

## Appendix D – Relational Analysis Results

A series of analyses were conducted to look for relationships within and across the ontology components of the Hazard Manager. The purpose of these analyses was to identify patterns in ontology items selected by study sites. For example, whether hazards discovered during Production were more likely to involve Usability issues than those discovered during Go-Live. Within this section of the Appendix, each relational question investigated is stated below and is paired with its corresponding answer.

### What is the relationship between “Stage of Discovery” and “Corrective Action” (initial vs. definitive)?

Production Use was the Stage of Discovery option most frequently selected with Initial (69.4%, n=304) or Definitive Fix (82.9%, n=363). The table below displays the Corrective Action options most frequently selected with Production Use.

Initial Fix	Definitive Fix
No Mitigation Plan Required 49.7% (n=83)	Case-Closed-Resolved 40.4% (n=200)
No Fix or Removal Required 16.5% (n=35)	Fix or Remove from use within 24 Hours 27.4% (n=64)
Partial 40.5% (n=92)	Complete 65% (n=165)
Training for End Users 56.3% (n=111)	Configuration Change (local IT) 40.8% (n=111)

As the table shows, there was a moderate relationship between Production Use and Initial and Definitive Fix. However, this relationship may be driven by an increased number of hazards that were discovered in Production Use rather than any other Stage of Discovery.

### What is the relationship between “Stage of Discovery”, “Causation” and “Impact”?

As can be seen in the table below, most hazards occurred during Production Use, were due to a usability, software design or organizational factor and most often resulted in patient risk rather than patient harm.

Stage of Discovery	Causation Category	Impact Them (risk vs. actual harm)	Number of Hazards with Combination
Production Use	Usability	Risk	177
Production Use	Usability	Actual	63
Production Use	Software Design	Risk	163
Production Use	Software Design	Actual	35
Production Use	Other Org. Factors	Risk	99
Production Use	Other Org. Factors	Actual	46

**What is the relationship between “Impact” options and “Causation” categories?**

Potential Impact (Risk)

- Risk of Care Process Compromise was most often selected with Usability (49.3%, n=244) and Software Design (16%, n=79).
- Type of Potential Care-Process Compromise was most often selected with Usability (42.8%, n=212) and Software Design (39.2%, n=194).
- Potential Impact of Care-Process Compromise was most often selected with Usability (42%, n=213) and Software Design (39.2%, n=194).

Actual Impact (Non-Risk)

- Actual patient harm rarely selected with a specific Causation category.

**What is the relationship between “Faulty Design” and the “Usability” causation category?**

As can be seen in the table below, there is a strong relationship between Faulty Design and Usability. In 78.7% of cases where Faulty Design was selected, a usability factor was also selected. Difficult Information Access (26.2%), Difficulty Data Entry (24.1%), Confusing Information Display (22.7%), Mismatch between HIT function and clinical reality (22.7%), and Inconsistent Information Display (19.9%) were most often selected with Faulty Design.

Usability Factor	Percent select with Faulty Design
Difficult Information Access	26.2%
Excessive Demands on Human Memory	5%
Confusing Information Display	22.7%
Inconsistent Information Display	19.9%
Mismatch between HIT function and clinical reality	22.7%
Inadequate or Confusing Feedback to the User	19.9%
Electronics-induced Credulity (excessive trust)	2.8%
Other	0.7%

**For those Hazards caused by “Faulty Design”, what causes, in addition to “Faulty Design”, were selected?**

Faulty Design was selected in 38% (n=189) of all hazards. It was the only causation factor selected for 34 hazards. For 155 hazards with Faulty Design, at least one other causation category was also selected:

	Usability	Data Quality	CDS	Software Design	Implementation	Hardware	Other User Factors	Other Org. Factors
Faulty Design	22% (n=111)	10% (n=49)	4% (n=21)	5% (n=25)	3% (n=17)	1% (n=6)	0.2% (n=5)	6% (n=31)

Usability (22%) and Data Quality (10%) were most frequently selected with Faulty Design. The table below displays the most frequently selected Usability and Data Quality causation factors that were selected with Faulty Design.

Usability	Data Quality
Difficult Information Access (37)	Incorrect Patient Information (20)
Difficulty Data Entry (34)	Lost Data (13)
Confusing Information Display (32)	
Mismatch between HIT function & Clinical Reality (32)	
Inadequate or Confusing Feedback to the User (28)	
Incorrect Patient Information (20)	

**For those Hazards caused by “User Error”, what causes, in addition to “User Error”, were selected?**

Unforced User Error was selected in 16% (n=79) of all hazards. It was the only causation factor selected in 24 hazards. For 55 hazards with Unforced User Error, at least one other causation category was also selected:

	Usability	Data Quality	CDS	Software Design	Implementation	Hardware	Other User Factors	Other Org. Factors
<b>Unforced User Error</b>	4.4% (n=22)	1.8% (n=9)	2.4% (n=12)	1.8% (n=9)	1% (n=5)	0	0.4% (n=2)	6.7% (n=33)

Other Organizational Factors and Usability were most frequently selected with Unforced User Error. The table below displays the most frequently selected Organizational and Usability causation factors that were selected with Faulty Design.

Other Organizational Factors	Usability
Other (12)	Mismatch between HIT Function and Clinical Reality (8)
Inadequate Training Structure (11)	Confusing Information Display (8)
	Excessive Demands on Human Memory (8)

**What is the relationship between “Type of Potential Care-Process Compromise” and “Potential Impact”?**

As can be seen in the table below, Potential Impact varied significantly across levels of Potential Care-Process Compromise.

Potential Impact	Delay in Care	Omission	Commission	Other
<b>Low</b>	22.3% (n=86)	6.7% (n=26)	10.6% (n=41)	2.8% (n=11)
<b>Medium</b>	5.7% (n=22)	5.4% (n=21)	12.4% (n=48)	1.8% (n=7)
<b>High</b>	3.9% (n=15)	9.6% (n=37)	16.8% (n=65)	1.8% (n=7)

**What is the relationship between “If there was patient harm, how serious was it?” and “Type of Patient Harm”?**

The only Type of Patient Harm selected was “Physical”. As can be seen in the table below, there isn’t enough data to determine whether there was relationship between “if there was patient harm, how serious was it” and “type of patient harm”.

Type of Patient Harm	Minor Adverse Effect, Likely to be Temp.	Minor Adverse Effect, Resolved	Minor Adverse Effect, Likely to be Chronic	Minor Adverse Effect, Chronic	Major Adverse Effect, Likely to be Temp.	Major Adverse Effect, Resolved	Major Adverse Effect, Likely to be Chronic	Major Adverse Effect, Chronic	Death
<b>Physical</b>	23.1% (n=3)	23.1% (n=3)	0	0	0	46.1% (n=6)	7.7% (n=1)	0	0
<b>Psychological</b>	0	0	0	0	0	0	0	0	0
<b>Financial</b>	0	0	0	0	0	0	0	0	0
<b>Reputational</b>	0	0	0	0	0	0	0	0	0