Data-Driven Management in Orthopedics

From Fragmented Information to Coordinated Patient Care

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OUTLINE

- Global directions for data-driven healthcare
- Overview of data-driven management
- The application of big data analysis
- Multimorbidity and the growing complexity of orthopedic care
- ICD-10-TM
- Future directions for nursing practice and education
- Conclusion

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Health Data Direction from WHA 79

> Strengthening health data systems is vital to enable countries to generate and use their own data to guide public health action



Dr. Tedros Adhanom Ghebreyesus
Director-General of WHO

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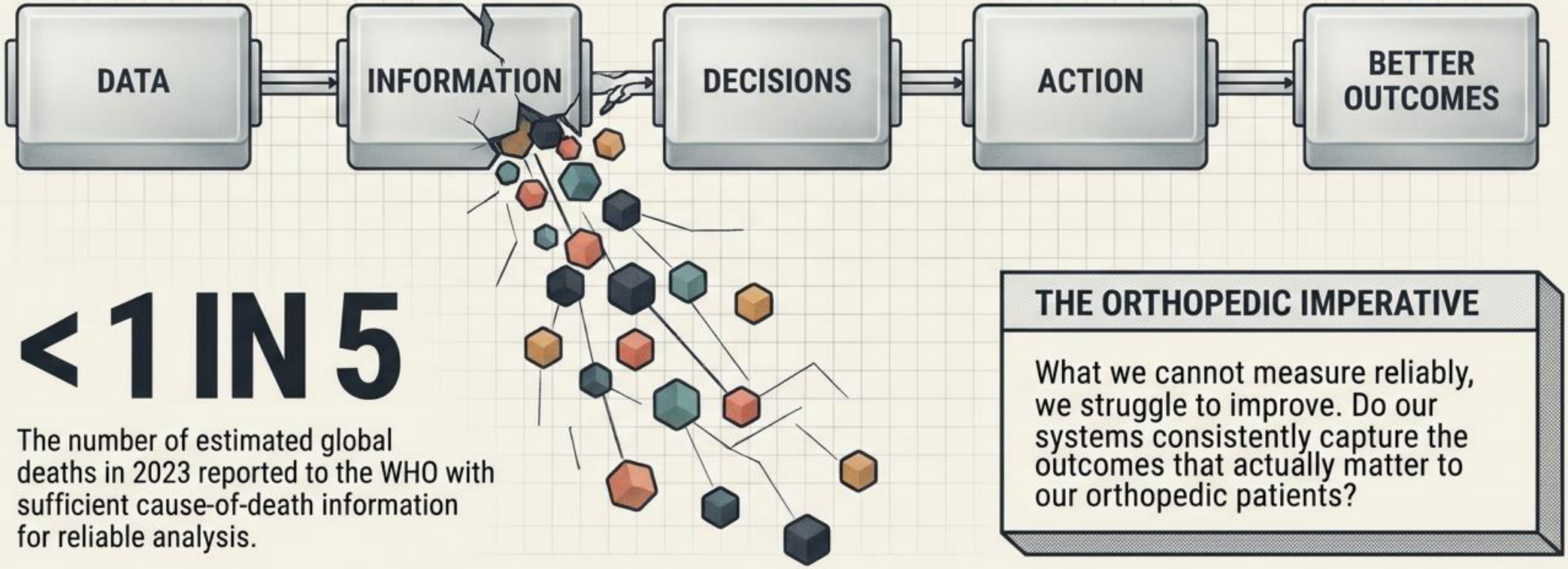
THE BROKEN PIPELINE



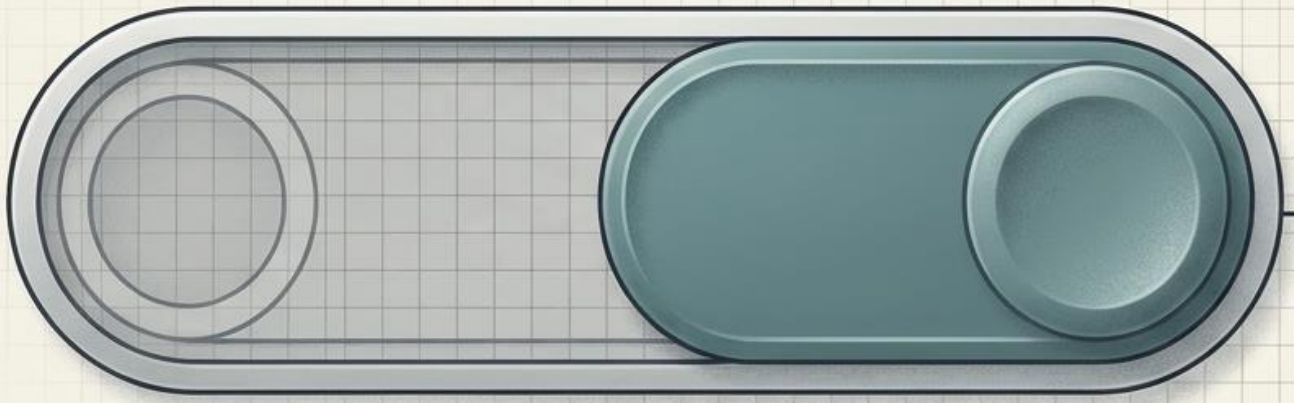
< 1 IN 5

The number of estimated global deaths in 2023 reported to the WHO with sufficient cause-of-death information for reliable analysis.

THE ORTHOPEDIC IMPERATIVE

What we cannot measure reliably, we struggle to improve. Do our systems consistently capture the outcomes that actually matter to our orthopedic patients?

"Nurses are not just the deliverers of technology, they're also the designers." — Howard Catton, ICN CEO



Identify meaningful patient and nursing outcomes.

Help design and **evaluate** digital tools.

Interpret information using clinical judgment.

Translate information into coordinated action.

The Deliverer

Outdated model: Technology forced onto nurses. Dashboards are difficult to use and lack clinical relevance.

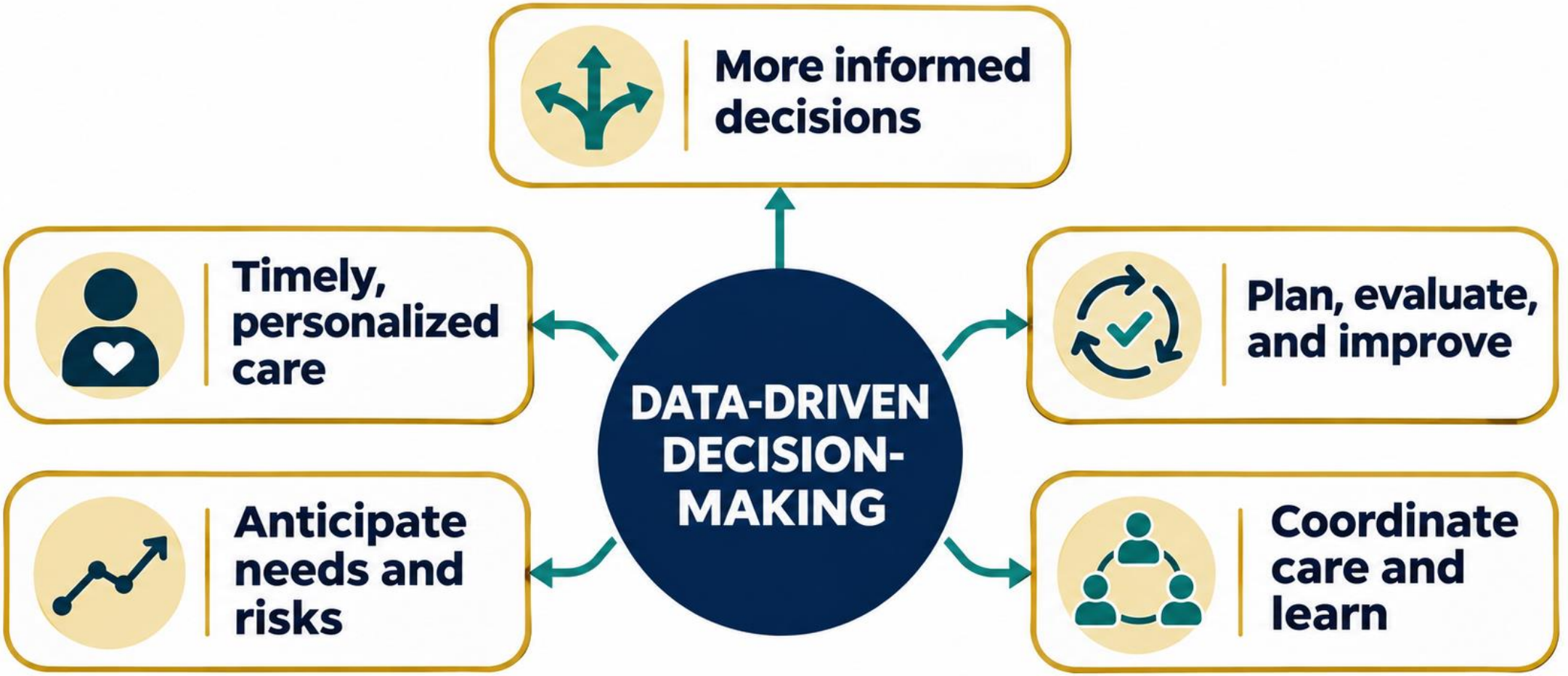
The Designer

Modern imperative: Nurses shaping technology. Identifying meaningful outcomes and ensuring safe, person-centered care.

Translating Global Directives to the Orthopedic Unit

Global Directions	Orthopedic Nursing Application
Fragmented data must be united	Bringing together clinical observations, rehab progress, and patient goals.
Interoperability and common standards matter	Consistent documentation across services (noting ICD-11 alone misses nursing outcomes)
Digital tech and AI development	Dashboards and alerts that help nurses recognize changing patient conditions.
Knowledge must be used in practice	Developing data literacy for real, bedside clinical decisions.

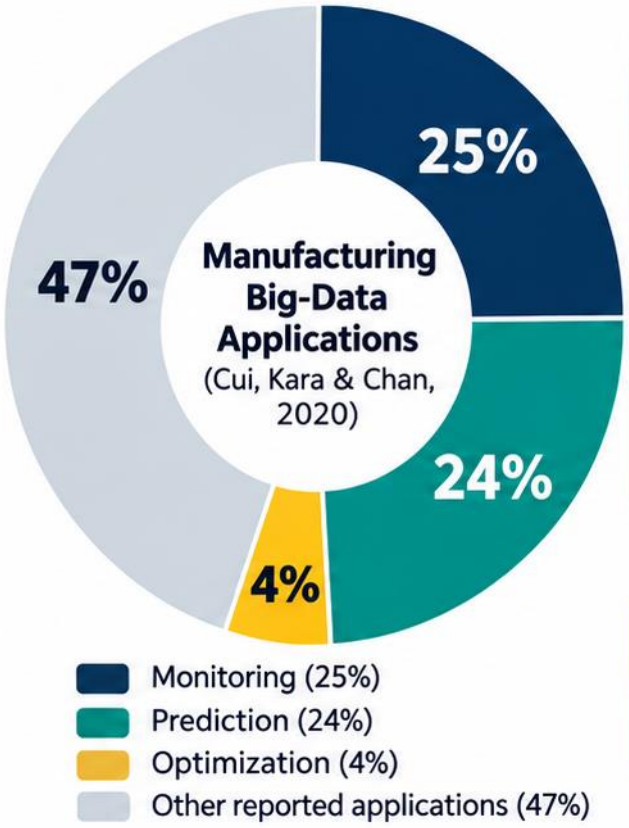
Why Data-Driven Decision-Making Matters



Meaningful data + evidence + clinical judgment

Big Data Applications: Three Analytics Areas in Focus

Examples from the manufacturing big data literature



DESCRIPTIVE ANALYTICS
Monitoring
25%

PREDICTIVE ANALYTICS
Prediction
24%

PRESCRIPTIVE ANALYTICS
Optimization
(closest source category)
4%

Other reported applications	
ICT framework	12%
Data analytics	10%
Data integration	4%
Data processing	2%
Data transformation	2%
Digital twin	1%
DSS	1%
Scheduling	2%
Risk management	2%
Data collection	4%
Knowledge management	1%
System modelling	1%
Data management	1%
System collaboration	5%

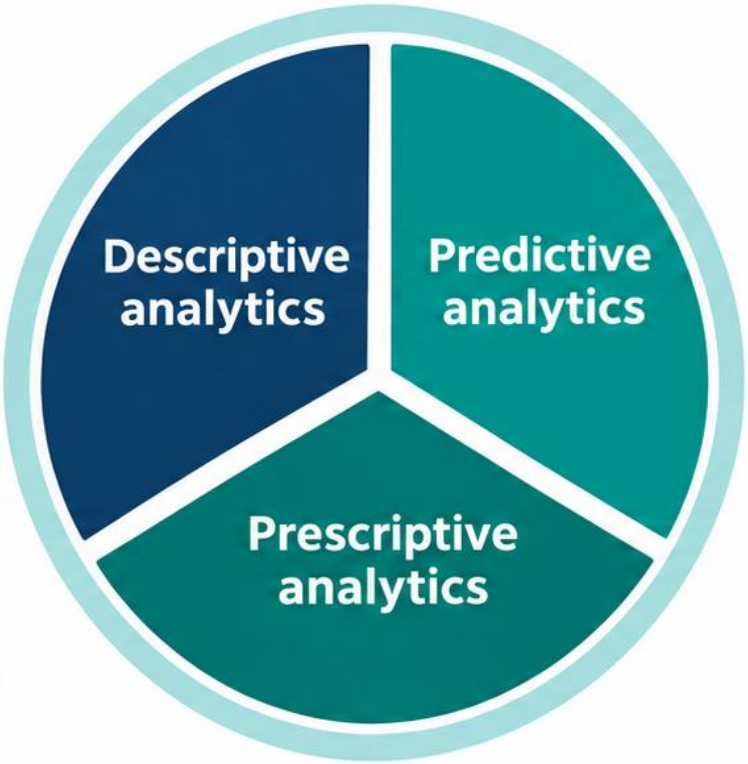
Teaching framework mapping; source categories are reported as named in the study.

Adapted from Cui, Kara & Chan (2020), *Robotics and Computer-Integrated Manufacturing, 62, 101861.*

From health data to evidence-informed public policy

DATA SOURCES → **BIG DATA ANALYTICS** → **PUBLIC HEALTH POLICY CYCLE**

- Electronic health records
- Public health records
- Administrative data
- Patient surveys
- Sensing data
- Clinical data
- Social networking sites
- Government website queries
- Insurance claims data
- Medical research and literature
- Omics data
- Fitness devices
- Mobile phones



PUBLIC HEALTH POLICY CYCLE

Problem identification • Agenda setting • Policy formulation • Implementation • Evaluation

Stakeholder engagement throughout

ANALYTICS FRAMEWORKS: FROM INSIGHT TO INTERVENTION



Descriptive Analytics

Question: What has happened or is happening?

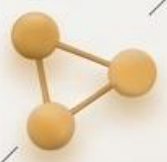
Mechanism: Summarizes historical/current data to show patterns, trends, and differences.



Predictive Analytics

Question: What may happen?

Mechanism: Uses data patterns and models to estimate future risks or outcomes.



Prescriptive Analytics

Question: What action could be taken?

Mechanism: Compares possible actions or strategies to identify options that may reduce risk or improve outcomes.

Data to Policy Cycle: Descriptive shows the problem → Predictive estimates the future → Prescriptive compares responses → Evaluate outcomes

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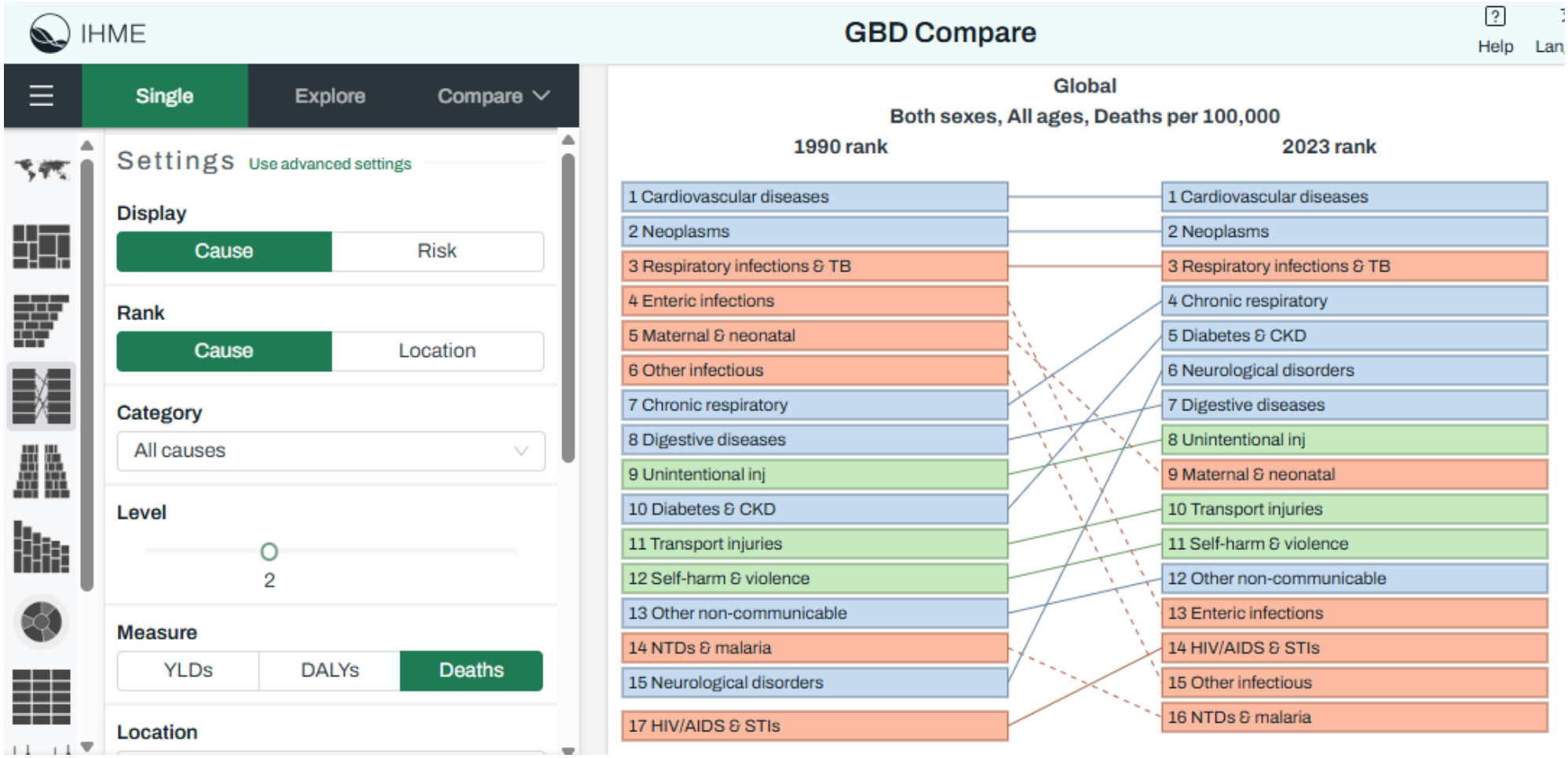
Example of Descriptive Analytic



Institute for Health Metrics and Evaluation (IHME). GBD Compare Data Visualization. Seattle, WA: IHME, University of Washington, 2020. Available from http://vizhub.healthdata.org/gbd-compare.

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Example of Descriptive Analytic

What risk factors drive the most death and disability combined?

- Metabolic risks
- Environmental/occupational risks
- Behavioral risks

Risk	2013 rank	2023 rank	Change in DALYs per 100k, 2013-2023
Tobacco	1	1	↑ +340.9
High fasting plasma glucose	4	2	↑ +817.9
Dietary risks	2	3	↑ +500.4
High blood pressure	3	4	↑ +456.8
Air pollution	5	5	↑ +191.0
Kidney dysfunction	6	6	↑ +460.5
High body-mass index	8	7	↑ +587.2
High alcohol use	7	8	↑ +160.6
Unsafe sex	9	9	↓ −38.4
High LDL	12	10	↑ +169.1

https://www.healthdata.org/research-analysis/health-by-location/profiles/thailand

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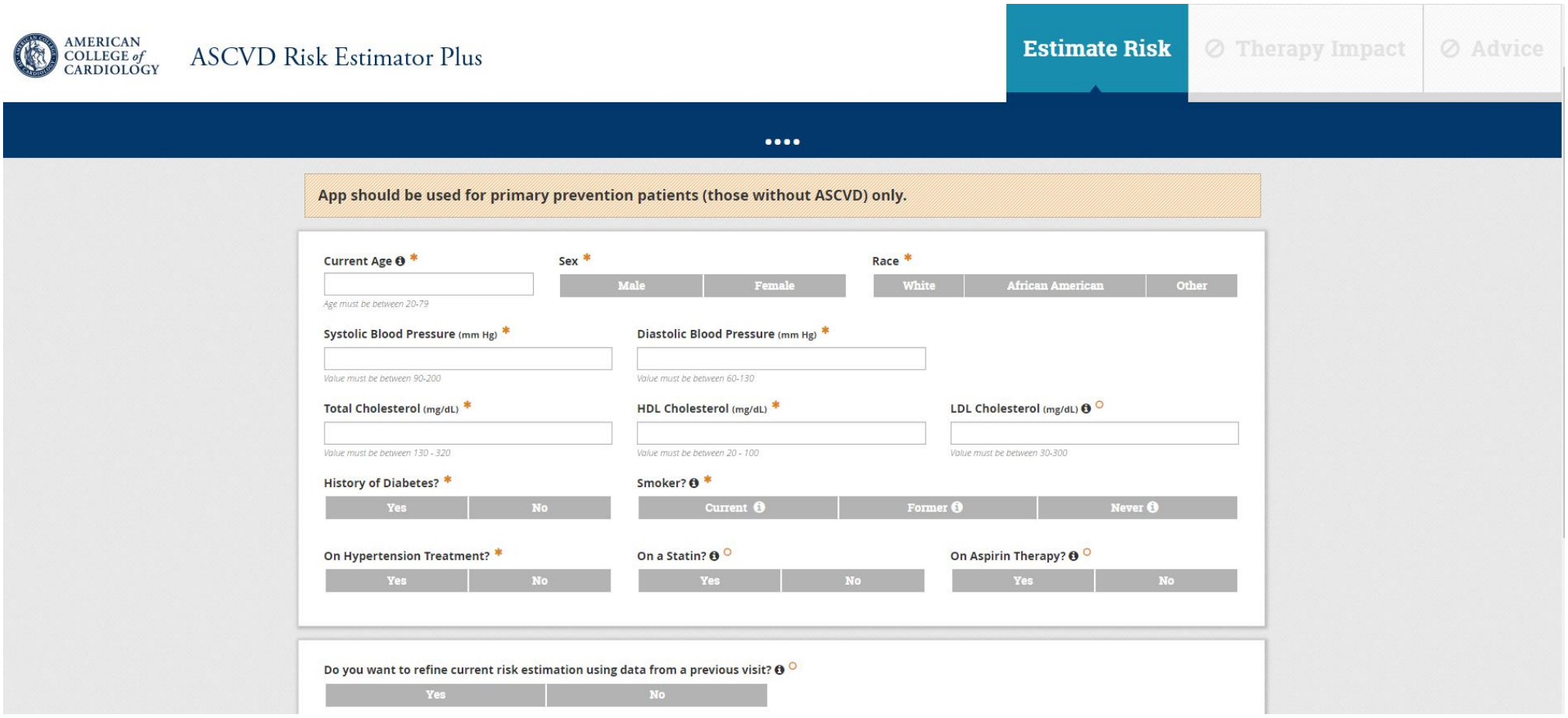
Example of Prediction Analytic



https://tools.acc.org/ascvd-risk-estimator-plus/#!/calculate/estimate/

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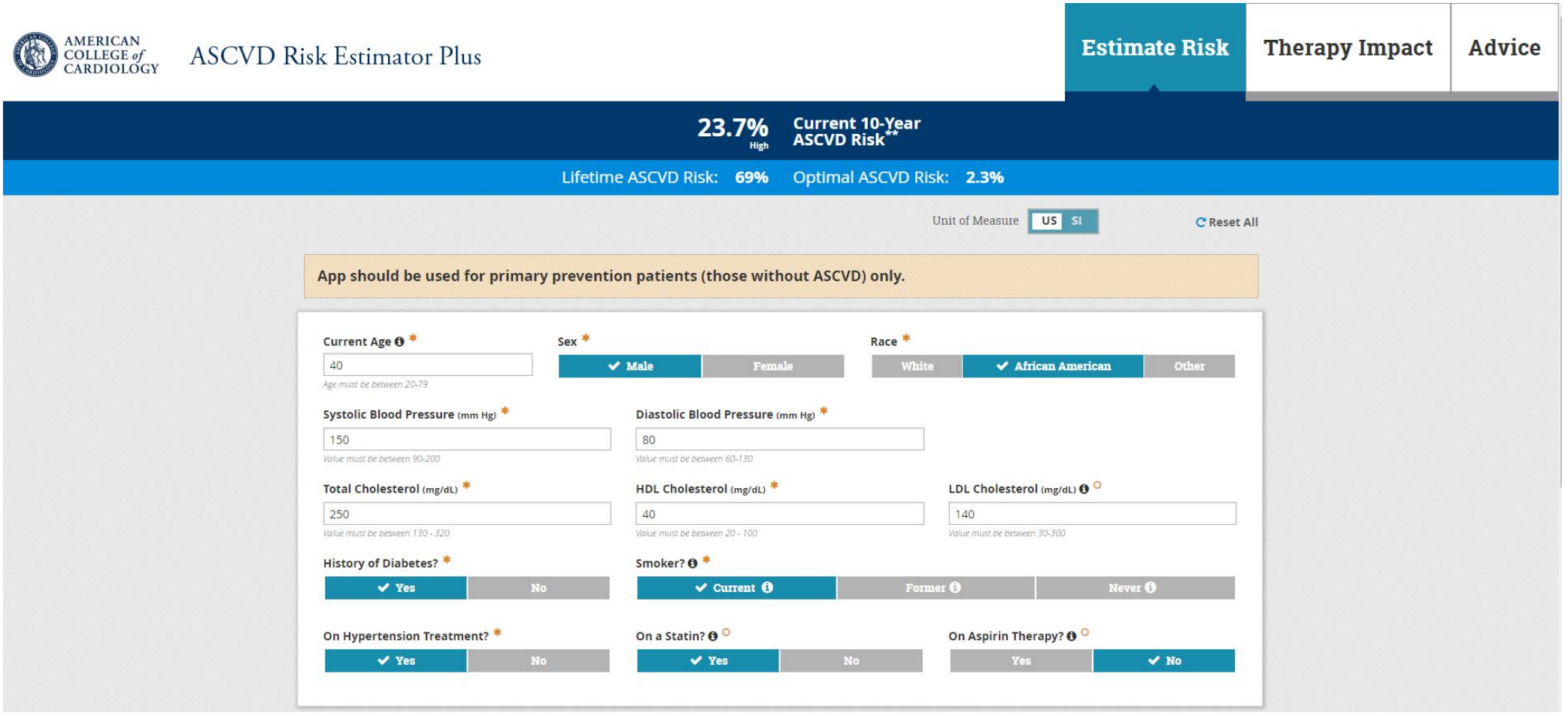
Example of Prediction Analytic



https://tools.acc.org/ascvd-risk-estimator-plus/#!/calculate/estimate/

Example of Prescriptive Analytic

CVDs risk 23.7%



If quit smoking, the projected risk is 17.3%



If start statin, the projected risk is 17.8%



If control blood pressure, the projected risk is 17.4%



If continue aspirin therapy, the projected risk is 21.4%

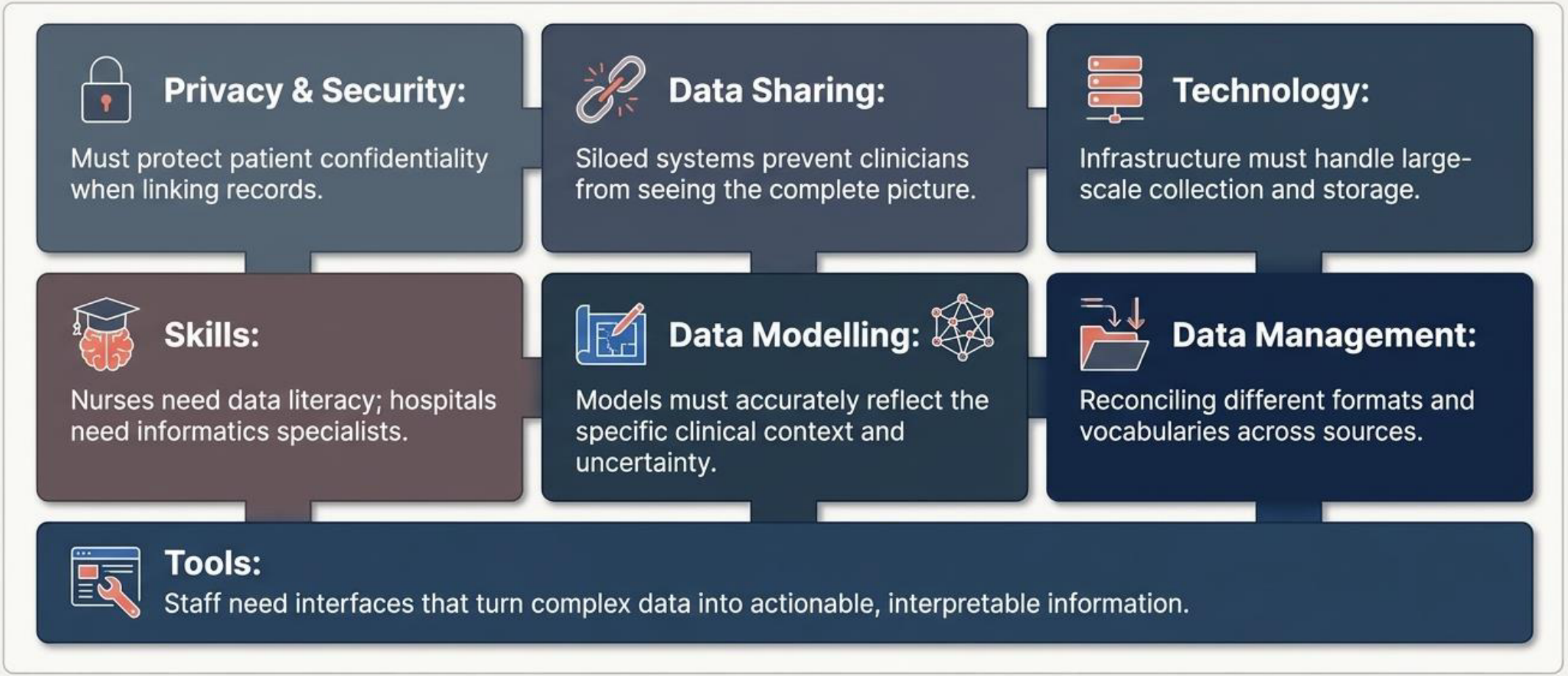


If quit smoking, start statin, control blood pressure, and continue aspirin therapy,the projected risk is 8.6%

https://tools.acc.org/ascvd-risk-estimator-plus/#!/calculate/estimate/

Navigating the Challenges of Big Data Application

The Obstacle Course Grid



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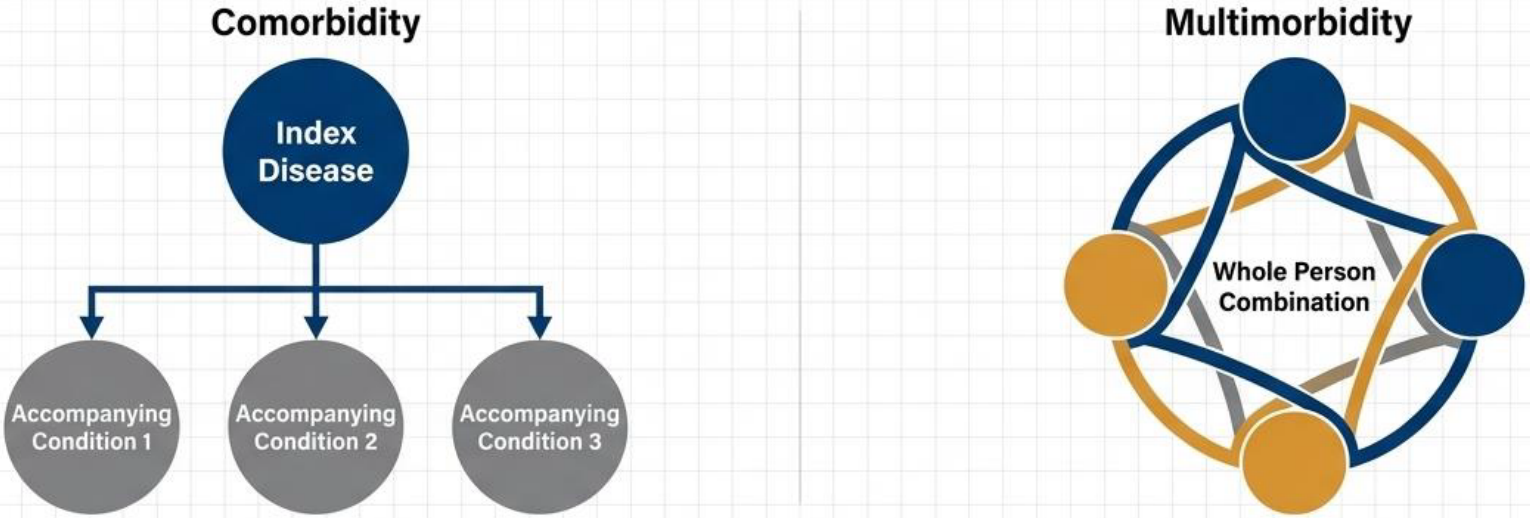
The Diagnostic Shift: Comorbidity vs. Multimorbidity



Feature	Comorbidity	Multimorbidity
Focus	A specific index disease and accompanying conditions	The combination of conditions within the person
Hierarchy	An index disease is explicitly identified	An index disease is not required
Clinical Question	How do other conditions affect the index disease?	How do coexisting conditions affect overall health?
Example	Diabetes is primary; heart failure and depression are secondary.	Diabetes, heart failure, and depression are considered together.

Harrison, C., et al. (2021). Comorbidity versus multimorbidity: Why it matters. Journal of Multimorbidity and Comorbidity, 11. https://doi.org/10.1177/2633556521993993.

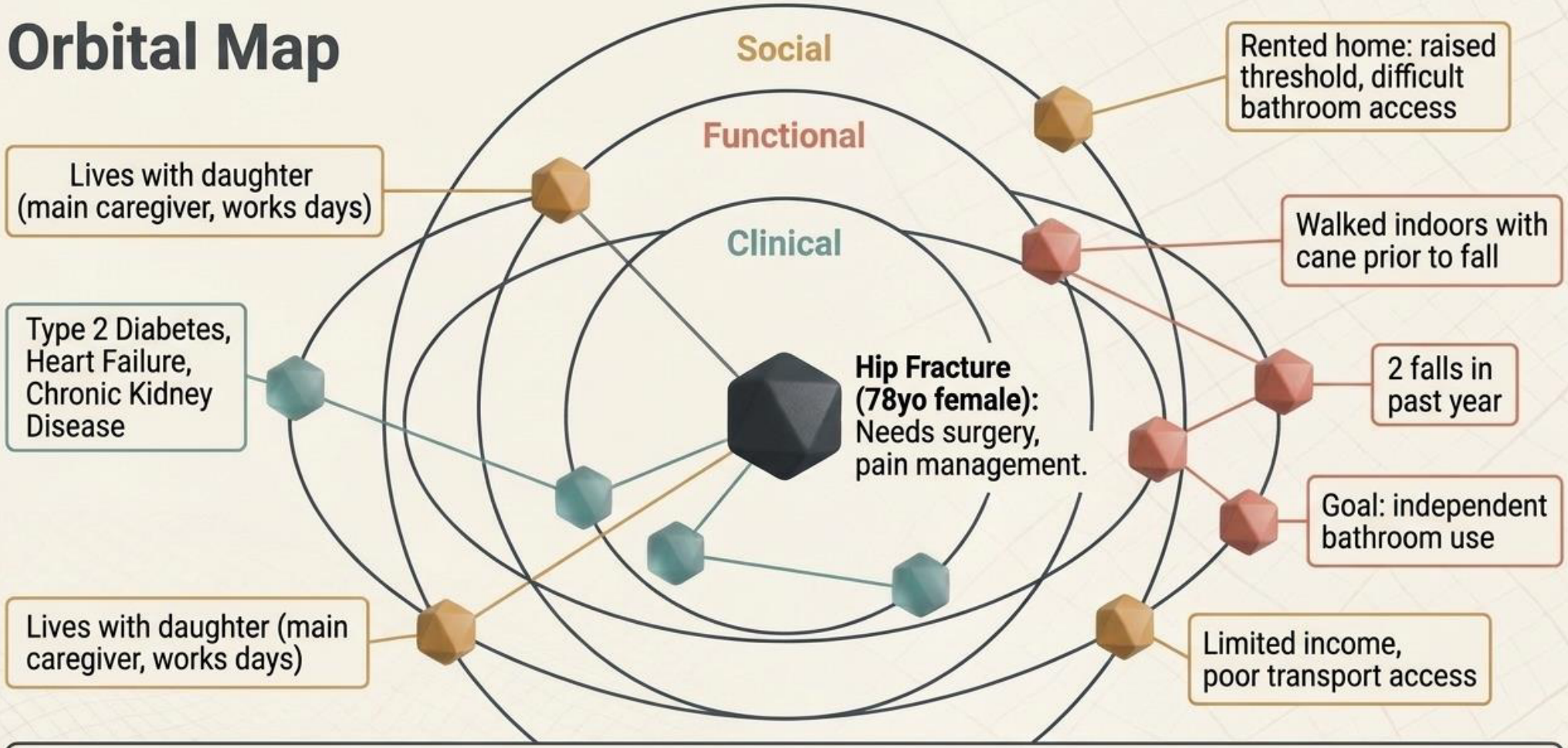
Mrs. Mali, 78: Orthopedic Recovery in Context

A hip fracture complicated by multimorbidity and social needs



Recovery planning must connect health, function, patient goals, caregiver capacity, and daily living conditions.

Orbital Map

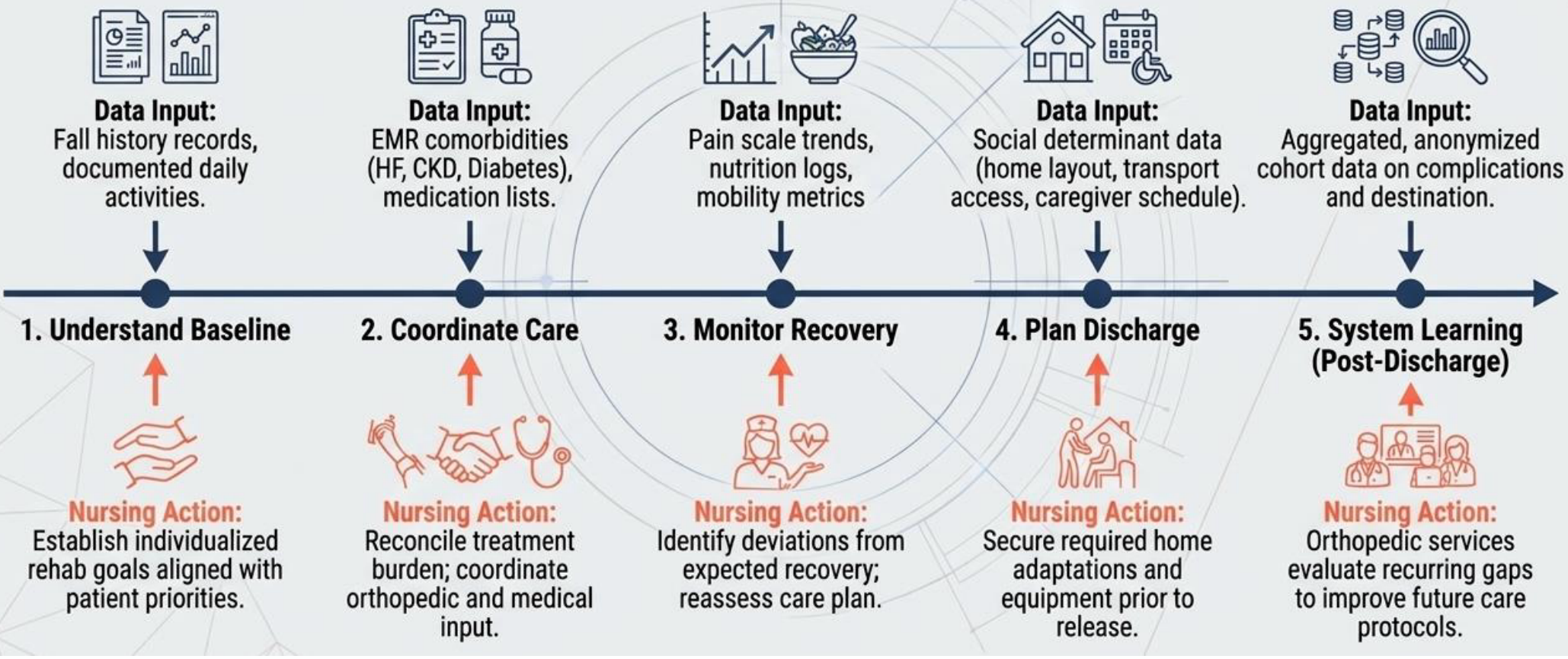


The Complexity Reality: NICE & WHO (ICOPE) guidance mandates that treating the fracture alone is insufficient; recovery depends on integrating clinical data with functional ability and social realities.

Data Inputs	Coordinated Clinical Action
Understand Baseline (Mobility, home layout, goals)	Set realistic, individualized rehab goals
Coordinate Comorbidities (Diabetes, HF, CKD, meds)	Coordinate medical, nursing, and rehab to manage treatment burden
Monitor Recovery (Pain scores, nutrition, functional trends)	Reassess care plan when progress differs from expectations
Plan Feasible Discharge (Raised threshold, daughter's work schedule, transport)	Secure equipment and home support *prior* to discharge
Support Shared Decisions (Patient priorities, caregiver capacity)	Tailor options to what is feasible and meaningful for the family
System Learning (Aggregated outcomes)	Identify recurring service gaps for future orthopedic patients

The Data-Driven Patient Journey

Connecting clinical data with function, caregiver capacity, and daily life.



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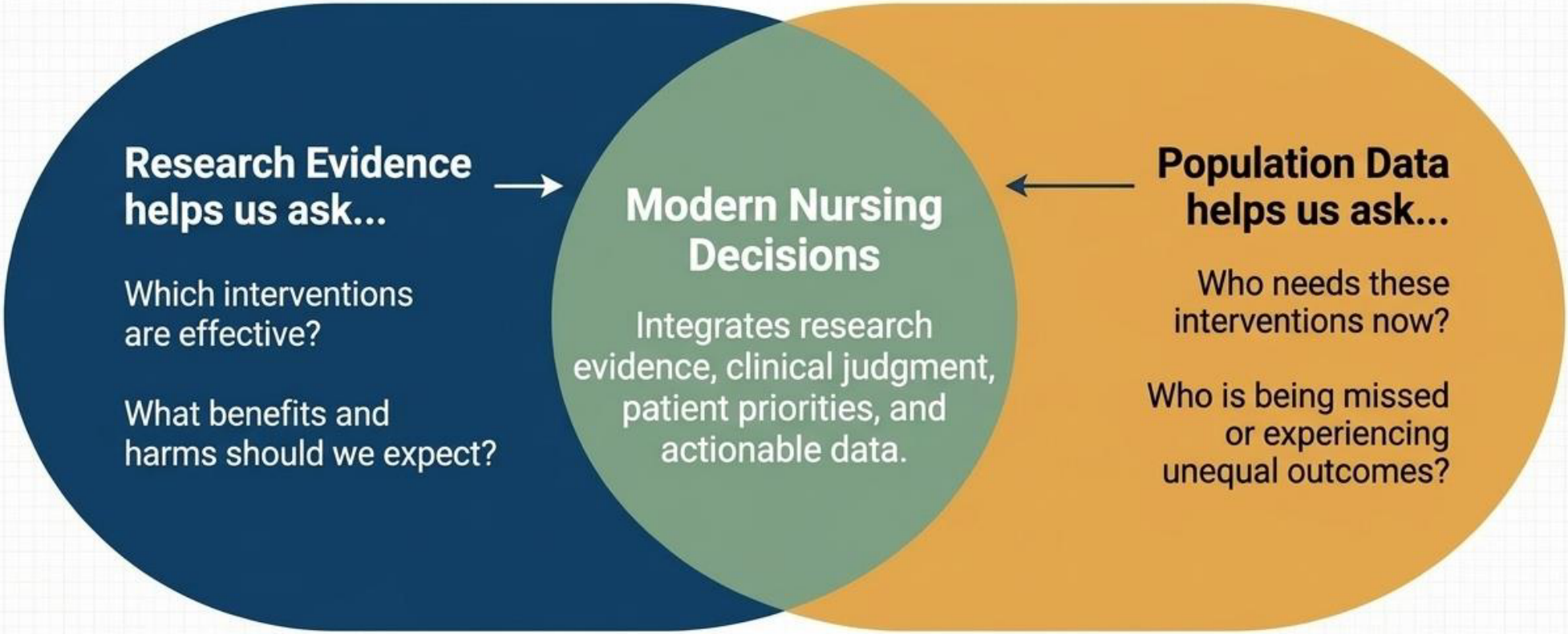
Connecting Research Evidence with Population Data



Knowing what works must be connected with knowing who needs care.

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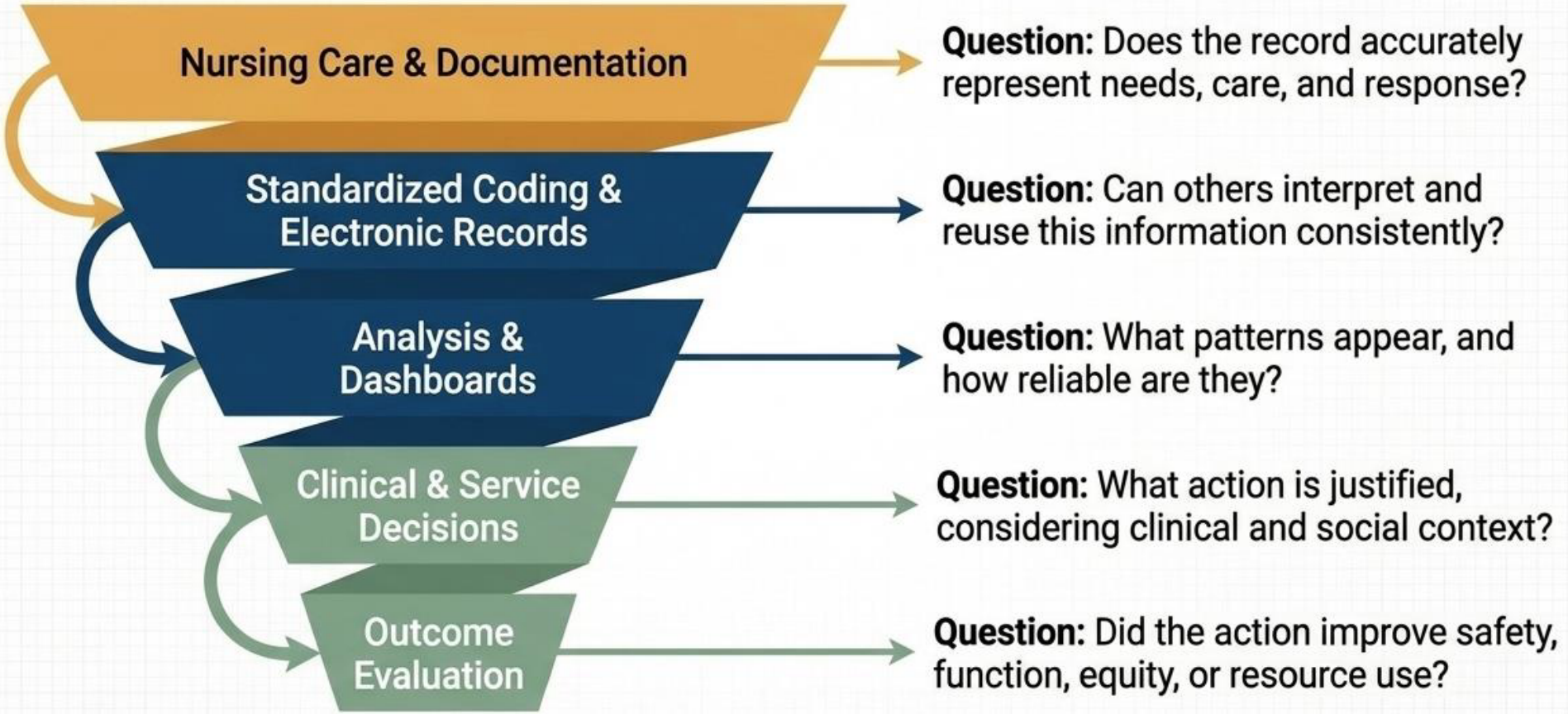
The Documentation Funnel: From Bedside to Dashboards



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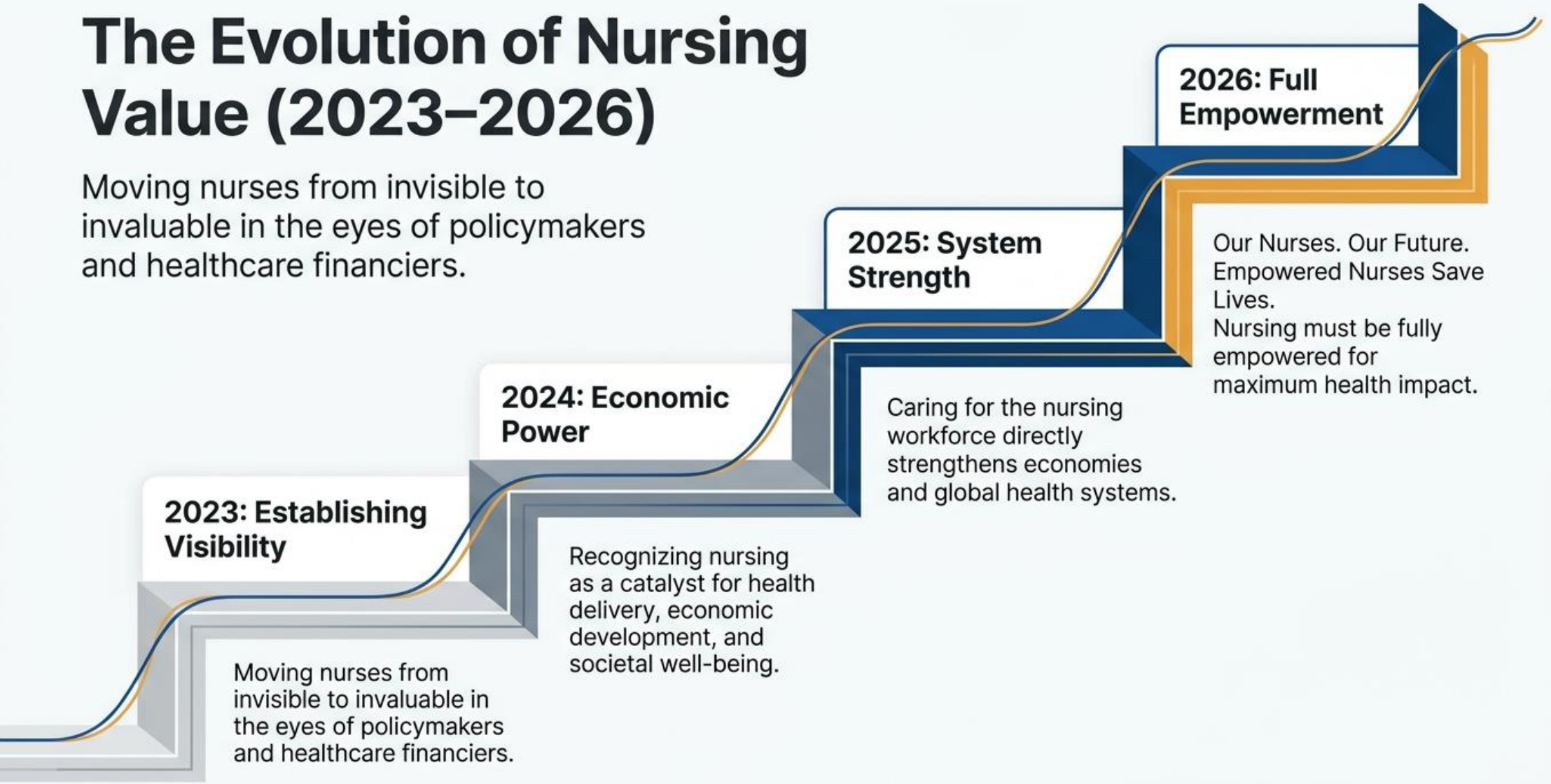
The Evolution of Nursing Value (2023–2026)

Moving nurses from invisible to invaluable in the eyes of policymakers and healthcare financiers.



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The Limitation of Invisible Work

Current Problem

Nursing Work → Remains Invisible

Nursing Outcomes → Underreported in Systems

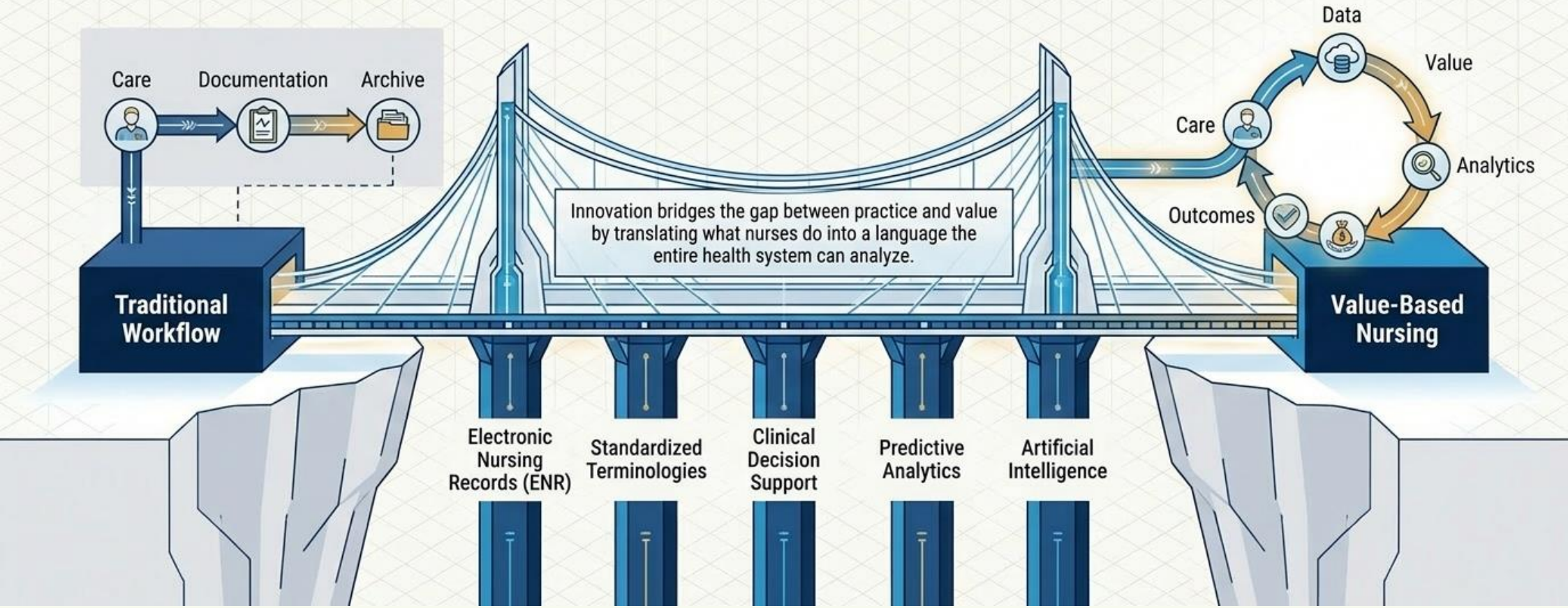
Nursing Value → Undervalued Systemically

Note: Current documentation fails to reflect actual outcomes.

The Data-Driven Future

- **Measurable Outcomes:** Nurse-sensitive indicators that hold up in audits.
- **Interoperability:** Data traveling across HIS, ENR, and national networks.
- **Quality Indicators:** Standardized signals for continuous improvement (HA).
- **Reimbursement Linkage:** Care directly reflected in financial coding (NHSO).
- **Evidence-Backed Decisions:** Workforce planning driven by data, not anecdote.

Digital innovation acts as the bridge that transforms ephemeral nursing activities into permanent, measurable healthcare value.



Thailand's Innovation: The ICD-10-TM Nursing Codes

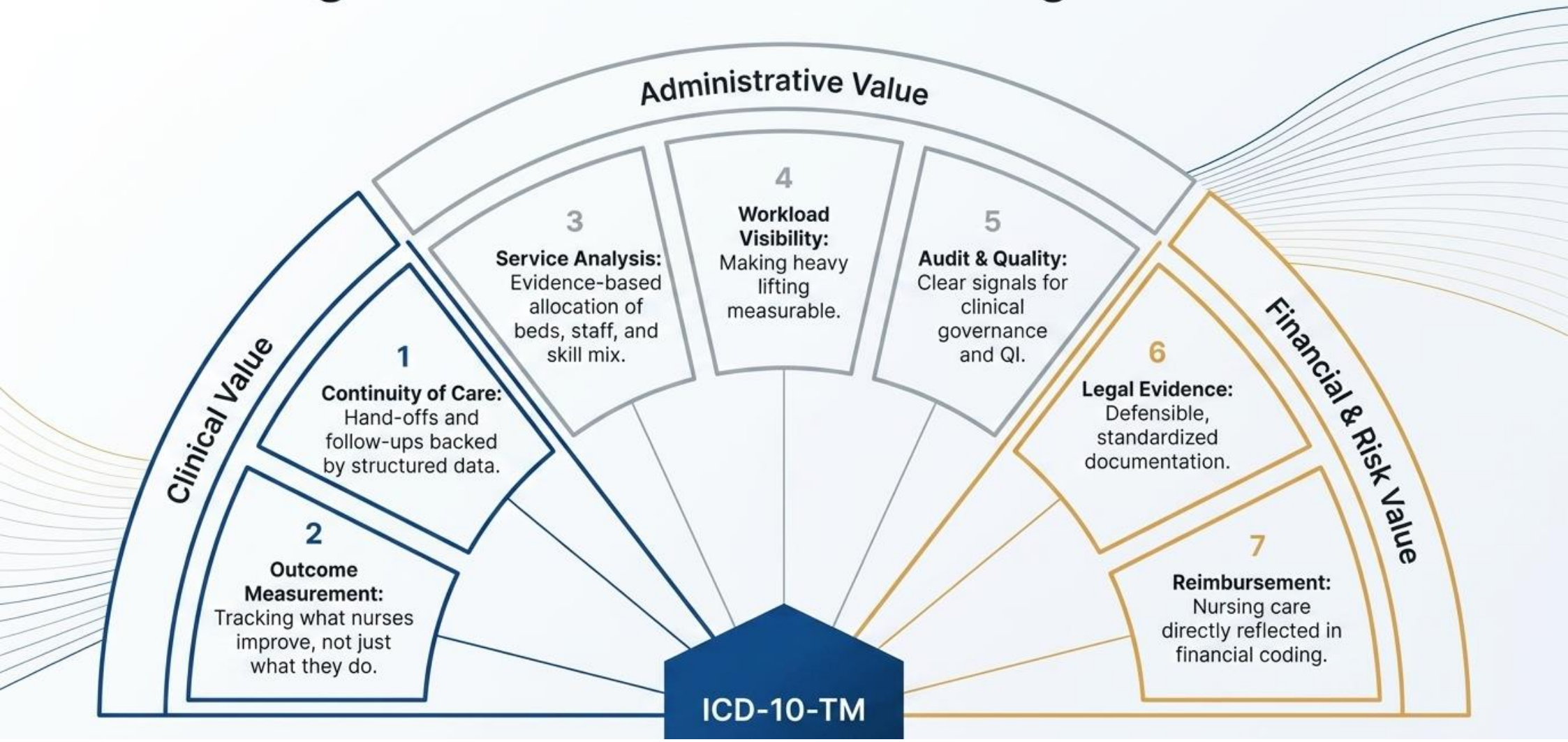
The Systemic Goal

Transforming **Documentation** into **Standardized Data** to capture **True Value**. Driven by Thai Nursing Council standards, HIS/ENR integration, and HA/PDPA legal requirements.

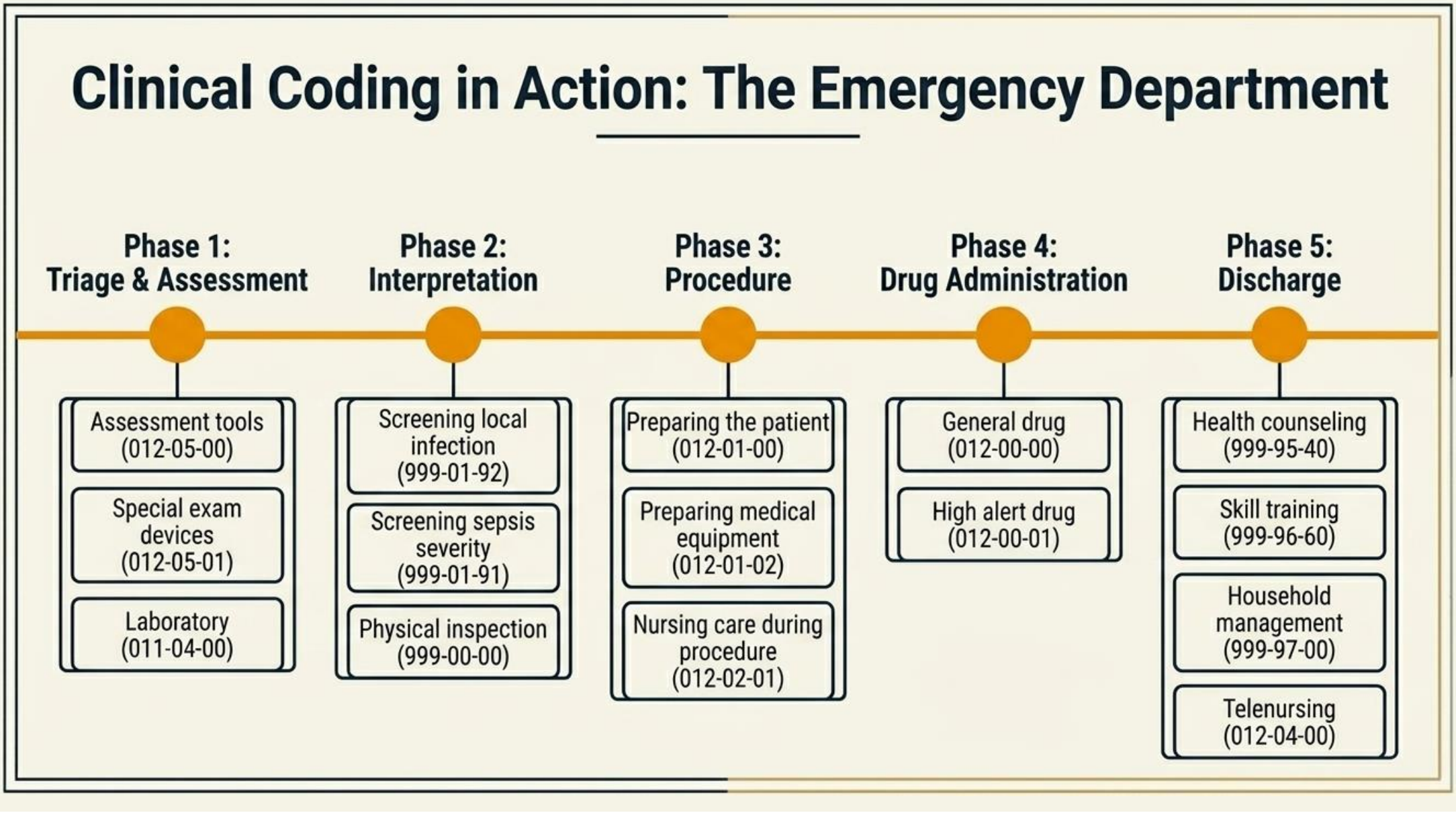
The 8 Categories / 37 Codes

	1. Screening, triage, health assessment	3 codes
	2. Interpretation of physical exams & special investigations	4 codes
	3. Drug administration	2 codes
	4. Monitoring symptom changes	2 codes
	5. Patient preparation for procedures	3 codes
	6. Intra and post-procedure care	8 codes
	7. General nursing care	11 codes
	8. Discharge planning, rehabilitation, maintenance	4 codes

The Strategic ROI of Standardized Coding



Clinical Coding in Action: The Emergency Department



Mapping the True Clinical Burden Across Departments

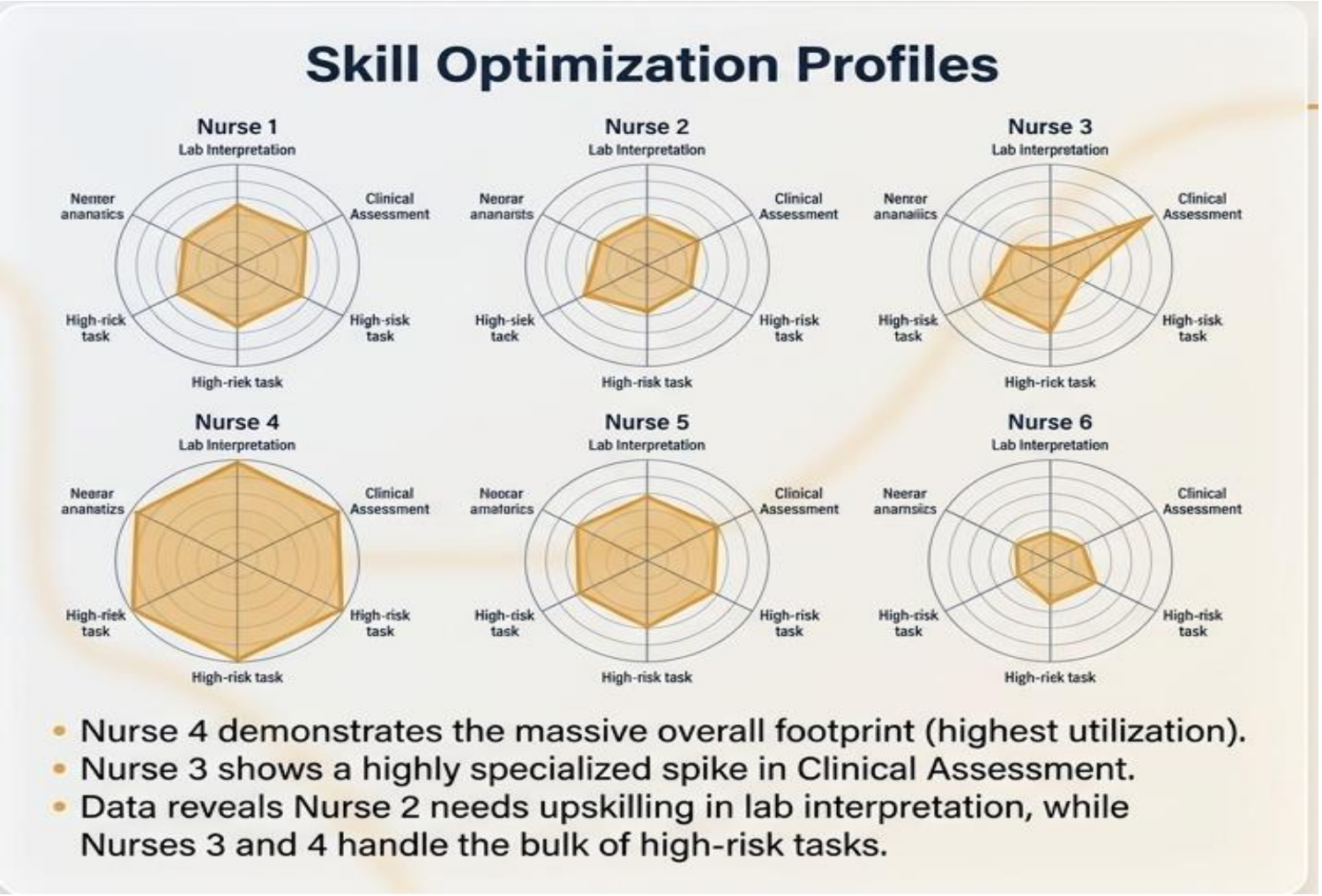
	Symptom Sev	Local Infec	Physical Exam	Lab Int	Assess Tools	Gen Drug	High Alert
Med	927	278	4664	5300	747	4483	798
Sur	777	921	5182	1643	3947	2150	268
VIP	90	464	954	357	548	643	23
ICU Sur	29	877	3695	2429	1006	2095	556
CCU	38	40	647	1034	61	755	444
Labor	383	83	988	208	377	747	43

Point 1: The Medical Ward carries the highest clinical decision-making burden (highest lab interpretation).

Point 2: Surgical areas focus heavily on assessment and infection surveillance.

Point 3: ICU nurses perform a significantly higher volume of advanced clinical tasks (high-alert drugs).

Illuminating Individual Competency and Value



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IMPACT OF ICD-10 NURSING SYSTEM

Turning Unseen Nursing Work into Measurable Value

The ICD-10 Nursing System captures, classifies, and analyzes every nursing activity.
It transforms invisible work into actionable data—driving better care, outcomes, and value.



10.1M+
Nursing Activities
Captured in 26 months
(Jan 2024 – Feb 2026)

1.83M+
Patient Encounters
Across 48 wards

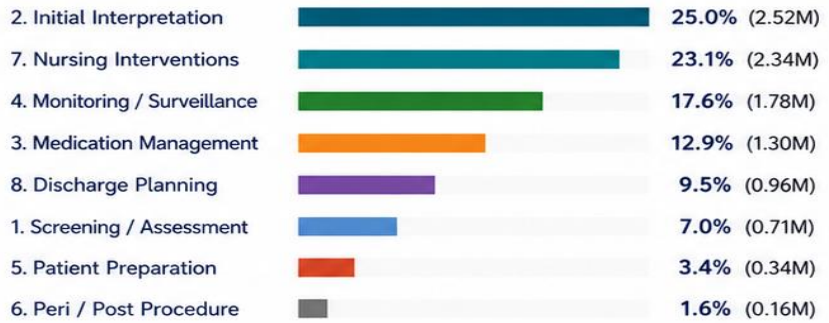
5.5
Activities per Patient
on Average

18.3%
High Alert Drug Administration

26
Months of Real-World Nursing Data

1. MAKING THE INVISIBLE VISIBLE

Breakdown of 10.1M+ Nursing Activities by 8 Categories



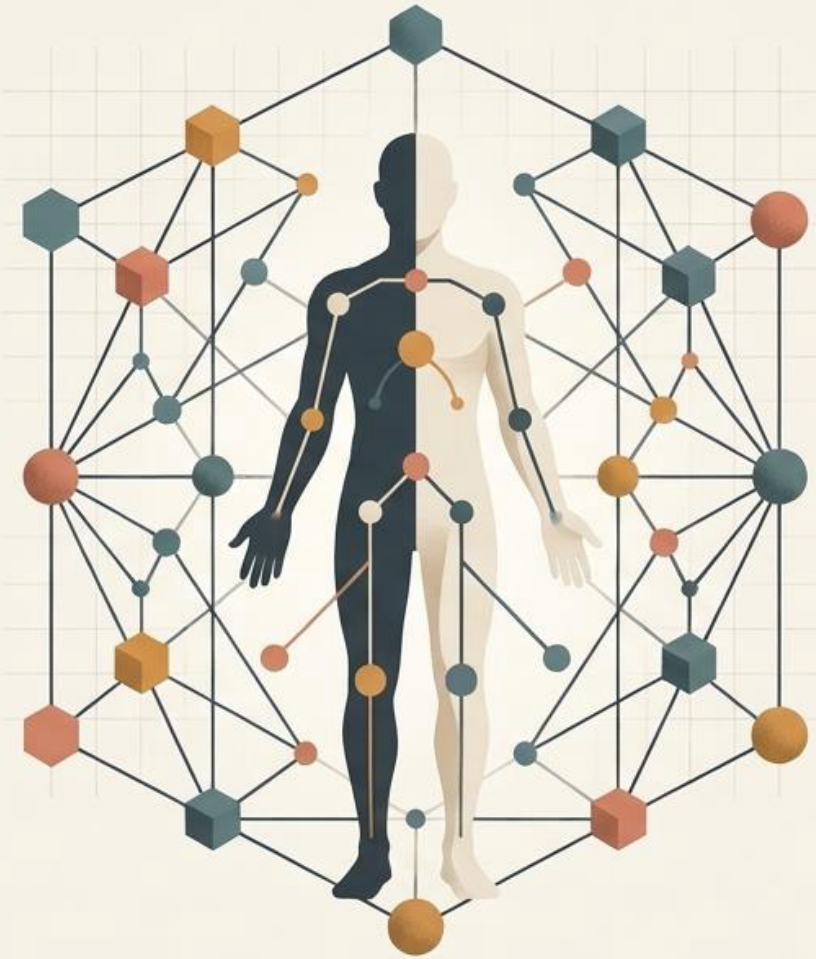
42.6% of activities are from "Initial Interpretation" (25.0%) and "Monitoring / Surveillance" (17.6%) — the core nursing work that legacy systems failed to count.

2. DRIVING BETTER PATIENT OUTCOMES

Nursing activities are significantly associated with reduced 30-day readmission risk.

High Monitoring (999-03-41)	↓	**5.5x** Lower risk
Counseling (999-95-40)	↓	**15.2x** Lower risk
Patient/Caregiver Training (999-96-60)	↓	**5.6x** Lower risk
Telenursing (012-04-00)	↓	**5.6x** Lower risk

Consistent nursing care before and after discharge creates continuity—reducing avoidable readmissions.



Core Takeaways

- **Data requires action:** Data is only valuable when it supports decisions, not simply when more is collected.
- **Analytics map the future:** Descriptive, predictive, and prescriptive tools help teams understand needs, anticipate risks, and compare responses.
- **Context is clinical:** Orthopedic data must connect the physical injury with multimorbidity, functional baselines, and social circumstances.
- **Nurses are the architects:** Frontline clinicians must help shape, interpret, and evaluate the data systems used in care.

"The future of orthopedic nursing is not only about collecting more data. It is about using meaningful data, together with nursing judgment and the patient's priorities, to make better decisions and support recovery."