

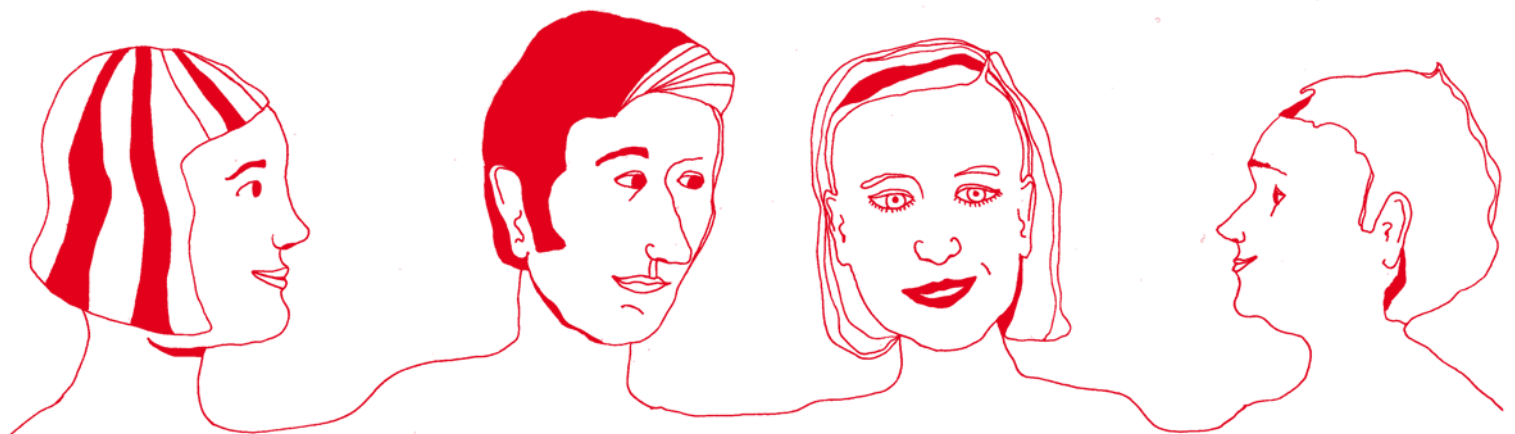
Users of a hospital emergency department
Diagnoses and mortality of those discharged
home from the emergency department

Oddný S Gunnarsdóttir

Nordic School of Public Health

Master of Public Health

MPH 2006:2



Users of a hospital emergency department. Diagnoses and mortality of those discharged home from the emergency department.

© Nordic School of Public Health

ISSN 1104-5701

ISBN 91-7997-128-8



Master of Public Health

– Essay –

Title and subtitle of the essay Users of a hospital emergency department Diagnoses and mortality of those discharged home from the emergency department				
Author Oddný S Gunnarsdóttir				
Author's position and address R N Division of Medical Education and Science, Landspítali University Hospital, Reykjavik, Iceland				
Date of approval December 13, 2005			Supervisor NHV/External Vilhjalmur Rafnsson, professor	
No of pages 23	Language – essay English	Language – abstract English	ISSN-no 1104-5701	ISBN-no 91-7997-128-8

Abstract

Objectives – To ascertain the annual number of users who were discharged home after visits to the emergency department, grouped by age, gender and number of visits during the calendar year, and to assess whether an increasing number of visits to the department predicted a higher mortality.

Methods – This is a retrospective cohort study, at the emergency department of Landspítali University Hospital, Reykjavik capital city area, Iceland. During the years of 1995 to 2001 19259 users visited the emergency department, and were discharged home and they were follow-up for cause specific mortality through a national registry. Standardised mortality ratio, with expected number based on national mortality rates was calculated and hazard ratios according to number of visits per calendar year using time dependent multivariate regression analysis were computed.

Results – The annual increase of visits to the emergency department among the patients discharged home was seven to 14 per cent per age group during the period 1995 to 2001, with a highest increase among older men. The most common discharge diagnosis was the category Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified. When emergency department users were compared with the general population, the standardised mortality ratio was 1.81 for men and 1.93 for women. Among those attending the emergency department two times, and three or more times in a calendar year, the mortality rate was higher than among those coming only once in a year. The causes of death which led to the highest mortality among frequent users of the emergency department were neoplasm, ischemic heart diseases, and the category external causes, particularly drug intoxication, suicides and probable suicides.

Conclusions – The mortality of users of the emergency department who had been discharged home turned out to be higher than that of the general population. Frequent users of the emergency department had a higher mortality than those visiting the department no more than once in a year. Since the emergency department serves general medicine and surgery patients, not injuries, the high mortality due to drug intoxication, suicide and probable suicide is notable. Further studies are needed into the diagnosis at discharge of those frequently using emergency departments, in an attempt to understand and possibly prevent this mortality.

Key words

Cause specific death, record linkage, intoxication, suicides

Users of a hospital emergency department

Diagnoses and mortality of users discharged home from the emergency department

Contents

Introduction.....	4
Methods.....	4
Source of data.....	5
Record linkage.....	7
Statistical methods.....	8
Ethical aspects.....	8
Results.....	8
Number of users.....	8
Discharge diagnoses.....	10
Mortality and general population.....	18
Mortality of internal comparison.....	18
Discussion.....	18
Conclusion.....	20
Funding.....	21
Acknowledgement.....	21
References.....	21

A part of the content of this monograph has been accepted for publication as a paper in Emergency Medical Journal: Gunnarsdottir SO, Rafnsson V. Mortality of users of a hospital emergency department.

Introduction

The number of individuals seeking emergency medical services and number of visits to hospital emergency departments has increased in the last decades in many developed countries, and has been the subject of attention in the public health discussion (1-4).

Some studies show that the majority of users consider themselves in need of emergency treatment and care (5,6). Other studies maintain that emergency departments users could as well be served by general practitioners or in primary health care centres (7,8) and have counted non urgent visits numbering 29 to 41 per cent of the total visits (7,8).

Several studies have focused on frequent users of emergency departments (2,5,9-12). The definition of the frequent user varies between studies and in most of the studies no attention is paid to whether the users of the emergency department were admitted to the hospitals or discharged home. Nor have the majority of the previous studies on emergency departments observed which medical specialist the users visited, generally analysing emergency department users as a rather homogenous group. In contrast, some studies have focused on certain groups of patients and are thus not suitable for describing emergency departments activities as a whole (11,13). Few emergency department studies have been devoted to those discharged home, however one study from USA dealt with such patients (14).

In follow up studies on emergency department users in Stockholm, Sweden, the users had increased mortality compared with the general population (2,12,15) and the frequent users of the emergency department had at least two-fold excess mortality (12). In the cohort with the nine years of follow-up time (12) the three dominant causes of death were diseases of the circulatory system, tumours and violent events including suicides. However, this study did not examine what medical specialists the users visited nor was it taken into consideration whether the patients were discharged home or admitted to hospital wards (12).

Previous descriptive studies on emergency department users of Landspítali University Hospital in Reykjavík date from 1991 and are limited to patients 70 years and older (13, 16).

It was thus considered of interest to describe the annual number of all users 18 years and older, who were discharged home, after a visit to the emergency department, classified according to age, gender, clinical diagnosis, number of visits in calendar year and to determine whether increasing number of emergency department visits in a single calendar year, predicted higher mortality.

Methods

This is a retrospective cohort study conducted at emergency department Landspítali University Hospital at Hringbraut which is the largest hospital in Iceland, it is state owned and administered by the Ministry of Health and Social Security.

Landspítali University Hospital serves on daily basis the Reykjavík capital city area. The hospital is at the forefront as concerns specialized and general health care in Iceland, and is the central base of knowledge for the nation's health service and the education of health

professionals. The Medical and the Nursing Faculties of the University of Iceland are closely connected with Landspítali University Hospital.

Source of data

In this study, the primary source of data was computer records from the Division of Information Technology at the Landspítali University Hospital, during the period 1995 to 2001. This period was selected because of data collection and registration at the emergency department was done at a uniform set. All residents of Iceland are included in the National Registry under a unique personal identification number which everyone receives at birth (a ten-digit number which includes the day, month, and year of birth). Each visit to the emergency department is filed under the personal identification number of the patient, enabling automatic and accurate record linkages. This database on emergency department visits also includes information on gender, admission date and hour, the main discharge diagnosis, and whether the person was discharged home after examination and treatment or was admitted to one of the hospital wards. The study was not only confined to new attendances but also mainly focused on users discharged home from the emergency department not including those referred to other departments or institutions. The main discharge diagnosis had been coded according to the International Classification of Diseases (ICD), 9th revision (17), during 1995 to 1996, and according to the 10th revision (18), during 1997 to 2001, and these were standardised to the 10th revision, and finally according to the European shortlist (19) which includes 65 categories of diseases. The category number 58, Injuries, poisoning and external causes, were not divided into subcategories and there was one additional category not included in the European shortlist that is to say: Factors influencing health status and contact with the health services, which is Chapter XXI in ICD 10 (table 1).

Table 1. European shortlist and the International Classification of Diseases, 9th revision and 10th revision (ICD-9), (ICD-10), main categories bolded

Categories of disease	Diseases	ICD-10	ICD-9
1	Certain infectious and parasitic diseases	A00-B99	001-139
2	Tuberculosis	A15-A19, B90	010-018,137
3	Menigocaccal infection	A39	036
4	Human immunodeficiency virus (HIV) disease	B20-B24	042-044
5	Viral hepatitis	B15-B19	070
6	Neoplasms	C00-D48	140-239
7	Malignant neoplasms	C00-C97	140-208
8	- of lip, oral cavity and pharx	C00-C14	140-149
9	- of oesophagus	C15	150
10	- of stomach	C16	151
11	- of colon	C18	153
12	- of rectum and anus	C19-C20-C21	154
13	- of liver	C22	155
14	- of pancreas	C25	157
15	- of trachea, broncus and lung	C32-C34	161-162
16	Malignant melanoma	C43	172
17	- of breast	C50	174-175
18	- of cervix uteri	C53	180
19	- of corpus uteri	C54-C55	179,182

20	- of ovary	C56	183.0
21	- of prostate	C61	185
22	- of kidney	C64	189.0
23	- of bladder	C67	188
24	- of lymphatic and haematopoietic and related tissue	C81-C96	200-208
25	Diseases of the blood and blood-forming or	D50-D89	279-289
26	Endocrine, nutritional and metabolic diseases	E00-E90	240-278
27	Diabetes mellitus	E10-E14	250
28	Mental and behavioural disorders	F00-F99	290-319
29	- due to use of alcohol	F10	291,303
30	- due to use of drugs and chemicals	F11-F16,F18- F19	304-305
31	Disease of the nervous system	G00-H95	320-389
32	Menigitis	G00-G03	320-322
33	Disease of the circulatory system	I00-I99	390-459
34	Ischemic heart diseases	I20-I25	410-414
35	Other forms of heart diseases	I30-33,I39-I52	420-423,425-429
36	Cerebrovascular diseases	I60-I69	430-438
37	Disease of the respiratory diseases	J00-J99	460-519
38	Influenza	J10-J11	487
39	Pneumonia	J12-J18	480-486
40	Chronic lower respiratory diseases	J40-J47	490-494,496
41	Asthma	J45-J46	493
42	Diseases of the digestive system	K00-K93	520-579
43	Peptic ulcers	K25-K28	531-534
44	Chronic liver diseases	K70,K73-K74	571.0-571.9
45	Diseases of the skin and subcutaneous tissues	L00-L99	680-709
46	Diseases of the musculoskeletal system	M00-M99	710-739
47	Rheumatoid arthritis and arthrosis	M05-M06,M15-M19	714-715
48	Diseases of the genitourinary system	N00-N99	580-629
49	Diseases of the kidney	N00-N29	580-594
50	Pregnancy, childbirth and puerperium	O00-O99	630-676
51	Certain conditions in the perinatal period	P00-P96	760-779
52	Congenital malformation	Q00-Q99	740-759
53	- of the nervous system	Q00-Q07	740-742
54	- of the circulatory system	Q20-Q28	745-747
55	Symptoms, sign and abnormal findings	R00-R99	780-799
56	Sudden infant death syndrome	R95	798.0
57	Cause of death unknown or unspecified	R96-R99	798.1-9,799
58	Injury, poisoning and external causes	V01-Y89	E800-E999
59	Accidents	V01-X59	E800-E929
60	Transport accidents	V01-Y89	E800-E848
61	Accidental falls	W00-W19	E880-E888
62	Accidental poisoning	X40-X49	E850-E869
63	Suicide and self inflicted injury	X60-X84	E950-E959
64	Homicide	X85-Y09	E960-E969
65	Injury undetermined how inflicted	Y10-Y34	E980-E989
XXI ¹⁾	Factors influencing health status and contact with the health services	Z00-Z99	V01-V82

1) Chapter XXI in ICD-10, not a separate category on the European shortlist

The emergency department serves internal medicine patients and general surgery patients aged 18 and older, the target population counted 178 thousand people in the year 2001. At the same hospital and nearby hospitals there are other emergency departments for psychiatry, paediatrics, gynaecology, and obstetrics, as well as a special casualty ward. In addition to these services, the primary health care system is accessible 24 hours a day. The structure and the finance of the health care system decide people's access to the emergency department so short description is given. Iceland has a welfare system similar to the other Nordic countries and public health and health care, including the emergency department service, are financed by government taxes and all residents are covered by national health insurance schemes which pay the bulk of the cost for the patient. The fee visitors must pay upon visiting the emergency department is similar to fees for out-patient-clinics and specialists service in out-of-hospital practices, which are also connected with national health insurance schemes, and these fees are a little higher than that paid while visiting the primary health care sector. In regard to sickness and minor injuries, general practitioners and the health authorities encourage patients first and foremost to consult their local health care centre; however, patients are free to visit specialist practices or the varying emergency departments at hospitals, including the emergency department at Landspítali University Hospital. The Icelandic health care system operates no referral system for the secondary or tertiary level of care, although every doctor can of course refer patients to a higher level of care and should do so as occasioned by medical indications.

The definition of the study cohort was all individuals 18 years or older who used the emergency department of Landspítali University Hospital at Hringbraut, and who were discharged home from the emergency department, during the time interval 1995 to 2001, both years included.

Record linkage

The first record linkage based on individual identification numbers permitted a count of the number of visits per individual and calendar year during the seven-year inclusion period (1995 to 2001). Subsequently, the users were categorised into groups, corresponding to the number of visits in any single calendar year.

Through the second record linkage with the National Registry, everyone was identified who had migrated from Iceland during the follow-up period (1995 through 2002), along with those who had no identification number (since they were not of Icelandic nationality). Both of these groups were excluded from the follow-up, as it is not possible to ascertain their vital status on the basis of the National Registry.

The third record linkage, i.e. with the National Cause of Death Registry, was performed to find the cause of death, which is registered as derived from death certificates. Both the National Registry and the National Cause of Death Registry are maintained at Statistics Iceland, where the causes of death have been coded according to the International Classification of Diseases, 9th and 10th revisions (17,18), standardised to the 10th revision, and according to the European shortlist (19), with 65 categories for cause of death. The Statistic Iceland delivered the information on cause of death in four separate files which subsequently had to be merged in one file. The National Cause of Death Registry was not fully computerised for the years 2001 and 2002 so 254 causes of death had to be obtained from paper files at the Statistic Iceland in order to complete the data acquisition. A death certificate was found for every deceased individual.

Statistical methods

The follow-up in regard to death started upon the date of each user's being discharged home after their first visit to the emergency department and concluded upon their death, or upon the closing date of the study at the end of year 2002, whichever occurred first. The number of visits each individual had made on a calendar year was counted during the seven-year inclusion period (1995 to 2001). The individual might switch to a higher category group by coming on either two visits or three or more visits during a calendar year, upon which the risk time was accordingly computed in more than one category.

The annual number of emergency department visits was divided both by gender and three age groupings: 18-49, 50-69 and 70 and older, to evaluate the increase in visits throughout the period of 1995 to 2001. Visits per year were related to the annual population of the Reykjavik capital city area (with population of 178,000 in year 2001), using a Poisson regression model and computing 95% confidence intervals.

The mortality of emergency department users were compared with the mortality of Iceland's general population. This was based on the five-year age- and gender-specific death rates of the population, 1996 to 2000, and conventional methods of calculating the standardized mortality ratio (SMR) and 95% confidence intervals (20) were applied.

The hazard ratio was computed for all causes of death and for selected categories of death in a time-dependent analysis using multiple regression and BMDP software (21), whereby gender was introduced as a dichotomous variable, age as a continuous variable in years, and the number of visits within a calendar year as an ordinal variable. The follow-up period was the same when computing the hazard ratio as when calculating the SMR, 1995 to 2002.

Ethical aspects

The National Bioethics Committee, the Ethical Committee of the Landspítali University Hospital, and the Data Protection Authority approved the study. According to working rules permission was needed from both ethical committees as the procedure includes a combination of data from the hospital and external sources of information (death certificates). Access to the data at the hospital was permitted by the medical director of Landspítali University Hospital, and head of the emergency department. Permission was obtained from the Statistic Iceland to use the National Registry and the National Cause of Death Registry.

Results

Number of users

During the years 1995 to 2001 the total number of visits to the emergency department was 45,242. The number of visits by men was 21,716 and by women 23,526. The number of users visiting the emergency department who were discharged home increased annually, except for year 1997, during the period of 1995 to 2001, table 2.

Altogether the number of visits to the emergency department by users who were discharged home during the inclusion period was 30,221, table 3. Of these there were 14,420 visits of men and 15,801 of women, but the total numbers of individuals amounted to 19,259. This means that many of the users made several visits in a single calendar year and also several users made visits in more than one calendar year. In the year 1995 about 15 users came each day and eight of them were discharged home, and in 2001 there were about 21 users each day

and 15 of them were discharged home. The proportion of users discharged home each year increased through the period, in the year 1995 54.5 per cent were discharged home and in the

Table 2. Total number of visits to the emergency department and the number users per year discharged home, divided on gender, during the period, 1995 to 2001

Year	Total number of visits		Number of discharged patients	
	Men	Women	Men	Women
	N (%)	N (%)	N (%)	N (%)
1995	2534 (11.7)	2768 (11.8)	1143 (10.0)	1319 (10.2)
1996	2929 (13.5)	3138 (13.3)	1427 (12.5)	1655 (12.8)
1997	2865 (13.2)	3138 (13.3)	1414 (12.4)	1602 (12.4)
1998	3063 (14.1)	3252 (13.8)	1609 (14.1)	1761 (13.6)
1999	3215 (14.8)	3538 (15.0)	1794 (15.8)	2057 (15.9)
2000	3347 (15.4)	3730 (15.9)	1910 (16.8)	2227 (17.2)
2001	3763(17.3)	3962 (16.8)	2093 (18.4)	2309 (17.9)
Total	21716 (100)	23526 (100)	11390 (100)	12930 (100)

Table 3. Total number of visits to the emergency department according to whether admitted to a hospital ward or discharged home during the period 1995 to 2001

Year	Total number of men and women, N	Admitted N (%)	Discharged N (%)
1995	5302	2414 (45.5)	2888 (54.5)
1996	6067	2294 (37.9)	3773 (62.2)
1997	6003	2318 (38.6)	3685 (61.4)
1998	6315	2194 (34.7)	4121 (65.3)
1999	6753	1915 (28.4)	4838 (71.6)
2000	7077	1765 (24.9)	5312 (75.1)
2001	7725	2121 (27.5)	5604 (72.5)
Total	45242	15021	30221

year 2001 72.5 per cent were discharged home, table 3. In 1995 the number of men and women discharged home was 2.888 and in 2001 the number was 5.604 or an increase of 94 per cent in the seven years period.

When the increase of users was analysed in relation to the population of Reykjavik capital city area the increase was more apparent among the older age groups and particularly among men, table 4. During the study period there was statistically significant increase in the incidence of visits among men and women of all three age groups, table 4.

Discharge diagnoses

Table 5 and 6 show the diagnoses according to the European shortlist for men and women who visited the emergency department and were discharged home. The most frequent

Table 4. Annual increase in emergency department visits of users discharged home and 95% confidence intervals (CI) during the inclusion period of 1995 to 2001, in relation to the population of the Reykjavik capital city area, in three age groups

Age (years)	Men		Women	
	Increase (%)	95% CI	Increase (%)	95% CI
18 to 49	6.7	5.4 to 8.0	7.6	7.3 to 7.9
50 to 69	9.3	7.5 to 10.9	7.2	5.5 to 8.9
70 and older	14.1	12.0 to 16.0	8.5	6.7 to 10.3

Table 5. Main diagnosis of men discharged home from the emergency department by calendar years according to European shortlist, main categories bolded

Categories of diseases	Calendar years							1995-2001
	1995	1996	1997	1998	1999	2000	2001	
1	74	95	68	86	103	97	65	588
2	0	0	0	0	0	0	1	1
3	0	0	0	0	0	0	0	0
4	0	0	0	1	0	0	1	2
5	0	1	2	1	3	0	0	7
6	17	22	16	26	34	40	53	208
7	15	20	14	24	28	33	47	181
8	0	0	0	1	1	1	1	4
9	0	2	1	1	0	0	0	4
10	0	0	0	2	0	0	0	2
11	2	2	0	2	3	2	1	12
12	0	1	0	0	2	1	0	4
13	1	3	0	0	0	0	0	4
14	0	0	0	0	0	0	0	0
15	5	4	2	4	6	10	15	46
16	0	0	0	0	0	0	2	2
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	3	5	2	5	5	8	19	47
22	1	0	1	0	1	2	0	5
23	1	1	5	1	1	1	2	12
24	1	2	2	2	5	2	3	17
25	19	23	23	28	18	15	20	146
26	25	33	24	31	20	22	33	188
27	9	11	14	12	12	11	14	83
28	75	90	73	91	105	110	123	667
29	26	31	35	40	55	52	63	302

30	16	12	4	11	21	11	13	88
31	76	79	94	103	125	127	136	740
32	0	0	1	0	2	3	3	9
33	234	286	273	331	337	440	454	2355
34	79	96	86	114	97	81	113	666
35	79	114	123	145	169	251	260	1141
36	33	25	11	15	14	16	11	125
37	84	108	89	135	138	125	114	793
38	1	2	0	1	7	2	5	18
39	23	44	37	44	34	27	32	241
40	19	25	21	42	33	40	30	210
41	9	14	13	23	12	16	12	99
42	106	117	155	159	170	178	174	1059
43	8	8	4	11	7	11	4	53
44	3	2	1	1	1	7	0	15
45	50	78	60	80	77	75	87	507
46	115	149	169	190	246	216	213	1298
47	10	7	6	9	8	7	3	50
48	93	135	132	139	205	235	298	1237
49	59	62	87	79	136	156	173	752
50	1	0	0	0	1	0	0	2
51	0	0	0	0	0	2	0	2
52	2	2	1	4	4	2	2	17
53	1	0	0	0	1	0	1	3
54	0	0	1	1	2	1	0	5
55	235	310	340	363	447	536	658	2889
56	0	0	0	0	0	0	0	0
57	1	1	0	0	0	0	0	2
58	104	125	138	173	194	227	170	1131
XXI¹⁾	55	95	55	58	73	105	152	593
All bolded	1365	1747	1710	1997	2297	2552	2752	14420

1) Chapter XXI in ICD-10, not a separate category on the European shortlist

Table 6. Main diagnosis of women discharged home from the emergency department by calendar years according to European shortlist, main categories bolded

Categories of diseases	Calendar years							
	1995	1996	1997	1998	1999	2000	2001	1995-2001
1	80	118	72	85	105	110	108	678
2	0	1	0	0	0	0	0	1
3	0	0	0	0	0	0	0	0
4	0	0	0	1	1	0	1	3
5	0	2	3	1	1	5	0	12
6	12	26	10	24	32	34	42	180
7	8	20	9	18	28	28	41	152
8	0	0	0	0	1	0	0	1
9	0	1	0	0	0	0	1	2
10	0	0	0	1	0	0	0	1
11	0	0	0	0	2	3	2	7
12	2	2	0	0	0	1	2	7

13	0	0	0	1	0	2	0	3
14	0	0	0	0	0	2	1	3
15	1	7	5	8	9	6	9	45
16	0	2	0	1	0	0	0	3
17	3	3	1	5	6	9	13	40
18	0	0	0	0	0	1	0	1
19	0	0	0	0	0	0	1	1
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	1	0	0	2	0	0	3
23	0	0	0	0	0	0	1	1
24	2	4	2	1	6	3	3	21
25	8	21	13	18	20	14	13	107
26	28	22	37	23	37	35	47	229
27	6	1	15	8	11	4	8	53
28	76	79	98	77	97	121	109	657
29	11	10	25	19	17	37	26	145
30	14	15	7	5	7	5	13	66
31	88	109	137	122	166	174	158	954
32	1	0	0	0	1	4	2	8
33	224	246	273	266	274	313	364	1960
34	65	60	73	61	41	53	64	417
35	80	101	112	123	138	165	193	912
36	31	35	12	19	14	13	22	146
37	103	172	110	158	212	158	164	1077
38	1	2	0	7	4	1	2	17
39	24	50	39	48	39	33	33	266
40	32	46	24	40	82	56	68	348
41	13	23	16	20	49	37	35	193
42	106	139	151	194	212	229	201	1232
43	4	5	9	6	4	7	6	41
44	2	0	0	0	0	1	3	6
45	55	66	59	75	82	86	88	511
46	164	245	229	234	300	297	230	1699
47	9	16	7	13	17	9	7	78
48	84	151	132	169	184	162	239	1121
49	21	43	47	47	50	54	86	348
50	1	5	3	2	2	1	0	14
51	0	0	0	0	0	0	0	0
52	4	5	2	3	1	0	6	21
53	1	0	0	0	0	0	4	5
54	0	0	2	2	0	0	2	6
55	284	406	391	391	508	635	682	3297
56	0	0	0	0	0	0	0	0
57	2	2	0	0	0	0	0	4
58	126	129	175	209	233	273	241	1386
XXI¹⁾	80	87	83	74	76	118	160	678
All bolded	1523	2026	1975	2124	2541	2760	2852	15801

1) Chapter XXI in ICD-10, not a separate category on the European shortlist

diagnosis was the category number 55, Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified, R00 - R99, according to ICD 10. The total number of users, men and women, in this category was 6.186 during the study period or average 20 per cent of the visits. In 1995 the corresponding figure was 18 per cent of the visits and 25 per cent in the year 2001.

The second most common diagnoses of the users discharged home from the emergency department was category number 33, Diseases of the circulatory system, I00 – I99, according to ICD 10. In total they were 4.315 or 14 per cent of the total visits during 1995 to 2001. The main subgroup of I00-I99 is Ischemic heart disease I20-I25. Both these disease categories were more common among men than women.

The third most common diagnoses of the users discharged home from the emergency department was category 46, Diseases of the musculoskeletal system and connective tissue, M00 - M99, according to ICD 10, altogether 2.997 visits. In 1995 10 per cent of the users had this category but in the year 2001 they were eight per cent.

The fourth most common diagnoses of the users discharged home from the emergency department was category 48, Diseases of the genitourinary system, N00 - N99, according to ICD 10. The number of visits was 2.358 or eight per cent of the total number of visits. In the year 1995 six per cent of the visits were in this category but in the year 2001 10 per cent was in this category. More men than women had this category.

Users with the category 58, Injury, poisoning and external causes, V01 – Y89, according to ICD 10, were 2.517, with the majority concerning women altogether 1386 visits.

Users with the category 42, Diseases of the digestive system, K00 - K93, according to ICD 10, were 2.291. Of these women were in majority. In 1995 the number of visits was 212 and in 2001 the number had increased to 375.

Four per cent of total visits to the emergency department were classified in the additional category, XXI, Factors influencing health status and contact with the health services. In 1995 these visits were 135 and steadily increased to 312 in 2001. Women were in majority or 54per cent.

Table 7. Number of users discharged home from the emergency department, related to their number of visits in any single calendar year

Number of visits	Number of patients	%	Men	Women	Number of deaths
One visit	16244	84.3	7589	8655	1672
Two visits	2213	11.5	1035	1178	320
Three visits	521	2.7	249	272	70
Four or more visits	281	1.5	154	127	43
Total	19259	100	9027	10232	2105

Table 7 shows the number of users of the emergency department who were discharged home according to the number of visits in any single calendar year. Eighty four per cent of the users of the emergency department only came once a year. Sixteen per cent of the users came two or more times during a single calendar year. However, 14 per cent of those making two or more visits in a calendar year had died during the follow-up period, 1995 to 2002, compared to ten per cent of those representing a single visit in a calendar year.

Table 8. Observed (Obs) and expected (Exp) number of deaths, standardised mortality ratio (SMR) and 95% confidence intervals (CI) among 9027 men discharged home from the emergency department, followed during the years 1995 to 2002

Age groups	Obs	Exp	SMR	95% CI	
18 – 19	1	0.39	2.56	0.03	14.27
20 – 24	5	2.60	1.92	0.62	4.49
25 – 29	10	2.42	4.13	1.98	7.60
30 – 34	13	2.61	4.98	2.65	8.52
35 – 39	8	3.50	2.29	0.98	4.50
40 – 44	16	4.43	3.61	2.06	5.87
45 – 49	25	7.12	3.51	2.27	5.18
50 – 54	34	10.45	3.25	2.25	4.55
55 – 59	63	19.54	3.22	2.48	4.13
60 – 64	63	24.78	2.54	1.95	3.25
65 – 69	89	46.40	1.92	1.54	2.36
70 – 74	170	83.71	2.03	1.74	2.36
75 – 79	196	124.45	1.57	1.36	1.81
80 – 84	178	133.22	1.34	1.15	1.55
85 – 104	217	134.42	1.61	1.41	1.84
18 – 104	1088	600.05	1.81	1.71	1.92

Table 9. Observed (Obs) and expected (Exp) number of deaths, standardised mortality ratio (SMR) and 95% confidence intervals (CI) among 10232 women discharged home from the emergency department, followed during the years 1995 to 2002

Age groups	Obs	Exp	SMR	95% CI	
18 – 19	0	0.31	0.00	-	11.83
20 – 24	8	1.47	5.44	2.34	10.72
25 – 29	3	1.01	2.97	0.60	8.68
30 – 34	5	1.22	4.10	1.32	9.56
35 – 39	10	1.12	8.93	4.27	16.42
40 – 44	15	2.79	5.38	3.01	8.87
45 – 49	21	4.78	4.39	2.72	6.72
50 – 54	27	8.01	3.37	2.22	4.90
55 – 59	48	13.67	3.51	2.59	4.66
60 – 64	44	17.62	2.50	1.81	3.35
65 – 69	74	33.47	2.21	1.74	2.78
70 – 74	106	50.44	2.10	1.72	2.54
75 – 79	138	90.50	1.52	1.28	1.80

80 – 84	181	138.10	1.31	1.13	1.52
85 – 104	337	161.92	2.08	1.86	2.32
18 – 104	1017	526.43	1.93	1.81	2.05

Table 10. Adjusted hazard ratio (HR) from multivariate regression and a 95% confidence interval (CI) for all causes of death and selected categories of death (ICD-10 in parentheses), according to gender, age in years, and the patient's highest number of visits in any single calendar year

	All causes of death (A00-Y89)			Malignant neoplasms (C00-C97)			Ischemic heart diseases (I20-I25)			Cerebrovascular diseases (I60-I69)		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
Men	1088	1.0	Reference	366	1.0	Reference	265	1.0	Reference	82	1.0	Reference
Women	1017	0.7	0.6 to 0.8	312	0.7	0.6 to 0.8	181	0.5	0.4 to 0.6	126	1.0	0.8 to 1.3
Age (years)		1.1	1.1 to 1.1		1.1	1.1 to 1.1		1.1	1.1 to 1.1		1.1	1.1 to 1.1
One visit	1672	1.0	Reference	541	1.0	Reference	350	1.0	Reference	181	1.0	Reference
Two visits	320	1.4	1.2 to 1.5	101	1.4	1.1 to 1.7	74	1.4	1.1 to 1.9	24	0.9	0.6 to 1.4
Three or more visits	113	1.7	1.4 to 2.0	36	1.8	1.3 to 2.5	22	1.5	1.0 to 2.3	3	0.4	0.1 to 1.3

Table 10. (Continued)

	Chronic lower respiratory diseases (J40-J47)			External causes of injury and poisoning (V01- Y89)			Accidental intoxication by drugs and chemicals. (X40-X49)			Suicide and injury undetermined how inflicted. (X60-X84, Y10-Y34)		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
Men	44	1.0	Reference	70	1.0	Reference	11	1.0	Reference	25	1.0	Reference
Women	60	1.0	0.7 to 1.4	39	0.5	0.4 to 0.7	10	0.8	0.3 to 1.9	16	0.6	0.3 to 1.0
Age (years)		1.1	1.1 to 1.1		1.0	1.0 to 1.0		1.0	1.0 to 1.0		1.0	1.0 to 1.0
One visit	80	1.0	Reference	77	1.0	Reference	9	1.0	Reference	26	1.0	Reference
Two visits	18	1.5	0.9 to 2.6	19	2.0	1.2 to 3.3	7	6.4	2.4 to 17.2	8	2.6	1.2 to 5.7
Three or more visits	6	1.7	0.7 to 4.0	13	3.9	2.1 to 7.0	5	12.8	4.3 to 38.6	7	6.3	2.7 to 14.6

Mortality and general population

The mortality from all causes for both men and women who had visited the emergency department and been discharged home was higher than in the general population, with an SMR in all age groups of 1.81 ($p < 0.001$) and 1.93 ($p < 0.001$) for men and women respectively, table 8 and 9. The SMRs were highest for the middle-aged (30-64 years old) and lower towards the highest ages, table 8 and 9.

Mortality of internal comparison

Nearly 70 per cent of the deaths were due to four categories of causes: malignant neoplasms (32.2%), ischemic heart diseases (21.2%), cerebrovascular disease (9.9%), and the category chronic lower respiratory diseases (4.9%). By adding the external causes of injury and poisoning (5.2%), including their subgroups of accidental intoxication (1.0%), and suicide and probable suicide (1.9%), these categories accounted for over 73.4 per cent of the overall death total of 2.105. The hazard ratios for these causes of death and all causes are shown in Table 10. The ratios were higher for men than women in the categories all causes of death, malignant neoplasms, ischemic heart diseases, external causes of injury and poisoning, and suicide and probable suicide. Furthermore, hazard ratios rose along with increasing numbers of emergency department visits for the categories; all causes of death, malignant neoplasm, ischemic heart disease, external causes of injury and poisoning, accidental intoxication, and suicide and probable suicide, and non-significantly for chronic lower respiratory diseases. For cerebrovascular diseases, however, the ratio decreased with increasing numbers of visits to the emergency department, albeit non-significantly. Analysing men and women separately for the same causes of death yielded similar ratios, but with wider confidence intervals.

Discussion

The study investigated the emergency department visits of patients 18 years and older who were discharged home, not including those referred to others departments or institutions, their diagnoses, their frequency of visits, and whether frequent visits predicted mortality. The pattern of discharged diagnosis was described. The annual increase in visits to the emergency department of patients who were discharged home was seven per cent or greater in every age group during the period of 1995 to 2001. The increase was more apparent among the older age groups and particularly among men.

The annual increase in total visits to the emergency department and annual increase in user who were discharged home from the emergency department can have explanations worth investigation but this study does not deal with the possible reason for this increase. These increases in number of visits to the emergency department demonstrate an increase burden of the resources of the emergency department and the hospital and in this connection it is noteworthy that in the year 2001 more than 70 per cent of the users were discharged home. With the reservation that there are differences in patients material, social structure of the communities, and finance of the health care system, 85-87 per cent of the users of emergency departments were discharged in two studies from the United States (4,22).

In the study period more than 6000 men and women discharged home from emergency department were classified into the diagnostic category: Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified. This particular category is a collection of working diagnoses and in the light of the fact that the users were discharged home, it is natural to suppose that they were not suffering from acute diseases. In the year

2001 about 4 users per day were classified into this category. The size of this group of users renders it feasible to study their prognosis in future studies.

The mortality of users of the emergency department who were discharged home was higher than that of the general population; in addition, their mortality rate was higher if they visited the emergency department either two times, and three or more times during the same year, rather than making only one visit within the calendar year.

One may assume that the vast majority of the patients had decided on their own, perhaps together with relatives, to visit the emergency department as there was no compulsory referral system in operation. Only a minority of the patients had been referred to the emergency department by other doctors, so that general medical aspects were more likely to involve the course of later events, for example whether the patients were admitted to some of the hospital wards or discharged home after medical examination and treatment. People visiting an emergency department might well be in poorer health than the general population (11,12); therefore, one may assume a higher mortality rate among them than among others, even if their condition did not require a hospital ward. Frequent visits to an emergency department might actually reflect a serious underlying disease such as malignant neoplasm or atherosclerotic disorders. These arguments are sensible when mortality from chronic prevalent diseases is considered, keeping in mind that the emergency department in the study serves internal medicine patients and general surgery patients. Nonetheless, the increased mortality due to injury, poisoning and external causes which presented itself in the study fits poorly with this reasoning, and the association between mortality due to injury and poisoning and frequent visits underlines the vulnerability of these users (12).

Users attending the emergency department are registered with diagnoses at the time of discharge, though the quality of registration has not been evaluated. The use of the personal identification numbers in the record linkages is considered to have strengthened the study, since they provided the possibility of ascertaining vital status, the causes of death, and the emigration status for every individual and enabled an accurate examination of how often they had attended the emergency department during the study period.

The usual method to evaluate the quality of the work and efficacy of the emergency department is to study how long after the visits did the death occur (22). That was not the objective of this study and will have to wait for future analysis. According to Statistics Iceland the autopsy rate is approximately 20 per cent. No study is available on the quality of the registration of the cause of death on death certificates in Iceland, however one assume that the quality of the death certificates are proportionally equally distributed into the different categories compared in the study so for that sake bias has not been introduced.

Given the number of disease categories in this study, concern about the need of adjustment for multiple comparisons may rise. There is no general agreement on how to approach this phenomenon (23,24) and some maintain that no correction is needed for multiple comparisons (24,25). Others advocate the use of confidence intervals rather than deciding merely from P-values whether “significant” or “non-significant” results have been obtained (26). In the multiple regression analysis in this study there was a common pattern for all causes. In the seven categories of death there is increasing mortality with increasing number of emergency department visits except for cerebrovascular diseases and thus there is no need for effort to minimise the risks for multiple testing for the interpretation of the results.

The mortality due to cerebrovascular diseases did not increase with increasing number of visits to the emergency department, as it did for all other categories of death and for some significantly, is without explanation. Indeed the mortality for cerebrovascular diseases seem to decrease with increasing number of visits, however the ratio for the highest category of visits were based on three cases and the confidence interval included unity. In the present study no specific analysis was done to clarify this phenomenon. Thus, we can only speculate on the reason for this finding and are willing to propose one hypothesis. It is possible that patient with symptoms or signs of cerebrovascular diseases were more often admitted to a hospital ward than others, but future studies on the material of this study in combination with information on those users of the emergency department, which were admitted to the hospital, maybe able to answer this question.

Previous studies on frequent users of emergency departments have often assessed whether the users could be adequately served by primary health care sector (7,8), and patients who refer themselves without requiring specific hospital treatment have been described as "inappropriate" users of the respective emergency department (27). Because a uniform definition is lacking for labelling patients and their condition as "inappropriate" (27), leading to the suggestion that the reasons for the patients utilisation of the emergency departments need to be studied further, particularly the social and psychological aspects (27,28). Frequent users of emergency departments have been considered a highly vulnerable group (29); however, there are only a few follow-up studies assessing the mortality of emergency department users (2,12,15), and they all originate in Stockholm, Sweden. Two of these previous studies had a very short follow-up time of one (2) and two years (15). The study by Hansagi and colleagues (12) was based on a nine-year follow-up, which paralleled this study by observing a mortality pattern whose predominant causes of death were neoplasm, disease of the circulatory system and external causes of death, and whose heavy users of emergency departments had excess mortality in every diagnosis, though particularly from external causes, suicides, probable suicides and alcohol/drug abuse (12). Based on these results, Hansagi et al. concluded that forms of care other than emergency departments should be considered for frequent emergency department users. To our knowledge this study is the first report on mortality of emergency department users who were discharged home, excluding those who were admitted to a hospital ward or institution. The visitors in this study utilised general medical and surgical services thus differ substantially from the Swedish emergency department users (12). In a later study on frequent emergency department users, Hansagi et al. (2) found that the Swedish patients were also frequent users of other health care services, including the primary health care sector, which renders unclear how it is best to meet the needs of these vulnerable patients in consideration of their higher mortality rate during the one-year follow-up period.

Conclusion

The annual increase in visits to the emergency department studied of patients who had been discharged home ranged from seven to 14 per cent by age groups during the period of 1995 to 2001, with a higher increase among older men. The most prevalent discharge diagnosis was the category Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified, (R00 - R99 according to ICD 10) which accounted for 25 per cent of the discharge diagnosis in the year 2001. The mortality of patients discharged home was higher than that of the general population. Frequent users of the emergency department had a higher mortality than those visiting the department no more than once in a year. The leading causes of death

among users of the emergency department were neoplasm, diseases of the circulatory system, cerebrovascular diseases, and the category of external causes, particularly drug intoxication and suicide and probable suicide. Further studies are needed on the discharge diagnosis of users of the emergency department, who were discharged home, in an attempt to understand and possibly prevent this high mortality.

Funding

This study was supported by a grant from the National University Hospital Research Fund.

Acknowledgements

I wish to thank my tutor Vilhjalmur Rafnsson for valuable guidance and support. I also want to thank Anna Björg Haukdal for preparing data and Helgi Sigvaldason for statistical advice and assistance.

References

1. Capewell S. The continuing rise in emergency admissions. *BMJ* 1996;312:991-2
2. Hansagi H, Olsson M, Sjöberg S, Tomson Y, Göransson S. Frequent use of the hospital emergency department is indicative of high use of other health care services. *Ann Emerg Med*. 2001;37:561-7.
3. Derlet RW. Overcrowding in emergency departments: Increased demand and decreased capacity. Editorial. *Ann Emerg Med* 2002;39:430-2.
4. McCaig LF, Burt CW. National hospital ambulatory medical care survey: 1999 emergency department summary. *Adv Data* 2001;25:1-34.
5. Lucas RH, Sanford SM. An analysis of frequent users of emergency care at an urban university hospital. *Ann Emerg Med* 1998;32:563-8.
6. Olsson M, Hansagi H. Repeated use of the emergency department: qualitative study of the patient's perspective. *Emerg Med J* 2001;18:430-4.
7. Lang T, Davido A, Diakité B, Agay E, Viel JE, Flicoteaux B. Non-urgent care in the hospital medical emergency department in France: how much and which health needs does it reflect? *J Epidemiol Commun Health* 1996;50 456-62.
8. Dale J, Green J, Reid F, Glucksman E. Primary care in the accident and emergency department: I. Prospective identification of patients. *BMJ* 1995;311:423-6.
9. Kne T, Young R, Spillande L. Frequent ED users: Patterns of use over time. *Am J Emerg Med* 1998;16:648-52.

10. Mandelberg JH, Kuhn RE, Kohn MA. Epidemiologic analysis of an urban, public emergency department's frequent users. *Acad Emerg Med* 2000;7:637-44.
11. Hansagi H, Norell SE, Magnusson G. Hospital care utilization in a 17,000 population sample: 5-year follow-up. *Soc Sci Med* 1985;20:487-92.
12. Hansagi H, Allebeck P, Edhag O, Magnusson G. Frequency of emergency department attendances as a predictor of mortality: nine-year follow-up of a population-based cohort. *J Public Health Med* 1990;12:39-44.
13. Baldursdóttir G, Arnar DO, Þorgeirsson G. Aldraðir á bráðamóttöku. Vandamál, úrvinnsla og afdrif. *Læknablaðið* 1992;Fylgirit 21:30
14. Cook LJ, Knight S, Junkins EP, Mann NC, Dean JM, Olson LM. Repeat Patients to the Emergency Department in a Statewide Database. *Acad Emerg Med* 2004;11:256-63.
15. Andrén GK, Rosenqvist U. Heavy users of an emergency department - a two year follow-up study. *Soc Sci Med* 1987;7:825-31.
16. Viðarson B, Baldursdóttir G, Arnar DO, Hrólfsdóttir N, Þorgeirsson G. Notkun róandi-, svefn- og geðlyfja hjá öldruðum á bráðamóttöku Landspítala. *Læknablaðið* 1992;Fylgirit 21:30
17. Manual of the international statistical classification of diseases, injuries and causes of death. Geneva, World Health Organization, 1977.
18. International statistical classification of diseases and related health problems. Geneva, World Health Organization, 1992.
19. http://europa.eu.int/comm/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=DSP_GEN_DESC_VIEW&StrNom=COD_1998&StrLanguageCode=EN&IntFamilyCode=&TxtSearch=European%20shortlist&IntCurrentPage=1 (21 October 2005).
20. Breslow NE, Day NE. Statistical methods in cancer research, Vol. II. The design and analysis of cohort studies. Lyon: International Agency for Research on Cancer, 1987.
21. Dixon WJ, Brown M, Engelman L, Jennrich RI. BMDP statistical Software Manual University of California Press, Berkeley, Los Angeles, Oxford 1990.
22. Kefer MP, Hargarten SW, Jentzen J. Death after discharge from the emergency department. *Ann Emerg Med* 1994;24:1102-1107.
23. Armitage P, Berry G. Statistical methods in medical research. Oxford: Blackwell Scientific, 1991.
24. Rothman KJ. Modern Epidemiology. Boston: Little, Brown, 1986.

25. Rothman KJ. No adjustment are needed for multiple comparison. *Epidemiol* 1990;1:43-46.
26. Hernberg S. *Introduction to Occupational Epidemiology*. Chelesea: Lewis Publisher, 1992.
27. Murphy AW. Inappropriate attenders at accident and emergency department I: definition, incidence and reasons for attendance. *Family Practice* 1998;15:23-32.
28. Lang T, Davido A, Diakité B, Agay E, Viel JF, Flicoteaux B. Using the hospital emergency department as a regular source of care. *Eur J Epidemiol* 1997;13:223-8.
29. Murphy AW, Leonard C, Plunkett PK, Brazier H, Conroy R, Lynam F, Bury G. Characteristics of attenders and their attendances at an urban accident and emergency department over a one year period. *J Accid Emerg Med* 1999;16:425-7.

