



The contribution of adverse events to death in hospitalised patients

Ellinor Christin Haukland, Christian Von Plessen,
Carsten Nieder, Kjersti Mevik, Barthold Vonen



“Adverse events (AEs) due to medical error are estimated to be the third leading cause of death in the USA” [1,2]

Studies of general hospitalised populations extrapolating that 0.6 – 1.1 percent of admissions result in death due to AEs^[3,4]

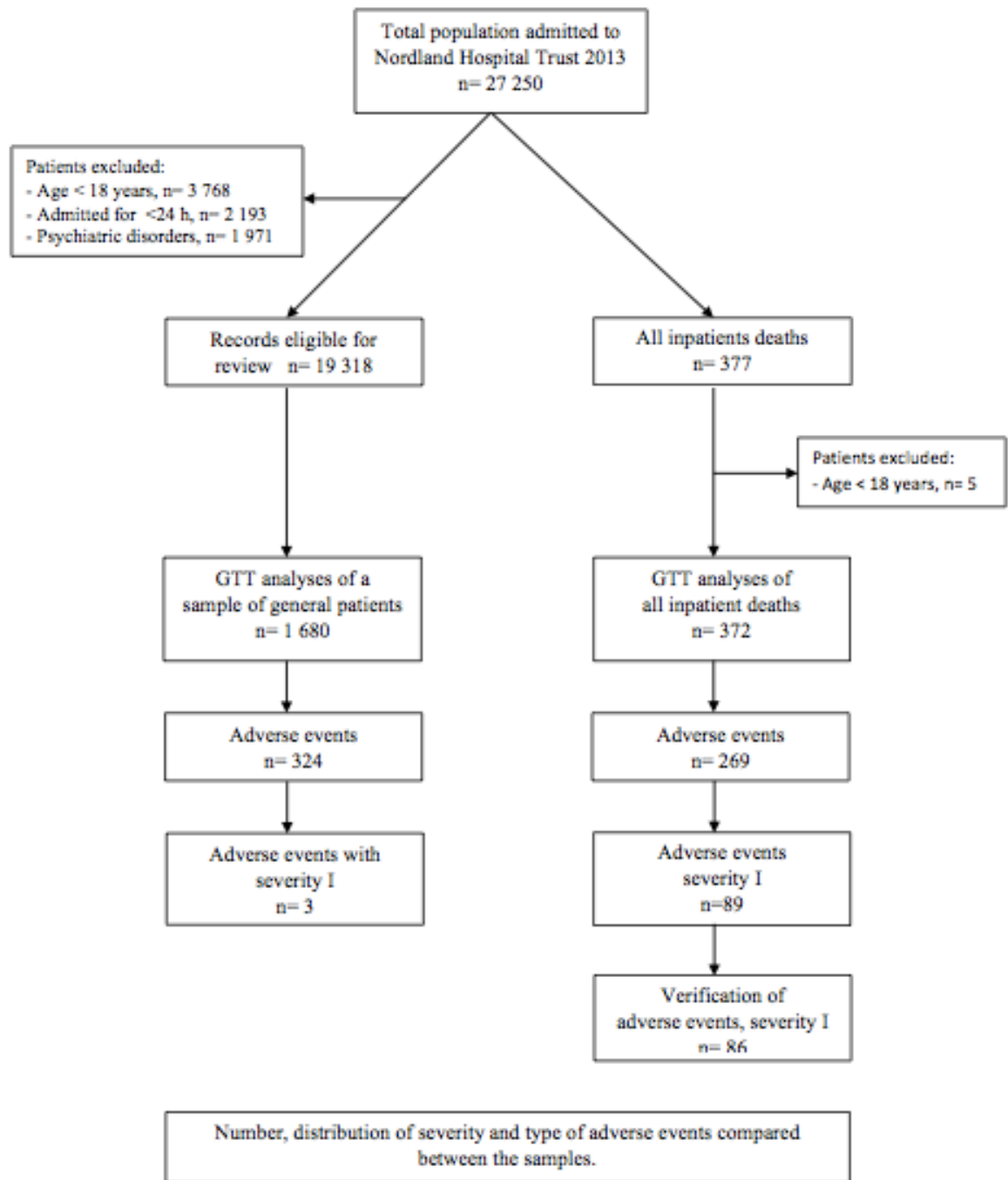
Studies of inpatient deaths indicate that AEs occur more often in patients dying in hospitals ^[5,6]



Objectives

- To investigate the contribution of severe adverse events to death in hospitalised patients
- Clarify methodological differences using the Global Trigger Tool method on all inpatient deaths compared to a sample of general hospitalised patients.





Method and study design



Table 1: Characteristics of patients

Parameter	General patients N=1 680	Inpatient deaths N=372	
Mean age, years (SD)	58.8 (21.3)	77.5 (13.2)	*
18 - 102	18 - 102	18 - 102	
Mean length of stay, days (SD)*	5.3 (5.9)	9.4 (11.7)	*
1 - 86	1 - 86	1 - 65	
Gender N (%)			*
Female	993 (59.1)	182 (44.9)	
Male	687 (40.9)	190 (51.1)	
Type admission N (%)			*
Acute	1211 (72.1)	364 (97.8)	
Planned	469 (27.9)	8 (2.2)	
Hospital N (%)			*
District Hospital Lofoten	240 (14.3)	56 (15.6)	
District Hospital Vesterålen	240 (14.3)	87 (23.4)	
Central Hospital Bodø	1200 (71.4)	227 (61.0)	
Department N (%)			*
Internal medicine	486 (28.9)	258 (69.4)	
Surgery	680 (40.5)	93 (25.0)	
Neurology	151 (9.0)	17 (4.6)	
Gynaecology	276 (16.4)	0	
Other departments	87 (5.2)	3 (0.8)	
Primary diagnosis N (%)			*
Infections	28 (1.7)	23 (6.2)	
Cancer	112 (6.7)	78 (21.0)	
Endocrine and Haematological	86 (5.1)	6 (1.6)	
Neurological disorders	69 (4.1)	4 (1.1)	
Circulatory disorders	164 (9.8)	102 (27.4)	
Respiratory disorders	127 (7.6)	93 (25)	
Gastrointestinal disorders	144 (8.6)	25 (6.7)	
Skeletal and muscular disorders	21 (1.3)	3 (0.8)	
Urinary disorders	150 (8.9)	16 (4.3)	
Pregnancy and birth	231 (13.8)	0	
Damage and poisoning	170 (10.1)	16 (4.3)	
Unspecific symptoms	114 (6.8)	4 (1.1)	
Other disorders	264 (15.7)	18 (4.8)	
Origin of AE N (%)			*
Primary care	43 (11.6)	51 (19.0)	
Hospital	329 (88.4)	218 (81.0)	

Note: *Differences between groups for all characteristics, $p < 0.0001$

Demographics

Patients dying in hospital differ from other hospitalised patients in many ways.

Estimating AEs contributing to death can not be done on studies based on general hospitalised patients.



Insidens rates for adverse events

Table 2: Incidence rates for adverse events

	Admissions with Adverse Events				Adverse Events per 1,000 patient days			
	Frequency	Percent	CI95 %	P-value*	Frequency	Rate	CI95 %	P-value*
Dead patients N= 372	170	46.0	39.6 - 53.5	0.000	269	76.7	68.1 - 86.4	0.000
General patients N=1 680	324	16.3	14.4 - 18.3		324	36.5	32.7 - 40.7	

Note: Comparison of admissions with at least one adverse event and adverse events per 1000 patient days.

*Negative Bi-nominal Regression.

Patients who dies in hospital

- experience nearly three times the rate of AEs pr admission
- have twice the rate of adverse events per 1 000 patient days

AEs contributes to inpatient death in 0.3 percent of hospital admissions



Severity of Adverse Events

Table 2: Distribution of adverse events by severity

Adverse Events	Severity categories				
	E	F	G *	H *	I *
General patients N= 324	174 (53.7)	133 (41.0)	12 (3.7)	2 (0.6)	3 (0.9)
Inpatient deaths N= 269	90 (33.4)	76 (28.3)	12 (4.5)	5 (1.9)	86 (32.0)

Notes: Severity categories according to the NCC MERP index.

1/3 of patients dying in hospital experience an AE so severe that it contributes to death

- Sample size makes a difference.
- GTT on inpatient deaths seems better to detect severe AEs contributing to death



Types of Adverse Events

Table 3: Comparing types of AEs

	AEs per 1 000 patient days Inpatient deaths vs. General patients		
	Exp (β)	P-value	CI 95%
Hospital Associated Infections	1.87	0.000	1.36-2.57
Urinary Tract Infection	0.99	0.967	0.51-1.90
Central Venous Catheter infection			
Ventilator Associated Pneumonia			
Other infections			
Lower Respiratory Infections	2.81	0.000	1.76-4.51
Surgical Complications	0.97	0.923	0.54-1.76
Infection after surgery			
Respiratory complication surgery			
Return to surgery			
Injury, repair or removal of organ			
Bleeding after surgery			
Any other operative complication			
Switch in surgery			
Bleeding and Thrombosis	1.65	0.198	0.77-3.55
Thrombosis – Embolism			
Bleeding			
Patient fall and Fracture	1.36	0.477	0.58-3.17
Patient fall			
Fracture			
Medication Harm	5.21	0.000	3.04-8.94
Obstetric Harm			
Pressure ulcers	2.23	0.043	1.03-4.85
Others	0.86	0.754	0.33-2.24
Allergy			
Medical Technical harm			
Deterioration of chronic illness			
Others			

Note: 23 types of AEs aggregated into e_{ij} adjusted for demographic variables.



Lower respiratory infections (LRI)

Patients dying in hospital have three times the rate of LRI

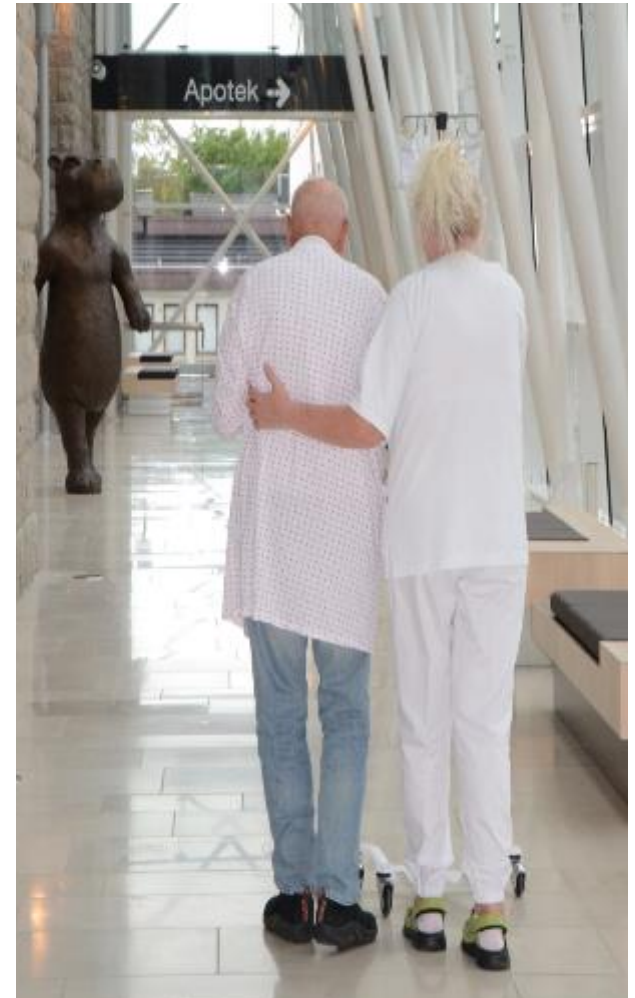
- 1/3 of the LRI contributing to death are present on admission
- Need to differentiate between types of LRI
 - Community associated
 - Healthcare associated
 - Hospital acquired



Medication AEs

Patients dying in hospital have 5 times the rate of AEs related to medications.

- 82% of the medication AEs origin in hospitals.
- Over 70 % are cancer patients



Strengths and limitations

Strengths

- All deaths included
- Good correlation between the physicians
- Including primary care
- Not judging preventability or expectancy of death

Limitations

- Limitations with retrospective reviews
- Information bias
- Small difference in GTT method for the two samples
- Hindsight bias



Conclusion

- Patients dying in hospitals experience *seven times the rate of severe AEs*
- Using the GTT method on a general hospitalised population the *sample size is too small* to provide reliable metrics of rarely occurring severe AEs.
- Reviewing all inpatient death by the Global Trigger Tool method provides *new valid and reliable data of severe adverse events contributing to death*



Thank you!



References

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