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# **Mortality and causes of death among asylum seekers in the Netherlands, 2002–2005**

IEA van Oostrum<sup>1</sup>, PhD, S Goosen, MSc<sup>1,2</sup> DG Uitenbroek<sup>3,4</sup>, PhD, H Koppenaar<sup>5</sup>, MD, Prof. K Stronks<sup>2</sup>, PhD

<sup>1</sup> Community Health Services for Asylum seekers , Netherlands Association for Community Health Services, Utrecht, The Netherlands

<sup>2</sup> Department of Public Health, Academic Medical Center, University of Amsterdam, The Netherlands

<sup>3</sup> Consultant, Quantitative Skills, Hilversum, The Netherlands

<sup>4</sup> Municipal Health Service (GG&GD), Amsterdam, The Netherlands

<sup>5</sup> Community Health Services for Asylum seekers Eastern Region, Arnhem, The Netherlands

Corresponding author: IEA van Oostrum, GGD Nederland, Adriaen van Ostadelaan 140, Postbus 85300, 3508 AH Utrecht, The Netherlands

Email: [IvanOostrum@ggd.nl](mailto:IvanOostrum@ggd.nl)

Phone: +31 302 52 50 88

Fax: +31 302 51 18 69

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## **What this paper adds**

### **What is already known on this subject?**

- Data about differences in overall and cause-specific mortality between asylum seekers and the general population in their western host countries are not available internationally.

### **What does this study add?**

- This study provides insight in mortality and causes of death among asylum seekers in the Netherlands.
- Mortality patterns are not homogeneous – there are great differences between subgroups by sex, age, region of origin; overall and for specific causes of death.
- Main causes of death are cancer, cardiovascular diseases, and external causes. Excess mortality compared with the host country population was large for infectious diseases, external causes, and mortality associated with pregnancy and childbirth.
- Health policies and services for asylum seekers should address both causes for which asylum seekers are at increased risk and causes with large absolute mortality, taking into account differences between subgroups.

## ABSTRACT

**Background:** The world's growing population of asylum seekers faces different health risks than the populations of their host countries due to pre- and post-migration risk factors. We currently lack insight into their health status.

**Methods:** We designed a unique notification system to monitor mortality in Dutch asylum seeker centres (2002-2005).

**Results:** Standardized for age and sex, the overall mortality rate among asylum seekers shows no difference with the Dutch population. However, rates differ between subpopulations by sex, age and region of origin and by cause of death. Mortality among asylum seekers was higher than among the Dutch reference population at younger ages and lower at ages above 40. The most frequent causes of death groups among asylum seekers are cancer, cardiovascular diseases, and external causes. We found increased mortality due to infectious diseases (males SMR=5.44; 95% CI 3.22-8.59, females SMR=7.53; 95% CI 4.22-12.43), external causes (males SMR=1.95; 95% CI; 0.52-2.46, females SMR=1.60; 95% CI 0.87-2.68), and congenital anomalies in females (SMR 2.42; 95% CI 1.16-4.45). Considerable differences were found between regions of origin. Maternal mortality was increased (rate ratio 10.08; 95% CI 8.02-12.83) as a result of deaths among African women.

**Conclusion:** Subgroups of asylum seekers by age, sex and region of origin, are at increased risk for certain causes of death in comparison to the host population. Policies and services for asylum seekers should address both causes for which asylum seekers are at increased risk and causes with large absolute mortality, taking into account differences between subgroups.

## INTRODUCTION

Of the estimated 11.4 million refugees worldwide in 2007,[1] 760,000 asylum seekers lived in Western countries. Presumably, pre- and post-migration factors are risks to asylum seekers' health, [2] as are genetic factors,[3,4] and stress factors before and during their flight from war-struck countries. Some authors mention limited access to healthcare as a negative factor.[5-7] Asylum seekers are thought to be subject to specific health problems, [6,7] of which infectious diseases and mental health problems receive the most attention.

Little evidence about the health of asylum seekers in Europe is available, however, there is not much systematic research; it is done on too small a scale or is limited to qualitative data. In quantitative studies, such as those based on national mortality statistics, it is impossible to distinguish asylum seekers from other migrants,[8] however, given the specific situation of asylum seekers, overall data on migrants are unlikely to be applicable to asylum seekers.

The aim of this study is, to determine differentials in overall and cause-specific mortality between asylum seekers and the Dutch population, to relate these to the available determinants such as age, gender, and country of origin, and to identify possible subgroups at risk.

Learning more about absolute number of deaths and mortality patterns may help healthcare providers plan adequate health provisions, while data about increased mortality due to specific causes of death of asylum seekers will help health authorities make choices for establishing specific prevention programmes **to reduce health risks** and inequalities in health.

## METHODS

### Study population

An asylum seeker is a person who has left his or her country of origin, has applied for recognition as a refugee in another country, and is awaiting a decision on his or her application.[ 9] The study population comprises all inhabitants of asylum seeker centres in the Netherlands (Box 1). Asylum seekers live in these centres until they receive a final decision about their asylum procedure. The average duration of residence in these centres increased from 23 months on 1 January 2002 to 47 months on 01 January 2005.[10] The reference population is the Dutch standard population for 2002-2005, as published by [Statistics Netherlands](#).[11]

#### **Box 1 Health services for asylum seekers in the Netherlands in the period 2002-2005.**

Asylum seekers in the Netherlands live in asylum seekers centres. They have freedom of movement but they may only work a limited number of weeks annually. The Central Agency for the Reception of Asylum Seekers manages all asylum seeker centres and is responsible for the provision of several entitlements for asylum seekers, including healthcare. Asylum seekers are entitled to full access to healthcare with minor exceptions. The Central Agency for the Reception of Asylum Seekers has contracted the Community Health Services ([CHS](#)) for Asylum Seekers to provide preventive health services in all asylum seeker centres for:

- Health education, child healthcare, infectious disease control, hygiene and safety inspections, and specific nurse practitioner services.
- Referral of asylum seekers to mainstream healthcare professionals and institutions and co-ordination of care.

### Data

The [Community Health Services \(CHS\) for Asylum Seekers](#) have managed a unique health notification system for asylum seekers since 2002 [as mortality data on asylum seekers cannot be derived from other mortality registers](#). Medical staff at asylum seeker centres report all deaths to their regional office. A doctor (HK) verifies and forwards the data in an anonymous form to epidemiologists at the central office of the CHS for Asylum Seekers. Statistics Netherlands codes all causes of death according to the International Classification of Diseases, 10th revision,[12] [into 17 main primary cause of death groups based on the European shortlist](#).[13]

The Central Agency for the Reception of Asylum Seekers provides monthly reference data about asylum seekers in centres by age and sex, including the numbers of births, stillbirths, and deaths. Individual data about inflow and outflow are unavailable, so we used the annual average of the monthly number of residents (listed by age group, nationality, and sex) who were present on the 1st day of each month. We summed the annual average occupations in the period 2002–2005 to obtain the denominators for our calculations.

The limited number of cases compelled us to merge countries of origin into regions (Box 2). In absence of a standard classification for health reporting for asylum seekers we used the regional classification of the United Nations High Commissioner for Refugees (UNHCR),[14] to group countries of origin. Because of the study population size, some UNHCR regions were merged on the basis of geographical location and/or cultural similarities (Appendix 1).

**Box 2. Regions of origin of asylum seekers in the Netherlands**

<i>Region of origin:</i>		<i>Major contributing countries of origin*</i>
WCS Africa	West, central and southern Africa	Democratic Republic of Congo, Angola
NEH Africa	North, east and Horn of Africa	Somalia, Sudan
CES Europe	Central, eastern and southern Europe	Azerbaijan, former Yugoslavia
ME/SW Asia	Middle East and southwest Asia	Afghanistan, Iraq
CES Asia	Central, east and southern Asia	China, Sri Lanka
Other		Stateless persons, South and Middle America.

\*Full classification available on-line (Appendix 1)

**Statistical analyses**

Mortality of asylum seekers was compared to mortality of the Dutch resident population by using data from the national mortality register of Statistics Netherlands for the years 2002-2005. Different mortality measures were applied. Comparisons for all-age overall and cause-specific mortality were made using indirectly Standardised Mortality Ratio's (SMR). [15] These were estimated by dividing the observed number of deaths among asylum seekers by the expected number of deaths, the latter being calculated by applying national age- and sex-specific mortality rates to age- and sex-specific numbers of asylum seekers. SMR values above 1 indicate higher mortality among asylum seekers than among the Dutch population. Rates of perinatal, infant, and maternal mortality of asylum seekers were expressed in terms of number of deaths per 1,000 or 100,000 births. These rates were compared with corresponding rates derived from the national mortality and birth

registers. Mortality rates by regions of origin were compared to the mortality rates for the Netherlands by means of age and sex-stratified rate ratios. We obtained 95% confidence intervals to SMR and mortality rates using SISA's t-test procedure (<http://www.quantitativeskills.com/sisa/>).

For the analysis of three broad cause-of-death groups (infectious diseases, external causes, chronic diseases) by region of origin, ratios were estimated by means of Poisson regression analyses, with number of deaths as dependent variable, number of person-years at risk as offset variable, and region of origin as independent variable. The Dutch population was taken as the reference group. The regression model was controlled for sex, and age. In the cause-specific analysis, because of small number of deaths, we applied a distinction into two broad age groups, divided in such way that the model showed the least error (e.g. 0-39 vs. 40+ years for chronic diseases). Poisson regression was applied using the R software (<http://www.r-project.org>). Confidence intervals were derived from the standard errors to the regression coefficients.



## RESULTS

### Population characteristics

The CES Europeans and ME/SW Asians were the largest subgroups of asylum seekers (table 1). There were considerably more male than female asylum seekers, but the sex distribution differed per region (Table 1). African populations were the youngest, followed by the ME/SW Asian population. The age distribution of the CES European population was more similar to the Dutch population.

In 2002–2005, 346 asylum seekers died and 28 stillborns (in 4327 deliveries) were reported. The sex of 15 death cases was unknown, and the causes of death were unknown for 39 cases. The overall crude mortality rate (156/100,000) of this young population was lower than that of the Dutch population, which was 859/100,000 inhabitants.

Table 1. Characteristics of the asylum seeker population in the Netherlands in 2002–2005

	All asylum seekers	WCS Africans	NEH Africans	CES Europeans	ME/SW Asians	CES Asians	Other countries
Number of person-years							
• Male	134,331	33,362	15,170	32,151	42,499	7,125	4,024
• Female	87,886	16,601	9,502	27,303	26,471	4,915	3,094
• Total	222,217	49,963	24,672	59,454	68,970	12,040	7,118
Percentage of all asylum seekers	100	22.5	11.1	26.8	31.1	5.4	3.2
Number of deaths*							
• Male	193	44	21	54	59	6	10
• Female	138	36	13	30	36	7	16
• Total	346*#	80	34	84	95	13	41*#
Percentage of total deaths	100	23.1	9.8	24.2	27.4	3.7	11.8

\*Nine persons whose country of origin was unknown were included in the category “other countries”

#Fifteen persons whose sex was not known are included

### **Cause-specific mortality: main primary cause of death categories**

The standardised overall mortality among asylum seekers was similar to that of the host population for males and females (table 2). The main causes of death of asylum seekers were cancer, cardiovascular diseases, and external causes of death (table 2). Mortality in asylum seekers was significantly increased in comparison with the host population for infectious diseases; diseases of the blood; congenital anomalies; and external causes. In contrast, asylum seekers had lower mortality for cancer, cardiovascular, respiratory, gastroenterological, and neurological diseases.

With 36 cases, perinatal mortality in asylum seekers (8.32/1000 births) was similar to that the Dutch population (rate ratio 1.16, 95% CI 0.84-1.61). The infant mortality rate (17 cases, 3.95/1000 live births) was not significantly different from that of the Dutch population (rate ratio 0.83, 95% CI 0.51-1.33). For 15 cases it was not reported whether the baby was alive at birth. The maternal mortality ratio (69.33/100,000 births) was 10.08 times as great as that of the Dutch population (95% CI 8.02–12.83) (results not in tables).

**Table 2. Mortality of asylum seekers as compared to the total population of the Netherlands (2002-2005): numbers of deaths, crude death rates and standardised mortality ratios**

Primary causes of death categories	Male					Female				
	Asylum seekers		NL	Asylum / NL		Asylum seekers		NL	Asylum / NL	
	Number of deaths	Crude death rate / 100,000 person years	Crude death rate / 100,000 person years	SMR*	95% CI	Number of deaths	Crude death rate / 100,000 person years	Crude death rate / 100,000 person years	SMR*	95% CI
All causes	193	206.80	831.00	0.93	0.75-1.12	138	121.52	824.15	1.14	0.86-1.43
Infectious and parasitic diseases	18	13.40	10.52	5.44	<b>3.22-8.59</b>	15	17.07	11.31	7.53	<b>4.22-12.43</b>
- Tuberculosis	2	1.49	0.53	13.02	<b>1.61-48.16</b>	3	3.41	0.36	47.65	<b>10.31-146.00</b>
- Hepatitis	3	2.23	0.46	16.52	<b>3.44-48.70</b>	1	1.14	0.19	18.77	0.50-111.00
- AIDS	10	7.44	0.86	14.04	<b>6.75-25.90</b>	6	6.83	10.44	39.99	<b>14.68-87.06</b>
Neoplasms	26	19.36	268.37	0.42	<b>0.27-0.61</b>	27	30.72	221.56	0.61	<b>0.40-0.89</b>
Blood/blood-forming organs and immunological diseases	1	0.74	2.33	1.77	0.02-9.77	3	3.41	3.51	6.95	<b>1.44-20.44</b>
Endocrine, nutritional, metabolic diseases	3	2.23	22.67	0.59	0.12-1.71	5	5.69	32.06	1.34	0.44-3.13
Mental and behavioural disorders	4	2.98	22.67	1.39	0.78-7.37	0	0	50.32	-	-
Diseases of the nervous system	1	0.74	19.02	0.18	<b>0.00-0.98</b>	1	1.14	23.33	0.26	0.00-1.40
Diseases of the circulatory system	36	26.80	269.09	0.75	0.53-1.04	31	25.27	273.16	1.17	0.79-1.65
Diseases of the respiratory system	4	2.98	86.35	0.38	<b>0.10-0.98</b>	1	1.14	74.28	0.14	<b>0.00-0.70</b>
Diseases of the digestive system	2	1.49	29.81	0.29	0.04-1.05	0	0	36.37	-	-
Diseases of the genitourinary system	2	1.49	14.04	1.23	0.15-4.43	2	2.28	19.05	1.32	0.16-4.78
Complications of pregnancy, childbirth, and the puerperium#	-	-	-	-	-	3	3.41	0.16	15.01	<b>3.09-43.83</b>
Conditions originating perinatal period#	4	2.98	3.56	0.60	0.16-1.55	4	4.55	2.52	0.84	0.23-2.13
Congenital anomalies#	7	5.21	3.52	1.30	0.52-2.46	10	11.38	3.08	2.42	<b>1.16-4.45</b>
Symptoms, signs, ill-defined conditions	15	10.42	36.80	1.19	0.66-1.95	22	25.03	37.94	3.78	<b>2.37-5.72</b>
External causes of injury/ poisoning	70	52.11	37.94	1.95	0.52-2.46	14	15.93	25.58	1.60	0.87-2.68
- Accidents and injuries*	40	29.78	21.70	2.12	<b>1.52-2.89</b>	7	7.96	17.48	1.67	0.77-3.44
- Accidents: drowning	12	8.93	12.98	12.88	<b>6.66-22.54</b>	4	4.55	6.03	18.74	<b>5.18-48.70</b>
- Suicide	22	16.38	1.61	1.63	<b>1.02-2.46</b>	3	3.41	0.74	0.90	0.19-2.63
- Homicide	5	3.72	0.67	2.13	0.94-5.55	3	3.41	0.44	4.01	0.83-11.69
- Other external causes of death	3	2.23	0.98	2.97	0.37-10.95	1	1.14	0.89	2.36	0.06-12.95

\* SMR standardised for age, 95% CI not including 1 in bold \* Accidents including drowning. # does not take into account the number of deliveries or births

## Differences by age, sex, and region

Comparison of overall mortality between asylum seekers and the Dutch population showed differences between subgroups by age, sex, and region of origin (figure 1). In the age groups < 1, 1-19 and 20-39 years mortality was increased in females from WCS Africa in comparison with Dutch females. Increased mortality was also found in the age group 1-19 years for males from WCS Africa and CES Europe, and in the age group 20-39 years for females from NEH Africa and males from CES Europe. In the age groups 40-64 and 65 years and over, mortality was lower than or at the same level as in the Dutch population for all regions of origin.

Poisson regression analysis, giving standardised rate ratio's corrected for age and sex (figure 2), shows increased risk of dying of infectious diseases for NEH and WCS Africans. WCS Africans and CES Europeans were at increased risk for dying of external causes of death, especially the young men (results not in figures). The risk of dying from chronic diseases was significantly lower in comparison with the host population for asylum seekers from all regions of origin, with exception of WCS Africa.

## Mortality for subgroups of main primary cause of death categories

AIDS, hepatitis and tuberculosis are the most common causes of infectious disease deaths among both male and female asylum seekers (table 2). Out of 33 infectious disease deaths, 29 were asylum seekers from WCS and NEH of Africa. From the AIDS-related cases even 15 out of 16 originate from these regions (results not in tables).

Table 2 shows that roughly half of the non-natural deaths resulted from accidents and injuries, predominantly of male asylum seekers. Accident or injury deaths prevailed in male asylum seekers younger than 30 years (34 of 40 cases, results not in table). For accidents and injuries there appear to be differences in mortality between regions of origin but the numbers are too small to draw firm conclusions. Suicide mortality was increased in males from NEH Africa (results not in tables). The high SMR for drowning is remarkable. Drowning occurred irrespective of season, and 16 of the 20 cases were younger than 20 years (results not in tables).

## DISCUSSION

This is the first study reporting overall and cause-specific mortality among asylum seekers as compared to the host population. It shows high numbers of deaths by cancer, cardiovascular diseases and external causes of death. Whereas at younger ages mortality among asylum seekers was higher than among the Dutch population, lower mortality was found above the age of 40. Mortality from cancer and cardiovascular disease was reduced, whereas mortality due to infectious diseases, pregnancy and childbirth, and external causes was increased. Important cause of death differences between regions of origin indicate that preventive health programmes for asylum seekers require a subgroup differentiated approach.

### Methodological considerations

The advantage of this study is that it provides the first data *specific* to asylum seekers and to identify mortality patterns within the asylum seeker population, differentiated by age, sex and region of origin. However, as a consequence of the limited size of the asylum population, although we studied four years, results for subgroups by region of origin and for cause of death categories, need to be interpreted with caution.

Part of the deaths among asylum seekers may be included in the national mortality register. They are, however, not identifiable and can therefore not be extracted from the reference data. As the number is small in comparison with the deaths in the reference population, the effect on the results is assumed to be limited.

Aggregation of data into UNHCR regions is chosen in the absence of a standard classification for asylum seekers and because of UNHCR's involvement with the study population. As the classification influences the results, validation of regional classification for health studies among asylum seekers would be welcome and would facilitate international comparison.

In the multivariate analysis, due to the limited number of cases, data were aggregated into just two age groups. This reduced error but may have allowed some effect of age differences to go unnoticed. It is unlikely that the risk differences we did find were the result of this procedure. The difference between the SMR and the rate ratio in the multivariate analysis for infectious diseases is remarkable. The SMR is very high because of the overrepresentation of younger age groups in the asylum population and because of a much higher infectious disease mortality among asylum seekers than among the Dutch in these age groups. The standardised rate ratio calculated with the

Poisson regression though, is less influenced by the fact that the asylum seeker age distribution is skewed.

### **Results in relation to other studies**

The way age affects asylum seekers' mortality, with lower mortality rates in older age groups and increased mortality rates in younger groups, is similar to that reported in labour migrant studies.[16-20] The cause-specific mortality of all asylum seekers combined, matches other studies that show increased mortality from infectious diseases and external causes in migrants.[16,20,21] Lower mortality from cancer matches other European studies among non-Western ethnic groups.[16-19] More importantly, we should note that analysis by region of origin showed considerable differences in mortality by causes of death between subgroups of asylum seekers.

The present study shows that increased risk of infectious disease mortality among asylum seekers is primarily a result of AIDS deaths in Africans. AIDS is, after all, a leading cause of mortality worldwide and the primary cause of death in sub-Saharan Africa.[22] Statistics Netherlands has identified AIDS as a major cause of death for migrants.[20] Tuberculosis and hepatitis are important causes of excess risk for labour migrants,[16] but low numbers of cases in asylum seekers make it difficult to draw conclusions regarding these diseases in asylum seekers.

Infant mortality for all migrants living in the Netherlands was reported to be increased 35% in comparison with the Dutch population. [20] Infant mortality among asylum seekers in this study, is similar to that of the general population. However, infant mortality is underestimated due to the fact that part of the 15 cases for which it is not reported whether the baby was alive at birth, could also be infant death cases. Perinatal mortality did not differ from the Dutch population, but was also underestimated due to underreporting of stillbirths and in addition possibly part of the 15 cases were stillbirths. The maternal mortality rate of asylum seekers was ten times as great as the general rate for the Netherlands, and twice that of the ethnic group with the highest risk (35/100,000 live births from Surinam/Antillean mothers).[23] In this study, the three mothers who died of complications of pregnancy and childbirth, originated from WCS Africa, where countries have estimated maternal mortalities of 905 (453–1480)/100,000 live births.[24] Home country risk factors for maternal mortality may still be present in women from this region. Added to the fact that WCS African asylum seekers also face many teenage pregnancies and abortions,[25] we believe

that WCS African asylum seeker mothers and babies are at increased risk with respect to issues of reproductive health and infancy.

The increased risk among asylum seekers for accidents and injuries, adds to the occasional evidence of increased injury risks among migrant groups.[21] Moreover, the existence of differences in injury mortality between subgroups are also seen in ethnic minority groups in the Netherlands.[26] The risk of drowning among asylum seekers is twice as high as among all non-Western migrants in the Netherlands, for which a 4–8 times increased risk in comparison with the native Dutch population has been described.[27,28]

Suicide has been described as a risk factor for Iranians and Afghans in England,[29] and for men from southern and eastern Europe in the Netherlands.[30] This study showed increased suicide mortality in males from NEH Africa. Further subgroup analysis of suicide cases, especially when data from additional years are included, may show more differences between subgroups by sex, age and region of origin, and will be studied separately. Suicide in asylum seekers may be related to traumatic events in the countries of flight and having to cope with an uncertain future. The suicide risk may also be imported from the countries of origin. Suicide rates among young men in former Soviet states have risen substantially since the 1990s, and are the major cause of death of young men.[31] Homicide was reported to be a risk factor for African and west Asian immigrants in the Netherlands,[16] but was not significantly increased among the asylum population in our study.

The health advantage for older asylum seekers, particularly with regard to the major chronic diseases, has also been seen among migrants in general,[16-19,32,33] and has been a topic of debate. The advantage may be caused by the 'healthy migrant effect', where only the strongest and healthiest in a population are able to migrate. Given the young age of many asylum seekers and the relatively older age at which the advantage is first observed, [34] it seems unlikely that the healthy migrant effect is an important factor in the relative health of the asylum population as a whole.

Mortality differentials between migrants and the general Dutch population diminished in the period 2002–2006,[26] amongst others, influenced by acculturation. For asylum seekers such decrease is not to be expected because of the continuous influx of new asylum seekers and outflow of asylum seekers after a decision on their asylum request. Health status at immigration will therefore remain an important health determinant for natural causes of death among asylum seekers.

### **Implications for policy and practice**

The results of our study point out important issues for asylum seeker health policies. It shows, that, in addition to the often-mentioned mental health and communicable diseases problems among asylum seekers, other health problems are of importance. The high absolute mortality for chronic diseases and external causes and the excess mortality in comparison with the host population due to infectious diseases, external causes of death and pregnancy and child birth related causes, reflects the variety of the burden of ill health among asylum seekers. It also indicates the importance of full access to health care and prevention for the asylum population.[2]

Preventive interventions should address the increased risk of subgroups for specific causes. The birth-related mortality in WCS African mothers, combined with this population's unfavourable reproductive health outcomes,[25] for example, indicates that targeted interventions addressing reproductive and infancy health risks, are required for this group. Drowning prevention should address all parents and children. As many asylum seekers have limited knowledge about the dangers of open water, good safety education,[28] and swimming lessons should be provided.

### **Future research**

Collection of mortality data on asylum seekers in other host countries is important as it is unclear whether the data presented can be extrapolated to asylum populations in these countries. Variations between host countries in composition of the asylum population, reception conditions, access to health care [2], and other factors may influence asylum seeker health and consequently mortality. If mortality data for asylum seekers in other host countries become available, analysis of aggregated mortality and cause of death data from several countries could contribute to explaining risk differences between subgroups of asylum seekers. For causes of death with high relative risks but low absolute numbers, such as maternal mortality, aggregation of data from different host countries is essential to allow in depth aetiological studies.

In addition to the need for more mortality studies there is also an international need for more insight in subgroup specific morbidity. Combination of mortality and morbidity data could guide the development of screening and prevention policies and practices to reduce health risks for asylum seekers. Such policies and practices should also be based on insight into which preventive interventions work for which asylum seekers. There is serious need for studies in this domain, as prevention is an extra challenge in a population whose first concern is their asylum procedure.



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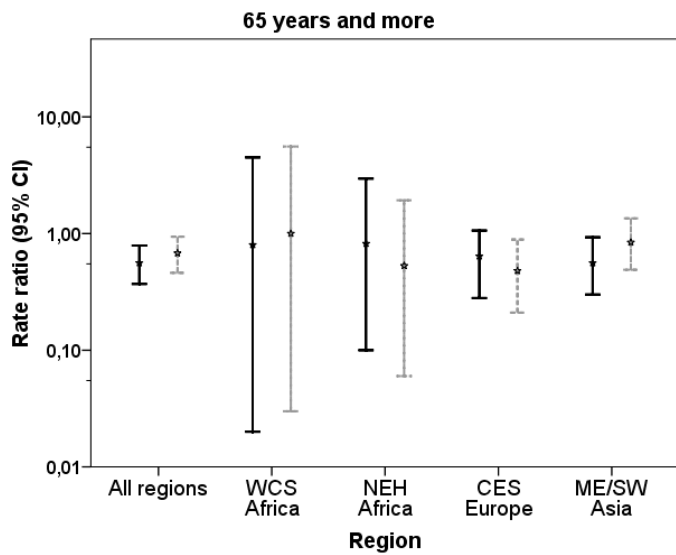
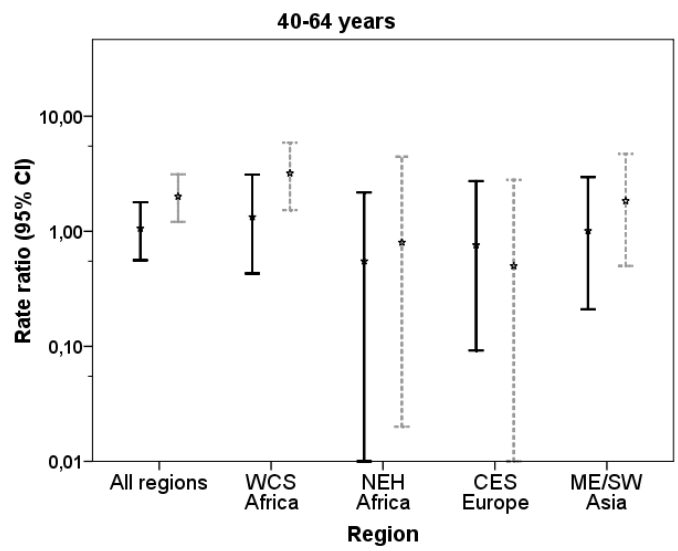
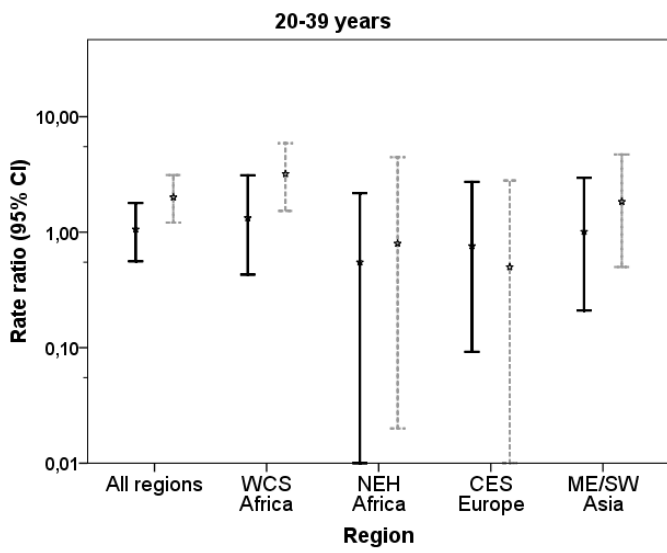
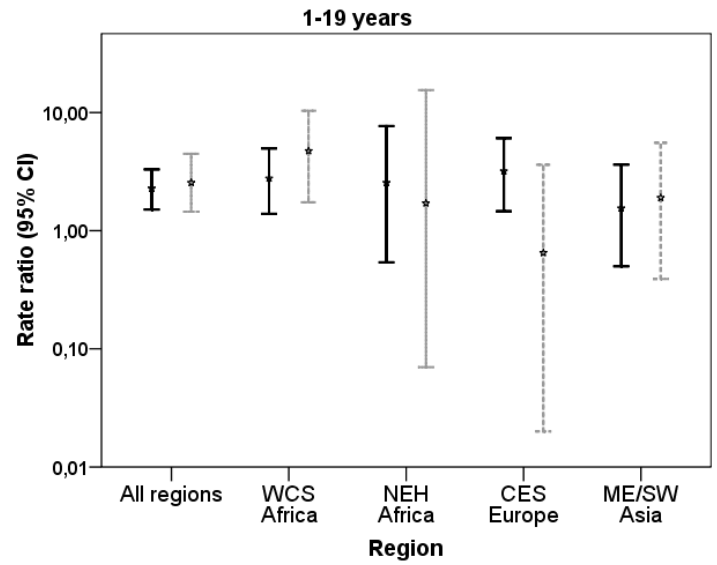
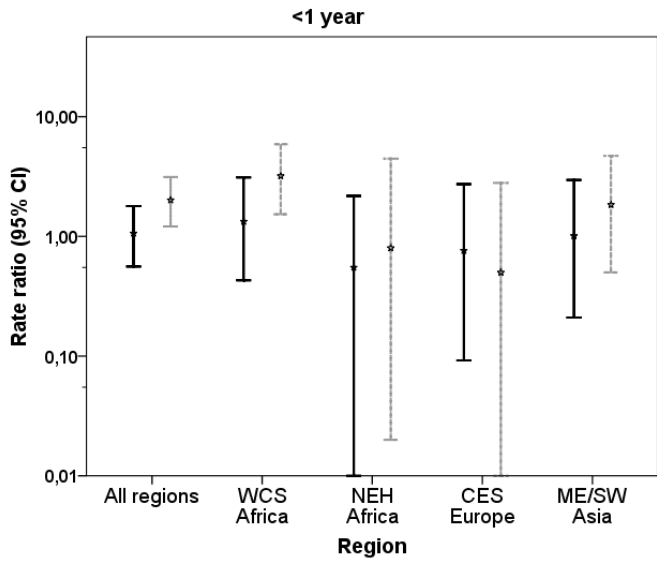
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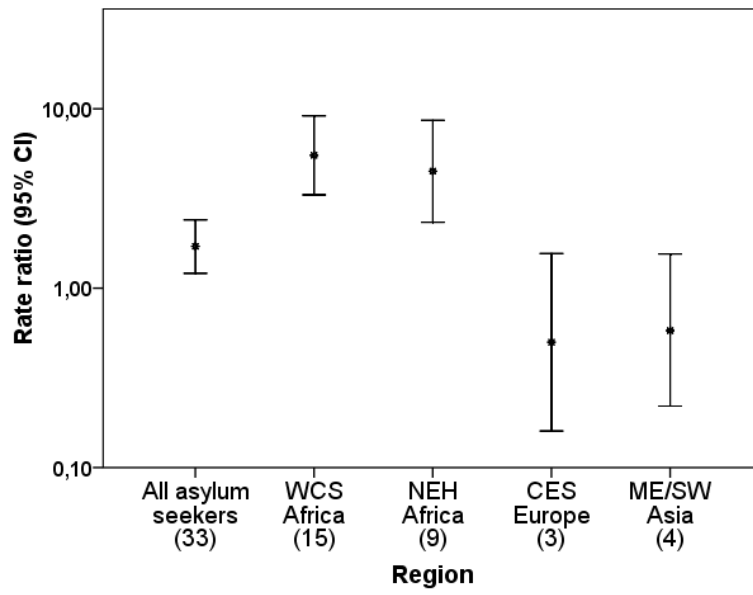
Figure 1. Rate ratio's by age group, sex and region of origin for asylum seekers in comparison with the Dutch standard population. 95% CIs not including 1 are considered significant. The numbers of deaths are: 0 years old (26 cases); 1–19 years old (44 cases); 20–39 years old (115 cases); 40–64 years old (83 cases); 65 years and more (64 cases), 15 cases of unknown sex not included in calculations. Data available on-line (Appendix 2).

Figure 2. Age and sex standardised rate ratio's for disease groups per region of origin in comparison with the Dutch population. a infectious diseases; b external causes; and c chronic diseases (all primary death causes other than infectious diseases and external causes of death). (2002–2005). CES Asia and 'other countries' not presented as no satisfying regression function could be determined.

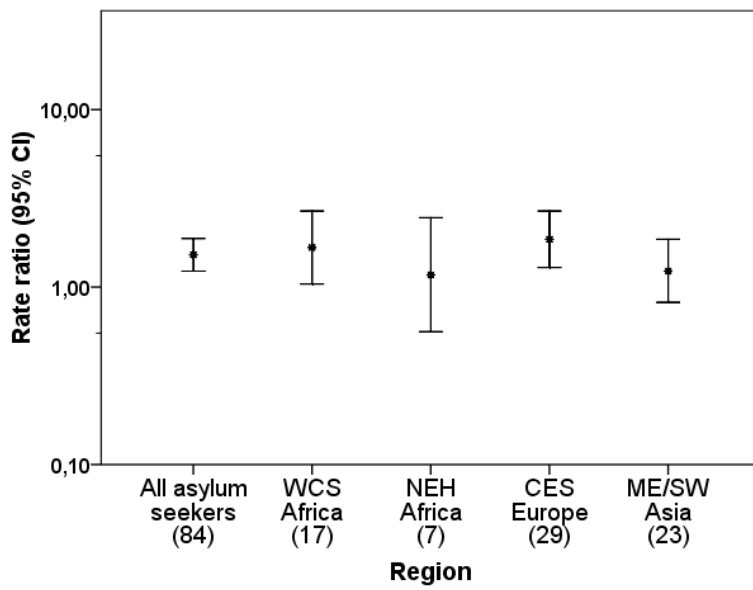


**Sex**  
 I Male I Female

### Infectious diseases



### External causes



### Chronic diseases

