

Registering complications at admission via the emergency department: an opportunity for improvement

F.J.H. Magdelijns^{1*}, D. Gulikers¹, E. Pijpers², R.P. Koopmans¹, P.M. Stassen¹

Department of ¹Internal Medicine, Division of Acute Medicine and ²General Medicine, Maastricht University Medical Center, Maastricht, the Netherlands, *corresponding author: tel: +31 (0)43-3875100, fax: +31 (0)43-3877822, e-mail: fabienne.magdelijns@mumc.nl

ABSTRACT

Background: To monitor and improve the quality of care we provide it is important to register complications. Complications occurring after discharge or after treatment at outpatient clinics are usually not registered and complications occurring in domains other than where they originated may be missed. The emergency department (ED) may offer an opportunity to register these complications. This study assesses the prevalence and nature of complications in patients at the moment of acute admission by internists.

Methods: A retrospective cohort study over a five-month period was performed in which we reviewed the charts of all patients who were admitted to our hospital via the ED by internists. We investigated the number, nature, preventability and severity of complications present at the moment of admission.

Results: In total, there were 1128 admissions. Of these, 284 patients were admitted 324 times (28.7%) due to a complication. The most common complication was medication-related (43.5%), in particular bleeding while using anticoagulants. The second most prevalent complication was chemotherapy-related (26.9%), while 17.3% were due to a procedure. Up to 27.8% of all complications were considered preventable. Eighteen (6.3%) patients died during their admission, seven (2.5%) did not recover completely. A total of 23.1% of all complications originated in specialities other than internal medicine.

Conclusion: Complications are a major reason for hospitalisation. Registering complications present at admission gives broad insight into the complications following the care doctors provide. It is important to understand these complications better to prevent such admissions.

KEYWORDS

Adverse drug events, adverse drug reaction, adverse event, complications, internal medicine

INTRODUCTION

Complications, including adverse drug reactions (ADRs), are common but definitely not harmless. In a way these complications mirror our quality of care. It is therefore important to register these complications to monitor and improve the quality of care we provide. In certain disciplines, such as surgery, it has been common practice for years to register complications,^{1,2} but in internal medicine we are just starting and lack extensive experience. To our knowledge, complications occurring after discharge or after treatment in outpatient clinics are not registered. Furthermore, it is our experience that many specialists do not treat their own complications. Hence, important feedback to prevent further complications will not always be reported to the specialist where the complication originated.

Until recently, most studies concerning complications focussed on complications during hospitalisation³⁻⁹ and ADRs causing admission.¹⁰⁻¹⁵ To our knowledge, the number of admissions due to complications that are not ADRs has not been studied. The emergency department (ED) can offer an opportunity to register all kinds of complications originating in more than one stage of treatment and in more than one speciality.

The present study aims to assess the prevalence and nature of complications in patients at the moment of acute admission by internists in a Dutch university medical care centre.

METHODS

Our study was conducted in a secondary and tertiary university medical care centre (Maastricht University Medical Centre; MUMC) in the Netherlands. All patients with an acute, non-planned admission via the ED by internists during the period May-September 2010 were included in the study (n = 1128). Most of our patients are referred by a general practitioner, except for some high urgency (ambulance) patients and some self-presenters. Outside office hours, a general practitioner assesses these self-presenters in a location adjacent to our ED. During office hours, acute internists assess both referred and non-referred patients at the ED and decide on further treatment, including admission to the hospital. In our hospital, acute internists assess patients with general medical problems as well as oncological, haematological, nephrological, gastrointestinal and rheumatological problems.

Retrospectively, we reviewed all admission charts. From these charts, we retrieved information on whether complications were present at the moment of admission and whether these complications led to hospitalisation. In addition, we evaluated the discharge letter. A complication was defined, according to the Dutch Internal Medicine Association,¹⁶ as 'any event or state during or following treatment by a specialist that influenced the health of the patient in such way that renewed treatment was necessary or that it led to damage'. All investigators successfully completed an E-learning course about the registration of complications.¹⁶

All complications were registered following national guidelines,¹⁶ hereby not only registering the complication itself but also its severity (with external factors and procedures that were necessary to diagnose or treat the complication taken into account). If a patient was admitted due to more than one complication, the main complication was scored. We registered the nature of all complications: medication-related, chemotherapy-related, diabetes mellitus-related, procedure-related, or others and we registered which speciality caused the complication. Two investigators independently evaluated whether the complication was preventable or not. In case of disagreement a third investigator decided on this issue. To determine the severity of a complication, all complications were categorised as a complication with (a) full recovery, (b) permanent damage or (c) leading to death. Moreover, we evaluated the survival *during* hospitalisation.

SPSS Statistics version 18 (SPSS Inc, Chicago, Illinois) was used to make Kaplan-Meier survival curves after a follow-up of one month. A log-rank (Mantel-Cox) test was used to compare the survival distributions per type of complication, sex and six age groups (<40 years; 40-50 years; 50-60 years; 60-70 years; 70-80 years; >80 years). To calculate the interobserver agreement we used Cohen's kappa.

The Medical Ethics Committee of the institution approved this study.

RESULTS

In the period May-September 2010, there were 3289 admissions in our hospital via the ED of whom 1128 were admitted to the internal medicine department (*table 1*).

In total, 284 patients were admitted 324 (28.7%) times due to a complication. The median age was 66 years.

Complications

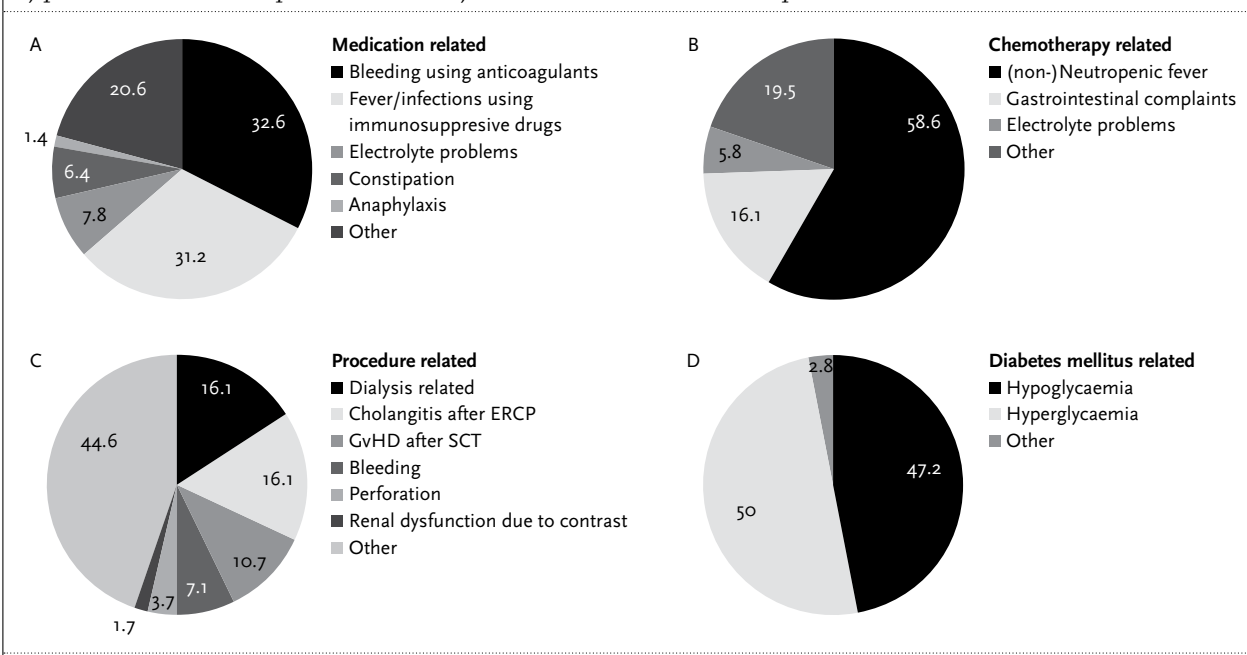
The most common complication was medication-related (43.5%), with bleeding while using anticoagulants (32.6%; 14.2% of total) as most prevalent in this category (*table 1* and *figure 1*). Another 44 (31.2%; 13.6% of total) medication-related complications were fever or an infection while using immunosuppressive drugs. The second most common group of complications was chemotherapy-related (26.9%). Fifty-six patients (17.3%) were admitted because of complications following a procedure. Thirty-six (11.1%)

Table 1. Patient characteristics and their complications

Study population	n (%)
Admissions for internal medicine	1128 (100)
Admissions because of complications	324 (28.7)
Patients admitted because of complications	284 (25.2)
Sex, female	160 (49.4)
Median age in years (range)	66 (21-96)
Duration of admission:	
Days (median, range)	8 (1-92)
Missing information	16 (4.9)
Complications	n (%)
<i>Medication-related</i>	141 (43.5)
Bleeding using anticoagulants	46 (14.2)
Coumarins	19 (5.9)
Other anticoagulants	27 (8.3)
Fever/infections using immunosuppressive drugs	44 (13.6)
Electrolyte problems	11 (3.4)
Constipation	9 (2.8)
Anaphylaxis	2 (0.6)
Other	29 (9.0)
<i>Chemotherapy-related</i>	87 (26.9)
Non-neutropenic fever	34 (10.5)
Neutropenic fever	17 (5.2)
Gastrointestinal complaints	14 (4.3)
Electrolyte problems	5 (1.5)
Other	17 (5.2)
<i>Procedure-related</i>	56 (17.3)
Dialysis related	9 (2.8)
Cholangitis after ERCP	8 (2.5)
GvHD after SCT	6 (1.9)
Bleeding	4 (1.2)
Perforation	2 (0.6)
Renal dysfunction due to contrast	1 (0.3)
Other	26 (8.0)
<i>Diabetes mellitus-related</i>	36 (11.1)
Hypoglycaemia	17 (5.2)
Hyperglycaemia	18 (5.6)
Ketoacidosis	2 (0.6)
Other (renal dysfunction)	1 (0.3)
<i>Other</i>	4 (1.2)
<i>While on a waiting list</i>	3 (0.9)

ERCP = endoscopic retrograde cholangiopancreatography; GvHD = graft versus host disease; SCT = stem cell transplantation.

Figure 1. Numbers are percentages of; A) medication-related complications, B) chemotherapy-related complications, C) procedure-related complications, and D) diabetes mellitus-related complications



ERCP = endoscopic retrograde cholangiopancreatography; GvHD = graft versus host disease; SCT = stem cell transplantation.

patients were admitted with diabetes mellitus-related complications. Overall, infections and fever secondary to immunosuppressive drugs or chemotherapy were the most prevalent complications (95; 29.3%). In 4% (n=13) of the admissions more than one complication was present.

Figure 1 illustrates the complications per category in more detail. In the medication-related category, anticoagulants and immunosuppressive drugs were the main causes of complications. Fever was the most prevalent chemotherapy-related complication.

Dialysis-related problems and cholangitis after endoscopic retrograde cholangiopancreatography (ERCP) accounted for 32.2% of the admissions in the procedure-related category.

Severity of the complications

The median duration of hospital stay was eight days in our cohort. While most (92.3%) of the patients recovered completely, 18 (6.3%) patients died (figure 2), and in seven patients the complication led to irreversible damage.

Figure 2 shows the survival of the whole cohort, with an overall 28-day survival of 93.7% (figure 2A). There were no statistically significant differences in survival for sex (p=0.53) (data not shown), for each type of complication (p=0.62) (figure 2B) nor for the different age groups (p=0.52) (data not shown).

Preventability of complications

Up to 27.8% of the complications were considered preventable (figure 3). The authors reached consensus

on the preventability in 95% with a high inter-observer agreement ($\kappa = 0.89$). Nearly all chemotherapy-related complications were judged inevitable, whereas most of the diabetes mellitus-related complications were judged preventable (69.4%). Of the patients with the complication 'bleeding while using coumarins', 63.2% had an international normalised ratio (INR) higher than 3. This bleeding was therefore judged preventable.

Domains in which complications originated

Most of the complications we found were related to treatment provided by internists (76.9%). Haematological and oncological treatments were responsible for half of the complications (49.4%) (table 2).

Other specialists than internists contributed to 23.1% of all admissions, mainly cardiology (13.9% of total). The majority of these complications were gastrointestinal bleeding while being treated with anticoagulants for atrial fibrillation.

DISCUSSION

Complications are a major reason for admissions via the ED by internists. In our study, complications were the reason for hospitalisation in 28.7% of all emergency admissions by internists. To our knowledge, data on the frequency and preventability of admissions by internists due to a complication have not been studied before in the Netherlands or elsewhere.

Figure 2. Survival during hospitalisation

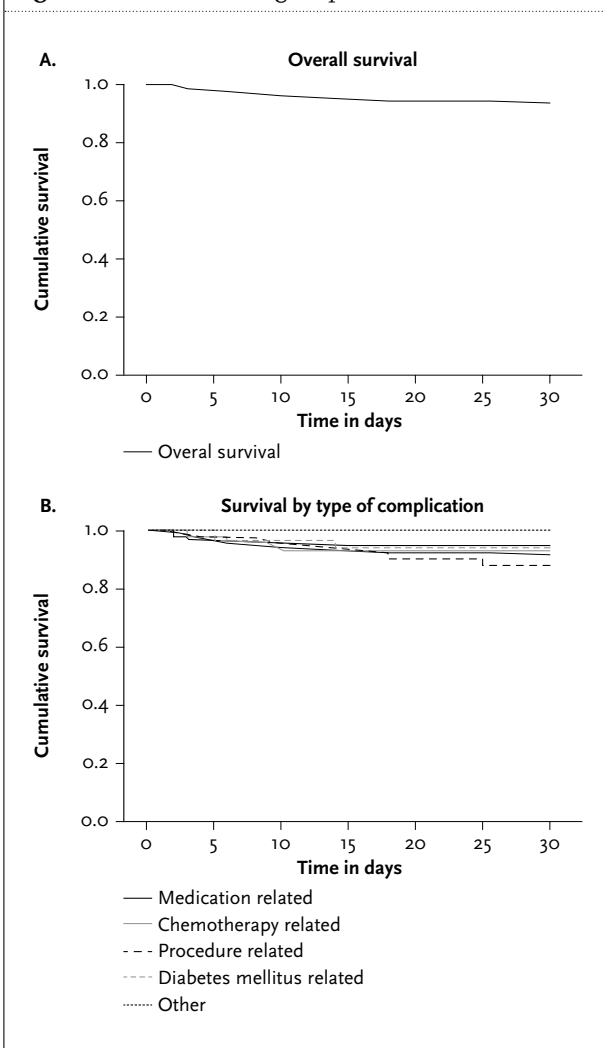


Table 2. Domains in which complications originated

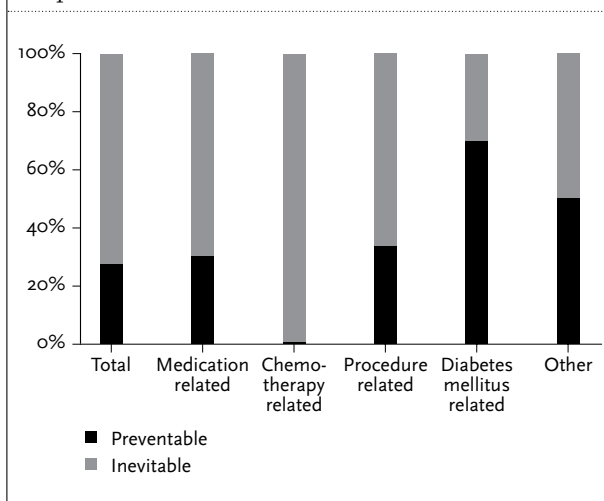
Internal medicine	n (%)*
Oncology	70 (21.6)
Haematology	53 (16.4)
Endocrinology	41 (12.7)
Nephrology	35 (10.8)
Gastroenterology	30 (9.3)
Immunology	7 (2.2)
Other internal medicine	13 (4.0)
Total	249 (76.9)
Other domains	n (%)*
Cardiology	45 (13.9)
General practitioner	9 (2.8)
Surgery	7 (2.2)
Neurology	4 (1.2)
Psychiatry	4 (1.2)
Urology	2 (0.6)
Rheumatology	2 (0.6)
Other	2 (0.6)
Total	75 (23.1)

*Percentages are of total (n=324).

Worldwide, the incidence of complications *during* hospital stay is substantial.³⁻⁹ For example, in Canada a complication rate of 7.5% was found,⁷ compared with 5.7-12.3% in Europe^{3-6,8} and 4.5% in Colombia.⁹ In the Netherlands, a retrospective patient record review study showed that the national incidence of complications among hospitalised patients was 5.7%, of which 39.6% were judged preventable.³ Focussing on the internal medicine department, a complication rate of 5.4% was found, of which 25.7% were judged preventable. In our study, the incidence of complications was much higher, but the percentage of complications that were judged preventable was comparable (27.8% and 25.7%, respectively). The higher incidence we found could be explained by the fact that the aforementioned studies assessed complications occurring *during* hospitalisation in all hospitalised patients, including electively admitted patients, whereas our study focussed on *the moment of acute admission* only. Comparing the prevalence of complications occurring in electively admitted patients with the complication rate of patients

presenting to the ED with complaints that turn out to be a complication of earlier provided treatment, is difficult. Although little is known about the prevalence and nature of complications at the time of admission, some studies have investigated the rate of medication-related admissions.¹⁰⁻¹⁵ Two German studies found an adverse drug reaction (ADR) related admission rate of 0.92-2.4%,^{12,13} one French study found an admission rate of 3.19%,¹⁴ and a Slovenian study of 5.8%.¹⁵ In the Netherlands, a multicentre study (Hospital Admissions Related to Medication; HARM study) showed that 5.6% of the unplanned admissions were possibly or probably medication-related.¹⁰ In our study, we found a higher medication-related admission rate of 12.5%. However, our study focussed on admissions by internists, while the aforementioned studies evaluated ADR hospital admissions by all specialists. Polypharmacy is common in patients treated by internists,¹⁷ which leads to a higher risk of medication-related admissions. This might explain the difference in prevalence. The HARM study, like our study, found that most (20.2%) of the medication-related admissions were caused by medications that affect blood coagulation (antiplatelet drugs (8.7%), oral anticoagulants (6.3%), non-steroidal anti-inflammatory drugs (NSAIDs (5.1%)). This was also found in other studies.^{11,13,15} The most important adverse event of anticoagulants, which reduce the risk of thromboembolism very effectively, is bleeding. Peri-procedural reversal and bridging of these agents has recently been reviewed in this journal.¹⁸ Antidiabetic drugs accounted for 11.1% of the admissions in our study, which is comparable to the HARM study (12.3%).

Figure 3. Preventability of the different types of complications



Most complications found in our study were mild, although they did lead to hospitalisation, and most patients recovered completely, which is comparable with previously discussed studies.^{3-5,7-11,13,14} We found a mortality rate of 6.3% of patients admitted due to a complication, which is comparable with the mortality rates found in studies investigating ADR-related admissions (1.7%-6.3%)^{10,11,13} and studies investigating complications *during* hospital admissions (3%-8%).^{4,6,9}

Nearly 30% of the complications were judged preventable, of which the diabetes-related complications were most often judged preventable (69.4%). The latter is a consequence of the fact that we judged a hyperglycaemia due to, for example, non-compliance as preventable. This is open for debate, as it is extremely difficult to regulate diabetes strictly within the limits of hyperglycaemia and hypoglycaemia.

The oncologist and haematologist accounted for most of the admissions due to a complication (21.6%). Most of these complications were infections or fever shortly after chemotherapy. Interestingly, 23.1% of the complications were caused by other specialities than internists, in particular the cardiologists (13.9%). However, we did not investigate admissions by, for example, cardiologists due to a complication following treatment started by internists. It is to be expected that other specialities treat complications caused by internists as well. This demonstrates that effective feedback between the different specialities is of utmost importance.

Complications (and their treatment) are not only potentially dangerous, but also expensive. A study performed in Germany found that ADRs account for €400 million per year,¹³ while in the United Kingdom the extra bed-days alone would account for £1 billion a year.⁶ The total

direct medical costs associated with complications in the Netherlands was found to be 2.4% of the national health care budget (total €14.5 billion in 2004), with preventable complications accounting for 1.1%.¹⁹ This emphasises that prevention of complications is relevant for the society as a whole, which stresses the need to get more insight into these (preventable) complications. In our study 27.8% of all complications were judged preventable.

Although complications should be avoided as much as possible, they will continue to occur. Therefore, complications challenge us to continually evaluate our own practice and its organisation. As registration and analysis of adverse outcomes are strong indicators of quality,² registration and analysis *per se* may improve our care. A reliable and constructive way to provide feedback on these complications should also be designed.

Limitations of the study

Our study has some limitations. Firstly, it is a small study based on one department, the internal medicine department, of one university hospital. It is important to emphasise that we did not study all the complications that occurred, since we focussed on emergency admissions by internists. We therefore could not include complications caused by internists that were treated by other specialities. To solve this problem, all admissions for all specialities should be included. Secondly, our study included patients who are admitted by internists via the ED only. Therefore, the results cannot be extrapolated to other settings. Thirdly, we did not investigate how many patients experienced a complication in relation to the number of treatments provided since this was not the aim of the study. Hence, it is important to read this study in the right perspective. Fourth, our study cannot be extrapolated to other countries without correcting for differences in the organisation of the health care system. This study, despite its limitations, does provide insight into the prevalence of complications at the moment of admission and justifies a more extensive study, which includes patients of more specialities.

Furthermore, hindsight bias might have occurred, as it is a general weakness of retrospective studies.²⁰ Knowing the outcome of a complication and its severity may influence judgement of cause and preventability. This source of bias may have led to overestimation of (preventable) complications. In addition, information was obtained from patient charts; poor quality of these charts could have led to underestimation of the incidence of complications. However, retrospective patient charts studies are currently the best method available for investigating complications.²¹ Moreover, to improve the reliability of the way we identified the complications and their preventability,²² all reviewers followed an E-learning course on complication registration and had to pass an exam.

In conclusion, our study demonstrated that complications were the reason for hospitalisation in 28.7% of all emergency admissions by internists. These complications were mostly bleeding (using anticoagulants) and infections or fever (during or after chemotherapy and/or during other immunosuppressive therapy). Although most patients recovered completely, mortality rate *during* subsequent hospitalisation was 6.3%. Interestingly, 27.8% of the complications were judged to be preventable. Moreover, almost a quarter of the complications originated in the field of other specialities than internal medicine. Registering complications in an ED is important for providing good quality of care and provides broad insight into the prevalence of complications originating during several stages of treatment provided by all sorts of doctors.

LEARNING POINTS

- Complications arise frequently, with hospitalisation being not uncommon.
- Complications are not innocent; some patients even die.
- Almost 30% of the complications are judged preventable.
- Registering complications is important for providing good quality of care.
- Registering complications in the emergency department broadens perspective.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

ORAL PRESENTATION

'Registering complications at the moment of admission via the emergency department broadens perspective'. Nederlandse Internisten Dagen, MECC Maastricht, 26 April 2012. The abstract was published in the Abstract book of the Netherlands Society of Internal Medicine (NIV).

REFERENCES

1. Veen EJ, Janssen-Heijnen ML, Leenen LP, Roukema JA. The registration of complications in surgery: a learning curve. *World J Surg.* 2005;29:402-9. Epub 2005/02/08.
2. Martin RC, 2nd, Brennan MF, Jaques DP. Quality of complication reporting in the surgical literature. *Ann Surg.* 2002;235:803-13. Epub 2002/05/30.
3. Zegers M, de Bruijne MC, Wagner C, et al. Adverse events and potentially preventable deaths in Dutch hospitals: results of a retrospective patient record review study. *Qual Saf Health Care.* 2009;18:297-302. Epub 2009/08/05.
4. Soop M, Fryksmark U, Koster M, Haglund B. The incidence of adverse events in Swedish hospitals: a retrospective medical record review study. *Int J Qual Health Care.* 2009;21:285-91. Epub 2009/06/27.
5. Aranaz-Andres JM, Aibar-Remon C, Vitaller-Burillo J, et al. Impact and preventability of adverse events in Spanish public hospitals: results of the Spanish National Study of Adverse Events (ENEAS). *Int J Qual Health Care.* 2009;21:408-14. Epub 2009/10/21.
6. Vincent C, Neale G, Woloshynowych M. Adverse events in British hospitals: preliminary retrospective record review. *BMJ.* 2001;322:517-9. Epub 2001/03/07.
7. Baker GR, Norton PG, Flintoft V, et al. The Canadian Adverse Events Study: the incidence of adverse events among hospital patients in Canada. *CMAJ.* 2004;170:1678-86. Epub 2004/05/26.
8. Schioler T, Lipczak H, Pedersen BL, et al. Incidence of adverse events in hospitals. A retrospective study of medical records. *Ugeskr Laeger.* 2001;163:5370-8. Epub 2001/10/10. Forekomsten af utilsigtede haendelser pa sygehuse. En retrospektiv gennemgang af journaler.
9. Gaitan-Duarte H, Eslava-Schmalbach J, Rodriguez-Malagon N, Forero-Supelano V, Santofimio-Sierra D, Altahona H. [Incidence and preventability of adverse events in patients hospitalised in three Colombian hospitals during 2006]. *Rev Salud Publica (Bogota).* 2008;10:215-26. Epub 2008/11/29. Incidencia y Evitabilidad de Eventos Adversos en Pacientes Hospitalizados en tres Instituciones Hospitalarias en Colombia, 2006.
10. Leendertse AJ, Egberts AC, Stoker LJ, van den Bemt PM. Frequency of and risk factors for preventable medication-related hospital admissions in the Netherlands. *Arch Intern Med.* 2008;168:1890-6. Epub 2008/09/24.
11. van der Hoof CS, Sturkenboom MC, van Grootheest K, Kingma HJ, Stricker BH. Adverse drug reaction-related hospitalisations: a nationwide study in The Netherlands. *Drug Saf.* 2006;29:161-8. Epub 2006/02/04.
12. Amann C, Hasford J, Stausberg J. Hospital Admission due to Adverse Drug Events (ADE): An Analysis of German Routine Hospital Data of 2006. *Gesundheitswesen.* 2011. Epub 2011/10/22. Stationäre Aufnahmen wegen unerwünschter Arzneimittelereignisse (UAE): Analyse der DRG-Statistik 2006.
13. Schneeweiss S, Hasford J, Gottler M, Hoffmann A, Riethling AK, Avorn J. Admissions caused by adverse drug events to internal medicine and emergency departments in hospitals: a longitudinal population-based study. *Eur J Clin Pharmacol.* 2002;58:285-91. Epub 2002/07/24.
14. Pouyanne P, Haramburu F, Imbs JL, Begaud B. Admissions to hospital caused by adverse drug reactions: cross sectional incidence study. *French Pharmacovigilance Centres. BMJ.* 2000;320:1036. Epub 2000/04/14.
15. Brvar M, Fokter N, Bunc M, Mozina M. The frequency of adverse drug reaction related admissions according to method of detection, admission urgency and medical department specialty. *BMC Clin Pharmacol.* 2009;9:8. Epub 2009/05/05.
16. Nederlandse Internisten Vereniging (NIV); Complicatieregistratie (E-learning), the Netherlands. Available from: <http://www.internisten.nl/home/kwaliteit/complicatieregistratie/complicatieregistratie2012> [cited 2012].
17. Schuler J, Duckelmann C, Beindl W, Prinz E, Michalski T, Pichler M. Polypharmacy and inappropriate prescribing in elderly internal-medicine patients in Austria. *Wien Klin Wochenschr.* 2008;120:733-41. Epub 2009/01/06.
18. Levi M, Eerenberg E, Kamphuisen PW. Periprocedural reversal and bridging of anticoagulant treatment. *Neth J Med.* 2011;69:268-73. Epub 2011/08/27.
19. Hoonhout LH, de Bruijne MC, Wagner C, et al. Direct medical costs of adverse events in Dutch hospitals. *BMC Health Serv Res.* 2009;9:27. Epub 2009/02/11.
20. Fischhoff B. Hindsight not equal to foresight: the effect of outcome knowledge on judgment under uncertainty. 1975. *Qual Saf Health Care.* 2003;12:304-11; discussion 11-2. Epub 2003/08/05.
21. Lilford RJ, Mohammed MA, Braunholtz D, Hofer TP. The measurement of active errors: methodological issues. *Qual Saf Health Care.* 2003;12(Suppl 2):ii8-12. Epub 2003/12/04.
22. Michel P, Quenon JL, de Sarasqueta AM, Scemama O. Comparison of three methods for estimating rates of adverse events and rates of preventable adverse events in acute care hospitals. *BMJ.* 2004;328:199. Epub 2004/01/24.