7× national avg)
- $100M+ raised across alumni
- 75% of companies have diverse founding teams

zeroto510.com

Why Risk Management Matters Early

- **See risks early:** Identify safety issues before design is locked – when fixes are faster and cheaper.
- **Connect risk to design:** Link hazards directly to design inputs, design controls and verification activities.
- **Stay proportionate:** Focus limited time and resources on the risks that matter most.
- **Meet regulatory expectations:** Demonstrate structured, traceable risk management from the start
- **Move faster with confidence:** Avoid repeat testing and improve budget predictability.

Key Requirements and Standards

ISO 14971-2019: The manufacturer shall establish, implement, document and maintain an ongoing process for:

a) identifying hazards and hazardous situations associated with a medical device;

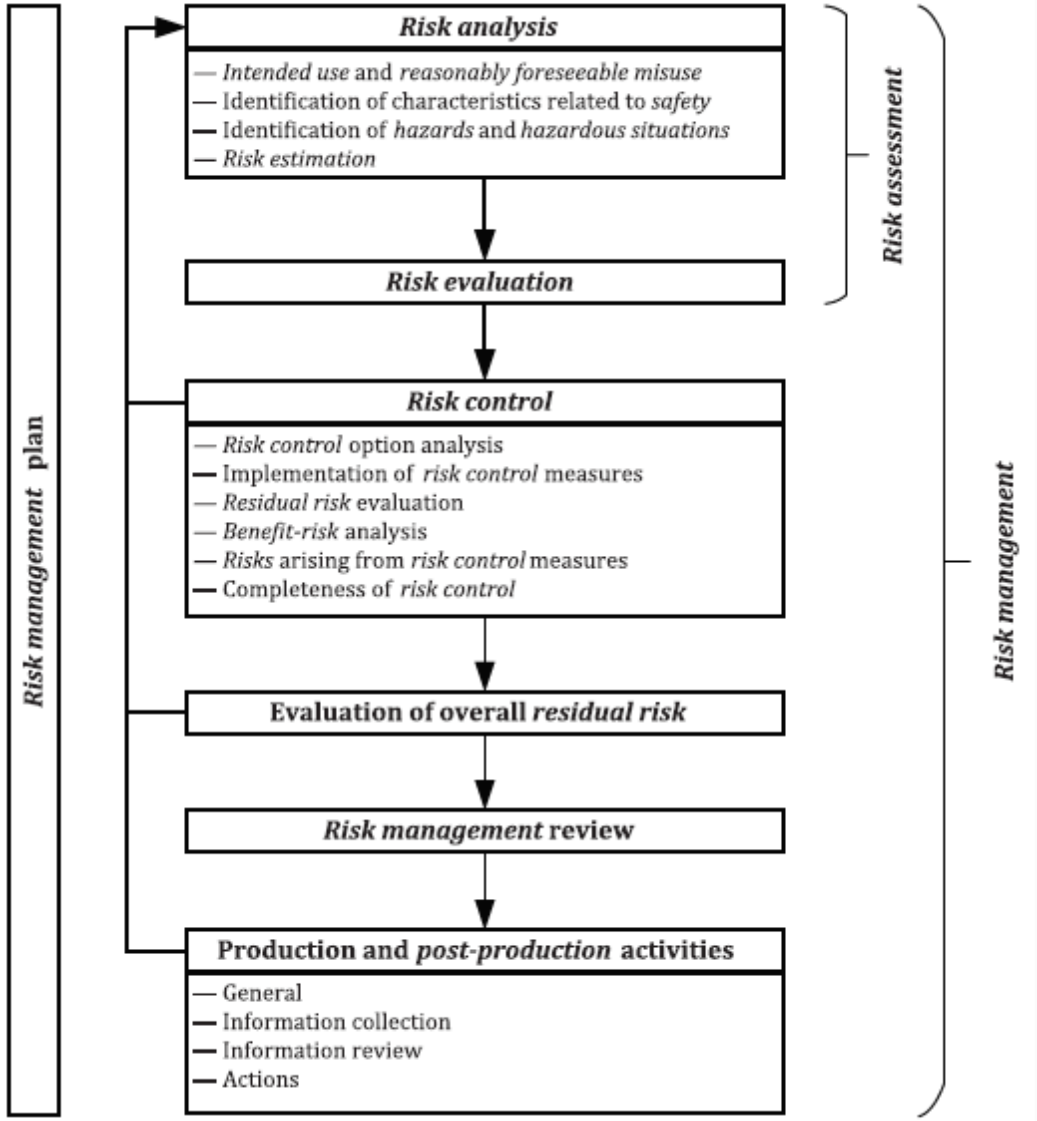
b) estimating and evaluating the associated risks;

c) controlling these risks, and

d) monitoring the effectiveness of the risk control measures.

This process shall apply throughout the life cycle of the medical device.

MDR and IVDR Annex I*: General Safety and Performance Requirements*



Typical Risk Management File Documents

“More than one way to skin the cat”!

- Risk Management Plan
- Preliminary Hazard Analysis (PHA)
- Design Failure Modes and Effects Analysis (DFMEA)
- Process Failure Modes and Effects Analysis (PFMEA)
- Risk Management Report
- *Software and Use FMEA often included.

Poll Quiz Question

What is your level of knowledge of Risk Management Regulatory requirements in EU and UK?

a) I have a high level of understanding
b) I have some level of understanding
c) I have a limited level of understanding
d) I have little to no level of understanding

Poll Quiz Question

What phase is your Start-up Company in?

a) Pre-seed
b) Seed
c) Series A
d) Series B or C
e) N/A: Not a Start-up; None of the above

Risk Management Plan Requirements – ISO 14971

Manufacturer shall establish and document a risk management plan and shall include at least:

A Risk Management Plan is key:

Identifies Hazards Early, before becoming costly failures $$$	**Links Controls to Evidence**: Traceability is Key!	**Build Resilience** to changes in design or any market shifts

A Risk Management Plan is a Requirement per ISO 14971:

- a) the **scope** of the planned risk management activities, identifying and **describing the medical device** and the **life cycle phases** for which each element of the plan is applicable;
- b) assignment of **responsibilities and authorities**;
- c) requirements for review of **risk management activities**;
- d) **criteria for risk acceptability**, based on the manufacturer's policy for determining acceptable risk, including for accepting risks when the probability of occurrence of harm cannot be estimated;
- e) a method to **evaluate the overall residual risk**, and criteria for **acceptability of the overall residual risk** based on the manufacturer's policy for determining acceptable risk;
- f) activities for verification of the **implementation and effectiveness of risk control measures**; and
- g) activities related to collection and review of relevant **production and post-production information**.
- If the plan changes during the *life cycle* of the *medical device*, a ***record* of the changes shall be maintained** in the *risk management file*.

Risk Estimation Example

Example Qualitative Severity Levels		
5	Catastrophic / Fatal	Results in death
4	Critical	Results in permanent impairment or irreversible injury
3	Serious / Major	Results in injury or impairment requiring medical or surgical intervention
2	Minor	Results in temporary injury or impairment not requiring medical or surgical intervention
1	Negligible	Results in inconvenience or temporary discomfort

Example Semi-Quantitative Probability Levels (includes detection)		
5	Frequent	$\geq 10^{-3}$
4	Probable	$<10^{-3}$ and $\geq 10^{-4}$
3	Occasional	$<10^{-4}$ and $\geq 10^{-5}$
2	Remote	$<10^{-5}$ and $\geq 10^{-6}$
1	Improbable	$<10^{-6}$

Risk Acceptability Table					
Probability	**Severity of Harm**				
	1	**2**	**3**	**4**	**5**
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Red = Unacceptable

Yellow = Must try to reduce further without impacting the risk/benefit ratio.

Green = Acceptable

*MDR: All risk must be reduced as far as possible. Acceptability determined by engineering team.

Preliminary Hazard Analysis Example

Hazard	Hazardous Situation	Potential Harms	Severity
Compromised sterile barrier (loss of sterility)	User opens package and uses device believing it is sterile	Infection with permanent damage	4
		Infection resolved with antibiotics	3
		Immune system response not requiring treatment	3
Device contains bacterial endotoxins	Patient exposed to bacterial endotoxins during device use	Reaction resulting in permanent damage	4
		Reaction resolved with medication	3
		Immune system response not requiring treatment	3

Hazard: Potential source of harm.
Hazardous Situation: Circumstance in which people, property or the environment is/are exposed to one or more hazards.
Harm: Injury or damage to the health of people, or damage to property or the environment.
Severity: Measure of the possible consequences of a hazard.

*Clinical literature is a great source for harms. AI is a good source for ideas, but needs help.

Example DFMEA Format Example

Design Function	Failure Mode	Potential Cause	Effect of Failure	Hazard / Harm	Severity	Probability of Occurrence	Initial Risk Level
Deliver medication at prescribed flow rate	Over-infusion	Flow control algorithm error – Incorrect pump speed	Excess medication delivered	Overdose leading to patient injury	High	Medium	High
	Under-infusion	Tubing kink not detected	Insufficient medication delivered	Sub-therapeutic dosing	Medium	Medium	Medium

Risk Control Measures	Verification of Implementation	Verification of Effectiveness	Post Risk Control Probability of Occurrence	Post Risk Control Risk Level	Residual Risks	Risk Acceptability Argument: Benefit / Risk and Residual Risk
Monitoring of pump speed with independent sensor	Design output reference	Design verification testing	Low	Medium	Risk of over-infusion	Argument for benefit outweighing risk. Noted in IFU.
Tubing design for kink resistance	Design output reference	Design verification testing	Low	Low	Risk of under-infusion	Argument for benefit outweighing risk. Noted in IFU.

Risk Management Report

This review shall ensure that:

- The risk management plan has been appropriately implemented.
- The overall residual risk is acceptable.
- Appropriate methods are in place to collect and review information in the production and post-production phases.

What our regulatory technical reviewers look for:

- Consistency of the risk management report with presented Clinical Evaluation.
- Evidence of feedback of clinical and post-market data into risk management. PMS data should align!
- Disclosure of residual risks to patients and users.
- Over-reliance on the IFU to mitigate risk.
- Ability to trace key risks through the file. Reference to protocol and report numbers.

Key Steps to Effective Risk Mapping

1. **Plan First**, ***Early Risk Mapping is Key*** (Start during concept phase):
    - Set boundaries: device features, phases, patient population, intended use.
    - Include cross-functional experts: engineers, clinicians, usability, regulatory & quality (ISO 14971, clauses 4.4/4.5).

2. **Establish Risk Criteria** system & Align with ISO 14971 &incorporate regulatory expectations (FDA/EUMDR; EU IVDR).

3. **Identify Hazards** & Hazardous situations, use tools like FMEAs and Ishikawa diagrams.

4. **Frame risks** in "if-then" statements for clarity.

5. **Estimate and Analyze Risks**: rate hazards on the likelihood and severity (i.e., on a 1-5 scale).

6. **Plot in a risk matrix** to visualize high-priority risks.

7. **Evaluate Acceptability** (ISO 14971) - decide which risks require controls. Define Thresholds for each zone: **Acceptable:** then no further action needed, **ALARP** (As Low as Reasonably Practicable/Possible: Mitigation required, if feasible; **Unacceptable:** then must reduce risk before proceeding.

8. **Identify & Implement risk controls**, Hierarchy Order: 1st - Inherent safety by design (Embed Safety into Design); 2nd protective measures; 3rd information for safety.

9. **Do not** use labelling to reduce the risk score.

10. **Document** each control and verify its effectiveness, ensuring clear traceability of objective evidence & testing.

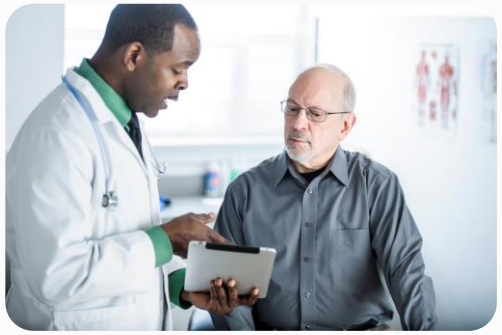
11. **Evaluate Residual Risk & Benefit Risk**, ensuring benefits outweigh residual risks.

12. **Maintain live file** with plan, records, controls, verification results, and residual risk analysis (ISO 14971 clause 4.5).

13. **Periodically review**, monitor, & Post Market production; continue feedback from complaints, update risk map.

Summary: Risk Management Best Practice

1. **Start Early**
   - Begin risk management when you define the device's purpose and user needs.
   - Make a plan: include scope, roles, criteria, and timeline.
2. **Find Hazards & Link to Design**
   - Turn intended use into possible harm scenarios
   - Use a matrix to link hazards to design inputs and add controls.
3. **Map the Risks**
   - Rate risks by likelihood and severity; compare to limits.
   - Show risks on a map to focus design work and trade-offs.
4. **Apply Controls**
   - Remove hazards, add protections, use warnings, then re-check risk ratings.
   - Link controls to design verification and document in DHF.
5. **Review Continuously**
   - Reassess risks at design milestones and after testing.
   - Use post-market feedback to update your risk map.
6. **Make Informed Decisions**
   - Use the risk map to make go/no-go decisions and, if further controls are required.
   - Keep clear traceability of hazards, controls, and evidence.



- ✓ **Identify risks early**
- ✓ **Link them to design and development activities**
- ✓ **Use your risk map to guide smarter decisions throughout the product lifecycle**
- ✓ **Ensure best practice via reference and alignment to ISO 14971**

Questions?

While BSI is globally known and trusted by Fortune 100 MedTech companies, did you know that **86%** of our client base is **small- to medium-sized enterprises?**

BSI Values our Startup Clients. *We are proud of our **client retention rate** of **96%**, as it truly reflects our proven framework, one that is known for robust due diligence and communication that can help startups succeed with regulatory clarity, from concept and design to global market access.*

BSI One Day Training Course:
ISO 14971:2019 Risk Management for Medical Devices
Discover the impact that ISO 14971 has on the decision-making processes in medical device manufacturing. Learn key principles on risk management and ISO 14971 interaction with QMS standards, MDR and IVDR.

Exclusive Offer for 'BSI Insight Webinar' Attendees

Minimum 10% Discount on Medical Device Training Courses

- All courses listed in the accompanying slide decks are eligible
- 10% is just the starting point – if you're considering multiple courses, your discount could be significantly higher
- Speak with a Training Advisor to explore the best options for you

Discount Code:

- **MEDDEVWEBINAR10**

Please send all enquiries to:

- Training.sales@bsigroup.com

BSI White papers - Medical Device White Papers

- MDR Technical documentation
- IVDR Classification White Paper
- Roadmap for Small-Medium Enterprise and Startups White Paper
- (A Roadmap for SMEs and Startups | BSI)

BSI Insight Series:
Startup Edition

Six webinars to help you ***align*** Regulatory Strategy with Startup Growth Stages:

Webinar Series (Every 2nd Tuesday of the Month):
Nov 11: Roadmap to Market Access: Understanding Global Device Regulations

Dec 9: Cracking the Code: MDR, IVDR and UKCA Classification and Indications for Use

Jan 13: How to Use Risk Mapping to Set Up Your Project for Success

Feb 10: Demystifying Design Controls and Clinical Planning

March 10: Building Safer Devices with Human Factors and Usability Engineering

Apr 14: From Prototype to Production: Manufacturing Pathways Explained

To register for the future Insight Series webinars: click here

Thank you for joining us today!

Jan 13: How to Use Risk Mapping to Set Up Your Project for Success