Healthcare consumption and health-related quality of life of intensive care survivors

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Chapter 5

Healthcare-related costs in very elderly intensive care patients

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ABSTRACT

Introduction: The long-term outcome of 'very old intensive care unit patients' (VOPs; ≥ 80 years) is often disappointing. Little is known about the healthcare costs of these VOPs in comparison to younger ICU patients and the very elderly in the general population not admitted to the ICU.

Methods: Data from a national health insurance claims database and a national quality registry for ICUs were combined. Costs of VOPs admitted to the ICU in 2013 were compared with costs of younger ICU patients (two groups, respectively 18-65 and 65-80 years old) and a matched control group of very elderly subjects who were not admitted to the ICU. We compared median costs and median costs per day alive in the year before ICU admission (2012), the year of ICU admission (2013) and the year after ICU admission (2014).

Results: A total of 9,272 VOPs were included and compared to three equally sized study groups. Median costs for VOPs in 2012, 2013 and 2014 (€5,944, €35,653 and €12,565) are higher compared to the ICU 18-65 population (€3,022, €30,223 and €5,052, all $p<0.001$) and the very elderly control population (€3,590, €4,238 and €4,723, all $p<0.001$). Compared to the ICU 65-80 population, costs of VOPs are higher in the year before and after ICU admission (€4,323 and €6,750, both $p<0.001$), but not in the year of ICU admission (€34,448, $p=0.950$). The median healthcare costs per day alive in the year before, the year of and the year after ICU admission are all higher for VOPs than for the other groups ($p<0.001$).

Conclusions: VOPs required more healthcare resources in the year before, the year of and the year after ICU admission compared to younger ICU patients and the very elderly control population, except compared to the ICU 65-80 population in the year of ICU admission. Healthcare costs per day alive, however, are substantially higher for VOPs than for all other study groups in all three studied years.

INTRODUCTION

The intensive care unit (ICU) is one of the most expensive departments of a hospital, consuming almost 15% of hospital budget and 1-2% of the gross domestic product (GDP) in Western countries [1-4]. After discharge, ICU survivors continue to consume significant healthcare resources [5].

'Very old intensive care unit patients' (VOPs; ≥ 80 years old) are responsible for a substantial proportion of ICU admissions, and as a result of ageing of the general population, they are a rapidly expanding subgroup of ICU patients in most Western countries [6-9].

Since both short- and long-term outcome of VOPs are worse than in younger patients [7, 10-15], the cost-effectiveness of ICU treatment in VOPs has been questioned. Although several studies about the outcome of ICU treatment of VOPs have been published in the last decade, little is known about the healthcare costs of VOPs in the period surrounding the ICU admission and how these costs compare to those of younger ICU patients or of the very elderly not admitted to the ICU. Information about healthcare utilization among VOPs before, during and after ICU treatment in relation to outcome is relevant to ethical and political discussions and decision making in times of increasing healthcare costs.

The aim of this study is to describe the healthcare costs of VOPs in the year before, the year of and the year after their ICU admission and compare them to younger ICU patients, and to a population-based control group of very elderly subjects not treated in the ICU.

METHODS

Study design

This is a retrospective cohort study combining clinical data of the Dutch national quality registry for ICUs [16] with data from the Dutch insurance claims database [17].

Data sources

Dutch National Intensive Care Evaluation registry

The Dutch National Intensive Care Evaluation (NICE) registry [16] is a national quality registry in which currently all Dutch ICUs participate [18]. These ICUs collect demographic, physiologic and clinical data of all admitted patients, including variables required to quantify the severity of illness (acute physiology score (APS) and acute physiology and chronic health evaluation (APACHE) III score [19]). APACHE III score is a covariate in the APACHE IV mortality prediction model [19].

Vektis insurance claims database

Health insurance is obligatory for all Dutch citizens. The Vektis databases [17] contain reimbursement data of essentially all (99%) Dutch inhabitants on all medical treatments paid for by Dutch insurance companies, as well as demographic information for all registered inhabitants of the Netherlands, such as date of birth, gender and a proxy for date of death (health insurance unregister date) and socioeconomic status (SES). The SES is derived from the zip code of the person and the SES score for that zip code, as determined by the Netherlands Institute for Social Research [20]. The SES score is based on the mean income of a zip code area where a person lives, the fraction of people with a low income, the fraction of people with low education and the fraction of unemployed people. The SES score is ranked and the national mean is 0 (range -6.65 to 3.02). A lower score indicates a lower SES and a higher score indicates a higher SES. Vektis also collects claims for pharmaceutical care. This information was used to determine the chronic conditions (Appendix 5.1).

Patient selection

For this study, all patients from the NICE registry aged 18 years or older during the year of ICU admission, admitted to an ICU in 2013 and discharged from the hospital before 1 January 2014 were included. From the Vektis database, an ICU subset and a control group were extracted. The ICU subset included all patients who had a claim for one or more ICU days in the year 2013 and were 18 years or older during the year of ICU admission. On the basis of this Vektis ICU subset, a population-based control group was created from all registered inhabitants of the Netherlands in the Vektis database. The control population, who had no claims for ICU care during the year 2013, was weighted on the combination of the variables age (in years), gender and quartiles of SES. Only ICU patients with no missing items for gender, age and SES were used in the weighting process.

Linking and matching processes

To link cost data of the Vektis database to clinical data of the NICE database, records were linked anonymously using a deterministic linkage algorithm [21] and linked in three steps [22]. First, records were linked if gender, date of birth, hospital of admission, and both the date of ICU admission date and ICU discharge date were identical in both datasets. Records which could not be linked during the first step proceeded to the second step. In the second step records were linked if gender, date of birth, hospital of admission and ICU admission date were identical. Records which could not be linked during the second step proceeded to the third step. In the third step records were linked if, besides gender, date of birth and hospital of admission, the ICU discharge date was identical in both databases. Records which were not linked after the third step were excluded.

After linking the NICE database and the Vektis database, we created our four study populations: the VOPs, the ICU 18-65, the ICU 65-80 patients, and a very elderly population control group. All ICU patients aged 80 years or older were included in the VOP population. This VOP population was matched 1:1 with very elderly control persons in the combined database on the basis of equal age, gender and quartile of SES. The VOP population was also matched 1:1 with ICU patients aged 18-65 years and ICU patients aged 65-80 years in the combined database. Matching for these two populations was done on the basis of equal gender and quartile of SES.

Primary outcome

Total healthcare costs were only available as a total sum in euros per person per calendar year. The total healthcare costs are based on all reimbursement data available from health insurance companies and also include costs for long-term facilities and nursing homes. The primary outcome of this study is the median healthcare costs. We analysed costs of 3 years: (1) the year before ICU admission, defined as 1 January 2012 until 31 December 2012; (2) the year of ICU admission, defined as 1 January 2013 until 31 December 2013; and (3) the year after ICU admission, defined as 1 January 2014 until 31 December 2014. For the readability, we will use the term median healthcare costs in the year before, during and after ICU admission. We will also report the mean healthcare costs, as from a societal perspective, the mean costs enable one to calculate a total burden for society.

Secondary outcome

The secondary outcome of this study is the median healthcare costs per day alive during the year before, the year of and the year after ICU admission. Costs per day alive are the total healthcare costs per patients per year divided by the number of days alive. The healthcare costs per day alive are calculated for the total population, and for subgroups based on mortality, comorbidities, APACHE IV predicted mortality, i.e. low risk (predicted mortality ≥ 0-30%), medium risk (predicted mortality ≥30 - 70%) and high risk (predicted mortality ≥ 70%) [19], gender, SES and admission category. Subgroup analyses were performed for survivors and non-survivors and we analysed the patients who survived the 3-year study period separately to identify drivers for increased costs.

Statistical analysis

Descriptive statistics were used to characterize the demographic data. Mean and standard deviation (SD) were used for normally distributed data, median and interquartile ranges (IQR) for non-normally distributed data; numbers and proportions were used to present categorical data.

Table 5.1 Characteristics of the 4 populations during the year of ICU admission

Socio-demographic characteristics	VOPs (n=9,068)	ICU 18-65 (n=9,068)	ICU 65-80 (n=9,068)	Control 80+ (n=9,068)
Male[a]	4,709 (52%)	4,709 (52%)	4,709 (52%)	4,709 (52%)
Age[b]	83 (81; 86)	54 (44; 60)	72 (68; 76)	83 (81; 86)
SES[b]	0.13 (-0.61; 0.75)	0.15 (-0.60; 0.76)	0.15 (-0.60; 0.75)	0.14 (-0.61; 0.76)
Died during 2013[a]	3,191 (35%)	1,029 (11%)	1,903 (21%)	748 (8%)
Died during 2014[a]	933 (10%)	443 (5%)	666 (7%)	701 (8%)
Characteristics of the first ICU admission				
Admission type[a]				
• Medical	4,338 (48%)	4,484 (49%)	3,658 (40%)	
• Planned surgery	3,219 (35%)	3,383 (37%)	4,348 (48%)	
• Emergency surgery	1,466 (16%)	1,157 (13%)	1,030 (11%)	
• Missing	45 (0.5%)	44 (0.5%)	32 (0.4%)	
Acute diagnoses[a]				
• CPR	493 (5%)	421 (5%)	461 (5%)	
• Burns	8 (0.1%)	16 (0.2%)	2 (0.02%)	
• Cardiac dysrhythmia	1,340 (15%)	543 (6%)	913 (10%)	
• GI bleeding	264 (3%)	154 (2%)	177 (2%)	
• CVA	396 (4%)	330 (4%)	334 (4%)	
• Intracranial mass effect	149 (2%)	427 (5%)	258 (3%)	
• Sepsis	1,055 (12%)	638 (7%)	827 (9%)	
• OHCA	321 (4%)	296 (3%)	275 (3%)	
• SAH	26 (0.3%)	185 (2%)	76 (0.8%)	
• Trauma	667 (7%)	537 (6%)	288 (3%)	
Mechanical ventilation during the first 24 hrs of ICU admission[a]	4142 (46%)	4256 (47%)	5046 (56%)*	
Length of ICU stay[bcd]	1.12 (0.79; 2.89)	0.99 (0.76; 2.55)	1.07 (0.81; 2.90)	
Length of hospital stay[bc]	10 (6; 16.57)	8 (4; 14)	9 (6; 16)	
APACHE III score[bef]	65 (52; 84)	41 (29; 61)	57 (44; 75)	
APS[bef]	45 (32; 63)	35 (24; 54)	41 (29; 58)	

COPD chronic obstructive pulmonary disease, *CPR* cardiopulmonary resuscitation, *GI* gastrointestinal, *CVA* cerebrovascular accident, *OHCA* out of hospital cardiac arrest, *SAH* subarachnoid haemorrhage

*Not significant

[a] Number and percentage (%)

[b] Median and IQR

[c] Length of ICU stay and length of hospital stay significantly different ($p<0.001$)

[d] Average costs of 1 day in the ICU in the Netherlands are about €2,500

[e] APACHE III and APS scores significantly different between groups ($p<0.001$)

[f] Only calculated for ICU admissions which met the APACHE IV inclusion criteria (VOPs n=8,481,ICU 18-65 n=8,510 and ICU 65-80 n=8,580)

The non-parametric Kruskal Wallis test was used to test the differences in median healthcare costs and in median healthcare costs per day alive between the study groups.

General linear modelling was used to estimate the cohort effect on the healthcare costs during the year before, the year of and the year after ICU admission. The healthcare costs per patient were skewed to the right and therefore the natural logarithm of the healthcare costs was used. Because of multiple comparisons a more stringent *p*-value of less than 0.001 was considered to indicate a statistically significant difference.

All statistical analyses were performed in SAS software (version 7.1; SAS Institute Inc, Cary, NC).

RESULTS

The NICE database contains 75,690 ICU admissions in 2013, of which 10,425 admissions were of VOPs (13.8%). When linked with the Vektis database, 71,018 ICU (94%) admissions of 65,731 individual ICU patients remained, including 9,749 admissions of 9,272 individual VOPs. After 1:1 matching, all four study groups consisted of 9068 unique individuals, as we excluded 204 (2%) patients that could not be matched. Figure 5.1 gives an overview of the data linkage and matching process, and the patient characteristics are shown in Table 5.1. The median APACHE III and APS (APACHE III score based on physiological disturbance, without reason for admission, age and comorbidities) scores of VOPs were higher than the scores of the younger ICU populations (all $p<0.001$).

Hospital mortality rates of the VOPs, the ICU 18-65 and the ICU 65-80 population were 24.2%, 8.5% and 14.9% respectively ($p<0.001$). Of the VOPs 35% died in 2013 and another 10% died in 2014 versus 11% and 5% of the ICU 18-65 population, 21% and 7% of the ICU 65-80 population, and 8% in 2013 as well as in 2014 for the very elderly control population ($p<0.001$).

Median and mean healthcare costs are shown in Figure 5.2. Median costs per patient for VOPs in the year before, during and after ICU admission (€5,944, €35,653 and €12,565) are higher than for the ICU 18-65 population (€3,022, €30,223 and €5,052, all $p<0.001$) and the very elderly control population costs (€3,590, €4,238 and €4,723, all $p<0.001$). Compared to the ICU 65-80 population, costs of VOPs are higher in the year before (€5,944 vs. €4,323 $p<0.001$) and the year after ICU admission (€12,565 vs. €6,750, $p<0.001$), but comparable in the year of ICU admission (€35,653 vs. €34,448, $p=0.95$).

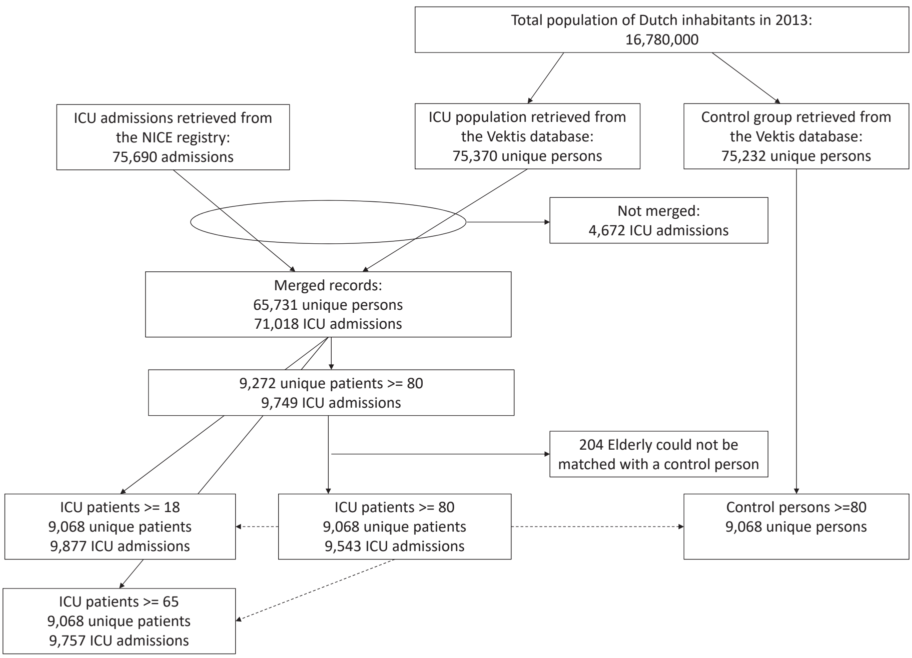


Figure 5.1 Overview of the data linkage process

The median healthcare costs per day alive during the year before, the year of and the year after ICU admission are higher for VOPs than for all the other study groups (*p*<0.001) (Figure 5.3).

Subgroup analyses are presented in detail in the Appendices (Appendix 5.2 to 5.11). VOPs have more chronic conditions in the year prior to admission and healthcare costs increase with increasing number of chronic conditions. During the year of ICU admission, healthcare costs are significantly higher for patients in the higher-risk group based on APACHE IV mortality prediction, for female patients, patients with a lower SES and patients admitted because of emergency surgery.

DISCUSSION

In this study, we evaluated healthcare costs of VOPs in comparison with two groups of younger ICU patients and a very elderly population control group in the year before, during and after ICU admission. VOPs required more healthcare resources during all three study years compared to the other study groups, with one exception: during the year of ICU admission costs of VOPs are similar to the costs of ICU 65-80 patients. However, healthcare costs per day alive are substantially higher for VOPs than for the other study groups in all studied

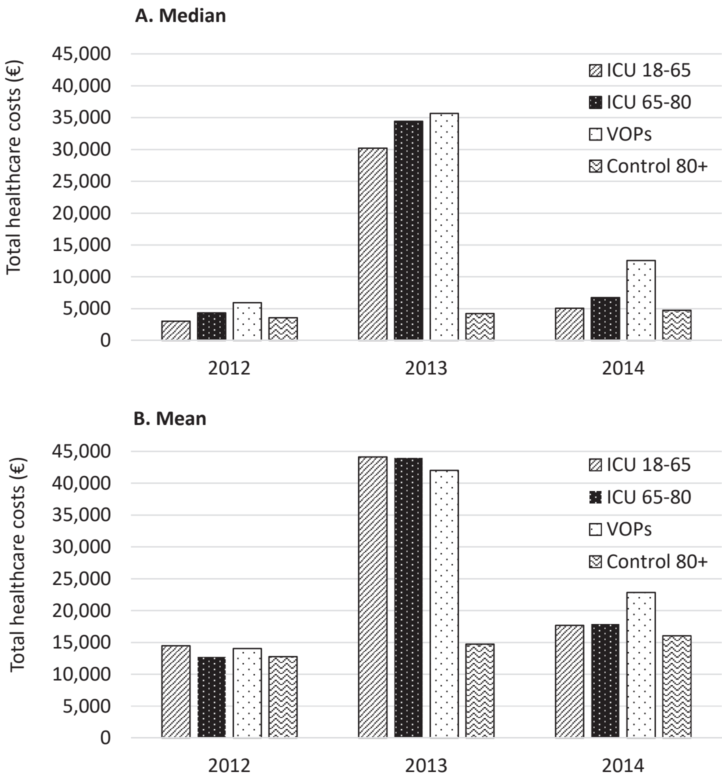


Figure 5.2 Median (A) and mean (B) total healthcare costs for the four study groups

years. Costs per day alive of VOPs are, compared to the ICU 18-65 patients, respectively 2, 1.5 and 3 times higher in the year before, the year of and the year after ICU admission, while remaining life expectancy is significantly lower.

Comparing our results to earlier studies is complicated for several reasons, including the different methods of cost calculation that are used and the various types of costs that are reported. Obviously, the absolute healthcare-related costs also depend on other factors, including country, region and healthcare system, and as a consequence, previous studies report a wide range of healthcare costs for older ICU patients. Our results are in contrast with a study in the USA, which showed that daily and total hospital costs were lower in older patients [23], but comparable with the results of a Canadian study on costs of ICU treatment in VOPs. The average costs in this study were $31,679 per ICU admission, $48,744 per ICU survivor and $61,783 per 1-year survivor [24]. These studies showed that the costs of ICU care of elderly patients are substantial, but only used direct ICU-associated costs and did not look beyond hospital discharge. Knowing that many of the healthcare-related or societal costs are made outside the hospital, we also included costs in the year before and

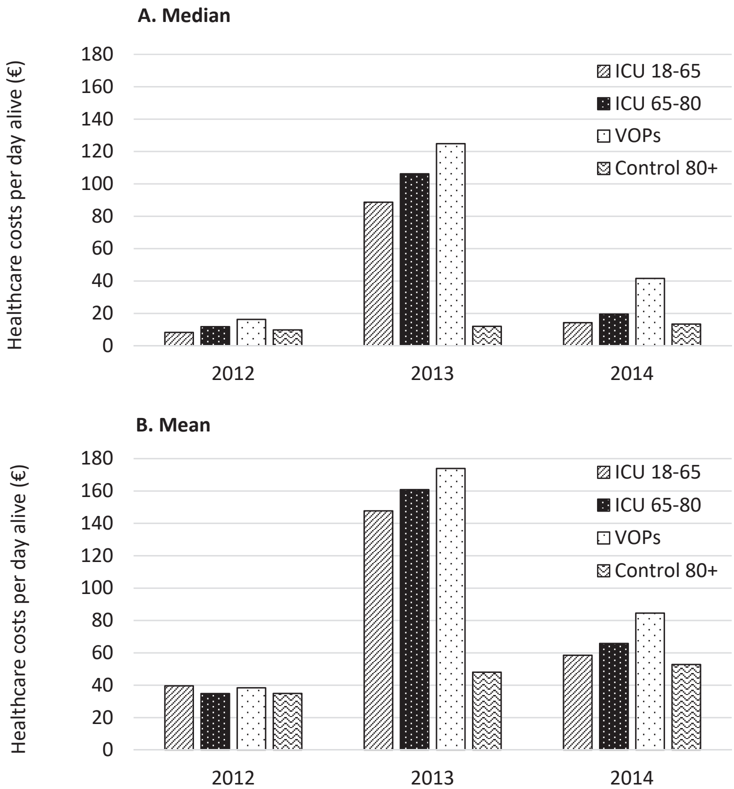


Figure 5.3 Median (A) and mean (B) healthcare costs per day alive for the four study groups

after ICU admission. In all age groups, costs were significantly higher in the year after ICU admission compared to the year before ICU admission, but this difference was most explicit in VOPs. It is known that ICU survivors, from all ages, suffer long-term physical, cognitive and/or psychiatric disabilities, defined as the post-intensive care syndrome (PICS) [25], with increased healthcare costs. However, after discharge the VOPs are more likely to be readmitted and are more dependent of long-term care facilities, nursing homes or rehabilitation centres compared to younger people [26-28].

In times of scarce healthcare resources, it is frequently questioned what society should accept to pay for a gained life year [value of the statistical life year (VOSL)]. These numbers will differ between persons and countries. In addition, in interpreting our results it is important to realize that for many very elderly subjects, preserving quality of life (QoL) is more important than prolonging their life and many of them prefer a lesser intensity of care, without undergoing invasive procedures [29, 30]. This reinforces the importance of early goals of care discussions. Unfortunately, we were not able to analyse functional outcome and QoL as this was not included in our datasets. If QoL data had been available, we could have calculated costs per quality adjusted life year (QALY). It is important to keep in mind, however, that QALYs are often based on surveys that incorporate physical functioning which is often lower in the elderly. Also life expectancy in very elderly persons is generally low [31, 32]. Simply calculating QALYs may not do justice to these nuances and carries the risk of unjustly suggesting that only limited resources should be allocated to these patients. In the Netherlands, a maximum of 80,000 euro per QALY was once suggested in cost utility analyses, but never enforced because of several shortcomings and ethical objections [31, 33]. Provided that QoL is good, the costs of VOPs that we found in our study would have been within these limits, although it might be unrealistic to assume that all VOPs have a good QoL after ICU discharge. HRQoL studies suggest that some older ICU survivors may accommodate to a degree of physical disability and still report good emotional and social wellbeing [34, 35], but it is also important to realize that these HRQoL studies are subject to survivorship and proxy response bias [36].

To our knowledge no studies exist in which healthcare-related costs of older versus younger ICU patients in the years around ICU admission are compared. Another strength of our study is that we used total healthcare costs, inpatient as well as outpatient costs of care and preceding and following ICU admission, rather than ICU costs only. This is important since many of these patients have extended hospitalizations and a prolonged recovery period. We used both total healthcare costs as costs per day alive. The linkage between the national health insurance claims database and the national clinical ICU registry, covering almost the entire country, provides valuable insight into the healthcare utilization of VOPs in comparison with younger ICU patients and a general population control group.

The study has limitations as well. One is that the total costs per patient, based on all reimbursement data available from health insurance companies, were only available as a total sum in euros per person per calendar year. We translated these costs into median and mean healthcare costs per patient per year and per patient per day alive. A limitation of the first, costs per patient per year, is mainly that it depends on the number of days alive, since follow-up periods in these groups might differ. However, a limitation of the second, costs per patient per day alive, is that if mortality is high, costs per day will likely be higher, since costs (including the high ICU costs) are spread out over fewer days alive. We believe that by reporting both outcome measures we provide good insight. A second limitation is that our study illustrates that substantial healthcare costs are accrued by ICU patients of all ages, both in the year of their ICU admission and the year thereafter, but does not provide an answer to the important question whether these costs are justified. A third limitation is that we did not adjust costs for severity of illness. The VOPs were more severely ill as both the median APACHE III and APS scores in the VOPs were significantly higher at ICU admission. The APACHE III score is dependent on age and more points are appointed for the older patients. However, the acute physiology score (points based only physiological parameters) was also higher in VOPs. This suggests more severe derangement at admission. This could, at least partially, be explained by a lower fraction of VOPs being admitted after elective surgery. Both severity of illness and type of admission will contribute to higher costs and mortality in VOPs. Another limitation is that we have no insights into the exact composition of the healthcare costs and that we only included the total amount of healthcare cost reimbursed by health insurance companies. The total healthcare costs do not include services paid for out of pocket or reimbursements via voluntary additional insurance, but we think this has not (or barely) affected our results, since our cost data included the most important parts of healthcare costs. Since the point of view of our analysis was the healthcare perspective and not the societal perspective, we did not include factors like loss of a job and other societal losses.

These limitations notwithstanding, we believe our results provide valuable insight into the healthcare utilization of VOPs in comparison to younger ICU patients and a very elderly control population.

In conclusion, we showed that VOPs required more healthcare resources in the year before, during and after ICU admission compared to the ICU 18-65 population and a very elderly control group. Compared to the ICU 65-80 population, VOPs required more healthcare resources in the year before and after ICU admission, but not in the year of ICU admission. However, costs corrected per day alive are substantially higher for VOPs in all three study years and compared to both other ICU populations and the very elderly control population. Our study illustrates that substantial healthcare costs are accrued by ICU patients of all ages, both in the year of their ICU admission and the year thereafter. Our study does not provide an answer to the difficult question whether these costs can always be justified. Because ICU resources are often limited, as are the number of life years that can be gained in good health in VOPs, there is a need for studies that evaluate cost per QALY in VOPs admitted to the ICU.

APPENDICES

Appendix 5.1 Overview of the number of chronic conditions* of the studied populations during the year before ICU admission.

	ICU 18-65 (n=9,068)	ICU 65-80 (n=9,068)	VOPs (n=9,068)	CO 80+ (n=9,068)
No chronic condition	4,949 (55%)	3,145 (35%)	2,775 (31%)	3,770 (42%)
One or more chronic conditions	4,119 (45%)	5,923 (65%)	6,393 (71%)	5,298 (58%)
Two or more chronic conditions	1,336 (15%)	2,279 (25%)	2,497 (28%)	1,691 (19%)

* Vektis also collects claims for pharmaceutical care, stored in the Pharmacy Information System. This information system contains information on provided drugs, including the Anatomical Therapeutic Chemical (ATC) code, the quantity that was supplied and the date the drug was supplied [37].
To determine chronic conditions, pharmaceutical cost groups (PCGs) were used as a proxy. PCGs are based on the idea that a patient with a certain chronic condition can be identified by claims known to be prescribed for that chronic condition [38,39]. An insured person is included into a specific PCG if more than a certain amount (accounting for approximately half a year of use e.g. over 180 defined daily doses) of prescribed drugs has been prescribed during a calendar year. The PCG are classified annually and different ATC codes of one PCG can be combined in order to reach the minimum defined daily doses. A person can be included in multiple PCGs. The definition of pharmaceutical cost groups is maintained by the 'Zorginstituut Nederland' (National Institute for Health Care) and classification is routinely performed by Vektis [40].

Appendix 5.2 Subgroups analyses

Median costs per patient and per patient per day alive for the different mortality groups are shown in Appendix 5.3 to Appendix 5.6, respectively. Additional subgroup analyses have been performed for patients who survived the whole 3-years study period. Among this group of survivors we first divided the elderly ICU group, the younger ICU group and the matched control group into groups based upon their number of chronic conditions (0, 1, 2 or more) (Appendix 5.7). Second we looked at severity of illness based upon the APACHE IV predicted mortality (Appendix 5.8). Furthermore, we analysed the differences in costs between subgroups, based on gender (Appendix 5.9) and quartiles of SES (Appendix 5.10). Finally, we grouped the three ICU populations by type of ICU admission (Appendix 5.11), based on the definitions of the NICE registry [16].

VOPs have more chronic conditions in the year prior to admission compared to the ICU 18-65 population, the ICU 65-80 population and the control population ($p<0.0001$) (Appendix 5.1). Healthcare costs increase with increasing number of chronic conditions and this is seen for all four study groups and in all three study years ($p<0.0001$) (Appendix 5.7). Stratifying the healthcare costs by chronic conditions showed great deviations and demonstrated that more chronic conditions means higher costs. These increased costs with more chronic conditions were seen in all three study years; before, during and after ICU admission and for all four studies populations, indicating that chronic conditions largely contribute to the healthcare costs.

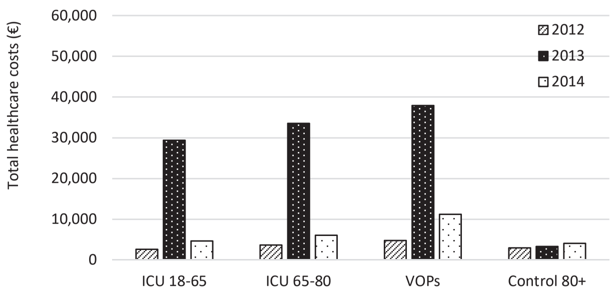
During the year before ICU admission, survivors of the high mortality risk group have lower healthcare costs compared to survivors of the low mortality risk group ($p<0.0001$). During the year of ICU admission, healthcare costs are significantly higher for higher Apache IV risks groups ($p<0.0001$). During the year after ICU admission survivors of the median mortality risk group have the highest healthcare cost ($p<0.0001$) (Appendix 5.8).

Female patients are more expensive than male patients in all three years of the study period ($p<0.0001$) within the ICU 65-80 population and the VOPs. In the ICU 18-65 population, female patients are significantly more expensive in the year before ($p<0.0001$) and the year after ICU admission ($p<0.0001$), but during the year of ICU admission the difference between men and women of this study population is not significant ($p<0.42$) (Appendix 5.9).

Patients with a higher SES had significantly less healthcare costs compared to people with a lower SES, in all four study populations, during the year before and the year after admission ($p<0.0001$) (Appendix 5.10).

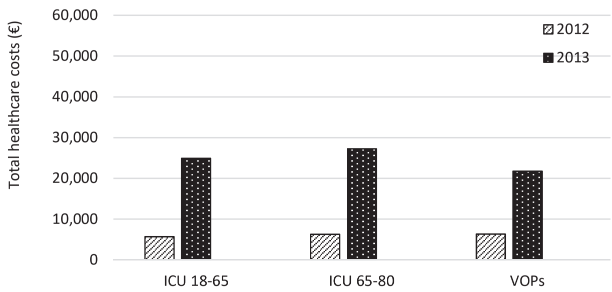
Survivors with a medical admission were most expensive in the year before and after ICU admission, compared to survivors of the elective and emergency surgery groups in these years (all p-values <0.0001). During the year of ICU admission, patients admitted because of emergency surgery were the most expensive, for all three ICU populations ($p<0.0001$, Appendix 5.11). For emergency patients, healthcare costs during the year of ICU admission were higher for the VOP population than for the ICU 18-65 population (p-value for interaction $p=0.0004$), but the differences between VOPs and the ICU 65-80 population was not significant (p-value for interaction $p=0.9942$).

A. Survivors



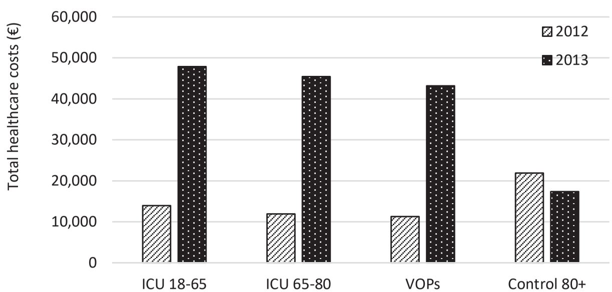
All p -values <0.001

B. Popoulation which died during hospital admission



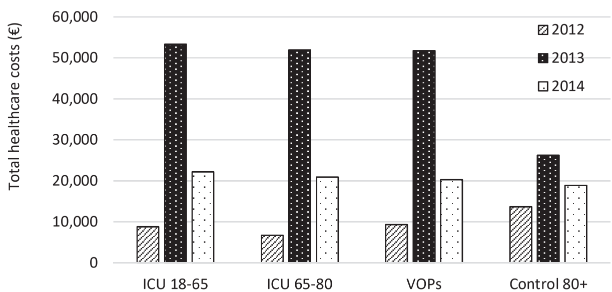
	VOPs vs ICU 65-80	VOPs vs ICU 18-65
2012	$p = 0.3796$	$p = 0.0071$
2013	$p < 0.001$	$p = 0.0004$

C. Population which died during 2013 after hospital discharge



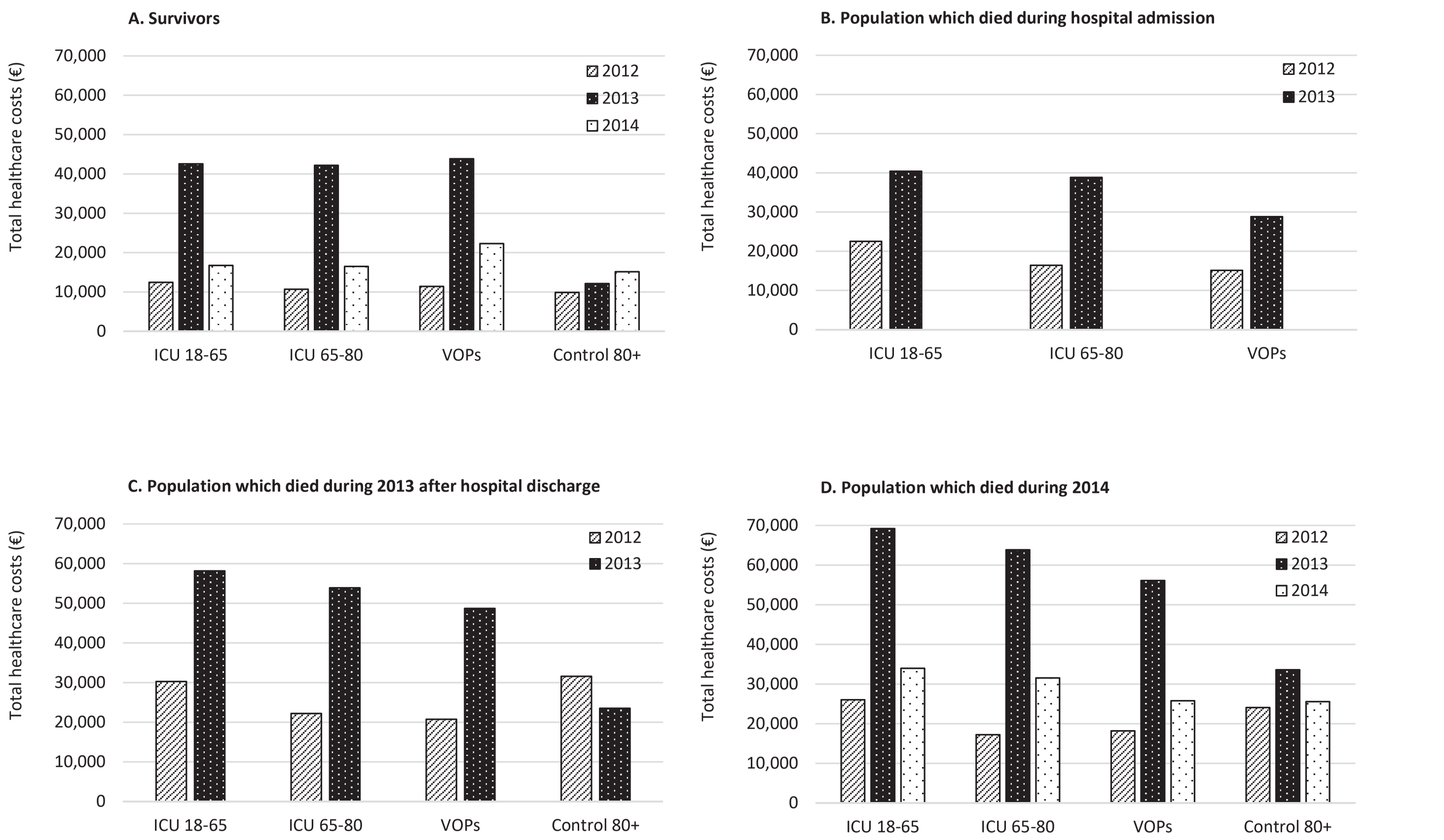
	VOPs vs ICU 65-80	VOPs vs ICU 18-65	VOPs vs CO 80+
2012	$p = 0.4976$	$p = 0.2695$	$p < 0.001$
2013	$p = 0.2497$	$p = 0.0309$	$p < 0.001$

D. Population which died during 2014



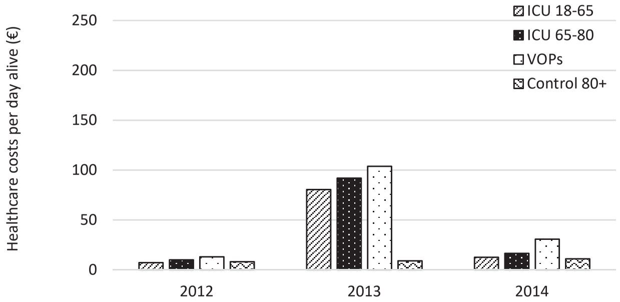
	VOPs vs ICU 65-80	VOPs vs ICU 18-65	VOPs vs CO 80+
2012	$p = 0.0006$	$p = 0.3255$	$p < 0.0001$
2013	$p = 0.0285$	$p = 0.0401$	$p < 0.0001$
2014	$p = 0.2081$	$p = 0.0557$	$p = 0.8673$

Appendix 5.3 Median total healthcare costs for the four study groups, divided in subgroups by mortality: A. Survivors, B. Population which died during hospital admission, C. Population which died during 2013 after hospital discharge and D. Population which died during 2014



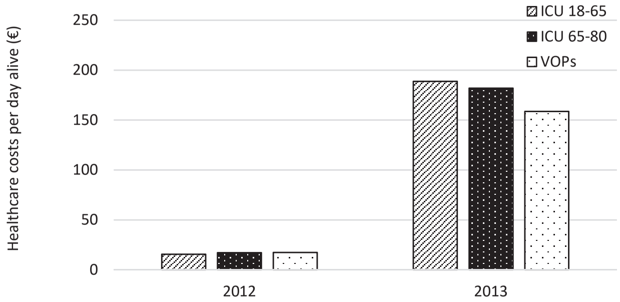
Appendix 5.4 Mean total healthcare costs for the four study groups, divided in subgroups by mortality: A. Survivors, B. Population which died during hospital admission, C. Population which died during 2013 after hospital discharge and D. Population which died during 2014

A. Survivors



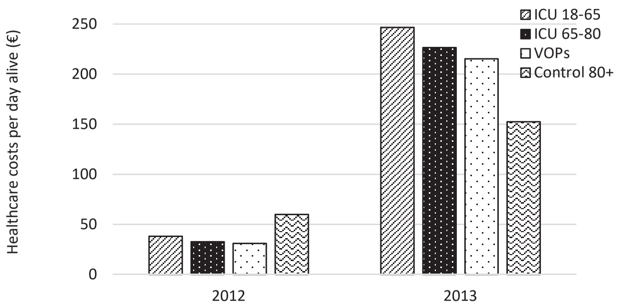
All p -values < 0.001

B. Population which died during hospital admission



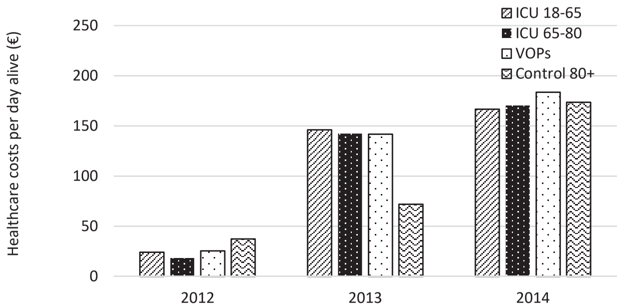
	VOPs vs ICU 65-80	VOPs vs ICU 18-65
2012	$p = 0.3796$	$p = 0.0071$
2013	$p < 0.0001$	$p = 0.0004$

C. Population which died during 2013 after hospital discharge



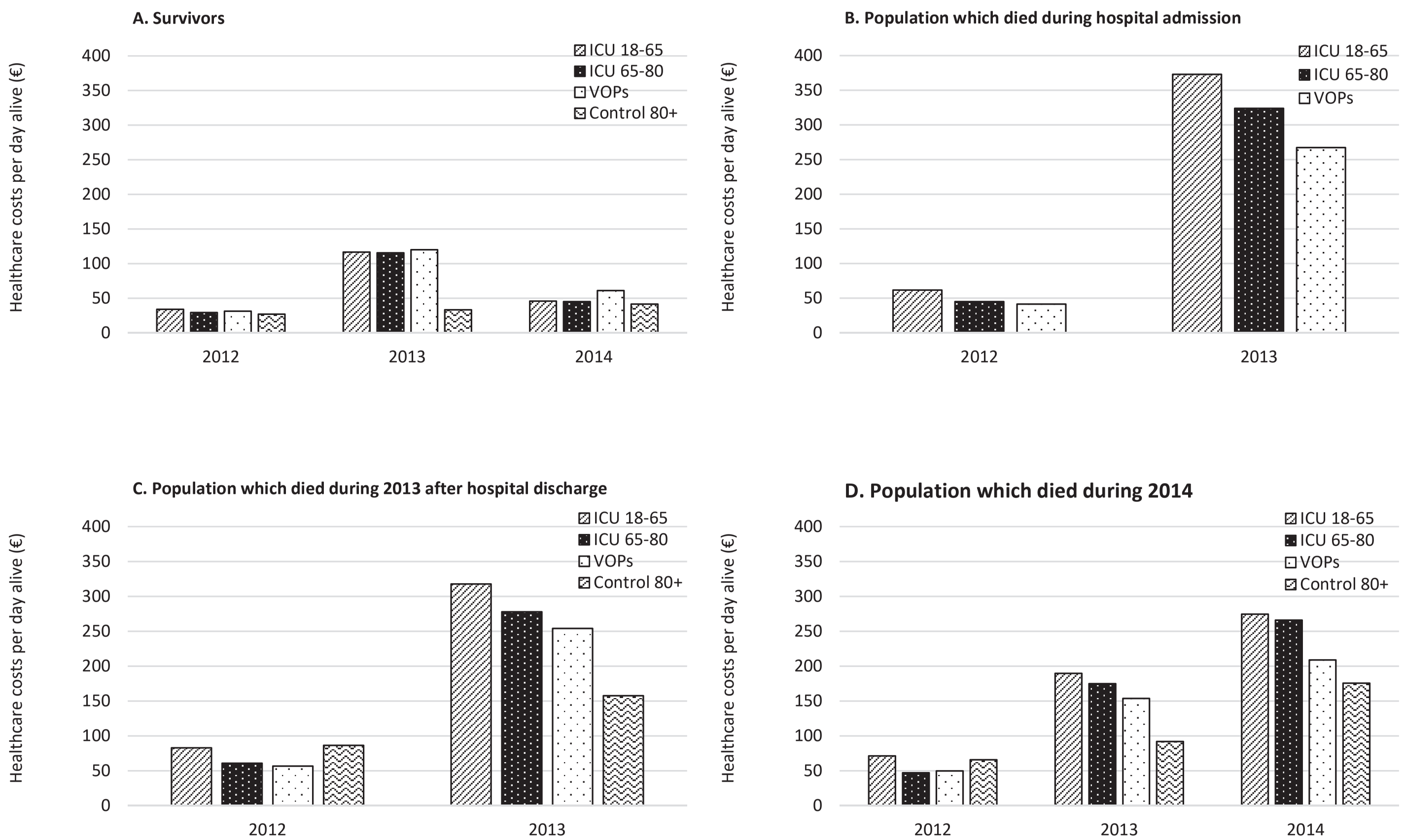
	VOPs vs ICU 65-80	VOPs vs ICU 18-65	VOPs vs CO 80+
2012	$p = 0.4976$	$p = 0.2695$	$p < 0.0001$
2013	$p = 0.2497$	$p = 0.0309$	$p < 0.0001$

D. Population which died during 2014

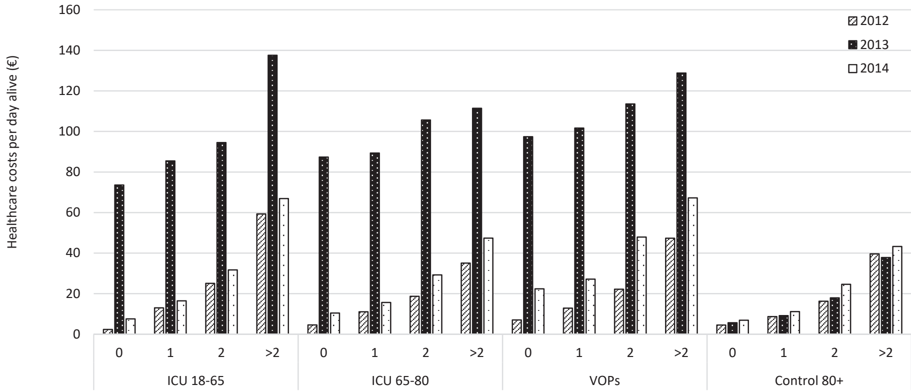


	VOPs vs ICU 65-80	VOPs vs ICU 18-65	VOPs vs CO 80+
2012	$p = 0.0006$	$p = 0.3255$	$p < 0.0001$
2013	$p = 0.0285$	$p = 0.0401$	$p < 0.0001$
2014	$p = 0.5036$	$p = 0.3692$	$p = 0.0149$

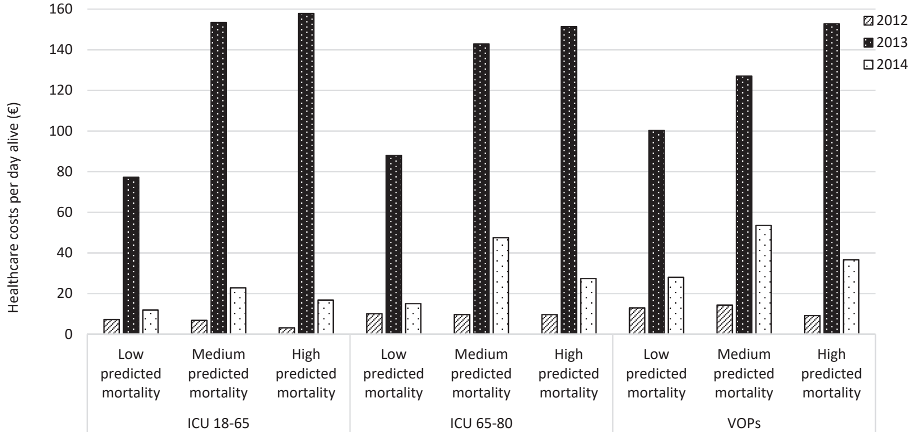
Appendix 5.5 Median total healthcare costs per day alive for the four study groups, divided in subgroups by mortality: A. Survivors, B. Population which died during hospital admission, C. Population which died during 2013 after hospital discharge and D. Population which died during 2014



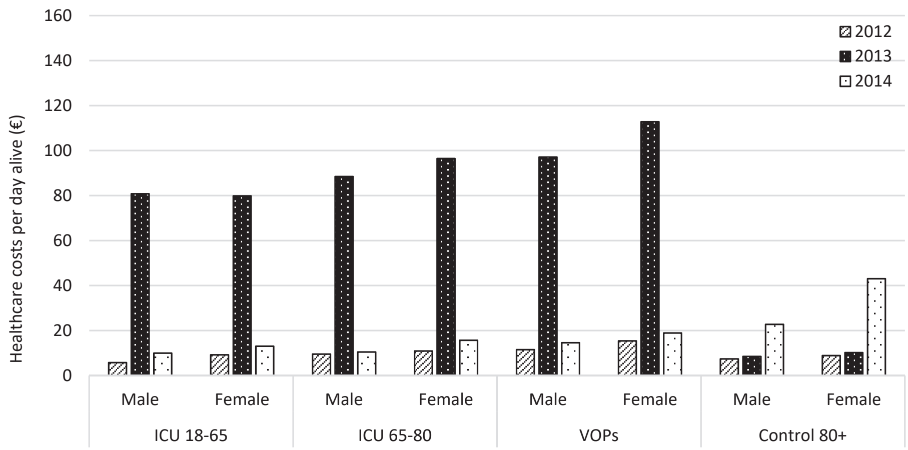
Appendix 5.6 Mean total healthcare costs per day alive for the four study groups divided, in subgroups by mortality: A. Survivors, B. Population which died during hospital admission, C. Population which died during 2013 after hospital discharge and D. Population which died during 2014



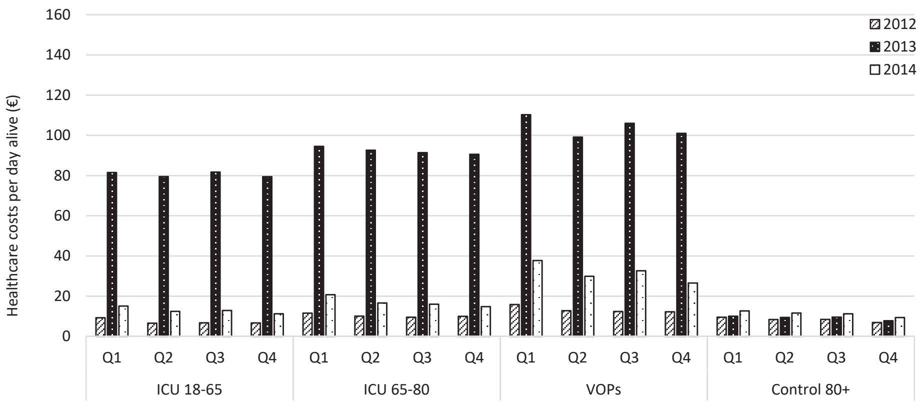
Appendix 5.7 Median healthcare costs per day alive of survivors, stratified by number of chronic conditions



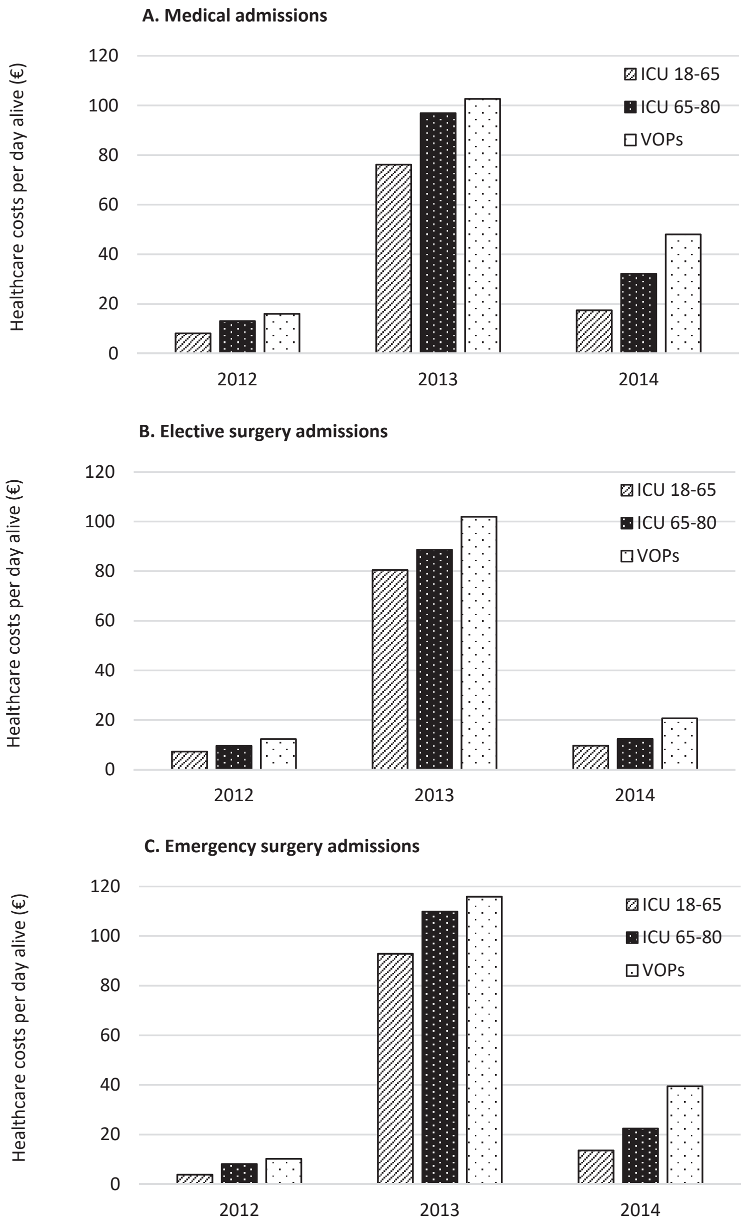
Appendix 5.8 Median healthcare costs per day alive of survivors, stratified by APACHE IV mortality risk-group



Appendix 5.9 Median healthcare costs per day alive of survivors, stratified by gender



Appendix 5.10 Median healthcare costs per day alive of survivors, stratified by socioeconomic status quartile



Appendix 5.11 Median healthcare costs per day alive of survivors, divided in subgroups by type of ICU admission: A. Medical admissions, B. Elective surgery admissions and C. Emergency surgery admissions

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