

ICU Misdiagnosis

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Scope

- Misdiagnoses are estimated to account for as many as 80K hospital deaths per year
- They represent a potentially significant source of preventable morbidity and mortality

ICU Role

- ICU care is:
 - Aggressive
 - Invasive
 - Uses continuous monitoring
 - Makes heavy use of diagnostic testing (labs, imaging etc.)
- Yet, it is estimated that the worst errors (Class I) are 2x as common in the ICU (Shojania, 2003).

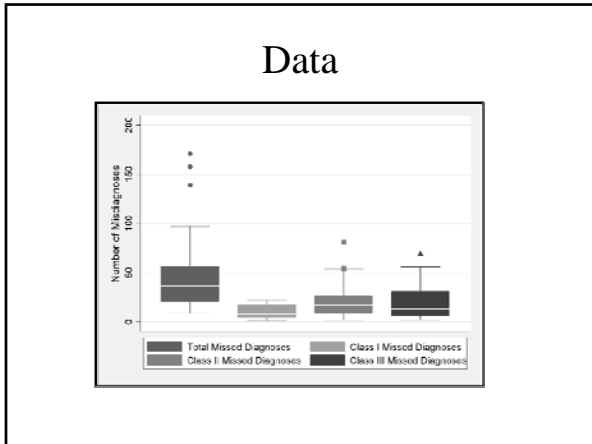


Error Classification

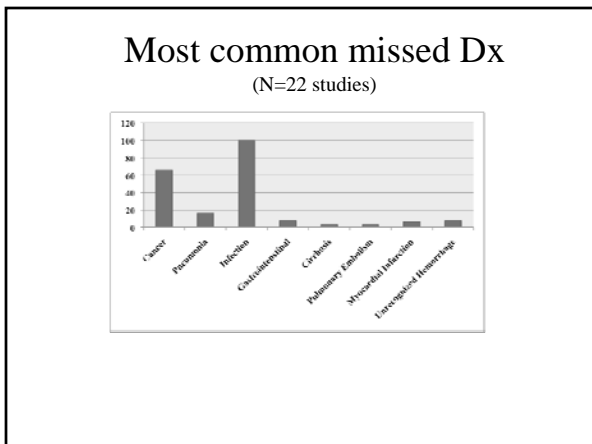
- Goldman Criteria (autopsy based)
 - Major Misdiagnosis
 - Class I-would have changed treatment and outcome
 - Class II-would not have changed outcome
 - Minor Misdiagnosis
 - Class III-related to terminal disease but not causative
 - Class IV-other minor discrepancy

Study	Year	# Deaths	# Autopsies	Total MisDx	MisDx Incidence (%)
Berlot	1999	346	159	51	32.1
Combes	2004	315	167	171	100
Dahl	1989	24	10	9	90
Dimopolous	2005	489	222	50	22.5
Duke	1999	238	not given	22	NA
Fish	2000	94	88	88	100
Getain	1990	48	34	20	58.8
Gut	1999	152	30	10	33.3
Janson	1976	100	100	48	48.0
Kallinen	2008	74	71	10	14.1
Koch	2008	1205	1205	158	13.1
Magret	2006	525	80	35	43.8
Maris	2007	786	289	61	21.1
Nadrous	2003	1997	453	97	24.3
Ong	2002	158	153	41	25.8
Papadakis	1992	401	172	48	27.9
Pastores	2007	658	86	25	29.2
Perkins	2003	636	38	21	55.3
Podbregar	2001	270	126	66	52.4
Roosen	2000	108	100	36	36.0
Saad	2007	NA	161	139	86.3
Sanchez	1999	67	24	24	100
Silvast	2003	388	346	19	5.5
Summ	2004	163	116	44	40
Sharma	2005	249	163	37	22.7
Tai	2001	401	91	18	19.8
Twigg	2001	252	97	23	23.7
Yalamarthi	1998	233	76	29	41.4

Study	Class I Rate (%)	Class II Rate (%)
Berlot	5.0	27.0
Combes	12.0	29.9
Dahl	60	30
Dimopolous	5.4	3.2
Duke	5.7	17.1
Gut	23.3	10
Kallinen	5.6	2.8
Magret	26.3	11.3
Nadrous	4.8	17.8
Ong	2.6	16.3
Papadakis	12.2	15.7
Pastores	17.4	11.6
Perkins	26.3	13.2
Podbregar	9.5	42.9
Roosen	22	14
Sanchez	4.2	96.0
Silvast	2.3	3.2
Sharma	2.5	12.3
Tai	9.9	11.0
Twigg	4.1	19.6



- ### Data: Distilled
- Range of MisDx is wide
 - 5.5-100% of autopsies (total)
 - 2.3-26.3% of autopsies for Class I
 - 3.2-96% of autopsies for Class II
 - Mean rate of all MisDx is 43.2% and median is 33.3% (unweighted for study period)
 - Class I mean =13.1%, median =7.6%
 - Class II mean =20.3%, median= 14.9%



Implications

- MisDx incidence is significant
- MisDx related harm likely results from both wrong/delayed Dx and complications from inappropriate testing/treatment.
- Class II/III errors>Class I; sign of systemic problems? (what about Class IV?)
- This data only scratches the surface as it does not account for non-lethal morbidity and suffering.

We conclude

- Misdiagnosis is common in the ICU environment despite:
 - the aggressiveness of care
 - heavy reliance on diagnostic testing
 - high staff to patient ratios, etc
- Why?

Root Causes?

- Demographics (age, hospital type etc) (linear regression fails to find correlation)
- Clinical presentation/underlying illness
- Immaturity of technology
- Environmental factors
- Cognitive and contextual factors

How Do We Defend Against These?



Environmental

- Address staffing issues
 - Establish safe nurse to patient ratios
 - Qualified Intensivist staffing
- Noise/distraction
 - Alarm fatigue



Cognitive/Contextual

- Major Issues



Drinking from the Fire Hose



- We are drowning in information
- But not always the right information

Moving Forward

- Like “alarm fatigue”, info overload risks missing important data and this may contribute to misDx
- Solutions may include
 - Cognitive Tools
 - Structured diagnostic algorithms
 - Checklists
 - Improved data display (integration, graphical)
 - “Artificial intelligence”

Summary

- We don't know the full impact of misDx in the ICU.
- Based on autopsy based data, it appears to be significant but this may be a fraction.
- We don't understand the root causes well enough.
- Need investigation into root causes before we can intelligently develop defenses and tools to improve.
