Improving Health Profile of Blood Donors as a Consequence of Transfusion Safety Efforts

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Abstract

Background: Transfusion safety rests heavily on the health of blood donors. Although they are perceived as being healthier than average, little is known about their long-term disease patterns and to which extent the blood banks' continuous efforts to optimize donor selection has resulted in improvements. We investigated mortality and cancer incidence among blood donors in Sweden and Denmark.

Study design and Methods: All computerized blood bank databases were compiled into one database, which we linked to national population and health data registers. Using a retrospective cohort study design, 1,110,329 blood donors were followed for up to 35 years from first computer-registered blood donation to death, emigration or December 31, 2002. Standardized mortality and incidence ratios expressed relative risk of death and cancer comparing blood donors to the general population.

Results: Blood donors had an overall mortality 30% lower (99% confidence interval 29%-31%) and cancer incidence 4% lower (99% confidence interval, 2%-5%) than the background population. Mortality rates and cancer incidence were lowest for outcomes that are recognized as being related to life-style factors such as smoking, or to the selection criteria for blood donation. Blood donors recruited in more recent years exhibited a lower relative mortality than those who started earlier.

Conclusion: Blood donors enjoy better than average health. Explicit and informal requirements for blood donation in Scandinavia, although mostly of a simple nature, have successfully refined the selection of a particularly healthy subpopulation.

Introduction

Selection of healthy donors is of the utmost importance for the safety of the blood supply. In addition to strong self-selection linked to altruism,[1-5] increasingly stringent exclusion criteria have been introduced over the years (see Box 1).

As a verification of the success of previous efforts, empiric observations have suggested that blood donors may represent a healthy subset of the population, reflected by low mortality[6], as well as a low risk of cancer[7], cardiovascular disease[8-11], and transfusion transmittable viral infections.[12,13] However, studies of donor health are few; most involve small sample sizes and limited follow-up.

We conducted a retrospective cohort study linking blood donation information that was routinely collected during three decades in Sweden and Denmark to nationwide and complete population, health and death registers. Our aim was to precisely quantify the degree to which the donors' health status, with overall and disease group-specific mortality as well as overall and site-specific cancer incidence as indicators, differs from that in the general population, and to evaluate if this difference has changed over calendar time.

Materials and Methods

Data sources

For a brief introduction to blood donor selection in Sweden and Denmark, see Box 1. During the later part of the 1960's, a steadily increasing number of Swedish blood centers, transfusion medicine clinics, and hospitals established computerized administrative registers of blood donations and transfusions.[14] Similar registers were established in Denmark during the early 1980's. In both countries these registers are based on the unique national registration numbers (NRN) that are assigned to all residents. We assembled these registers and created the Scandinavian Donation and Transfusion Database (SCANDAT) which is described in detail elsewhere.[15] From this database we extracted information on all individuals who had contributed at least one whole blood, plasma or platelet donation between 1968 and 2002.

Using each identified donor's NRN, we obtained information about causes of death and all cancer diagnoses by performing record linkages with nationwide cause of death and cancer registers. In both countries, these registers cover the entire population and have been in use since well before the start of the study period.[16-18] We also performed linkages with national migration registers to obtain emigration dates for accurate censoring.

Follow-up and statistical analyses

Blood donors were followed from their first recorded whole-blood, plasma or platelet donation until death, emigration or end of follow-up, whichever occurred first. For cause-specific mortality analyses, end of follow-up was December 31, 2002 in Sweden and December 31, 2000 in Denmark. For cancer incidence analyses, follow-up ended on December 31, 2002 in both countries.

Mortality analyses were conducted for all-cause mortality and for groups of specific causes of death as defined by the chapters of revisions 7-9 of the International Classification of Disease (ICD). Cancer analyses were conducted for all cancers combined and for cancer at specific sites, as defined by ICD revision 7.

The relative risks of death and cancer, comparing the cohort of blood donors to the general population, were expressed as standardized mortality ratios (SMR) and standardized incidence ratios (SIR), respectively. Specifically, these ratios were calculated by dividing the observed number of deaths or cancers by the number expected if the donor cohort experienced the same mortality or cancer incidence rates as the background population in each of the strata defined by country, sex, age, and five-year calendar period. Ninety-nine percent confidence intervals were calculated for the SMRs and SIRs using a Poisson approximation.[19] A more stringent confidence level was chosen to partly account for multiple statistical tests. To examine the relationship between year of first recorded donation and mortality, the aggregated follow-up experience of separate sub-cohorts of blood donors with a first recorded donation in a given calendar time interval was similarly compared (using SMR) to the background population. All data processing and statistical analysis was conducted using SAS version 9.1.3 (SAS Institute, Cary, NC, USA). The conduct of this study was approved by all regional ethics committees in Sweden, the Danish Scientific Ethics Committee and the Danish Data Protection Agency.

Results

Characteristics of the donor cohort

We identified a total of 1,110,329 blood donors (489,293 women and 621,036 men) who performed a total of 14,796,856 donations during the study period (Table 1). The mean age at entry into the cohort was 33.5 years (SD=11.2) and the median follow-up time was 10.3 years (12.0 and 6.4 years in Sweden and Denmark respectively). The age and sex distribution of active blood donors changed noticeably over time. The mean age of active blood donors increased from 37 years in 1985 to 42 years in 2000. Concurrently, the proportion of male donors decreased from 65 to 57 percent.

Mortality of Donors

Overall, 32,640 deaths were observed among the blood donors during follow-up compared to 46,586 deaths expected (SMR=0.70, 99% CI 0.69-0.71), with a slightly lower mortality ratio in female donors (SMR=0.67 99% CI 0.65-0.69 vs. 0.71 99% CI 0.70-0.72 in males). Table 2 presents the cause-specific SMR for each chapter of the ICD. Donors were at a considerably reduced risk of dying from a number of diseases, most notably endocrine and nutritional diseases (SMR=0.37, 99% CI 0.31-0.44) and infectious diseases (SMR=0.44, 99% CI 0.36-0.53). The risk of dying from major causes of death such as diseases of the circulatory system or diseases of the respiratory system was also reduced (SMR=0.68, 99% CI 0.67-0.70 and SMR=0.54, 99% CI 0.50-0.58, respectively). The risk of death from neoplastic diseases or external causes was less reduced (SMR=0.80, 99% CI 0.78-0.82, and 0.79, 99% CI 0.76-0.82, respectively).

Stratifying by year of first recorded donation, there was a trend towards lower mortality relative to the background population among blood donors who started donating more recently (Figure 1). The same pattern existed for all causes of death, but was most pronounced for infectious diseases and diseases of the respiratory or cardiovascular system.

To verify that the downward trend in Figure 1 was not biased by an interaction between age and calendar period, we also calculated SMRs stratified by calendar period of first donation, age at first donation and attained age. The pattern of decreasing mortality was evident in all age strata, albeit less pronounced among those began donating blood at a younger age (Table 3). The table also demonstrates that the risk reduction remained on a similar level after more than 2 decades of follow-up and beyond age 65, when the donation career had come to an end for most cohort members. To exclude the possibility of an interaction with length of follow-up, the analyses were repeated with consideration only to the first 10 years of follow-up, again with virtually the same declining mortality (data not shown).

Cancer Incidence in Donors

A total of 38,169 cancers were observed among the donors during follow-up, compared to 39,650 cancers expected (SIR=0.96, 99% CI 0.95-0.98), with no evidence of a difference between male and female donors (SIR for males: 0.96 99% CI 0.94-0.98, SIR for females: 0.97 99% CI 0.95-0.99). There was little variation with calendar period, sex or attained age (data not shown). The relative risk of cancer by anatomical site is presented in Table 4. As with the overall cancer analyses, site-specific cancer risks varied little with calendar period, sex or age (data not shown). Although the observed number of cases corresponded well with the number expected for most sites, markedly reduced risks were observed for certain types of cancer, most notably those of the respiratory system (mouth, larynx, lung) and the liver. For primary lung cancer the SIR was 0.77 (99% CI 0.73-0.81) and for primary liver cancer the SIR was 0.66 (99% CI 0.55-0.78). Donors who started donating blood after the introduction of Hepatitis C screening in 1991 had an SIR of liver cancer of 0.44 (99% CI 0.25-0.71), compared to 0.70 (99% CI 0.58-0.84) for donors who started donating blood

prior to 1991. No significant departures from the expected incidence was observed for any of the hematological or lymphatic cancers, separately or combined.

An increased relative risk was observed at four anatomical sites: carcinoma of the breast (SIR=1.08; 99% CI 1.04-1.12), prostate cancer (SIR=1.21; 99% CI 1.16-1.26), testicular cancer (SIR=1.20; 99% CI 1.09-1.32), and malignant melanoma (SIR=1.17; 99% CI 1.11-1.24).

Discussion

Consistent with the popular belief that blood donors constitute a healthy subpopulation, we observed mortality rates among Swedish and Danish blood donors that were significantly lower than that of the background population, with a SMR of approximately 70%. The reduced mortality pertained to most causes of death. Interestingly, analyses stratified by calendar year of first registered donation indicate that the mortality of donors is decreasing steadily relative to the background population. Thus, the mortality of blood donors who started donating in the early 1970's differed only marginally from that in the general population, whereas it was approximately halved among donors recruited in the 1990's. This trend of decreasing mortality was particularly marked for deaths due to respiratory and infectious diseases. Similar calendar period effects have been found in a previous study of the prevalence of transfusion transmittable infections among first-time blood donors.[13]

Cancer incidence was also reduced in donors relative to the background population, although not to the same extent as mortality. This finding is consistent with that of a study investigating the healthy worker effect for cancer incidence in Sweden.[20] We found a substantially reduced risk for cancers that are related to smoking, such as cancer of the respiratory system and the upper gastro-intestinal tract. These findings are in line with a previous study of Swedish donors, a small subset of the present study cohort,[7] and are also consistent with the presumed healthy lifestyle of blood donors in general. A risk reduction of even greater magnitude was observed for liver cancer, no doubt due in part to its strong association with the blood donor selection criteria of not having Hepatitis B or C virus infection, and absence of alcohol abuse among health-conscious individuals. Donors who first donated after 1991 (when Hepatitis C screening was introduced) had a substantially lower risk of liver cancer than earlier donors. While the prevalence of Hepatitis C is relatively

low in Scandinavia,[21] the markedly reduced risk of primary liver cancer, if solely due to the removal of donors with Hepatitis C, would suggest that the relative risk associated with this infection is very high in Scandinavia, with an entailing high etiologic fraction. However, considering the relatively low etiologic fraction previously observed,[21] it seems more likely that much of the risk reduction is due to successful exclusion of donors with other risk factors, such as heavy alcohol consumption.[22]

The increased risks for breast, prostate and testicular cancer and for malignant melanoma were similar in all calendar periods. We speculate that these risks reflect to some extent the selection of persons of high socio-economic status and health awareness into the blood donor population.[5,23-27] However, as we did not have access to any specific data on such factors, we are unable to draw any firm conclusions about this issue. Risks may be elevated by increased detection of otherwise sub-clinical cancers, due to donors coming into regular contact with the health care system for blood donation, and perhaps also increased self detection. The greater deficit for cancer mortality compared to incidence points to possible screening effects. Notably, the drop in cancer mortality across successive sub-cohorts defined by calendar year of first recorded donation, not accompanied by a corresponding decline in relative cancer incidence, represents a better prognosis in donors, which is consistent, albeit of smaller magnitude, with what is observed in screened populations,[28,29] and may be due to better surveillance of this group.

There are several different selection mechanisms that act upon blood donors. In addition to presumably strong self-selection, reinforced by the blood collecting authorities through their public relations and, in Sweden also remuneration policies, blood centers impose a number of behavioral and health-related exclusion criteria which have become increasingly strict over time, in particular after the HIV epidemic in the early 1980s (see

Box 1). This has most likely changed the composition of the blood donor population, which may contribute to the observed trend of decreasing mortality in Figure 1. Although we have not been able to determine the impact of the implemented exclusion criteria individually, our results nonetheless provide some evidence that changes in donor selection have ensured a healthy donor population.

Strengths of this study include the population-based and prospective registration, with high quality data ensured by medico-legal and administrative requirements. Owing to the availability of population-based registers follow-up is virtually complete and unbiased. The very large sample size, as manifest by extraordinary statistical precision, allows us to detect even small changes in mortality and cancer risk. However, one caveat is the incomplete coverage of donors in the earlier years of this investigation as computerized records were introduced gradually, i.e. county by county, and complete coverage was not attained until the 1990's. Blood centers are deemed to provide essentially complete data from the first date of computerized recording, but if covered and non-covered catchment areas differed substantially in demographic profile, this could introduce bias in the early periods. Given that the introduction of computerized recording was not systematic in any geographic or demographic sense, we believe that such bias, if it exists, is likely to be of limited importance in our study. There is another potential pitfall linked to the variable coverage of the registration over time: when a new blood center started computerized registration, all current blood donors, regardless of age, appeared as new donors in the register. Therefore in earlier years, when new centers were frequently added to the registration system, the sub-cohorts defined by year of first recorded donation did not consist only of newly recruited donors. On the contrary, a considerable proportion was composed of already established donors, whose first donation could have occurred many years earlier. To check that the

downward trend in Figure 1 was not biased by such features of the data, we repeated the analysis using only donors who had performed at least one donation in each considered calendar year, and obtained essentially the same pattern (data not shown).

We conclude that the Scandinavian blood donors enjoy better than average health, and that more recently recruited donors depart further from the population average. It appears that the selection forces, reinforced by active measures that are generally of a simple nature (like introduction of screening tests, strict implementation of careful medical history taking, and relative reduction of the economic compensation) have contributed to a gradual enrichment of the donor pool with particularly healthy individuals. Most importantly, this has been achieved without any obvious compromise of the blood supply.

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Tables

Box 1 - Transfusion Medicine in Sweden and Denmark

- Swedish and Danish transfusion services have been government organized since the 1950s

- Criteria for blood donor selection are specified in national guidelines and have followed the same general principles in the two countries throughout the period 1968-2002

- Blood donors answer questions concerning medical history, general health, and relevant lifestyle factors

- Upon registration for blood donation, the physical appearance is assessed, and in Sweden new blood donors have their blood pressure and pulse measured

- A potential donor has to be over 18 years of age and is recommended to cease donating at age 65, should weigh not less than 50 kg, and have a hemoglobin value of no less than 135 g/L for men and 125 g/L for women

- Whereas blood donation has never been compensated in Denmark, Swedish blood donors have since the 1960s been given 30 SEK (today corresponding to approximately $4 USD) per donation. Due to the inflation, the value of this remuneration has eroded, and the economical incentive for donors has, in effect, disappeared.

- Various screening tests and deferral policies have been introduced during the period:

Test	Denmark	Sweden
Syphilis	Not tested	1948-54
HBsAg	1975-1983	1970-72
Anti-HIV-1	1986	1985
Anti-HBc	Not tested	1989-91
Anti-HIV-2	1994	1991
Anti-HCV	1991	1990-92
Anti-HTLV-I+II	1994	1994

Criteria	Year of introduction*	Deferral	Note
Medical conditions			
Heart disease	1968	Permanent	
Diabetes	1968	Permanent	Type II diabetes not requiring medical therapy is accepted
Kidney disease	1968	Permanent	
Epilepsy	1968	Permanent	
Allergy	1968	Permanent	Moderate untreated and asymptomatic allergy is accepted
Cancer history	1989	Permanent	In situ cancers and basaliomas are exempted
Infectious disease			
Malaria	1968	Permanent	
Syphilis	1968	Permanent	
Hepatitis	1968	Permanent	
Infectious risk†			
Received blood transfusion	1968	6 months	
Tattoo	1968	6 months	
IV drug use	1984	Permanent	
Sexual activity†			
Male sex with male	1983	Permanent	
Sex with prostitute	1984	Permanent	Sex with a prostitute is in Denmark reason for a 12 month deferral
New sex partner	2001	3 months	

*These dates are for Sweden, but criteria have been introduced in Denmark at approximately the same time
†Donors with an obvious high-risk behaviour have successively been excluded from blood donation

Table 1 – Characteristics of Study Population

	Sweden	Denmark	Total
Number of subjects	777,386	332,943	1,110,329
Sex			
Female	329,290	160,003	489,293
Male	448,096	172,940	621,036
Age at entry into cohort (yr.), N (%)			
< 30	381,523 (49,1)	98,151 (29,5)	479,674 (43,2)
30-39	196,961 (25,3)	91,025 (27,3)	287,986 (25,9)
40-49	132,642 (17,1)	82,243 (24,7)	214,885 (19,4)
50-59	58,626 (7,5)	50,258 (15,1)	108,884 (9,8)
≥60	7,634 (1,0)	11,266 (3,4)	18,900 (1,7)
Mean age at entry into cohort, yr. (SD)	31,9 (10,7)	37,2 (11,6)	33,5 (11,2)
Median length of follow-up, yrs. (range)	12,0 (0-35)	6,4 (0-22)	10,3 (0-35)
Total accumulated person-years of follow-up	10,396,083	2,646,154	13,042,237
Average number of donations (SD)	14,9 (23,2)	9,7 (8,9)	13,3 (20,1)

Table 2 - Observed and Expected number of deaths with Standardized Mortality Ratios presented by ICD chapter

Cause of Death	Observed	Expected	Standardized Mortality Ratio (99% CI)*
All causes†	32,640	46,586	0.70 (0.69-0.71)
Infectious diseases (I)	194	440	0.44 (0.36-0.53)
Neoplasms (II)	11,327	14,226	0.80 (0.78-0.82)
Endocrine and nutritional diseases (III)	237	639	0.37 (0.31-0.44)
Diseases of the blood and blood-forming organs (IV)	228	593	0.38 (0.32-0.46)
Mental and behavioural disorders (V)	866	1 327	0.65 (0.60-0.71)
Diseases of the central nervous system and sensory organs (VI)	572	950	0.60 (0.54-0.67)
Diseases of the circulatory system (VII)	10,778	15,779	0.68 (0.67-0.70)
Diseases of the respiratory system (VIII)	1,144	2,136	0.54 (0.50-0.58)
Diseases of the digestive system (IX)	1,173	2,076	0.57 (0.52-0.61)
Diseases of the genitourinary system (X)	163	345	0.47 (0.38-0.58)
Diseases of the pregnancy and childbirth (XI)	7	9	0.74 (0.21-1.81)
Diseases of the skin and subcutaneous tissue (XII)	9	25	0.36 (0.12-0.80)
Diseases of the musculoskeletal system and connective tissue (XIII)	69	178	0.39 (0.28-0.52)
Other diseases (XVI)	497	979	0.51 (0.45-0.57)
External causes of mortality (XVII)	5,295	6,716	0.79 (0.76-0.82)

*CI denotes Confidence Interval

†The total numbers do not add up as chapter XIV (Congenital malfomations) and chapter XV (Certain conditions originating in the perinatal period) have been excluded from the table.

Table 3 – Standardized Mortality Ratios stratified by attained age, calendar period of first donation and age at first donation

Age at first donation	Attained age	Calendar period of first donation: 1968 - 1974	1975 - 1984	1985 - 1994	1995 - 2002
		*Standardized Mortality Ratio (99% CI)**			
18-29 years	18-29	0.82 (0.69-0.97)	0.74 (0.64-0.84)	0.71 (0.63-0.80)	0.60 (0.48-0.73)
	30-39	0.86 (0.76-0.96)	0.69 (0.62-0.77)	0.55 (0.49-0.62)	0.58 (0.38-0.86)
	40-49	0.82 (0.75-0.90)	0.70 (0.63-0.78)	0.47 (0.32-0.67)	
	50-64	0.84 (0.77-0.92)	0.79 (0.58-1.04)		
	≥65				
30-39 years	18-29				
	30-39	0.92 (0.73-1.14)	0.63 (0.52-0.75)	0.44 (0.37-0.51)	0.42 (0.33-0.54)
	40-49	0.97 (0.86-1.08)	0.68 (0.61-0.74)	0.50 (0.46-0.56)	0.44 (0.30-0.61)
	50-64	0.98 (0.91-1.04)	0.70 (0.65-0.76)	0.58 (0.46-0.73)	
	≥65	0.86 (0.76-0.96)	0.43 (0.05-1.56)		
40-49 years	18-29				
	30-39				
	40-49	0.92 (0.77-1.10)	0.59 (0.49-0.70)	0.47 (0.42-0.52)	0.37 (0.30-0.44)
	50-64	0.91 (0.85-0.97)	0.69 (0.65-0.74)	0.54 (0.51-0.58)	0.41 (0.31-0.53)
	≥65	0.91 (0.86-0.95)	0.78 (0.70-0.86)	0.37 (0.08-1.05)	
50-64 years	18-29				
	30-39				
	40-49				
	50-64	0.83 (0.75-0.92)	0.58 (0.53-0.65)	0.47 (0.44-0.51)	0.39 (0.34-0.44)
	≥65	0.89 (0.86-0.92)	0.73 (0.69-0.77)	0.54 (0.51-0.58)	0.39 (0.28-0.51)

*CI denotes Confidence Interval

Table 4 - Observed and Expected number of cancer cases with Standardized Incidence Ratios presented by anatomical site

Site (ICD-7 code)	**Observed**	**Expected**	**SIR (99 % CI)**
All cancers	38,169	39,650	0.96 (0.95 - 0.98)
Lip (140)	117	165	0.71 (0.55 - 0.89)
Tongue (141)	129	165	0.78 (0.62 - 0.98)
Salivary glands (142)	105	100	1.05 (0.81 - 1.35)
Mouth (143-144)	160	241	0.66 (0.54 - 0.81)
Pharynx (145-148)	264	339	0.78 (0.66 - 0.91)
Oesophagus (150)	292	388	0.75 (0.64 - 0.87)
Stomach (151)	759	966	0.79 (0.71 - 0.86)
Small intestine (152)	138	173	0.80 (0.63 - 0.99)
Colon, incl. recto sigmoid (153)	2,136	2,265	0.94 (0.89 - 1.00)
Rectum, excl. anus (154)	1,383	1,462	0.95 (0.88 - 1.01)
Liver (155.0)	226	345	0.66 (0.55 - 0.78)
Gallbladder, bil.pass., amp. Vater (155.1)	203	307	0.66 (0.55 - 0.79)
Liver, not spec. as primary (156)	92	159	0.58 (0.44 - 0.76)
Pancreas (157)	718	839	0.86 (0.78 - 0.94)
Peritoneum and unspecified (158-159)	29	38	0.77 (0.45 - 1.23)
Nasal cavities, and sinuses (160)	59	70	0.84 (0.59 - 1.17)
Larynx (161)	227	335	0.68 (0.57 - 0.80)
Lung primary, tracheae (162.0,162.1)	2,543	3,300	0.77 (0.73 - 0.81)
Pleura (162.2)	139	131	1.06 (0.84 - 1.31)
Lung, not spec. as primary (163)	44	52	0.85 (0.56 - 1.25)
Mediastinum (164)	26	16	1.68 (0.95 - 2.72)
Breast (170)	5,597	5,191	1.08 (1.04 - 1.12)
Cervix uteri (171)	672	877	0.77 (0.69 - 0.85)
Corpus uteri (172)	615	741	0.83 (0.75 - 0.92)
Uterus, other parts and unspec. (173-174)	71	93	0.76 (0.55 - 1.03)
Ovary, fallopian tube,broad ligament (175)	769	826	0.93 (0.85 - 1.02)
Other and unspec. female gen. Organs (176)	76	96	0.79 (0.57 - 1.05)
Prostate (177)	4,594	3,796	1.21 (1.16 - 1.26)
Testis (178)	763	634	1.20 (1.09 - 1.32)
Other and unspec. male gen. organs (179)	78	90	0.86 (0.63 - 1.15)
Kidney (180)	939	1,122	0.84 (0.77 - 0.91)
Bladder incl. papilloma (181)	1,845	1,884	0.98 (0.92 - 1.04)
Melanoma of skin (190)	2,483	2,116	1.17 (1.11 - 1.24)
Other skin (191)	2,981	2,916	1.02 (0.97 - 1.07)
Eye (192)	115	120	0.96 (0.74 - 1.21)
Brain and nervous system (193)	1,747	1,850	0.94 (0.89 - 1.00)
Thyroid (194)	399	381	1.05 (0.92 - 1.19)
Endocrinal glands (195)	584	632	0.92 (0.83 - 1.03)
Bone (196)	93	92	1.02 (0.77 - 1.32)
Connective tissue (197)	294	287	1.02 (0.88 - 1.19)
Metastases (198)	93	129	0.72 (0.54 - 0.94)
Other and unspecified sites (199)	737	963	0.77 (0.69 - 0.84)
Non-Hodgkin lymphoma (200,202,205.99)	1,233	1,286	0.96 (0.89 - 1.03)
Hodgkins disease (201)	300	308	0.98 (0.84 - 1.13)
Multiple myeloma (203)	411	453	0.91 (0.80 - 1.03)
Leukemia (204-207)	891	914	0.97 (0.89 - 1.06)

*CI denotes Confidence Interval

Figure legends

Figure 1: Overall and cause-specific standardized mortality ratio by year of first recorded donation