



POPUP Project

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## Research Report

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# Table of Contents

<b>1 Descriptive analysis of hospital care access systems</b>	<b>2</b>
1.1 The bigger picture . . . . .	2
1.1.1 Patient distribution with respect to systems . . . . .	2
1.1.2 Patient gender distribution with respect to systems . . . . .	3
1.1.3 Patient age distribution with respect to systems . . . . .	3
1.1.4 Patient regional distribution with respect to systems . . . . .	4
1.1.5 Evolution of stays regional distribution with respect to systems . . . . .	7
1.1.6 Stays: total and mean number distribution with respect to systems	9
1.1.7 Evolution of stays and patients counts . . . . .	10
1.2 Thematic Analysis : <i>patients and stays level</i> . . . . .	12
1.2.1 GHM structure per system . . . . .	12
1.2.2 Big GHMs blocks distribution . . . . .	12
1.2.3 Granular GHMs blocks distribution . . . . .	16
1.2.4 GHMs associated with mortality distribution . . . . .	18
1.2.5 Yearly evolution of patients contingents for the most represented GHMs groups . . . . .	21
1.2.6 Critical Care Analysis . . . . .	23
1.2.7 Cost analysis . . . . .	31
1.3 Séances GHM focus . . . . .	36
<b>2 Comparative analysis between social systems and the base system</b>	<b>39</b>
2.1 Stays duration analysis . . . . .	40
2.2 Critical care duration analysis . . . . .	44
2.3 Stays Cost analysis . . . . .	48
<b>3 Econometric modeling</b>	<b>52</b>
3.1 Cost explaining factors : is system membership decisive ? . . . . .	52
3.2 Patient volume per system: does public policy have an impact ? . . . . .	55
3.2.1 2013 : removal of AME's entry rights . . . . .	55
3.2.2 2020 : introduction of a waiting period for asylum seekers for ac- cessing the general healthcare system . . . . .	57

# Chapter 1

## Descriptive analysis of hospital care access systems

This part focuses on describing from different standpoints a *PSMI* sample. This dataset consists of about 3 million french hospital stays observation from 2011 to 2021 across 4 hospital care access systems of interest :

1. AME : *Aide médicale d'Etat*
2. SUV : *Soins urgents et vitaux*
3. CMU-C : *Couverture maladie universelle complémentaire/complémentaire santé solidaire*
4. AMO (CMU-C beneficiaries excluded) : *Assurance maladie obligatoire*

The exploratory analysis conducted aims at characterizing the key top level differences between these systems. We start drawing the bigger picture by describing the demographics and geographical distribution of patients. Then, we dive into a thematic analysis whereby we try to apprehend, both generally and across time, stays and patients in various important dimensions such as *ghm* structure, condition criticality or costs. Finally, we focus on two specific topics that polarize noteworthy patterns: *Séances CMD* and *DOM-TOM* regions.

### 1.1 The bigger picture

#### 1.1.1 Patient distribution with respect to systems

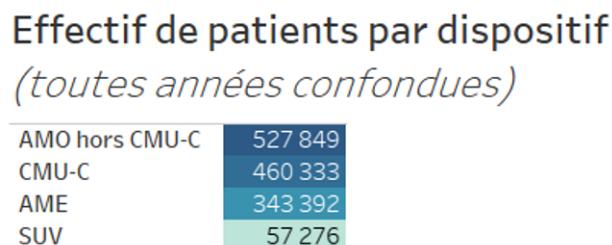


Figure 1.1: Number of patients per system (all years included)

As Fig 1.1 shows, our PMSI sample loosely relates to the actual distribution of patients in each systems. The majority of french people belongs to the wider systems such as AMO for the most part and CMU-C which targets populations in need of extra financial support. AME, targeting specifically migrants, asylum seekers, represents nonetheless an important portion of the dataset. SUV, designed for undocumented patients in dyer need of hospital care is less represented group without about 60k patients from 2011 to 2022.

### 1.1.2 Patient gender distribution with respect to systems

Répartition par sexe de l'effectif des patients  
(selon le dispositif, toutes années confondues)

raison	Homme	Femme
AME	38,48%	61,55%
AMO hors CMU-C	44,08%	55,93%
CMU-C	44,95%	55,07%
SUV	48,01%	52,01%

Figure 1.2: Breakdown by sex and by system of the number of patients (all years included)

There is a clear over-representation of women in all systems when we look at the sample globally. This importance is variable, spreading from 52% of the SUV population to over 61% for AME. In addition, Fig 1.2 allows us to observe the similarity of the gender breakdown between AMO and CMU-C, which rest in the middle of the spectrum, making the migrant targeted systems lying on both ends of this gradient of women over-representation.

### 1.1.3 Patient age distribution with respect to systems

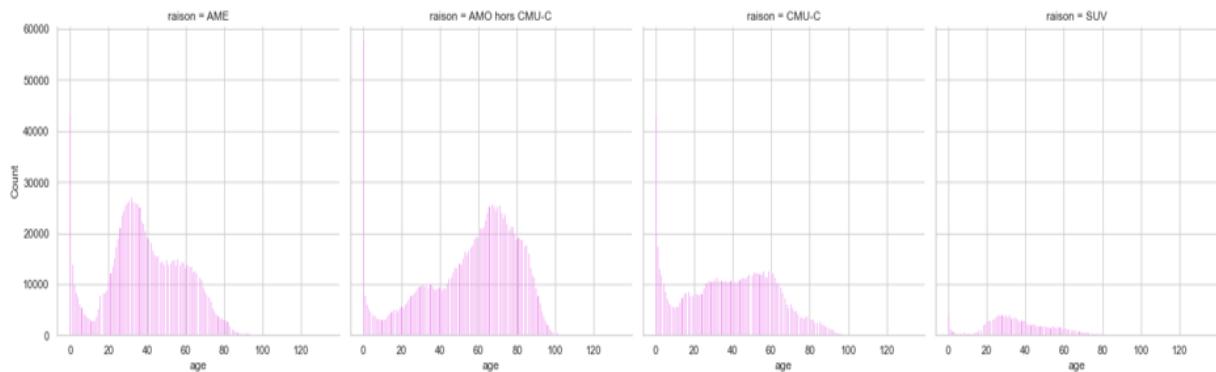


Figure 1.3: Breakdown by systems of the age distribution of patients (all years included)

From Fig 1.3 and 1.4, we can observe that SUV and AME are youngest systems, followed by CMU-C. AMO replicates the larger population and features senior patients

as its main contingent. In more details, with a mean age of respectively 36 years and a median age of 34 years old SUV constitutes the youngest system with about 50% of its population lying between 25 and 47 year old. On the other end, AMO's mean and median age are, respectively, 55 and 61 year old with about 50% of its population ranging from 40 to 74 year old.

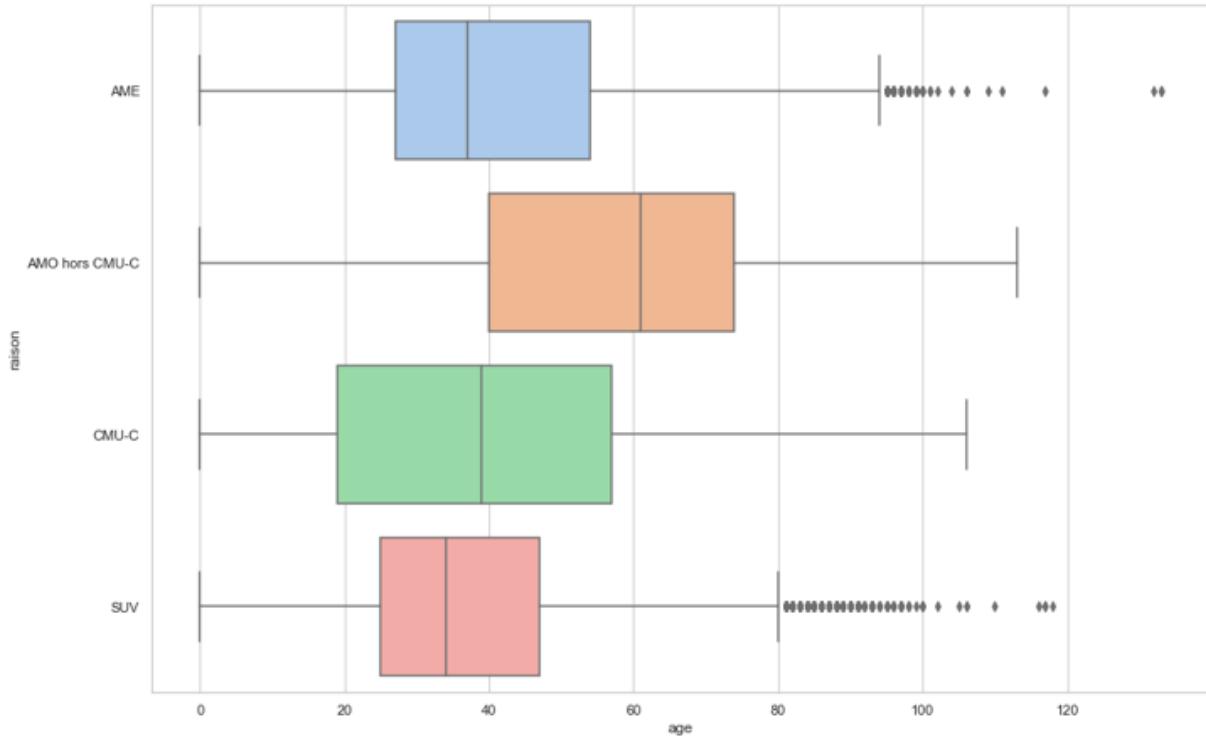


Figure 1.4: Boxplots by systems of the age distribution of patients (all years included)

#### 1.1.4 Patient regional distribution with respect to systems

When we analyze patient regional distribution across systems we generally observe a polarization around the main metropolitan centers. The 4 following maps go beyond this approach by trying to apprehend the spatial distribution of a demographic index (patients per 1Ok inhabitants). The pattern that emerges is that SUV and AME patients are concentrated mainly in DOM TOM and the Paris metropolitan area. AMO and CMU-C are less polarized, spreading more evenly on the french territory. The high index number for Guyana for AMO is more revealing of a relatively low population than of significant patient number in this region relatively to others.

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

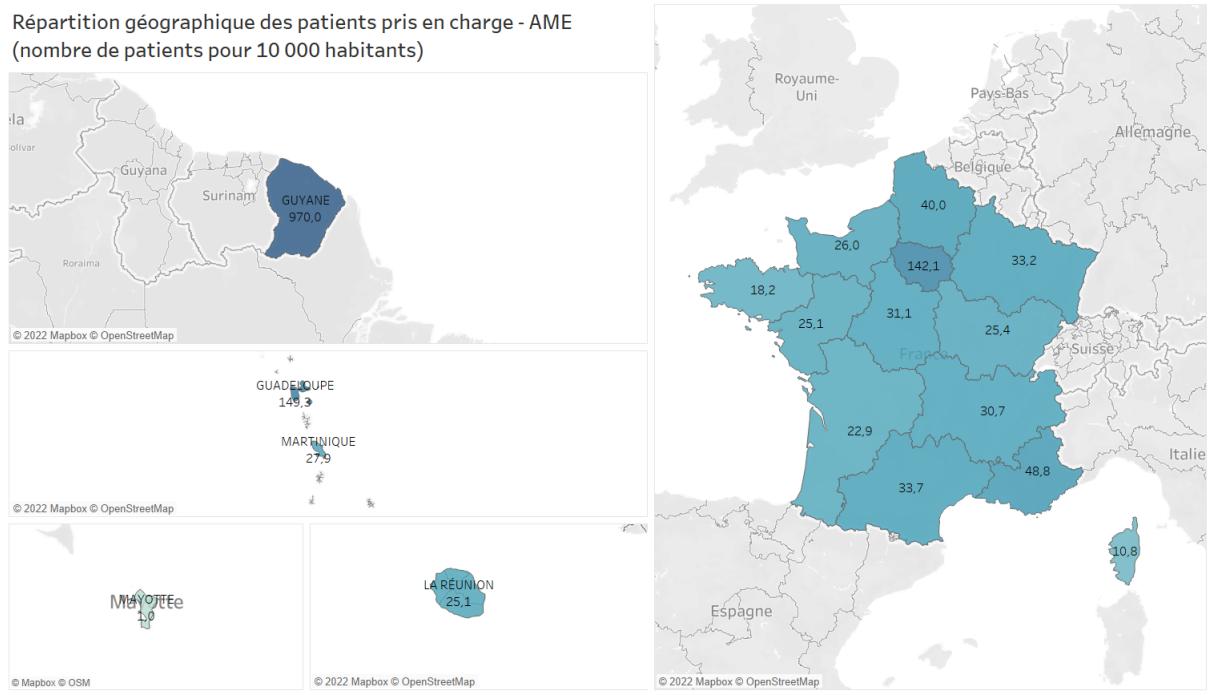


Figure 1.5: Regional distribution of AME patients (all years included)

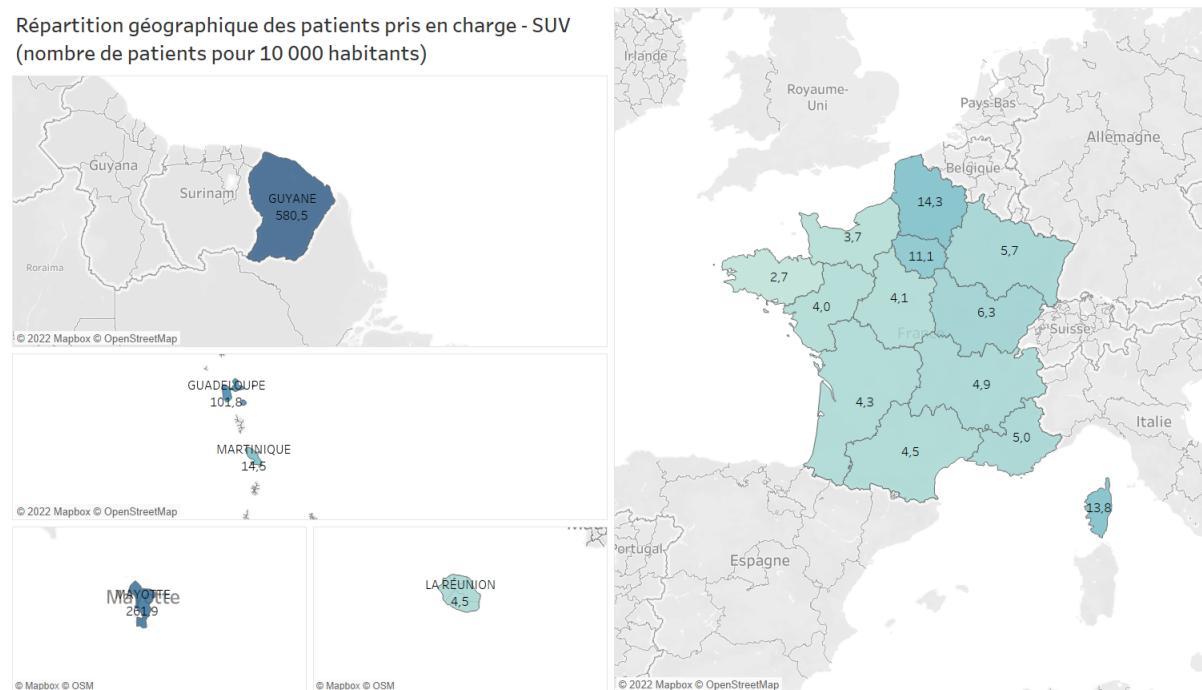


Figure 1.6: Regional distribution of SUV patients (all years included)

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

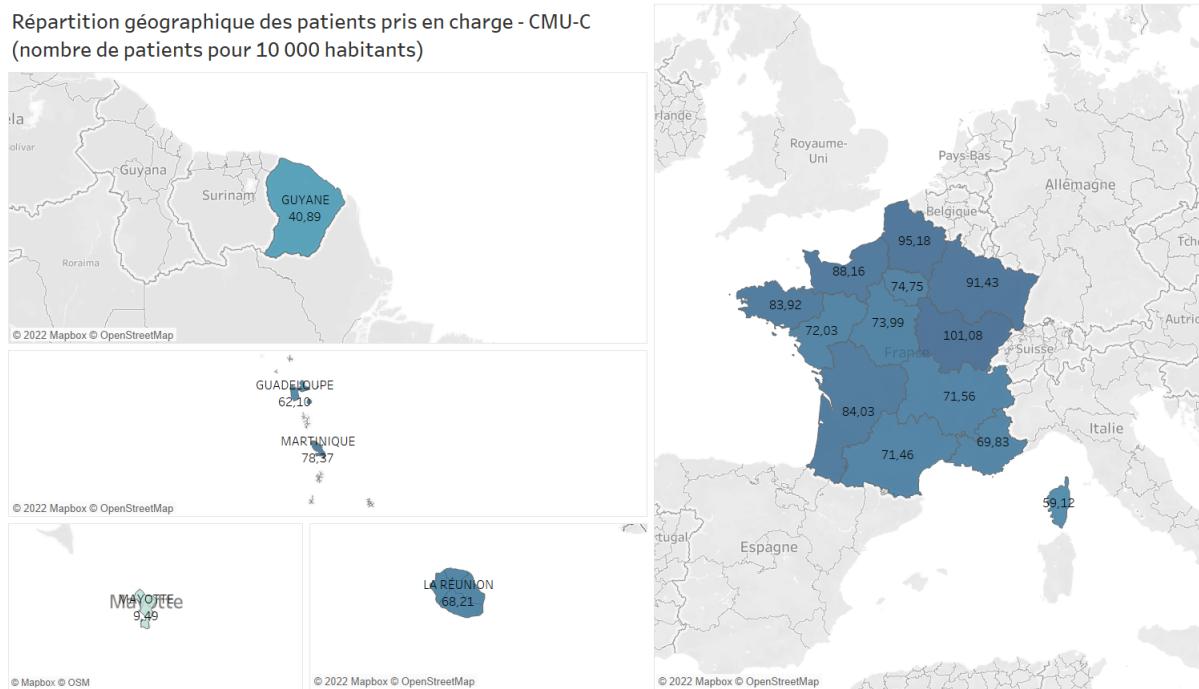


Figure 1.7: Regional distribution of CMU-C patients (all years included)

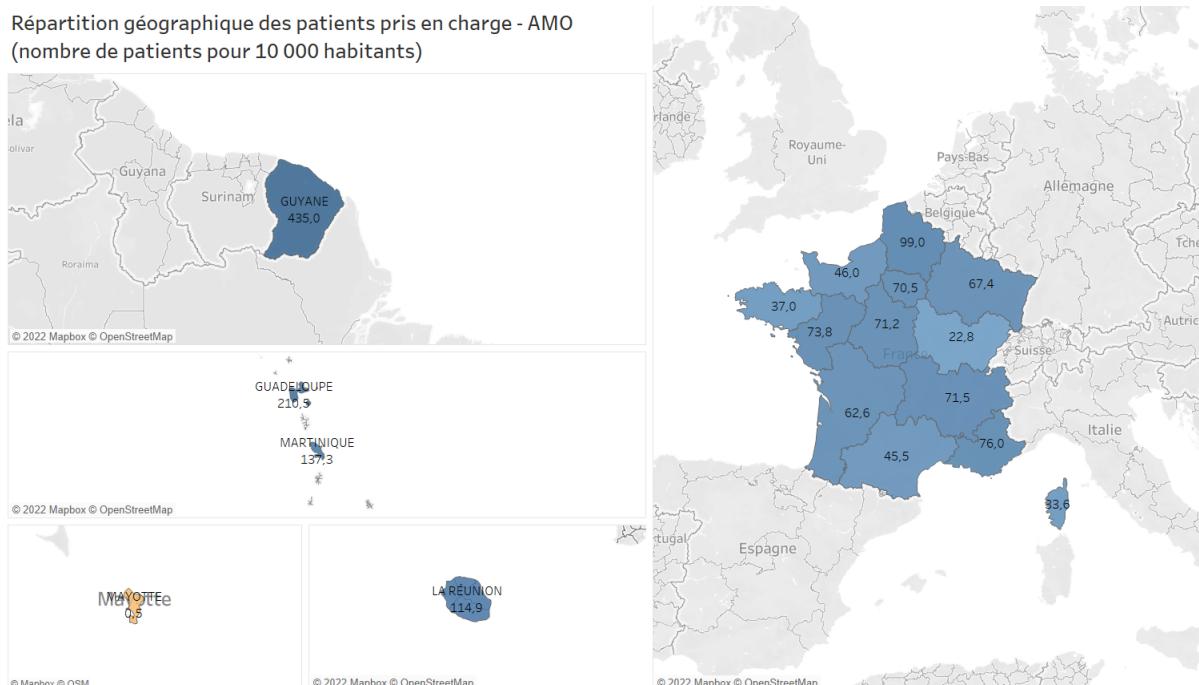


Figure 1.8: Regional distribution of AMO patients (all years included)

### 1.1.5 Evolution of stays regional distribution with respect to systems

When considering the dynamics of the regional stays distribution across systems, two general trends come up. The first one refers to a relative stability in the regional composition as it is the case for AMO base system throughout the 10 years of data available. We can also include AME in this category although it experienced a steady increase in the Guyane region share eating up the large portion that Ile-de-France originally had.

The second trend pattern is that of abrupt change in the composition as it can be observed for CMU-C and more so SUV. The sudden drop of Grand-Est region from about 15% in 2013 to approximately 5% of CMU-C's annual stays in 2014 testifies of an important regional reconfiguration that was maintained through time as this share stayed in that range since then. SUV experience an even more blunt change in its regional structure as Mayotte region stays went from representing up to 15% of SUV annual stays to essentially zero since 2019.

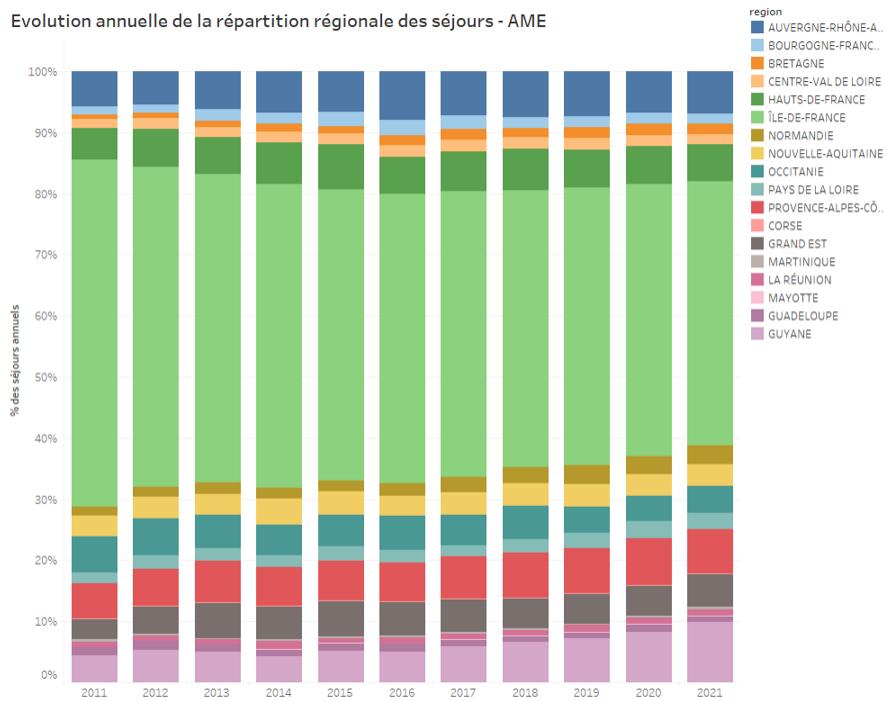


Figure 1.9: Evolution of regional distribution of AME patients

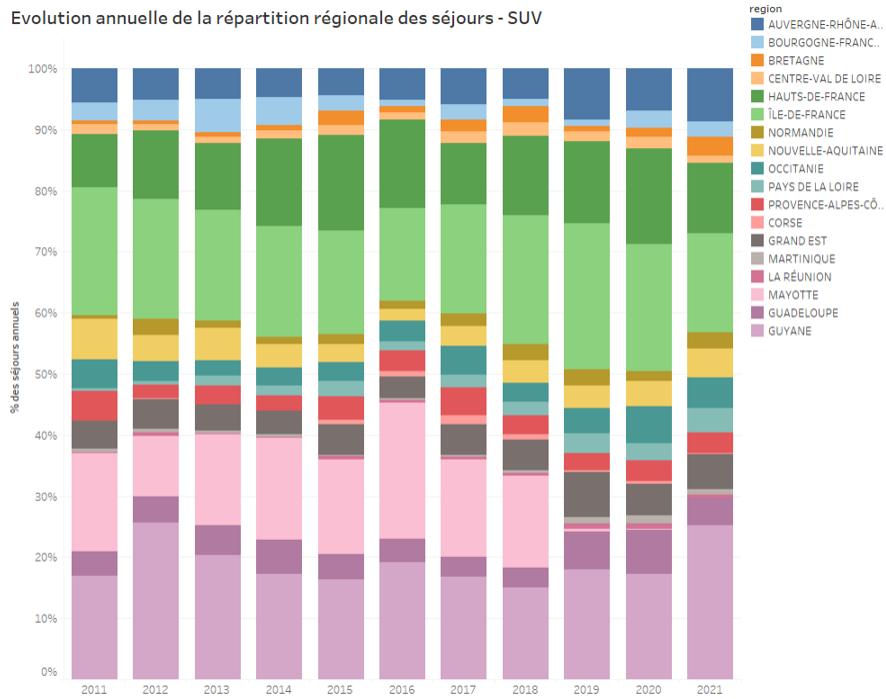


Figure 1.10: Evolution of regional distribution of SUV patients

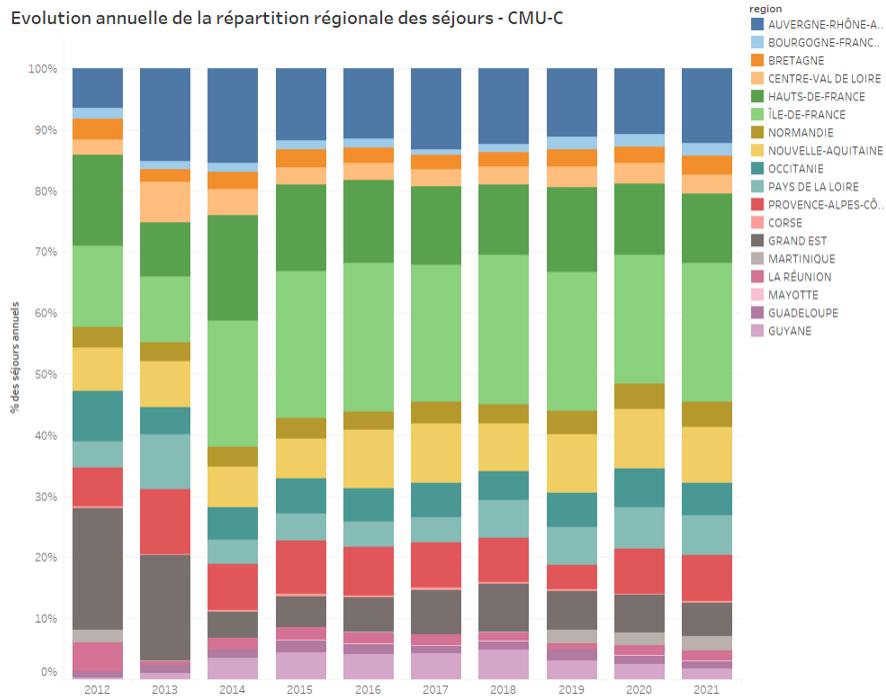


Figure 1.11: Evolution of regional distribution of CMU-C patients

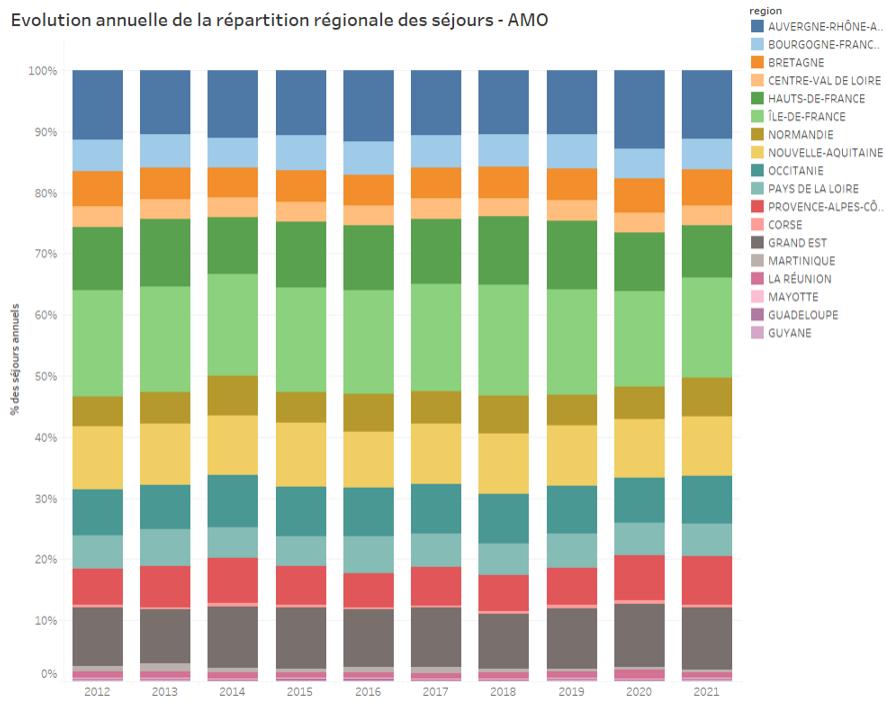


Figure 1.12: Evolution of regional distribution of AMO patients

### 1.1.6 Stays: total and mean number distribution with respect to systems

The total stays distribution follows the same ordering logic as the patients number distribution shown above. An interesting difference is the fact that AME's count is way near that of AMO's with a difference of about 200K stays.

This observation is confirmed by the high mean number of stays per patient displayed by AME at 3.1 stays, about 1 stay more than AMO and SUV and 1.5 stays more than CMU-C.

Nombre de séjours par dispositif (toutes années confondues)	
AMO hors CMU-C	1 231 510
AME	1 080 732
CMU-C	786 533
SUV	131 449

Figure 1.13: Stays repartition across systems (all years included)

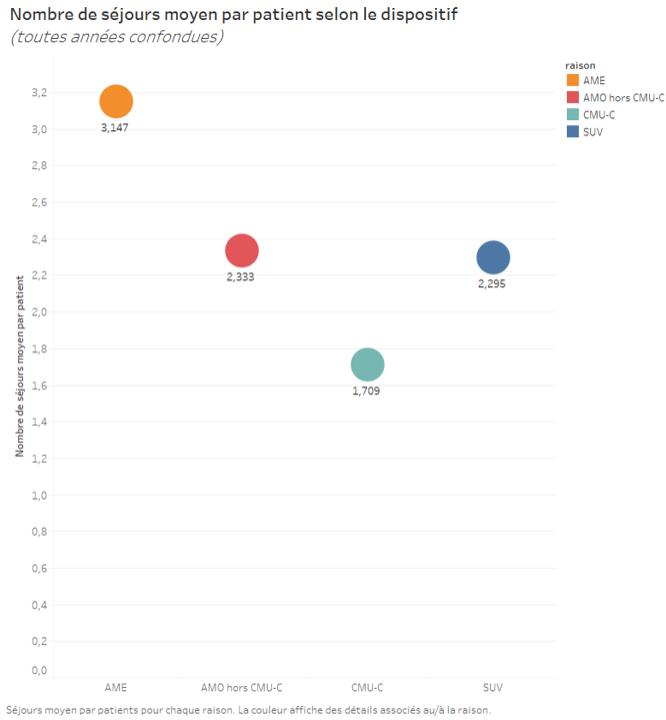


Figure 1.14: Mean stays number per patient repartition across systems (all years included)

### 1.1.7 Evolution of stays and patients counts

The dynamic profile of the yearly count of stays and patients is the same for every system. We can distinguish three groups. AME,AMO with a sizeable absolute increase from 2011/2012 to 2021 be it in terms of patients or stays. SUV with a steady absolute growth and these two dimension that double in the 10 years windows its initial 2011 counts. Finally, CMU-C exhibits a more erratic dynamic with an important drop between 2013 and 2014 followed by a steady increase the following years to retrieve its initial 2012 levels. Regarding mean stays count per patient, we observe an interesting convergence between SUV and CMU-C on one hand from respectively 1.5/1.6 stays to 1.8 stays over the period; and on the other hand AME and AMO from respectively 1.9/2.1 stays to 2.45 stays.

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

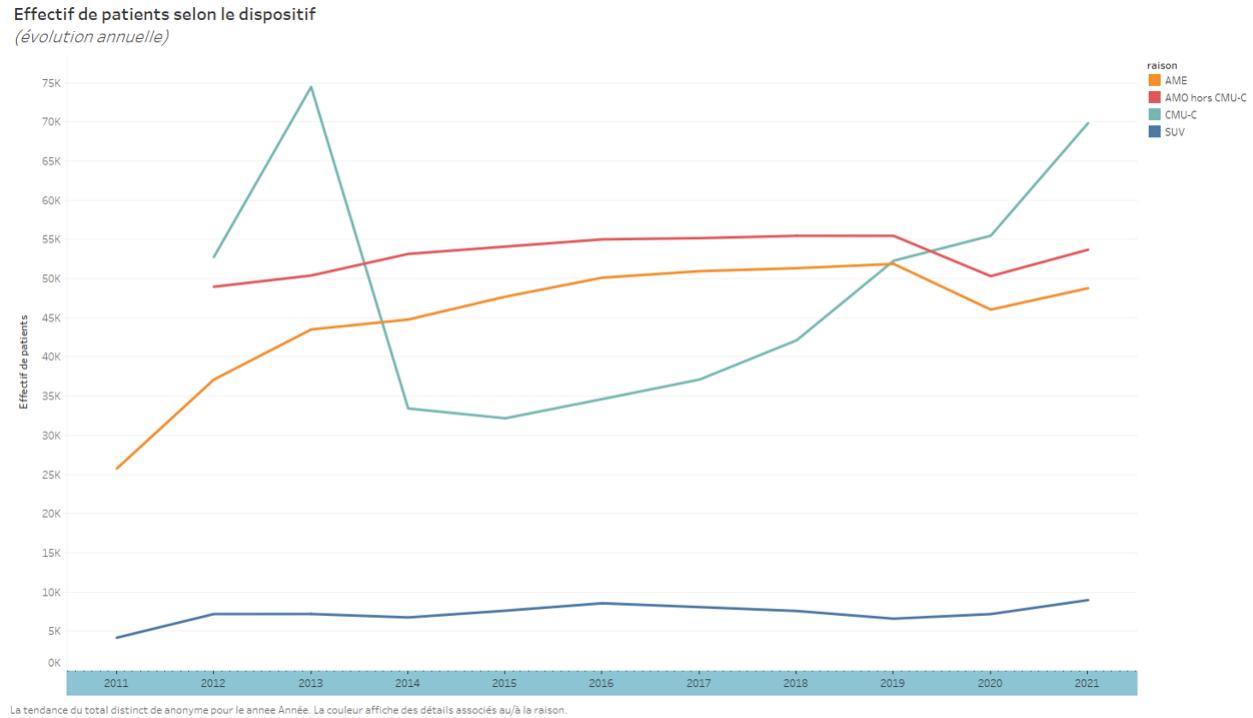


Figure 1.15: Yearly evolution of patient count across systems

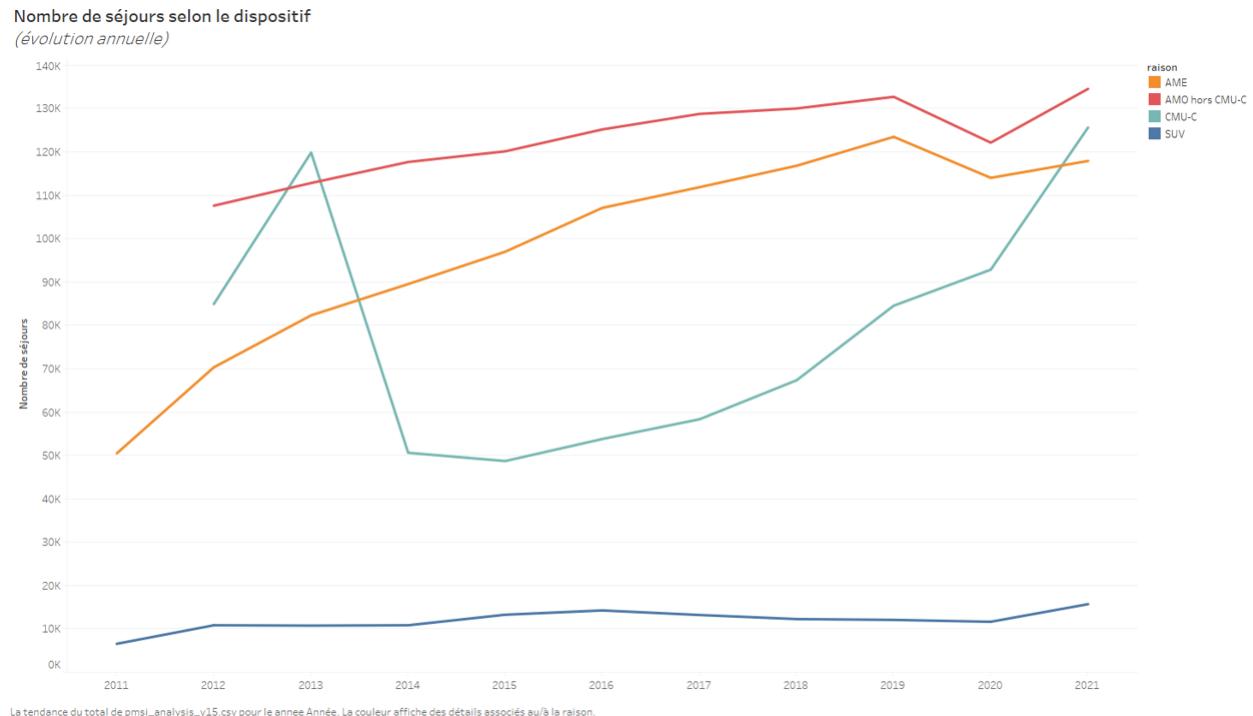


Figure 1.16: Yearly evolution of stays count across systems

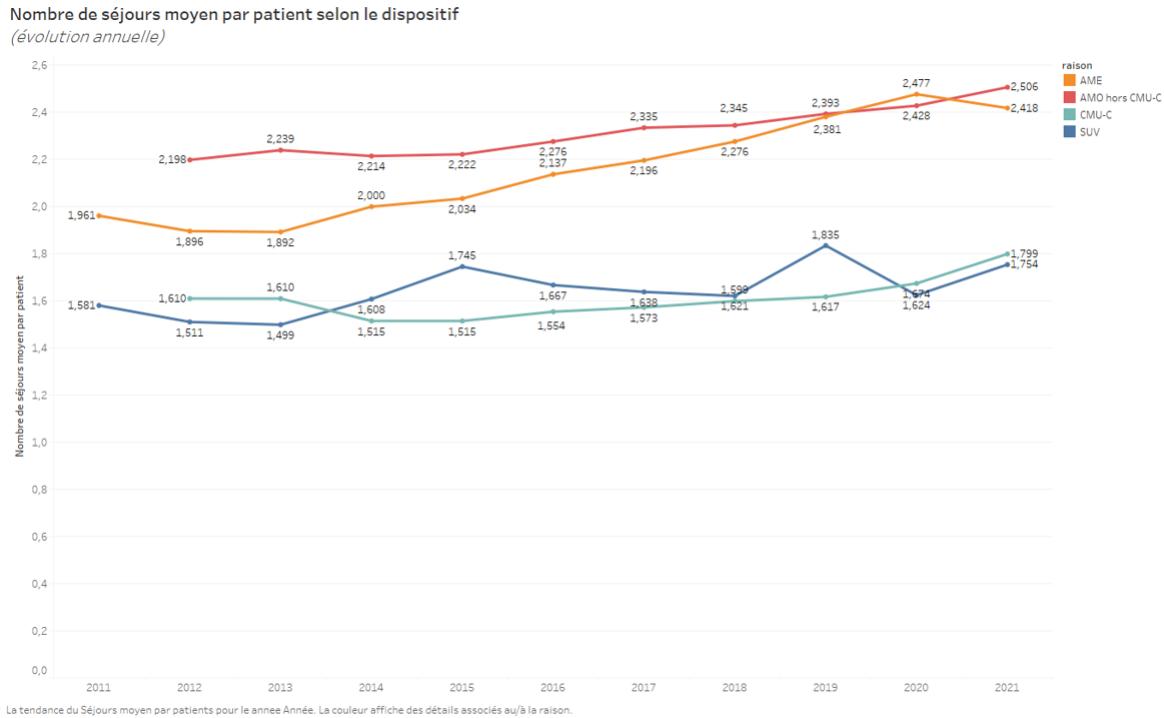


Figure 1.17: Yearly evolution of mean stays count per patient across systems

## 1.2 Thematic Analysis : *patients and stays level*

### 1.2.1 GHM structure per system

The analysis of the GHM structure of each system was done in several ways in an effort to highlight different dimensions underlying the stays.

This work was done according to two temporal dimensions :

1. *Statically* : taking into account the data from all years, we performed 4 types of study:
  - (a) The first one consisted in shedding light upon the distribution of 2 big interventions blocks "Gynecology/Obstetrics", "Oncology".
  - (b) The second approach is more granular and brought us to define 20 GHMs group that made sense given the GHMs and their isolated occurrences.
  - (c) Finally, we looked at the distribution of GHMs associated with mortality.
  - (d) *Dynamically* : exploring the yearly evolution of patients contingents for the most represented GHMs groups across all systems.

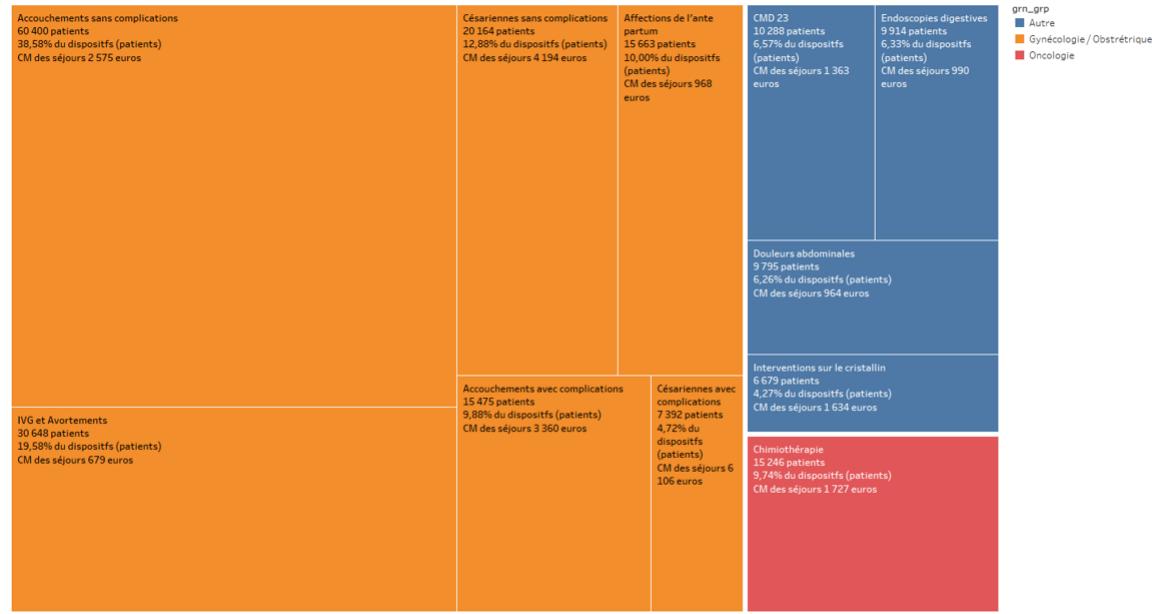
### 1.2.2 Big GHMs blocks distribution

We see a striking domination of obstetrics/gynecology themed GHMs for the migrant targeted systems SUV and AME. Oncology is the second contingent for this systems

with a fraction of the dominant block patients. For the two more general systems, we observe more balanced patient contigents, with obstetrics/gynecology leading the way with "others" GHMs block. This suggests more fragmentation in GHMs for AMO and CMU-C.

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

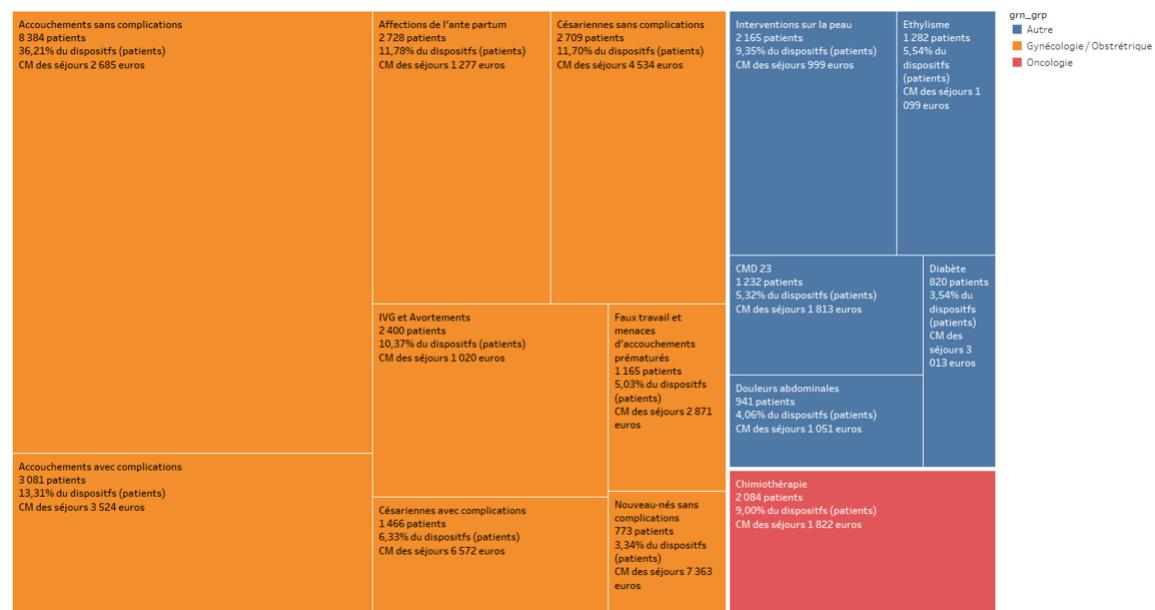
Répartition de l'effectif de patients des top groupes - AME  
(toutes années confondues)



Gro\_cln, total distinct de anonyme,% sur le total Total distinct de anonyme et moyenne de cost. La couleur affiche des détails associés au/a la grn\_grp. La taille correspond au/a la total distinct de anonyme. Les repères sont étiquetés par gro\_cln, total distinct de anonyme,% sur le total Total distinct de anonyme et moyenne de cost. Les données sont filtrées sur raison, qui conserve AME. La vue est filtrée sur le/la grp\_clnExclusions (grn\_grp, gro\_cln). Le filtre grp\_cln conserve 12 membres sur 21. Le filtre Exclusions (grn\_grp, gro\_cln) conserve 20 membres.

Figure 1.18: Big GHMs blocks distribution(patients, AME, all years included)

Répartition de l'effectif de patients des top groupes - SUV  
(toutes années confondues)

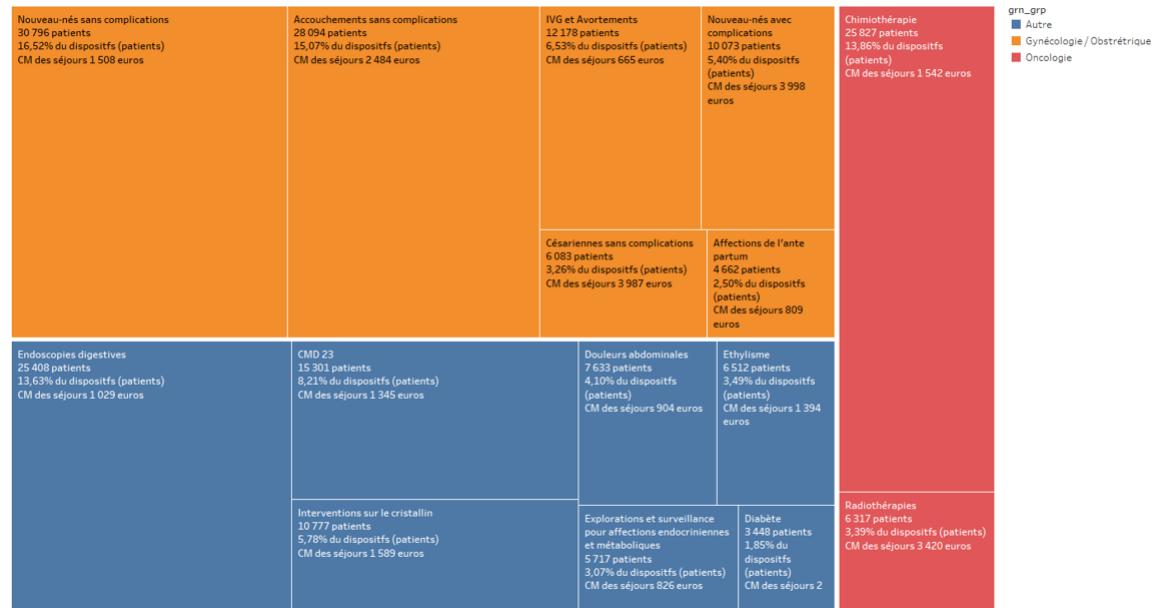


Gro\_cln, total distinct de anonyme,% sur le total Total distinct de anonyme et moyenne de cost. La couleur affiche des détails associés au/a la grn\_grp. La taille correspond au/a la total distinct de anonyme. Les repères sont étiquetés par gro\_cln, total distinct de anonyme,% sur le total Total distinct de anonyme et moyenne de cost. Les données sont filtrées sur raison, qui conserve SUV. La vue est filtrée sur grp\_cln, qui conserve 14 membres sur 21.

Figure 1.19: Big GHMs blocks distribution (patients, SUV, all years included)

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

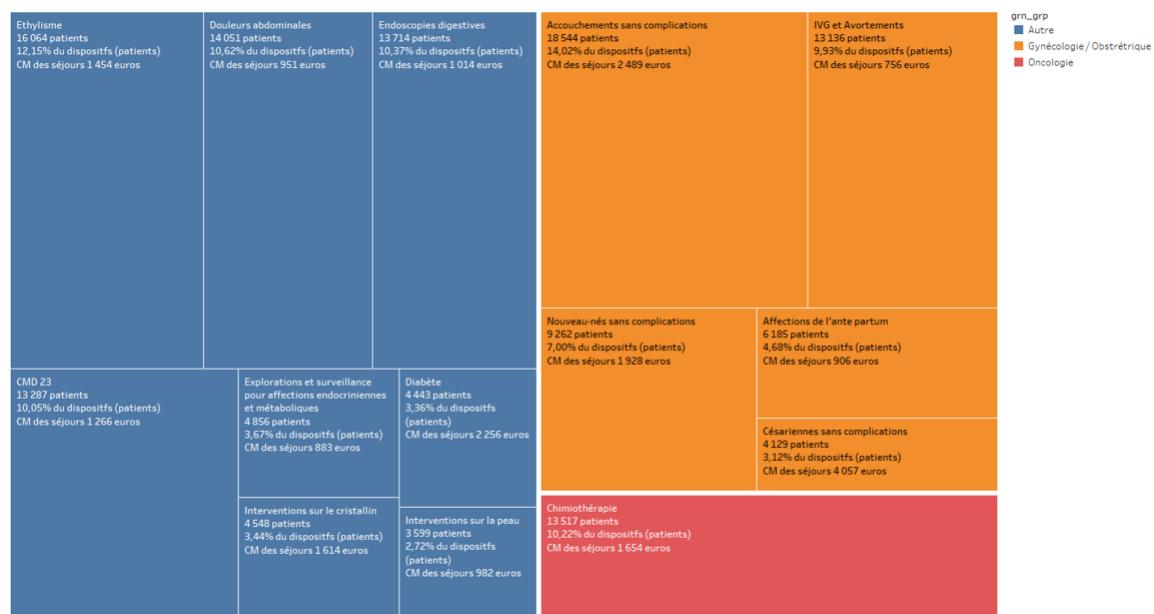
Répartition de l'effectif de patients des top groupes - AMO  
(toutes années confondues)



Grp\_cln,total distinct de anonyme,% sur le total Total distinct de anonymeetmoyenne de cost. La couleur affiche des détails associés au/à la grn\_grp. La taille correspond au/à la total distinct de anonyme. Les repères sont étiquetés par grp\_cln,total distinct de anonyme,% sur le total Total distinct de anonymeetmoyenne de cost. Les données sont filtrées sur raison, qui conserve AMO hors CMU-C. La vue est filtrée sur grp\_cln, qui conserve 15 membres sur 21.

Figure 1.20: Big GHMs blocks distribution(patients, AMO, all years included)

Répartition de l'effectif de patients des top groupes - CMU-C  
(toutes années confondues)



Grp\_cln,total distinct de anonyme,% sur le total Total distinct de anonymeetmoyenne de cost. La couleur affiche des détails associés au/à la grn\_grp. La taille correspond au/à la total distinct de anonyme. Les repères sont étiquetés par grp\_cln,total distinct de anonyme,% sur le total Total distinct de anonymeetmoyenne de cost. Les données sont filtrées sur raison, qui conserve CMU-C. La vue est filtrée sur le/la grp\_clnnetExclusions (grp\_cln,grp\_cln). Le filtre grp\_cln conserve 15 membres sur 21. Le filtre Exclusions (grp\_cln,grp\_cln) conserve 20 membres.

Figure 1.21: Big GHMs blocks distribution(patients, CMU-C, all years included)

### 1.2.3 Granular GHMs blocks distribution

The following charts shed light upon a distinctive factor between SUV and AME. SUV's top 5 GHMs blocks all relate to gynecology and obstetrics, with about 10% of the system patients concerned with abortion "IVG". In addition, the second top GHM block evokes childbirth with complications, suggesting high precariousness within this system. In the other hand, AME still has 3 of its Top GHM blocks related to gynecology and obstetrics, however no mention of complications and presence of additional blocks related to chemotherapy and CMD23.

CMU-C's and AMO's granular GHM block distribution features way more fragmentation with top blocks related to obstetrics/genecology, chemotherapy, endoscopy, abdominal pain and alcoholism.

Répartition de l'effectif de patients des top groupes - AME  
(toutes années confondues)



Grp\_cln, total distinct de anonyme,% sur le total Total distinct de anonyme et moyenne de cost. La couleur affiche des détails associés au/a la grp\_cln. La taille correspond au/a la total distinct de anonyme. Les repères sont étiquetés par grp\_cln, total distinct de anonyme,% sur le total Total distinct de anonyme et moyenne de cost. Les données sont filtrées sur raison, qui conserve AME. La vue est filtrée sur grp\_cln, qui conserve 12 membres sur 21.

Figure 1.22: Granular GHMs blocks distribution(patients, AME, all years included)

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

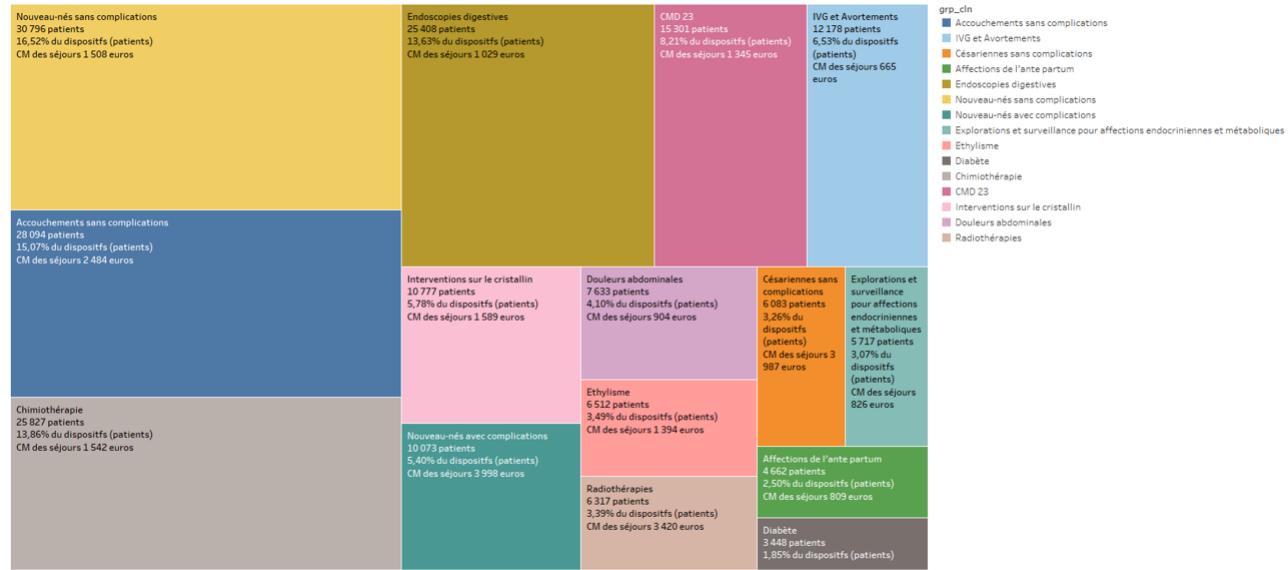
## Répartition de l'effectif de patients des top groupes - SUV (toutes années confondues)



$\text{grp\_clin}, \text{total distinct de anonyme, \% sur le total}$  Total distinct de anonyme et moyenne de cost. La couleur affiche des détails associés au la grp\_clin. La taille correspond au la total distinct de anonyme. Les séries sont étiquetées par  $\text{grp\_clin}, \text{total distinct de anonyme, \% sur le total}$  Total distinct de anonyme et moyenne de cost. Les données sont filtrées sur raison, qui conserve SUV. La vue est filtrée sur grp\_clin, qui s'ert 14 membres sur 21.

Figure 1.23: Granular GHMs blocks distribution (patients, SUV, all years included)

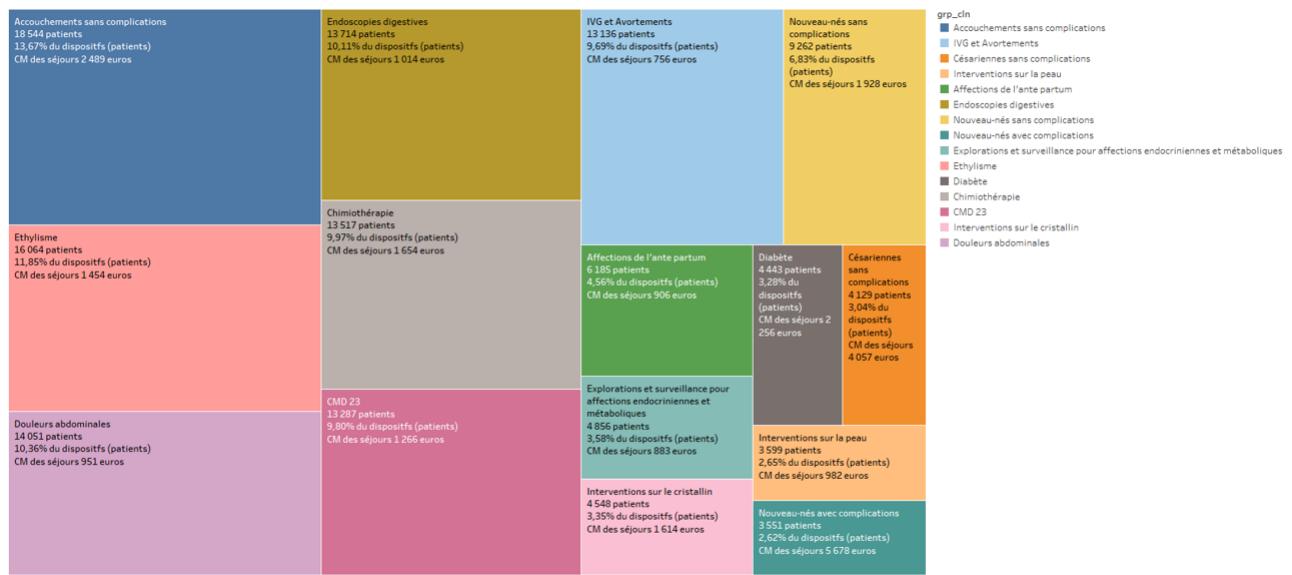
## Répartition de l'effectif de patients des top groupes - AMC (toutes années confondues)



`grp_cln,total distinct of anonyme,% sur le total Total distinct de anonyme et moyenne de cost.` La couleur affiche des détails associés au/à la `grp_cln`. La taille correspond au/à la `total distinct of anonyme`. Les repères sont étiquetés par `grp_cln,total distinct of anonyme,% sur le total Total distinct de anonyme et moyenne de cost.` Les données sont filtrées sur raison, qui conserve AMO hors CMU-C. La vue est filtrée sur `grp_cln`, qui conserve 15 membres sur 21.

Figure 1.24: Granular GHMs blocks distribution (patients, AMO, all years included)

Répartition de l'effectif de patients des top groupes - CMU-C  
(toutes années confondues)



Grp\_clin,total distinct d'anonyme,% sur le total Total distinct d'anonyme et moyenne de cost. La couleur affiche des détails associés au/a la grp\_clin. La taille correspond au/a la total distinct d'anonyme. Les repères sont étiquetés par grp\_clin,total distinct d'anonyme,% sur le total Total distinct d'anonyme et moyenne de cost. Les données sont filtrées sur raison, qui conserve CMU-C. La vue est filtrée sur grp\_clin, qui conserve 15 membres sur 21.

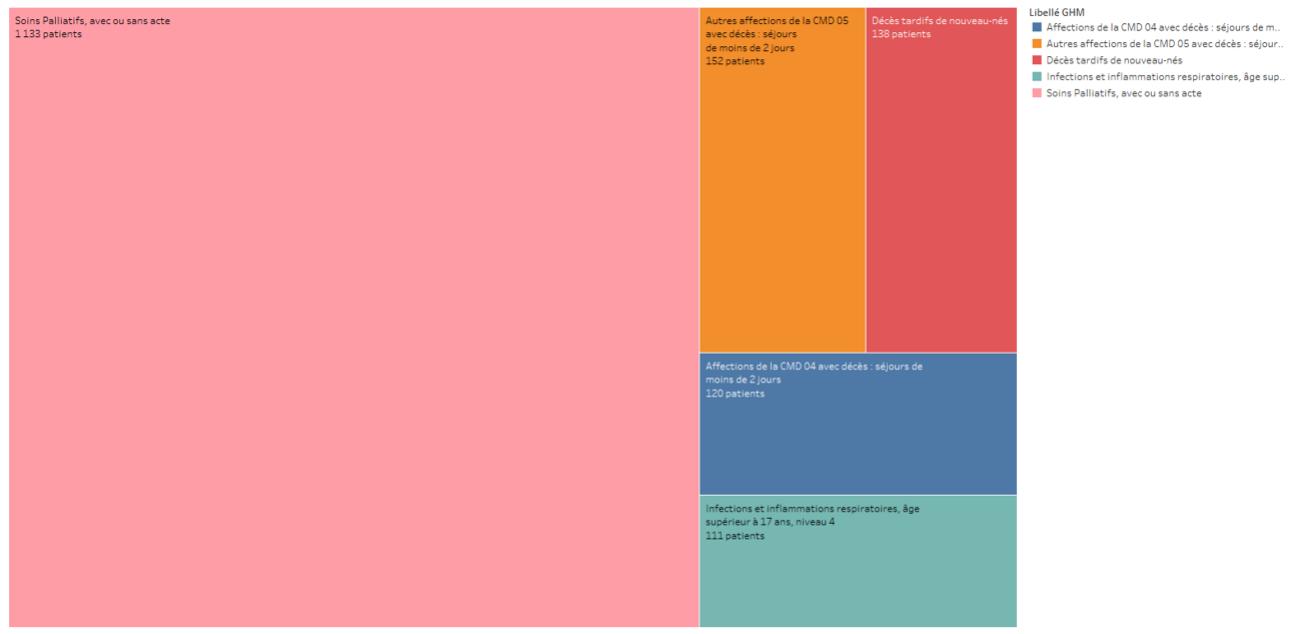
Figure 1.25: Granular GHMs blocks distribution(patients, CMU-C, all years included)

#### 1.2.4 GHMs associated with mortality distribution

The data reveals that beyond the palliative care GHM that is dominant across all systems, there is some differentiating factors between systems. SUV features hepatobiliary or pancreatic disorders, as well as respiratory infections and inflammations and premature newborn deaths as GHMs associated with death. Whereas AME's distribution is less diverse and contains specifically late newborn deaths and respiratory infections and inflammations GHMs. AMO and CMU-C death related GHMs distribution is again more fragmented and features GHMs pertaining to oncology, respiratory disorders and cardiology.

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

Répartition de l'effectif de patients des top ghm liés à la mort - AME  
(toutes années confondues)



Libellé GHM total distinct de anonyme. La couleur affiche des détails associés au/à la Libellé GHM. La taille correspond au/à la total distinct de anonyme. Les repères sont étiquetés par Libellé GHM total distinct de anonyme. Les données sont filtrées sur le/la Death,raison=Death. Le filtre Death conserve Dead. Le filtre raison conserve AME. La vue est filtrée sur total distinct de anonyme, qui inclut les valeurs supérieures ou égales à 97.

Figure 1.26: Death GHMs blocks distribution(patients, AME, all years included)

Répartition de l'effectif de patients des top ghm liés à la mort - SUV  
(toutes années confondues)



Libellé GHM total distinct de anonyme. La couleur affiche des détails associés au/à la Libellé GHM. La taille correspond au/à la total distinct de anonyme. Les repères sont étiquetés par Libellé GHM total distinct de anonyme. Les données sont filtrées sur le/la Death,raison=Exclusions (grn\_gro.Libellé GHM). Le filtre Death conserve Dead. Le filtre raison conserve SUV. Le filtre Exclusions (grn\_gro.Libellé GHM) conserve 2 471 membres. La vue est filtrée sur total distinct de anonyme, qui inclut les valeurs supérieures ou égales à 21.

Figure 1.27: Death GHMs blocks distribution(patients, SUV, all years included)

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

Répartition de l'effectif de patients des top ghm liés à la mort - AMO Hors CMU-C  
(toutes années confondues)



Libellé GHM total distinct de anonyme. La couleur affiche des détails associés au/a la Libellé GHM. La taille correspond au/a la total distinct de anonyme. Les repères sont étiquetés par Libellé GHM total distinct de anonyme. Les données sont filtrées sur le/la Deathtraison. Le filtre Death conserve Dead. Le filtre raison conserve AMO hors CMU-C. La vue est filtrée sur total distinct de anonyme, qui inclut les valeurs supérieures ou égales à 304.

Figure 1.28: Death GHMs blocks distribution(patients, AMO, all years included)

Répartition de l'effectif de patients des top ghm liés à la mort - CMU-C  
(toutes années confondues)



Libellé GHM total distinct de anonyme. La couleur affiche des détails associés au/a la Libellé GHM. La taille correspond au/a la total distinct de anonyme. Les repères sont étiquetés par Libellé GHM total distinct de anonyme. Les données sont filtrées sur le/la Deathtraison. Le filtre Death conserve Dead. Le filtre raison conserve CMU-C. La vue est filtrée sur total distinct de anonyme, qui inclut les valeurs supérieures ou égales à 146.

Figure 1.29: Death GHMs blocks distribution(patients, CMU-C, all years included)

### 1.2.5 Yearly evolution of patients contingents for the most represented GHMs groups

AMO systems features a great stability brought time of the top GHMs group patient counts. This is not the case for AME and CMU-C systems that experienced a large drop of abortions. This large dwindle is not featured in the SUV case where abortion remains relatively stable over the 10 year period. Interestingly enough, we observe peaks for child deliveries without complications in 2013 and 2017 for CMU-C and in 2016 for SUV.

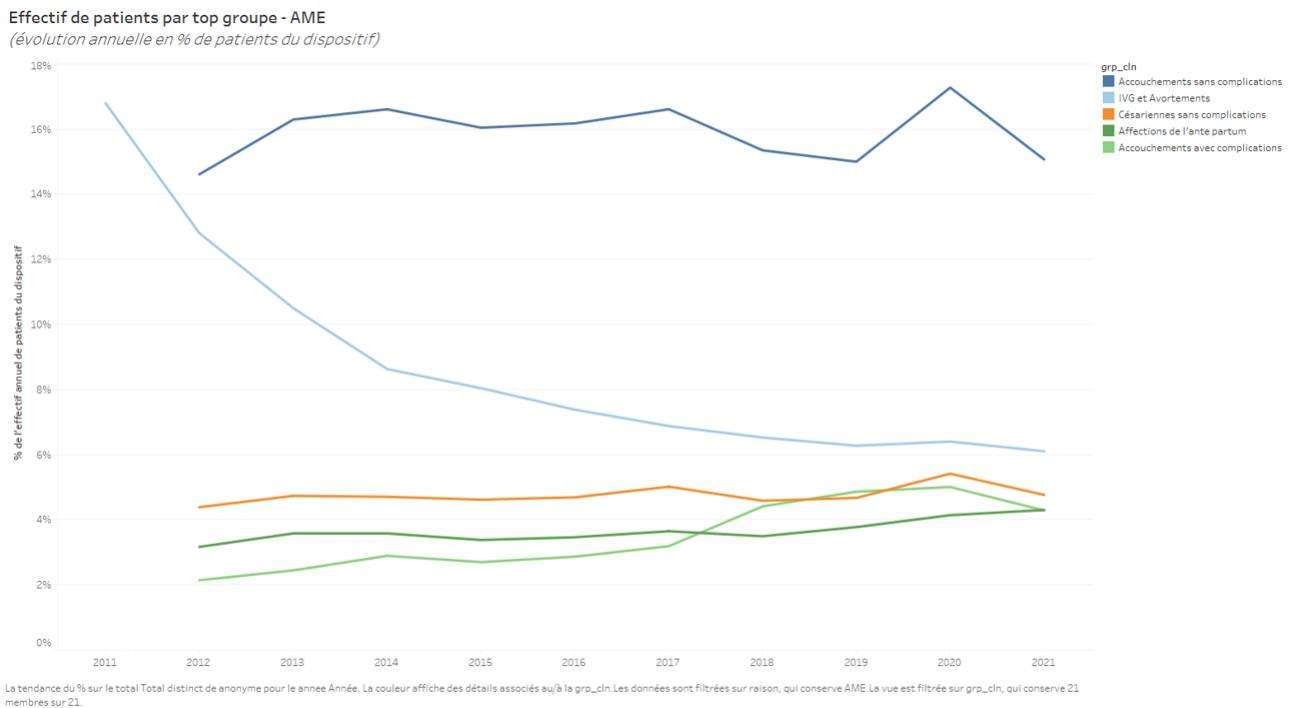


Figure 1.30: Yearly evolution of top GHMs groups (patients, AME)

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

**Effectif de patients par top groupe - SUV**  
(évolution annuelle en % de patients du dispositif)

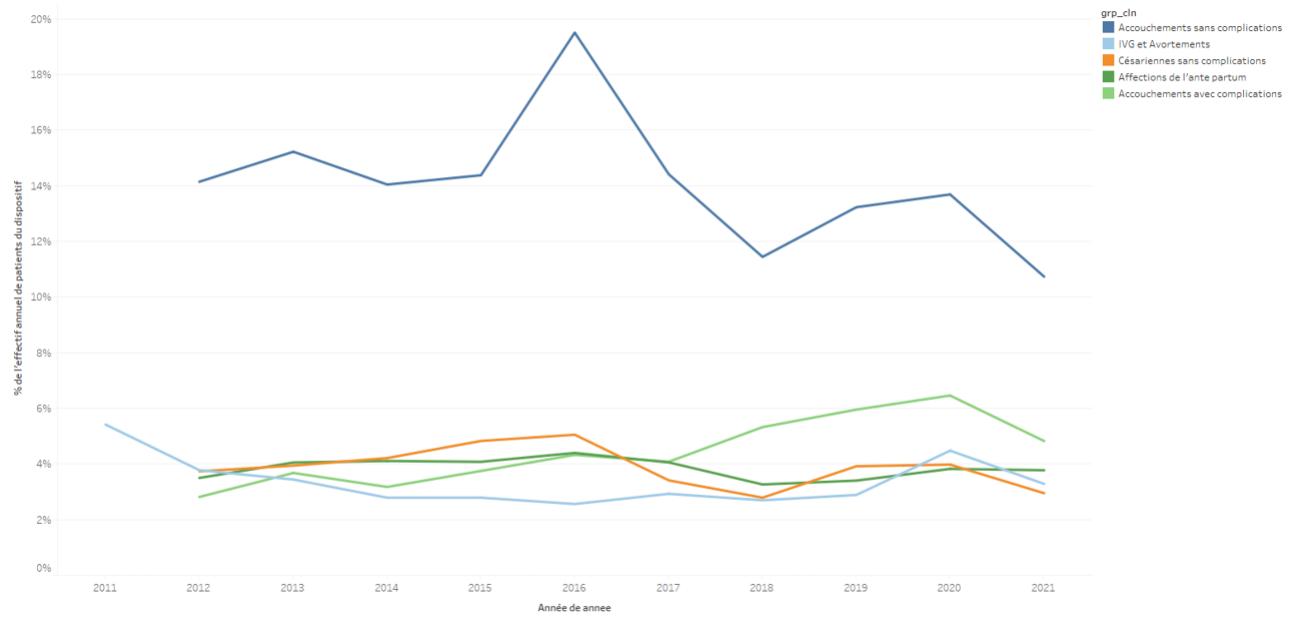


Figure 1.31: Yearly evolution of top GHMs groups (patients, SUV)

**Effectif de patients par top groupe - AMO hors CMU-C**  
(évolution annuelle en % de patients du dispositif)

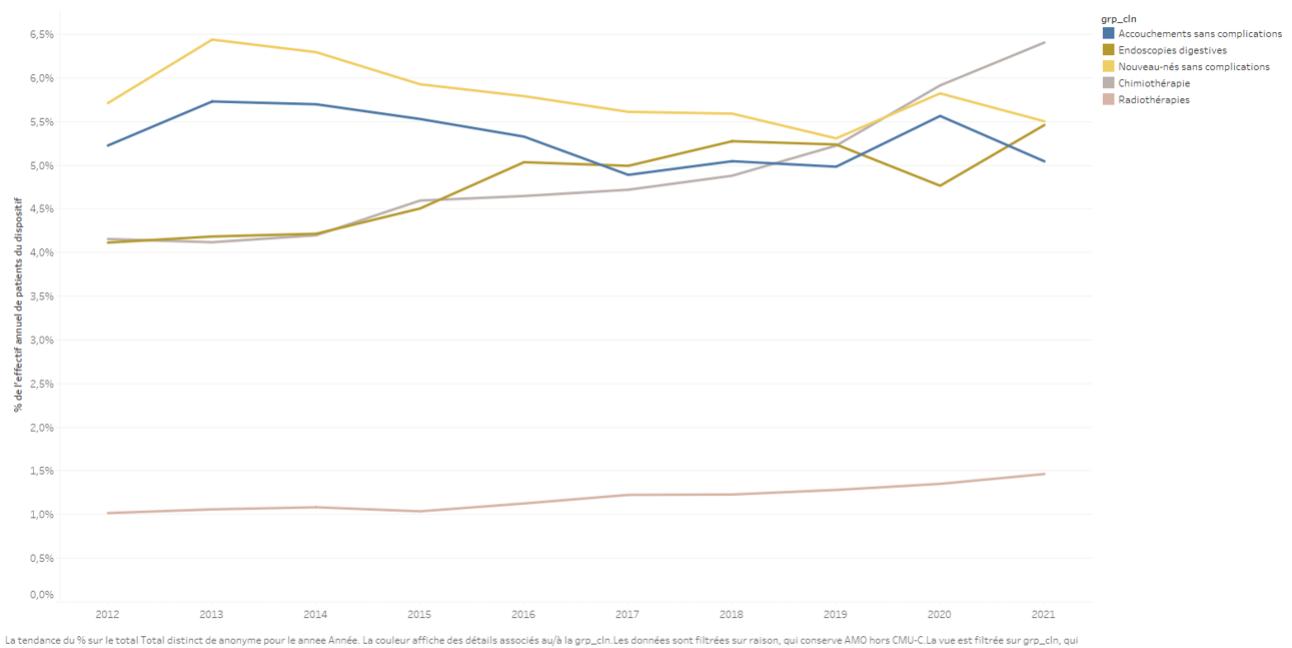


Figure 1.32: Yearly evolution of top GHMs groups (patients, AMO)

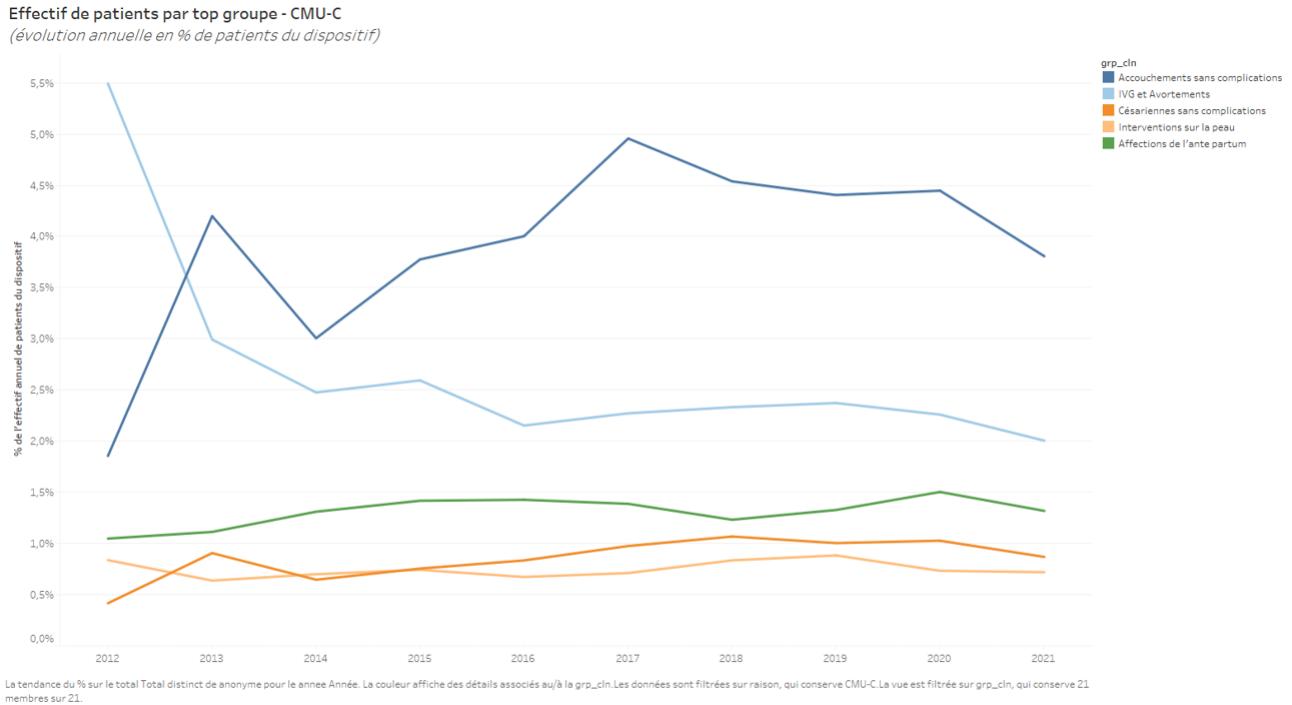


Figure 1.33: Yearly evolution of top GHMs groups (patients, CMU-C)

### 1.2.6 Critical Care Analysis

In this section we analyze the critical care differences between systems by leveraging two notions :

1. GHMs encoded with a severity gradation ( makes up for about one third of all GHMs
2. Critical care supplement recorded in terms of days and used in stay cost computation

We will proceed by distinguishing a *static* analysis all year included and a *dynamic* one where we observe yearly evolution. We will finally focus on the actual GHMs blocks that participate most in critical care.

#### Static

We observe that SUV system has the most important proportion of level 4 severity stays (7%), CMU-C having the largest proportion of level 1 severity stays(24%). A chisquare test insures us that stays severity level is not statistically independent from systems. Furthermore, SUV system has the largest proportion of stays with at least one supplement (7%) and the highest mean supplement (0.65 days) denoting an especially fragile population. The AMO base system is at the other end of the spectrum featuring only 0.3 days of mean supplement and 4.5% of its population with at least one supplement. AME case stands up as it is characterized by a small percentage of its population with supplement (4.5%) and a rather high mean supplement (0.45 days)

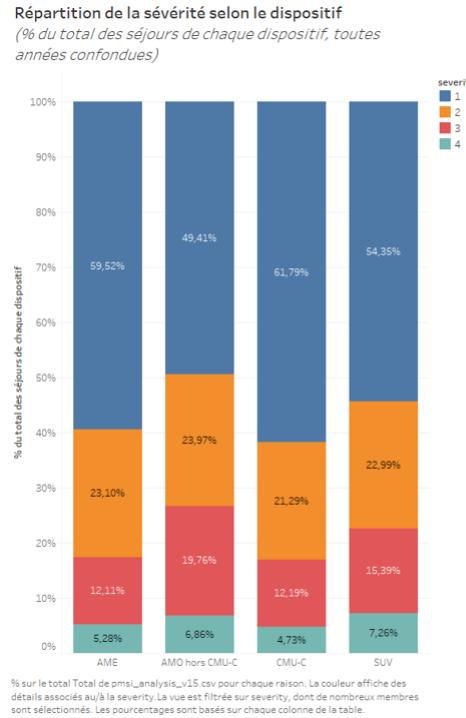


Figure 1.34: Severity distribution across systems (AYI)

Part des séjours avec au moins un supplément  
(par dispositif, toutes années confondues)

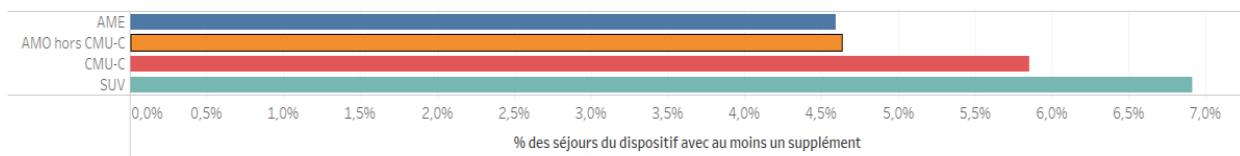


Figure 1.35: Proportion of stays with at least one supplement distribution (AS,AYI)

Supplément moyen par dispositif  
(en jours, tous suppléments confondus, toutes années confondues)

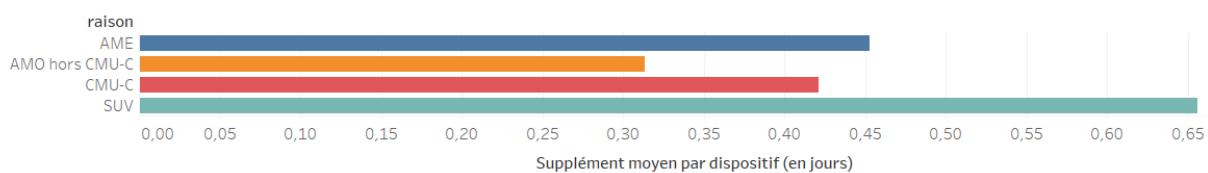


Figure 1.36: Mean supplement in terms of days distribution(AS,AYI)

## Dynamic

In terms of severity levels distribution evolution we notice a similar pattern across all systems. A sensible decrease of the level 1 from 2012 to 2021 accompanied with mostly an sizeable increase of level 3 and 4 severities that nearly doubled over that time period.

Regarding supplement stays proportion evolution, we can distinguish two group of systems. AME and AMO that remained within the a relatively tight percentage range between 4.2% and 4.8%. SUV and CMU-C that both experienced large fluctuations. CMU-C exhibits a roughly steady increase from 5.3% to 6.2%. SUV's evolution is more chaotic, with a massive dwindle from 2015 to 2016 at 6.1%, it has overall increased from 6.2% to 6.9% in 2021 culminating at 7.4% in 2020.

Mean supplement evolution highlights 3 patterns. Stability with AMO's mean supplement remaining approximately stable through time. Increase within which we can distinguish the growth of CMU's mean from 0.38 to 0.45 days and the modest 0.04 days gain of AME featuring a peak at nearly 0.5 days in 2015. And finally the high volatility evolution of SUV, exhibiting an important surge of 0.24 days culminating at 0.8 days from 2012 to 2013 and a sizeable decrease the following years leading to 0.6 days of mean supplement in 2021.

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

Répartition de la sévérité pour le dispositif AME  
(% du total annuel des séjours, évolution annuelle)

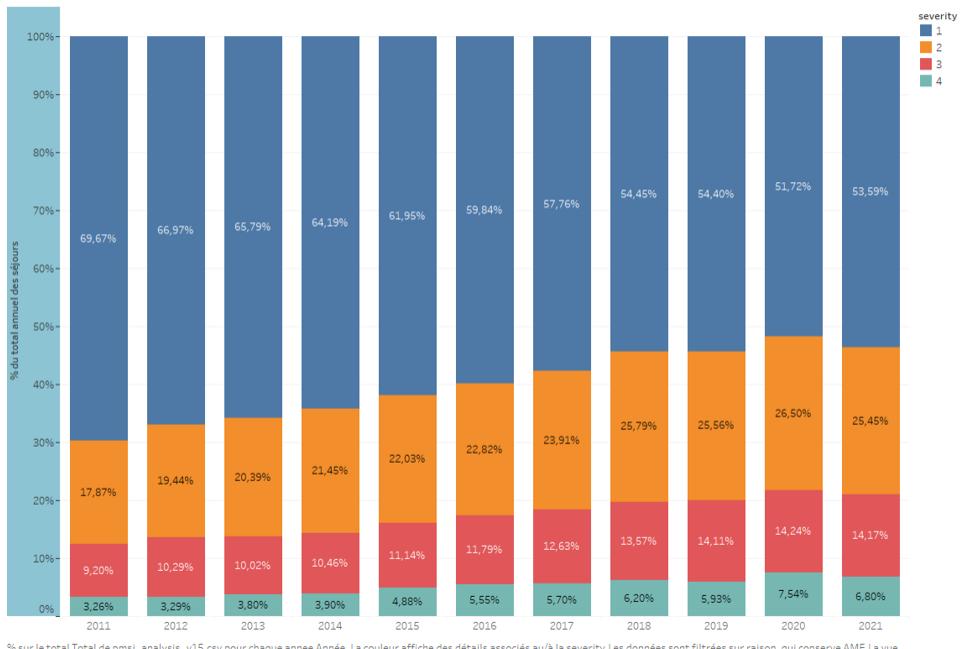


Figure 1.37: Severity distribution evolution (AME)

Répartition de la sévérité pour le dispositif SUV  
(% du total annuel des séjours, évolution annuelle)

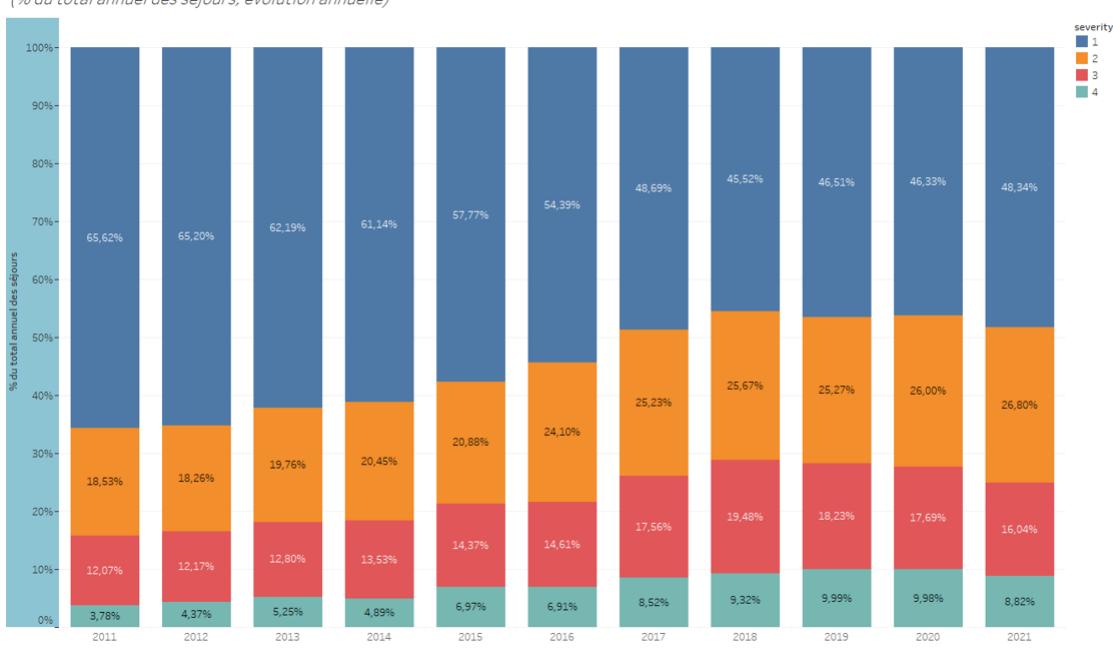
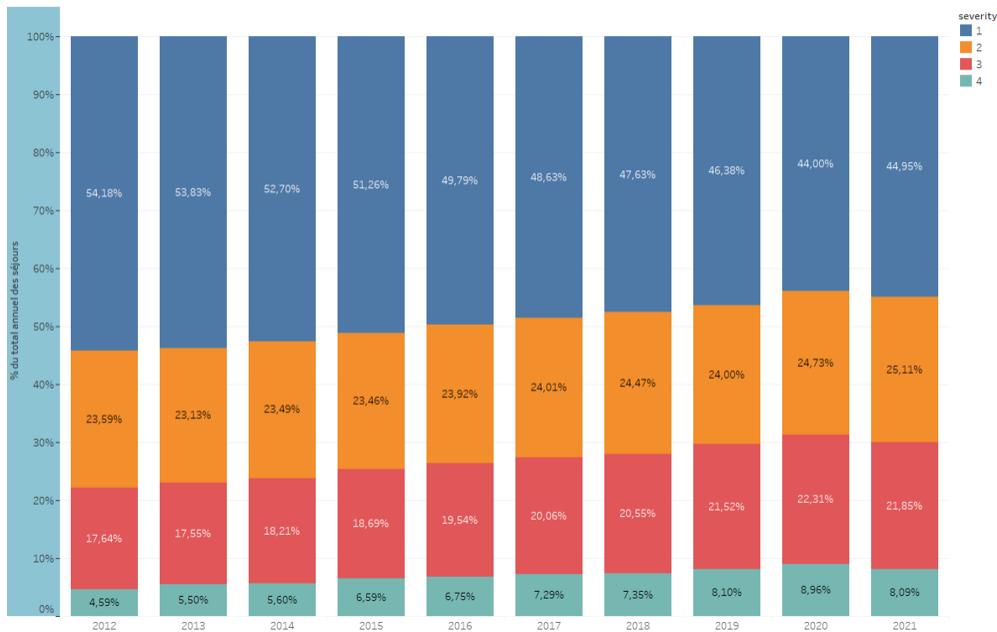


Figure 1.38: Severity distribution evolution (SUV)

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

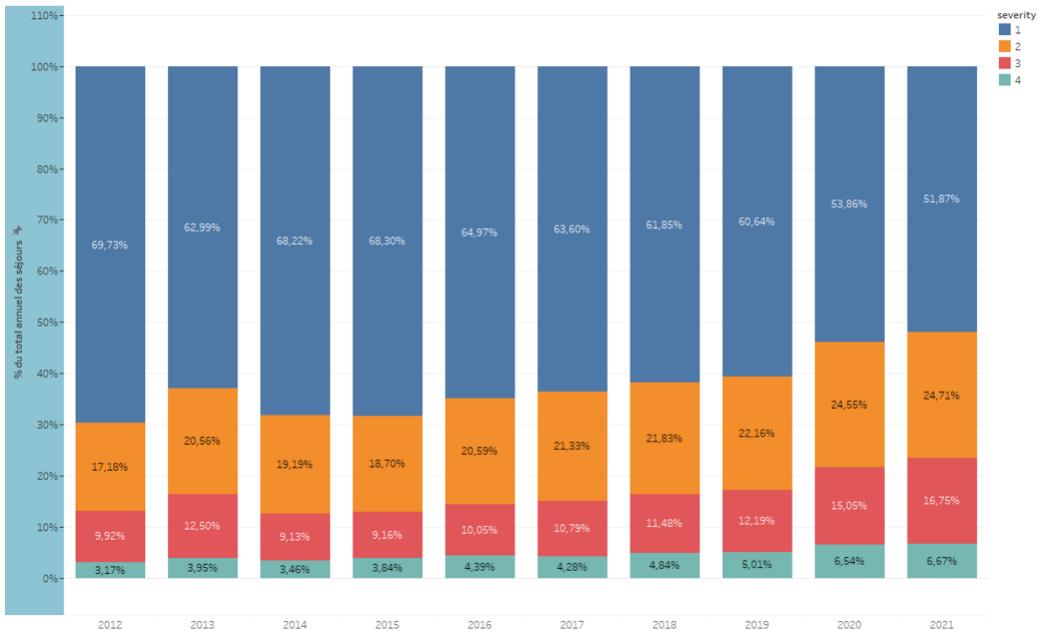
Répartition de la sévérité pour le dispositif AMO  
(% du total annuel des séjours, évolution annuelle)



% sur le total Total de pmsi\_Analysis\_v15.csv pour chaque année Année. La couleur affiche des détails associés au/à la severity. Les données sont filtrées sur raison, qui conserve AMO hors CMU-C. La vue est filtrée sur severity, dont de nombreux membres sont sélectionnés. Les pourcentages sont basés sur chaque colonne de la table.

Figure 1.39: Severity distribution evolution (AMO)

Répartition de la sévérité pour le dispositif CMU-C  
(% du total annuel des séjours, évolution annuelle)



% sur le total Total de pmsi\_Analysis\_v15.csv pour chaque année Année. La couleur affiche des détails associés au/à la severity. Les données sont filtrées sur raison, qui conserve CMU-C. La vue est filtrée sur severity, dont de nombreux membres sont sélectionnés. Les pourcentages sont basés sur chaque colonne de la table.

Figure 1.40: Severity distribution evolution (CMU)

**Part des séjours avec au moins un supplément  
(par dispositif, évolution annuelle)**

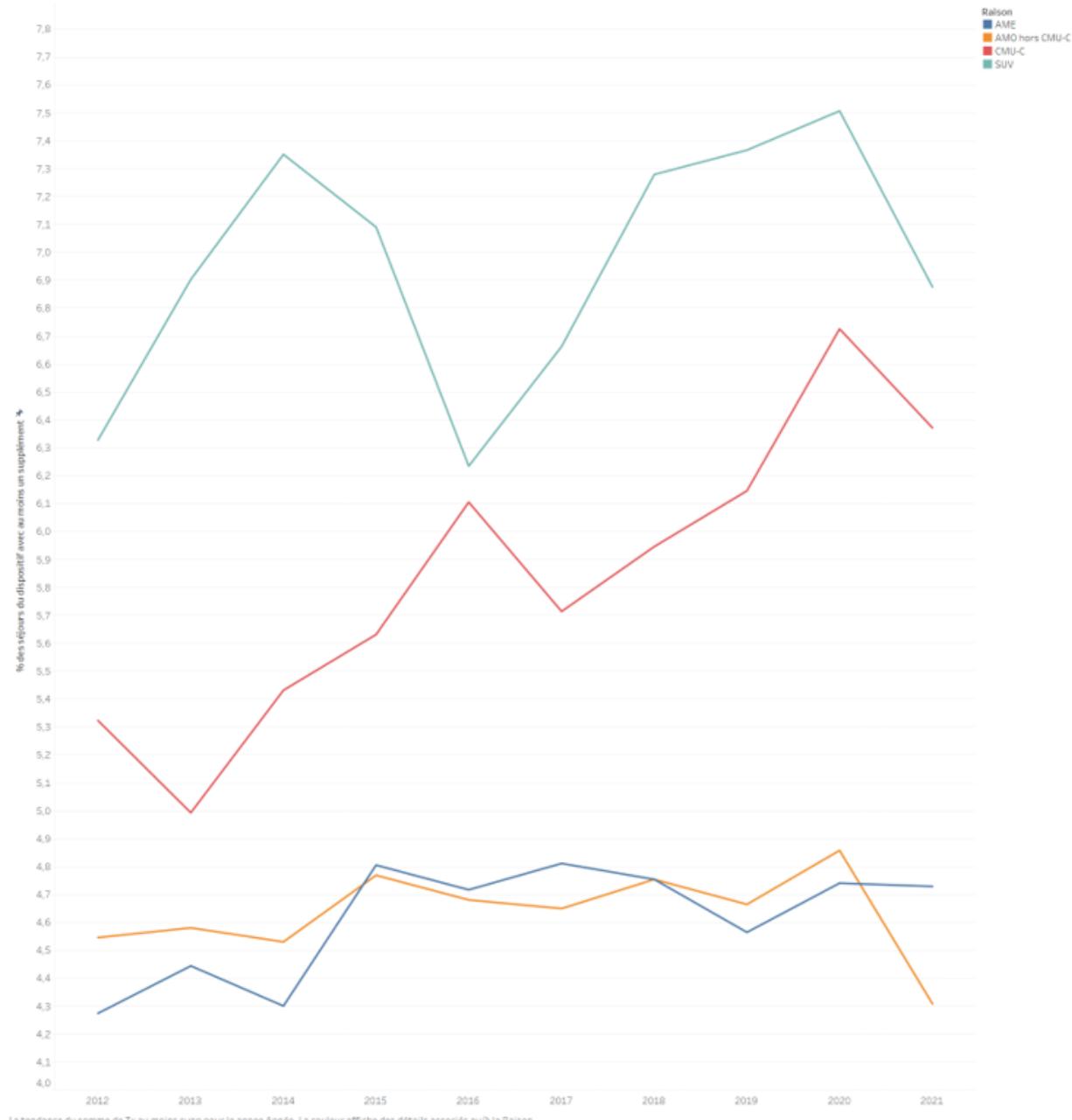


Figure 1.41: Supplement stays proportion evolution (AS)

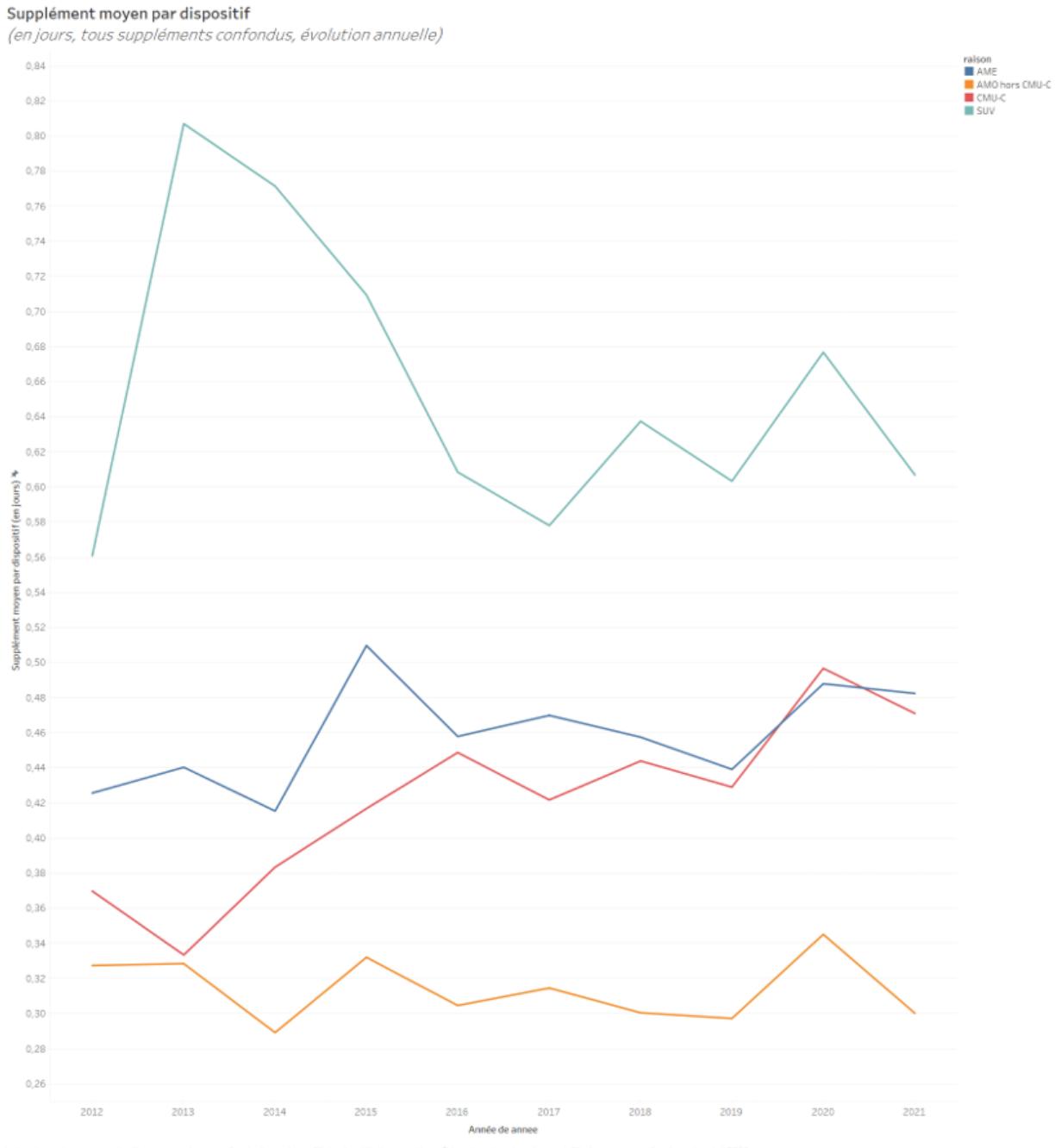


Figure 1.42: Mean supplement evolution (AS)

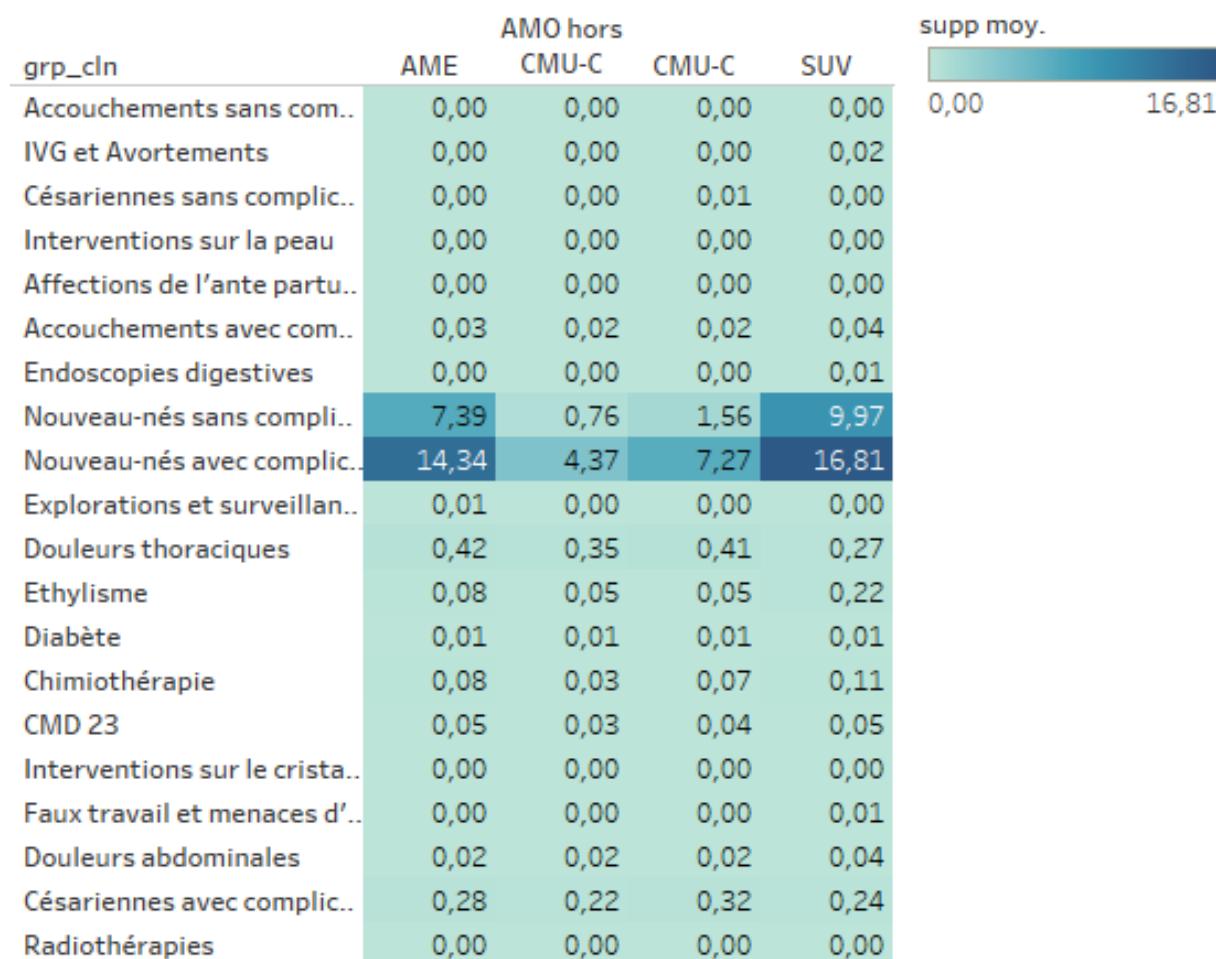
### Critical care accross GHMs blocks and systems

The two following tables allow us to apprehend which are the GHMs blocks that are the most targeted by critical care. Analyzing the mean supplement across all the critical range, we notice a cross system pattern : neonatology has the highest mean supplement. When we further this analysis by not taking into account neonatology supplement. Doing

so, we observe two cross systems GHMs block with high mean supplement : chest pain and caesarean section with complication. SUV system distinguishes itself by featuring two more GHMs blocks with high mean supplement : alcoholism and chemotherapy.

## Supplément moyen par groupe selon le dispositif

(en jours, toutes années confondues)

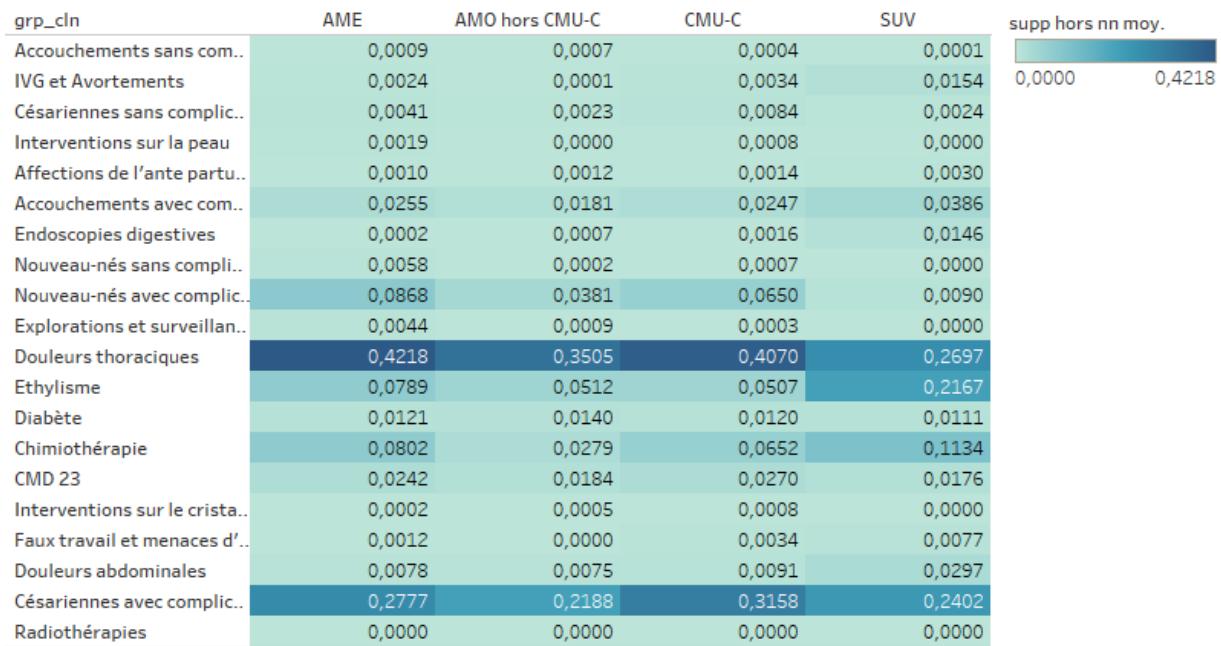


Moyenne de supp représenté selon raison vs. grp\_cln. La couleur met en avant le/la moyenne de supp. Les repères sont étiquetés par moyenne de supp. La vue est filtrée sur grp\_cln, qui exclut Autres.

Figure 1.43: Mean supplements across GHMs blocks and systems(AYI)

### Supplément moyen par groupe selon le dispositif

(en jours, toutes années confondues - suppléments de néonatalogie exclus)



Moyenne de supp hors nn représenté selon raison vs. grp\_cln. La couleur met en avant le/la moyenne de supp hors nn. Les repères sont étiquetés par moyenne de supp hors nn. La vue est filtrée sur grp\_cln, qui exclut Autres.

Figure 1.44: Mean supplements across GHMs blocks and systems(AYI, neonatology excluded)

### 1.2.7 Cost analysis

In this section, we break up the cost analysis in two usual groups : *static* and *dynamic*. Whithin the *static* analysis, in addition to total cost and mean cost description , we will project total cost on the granular GHMs blocks to determine which are the most financially prominent GHMs across systems.

#### Static

Total stays cost across systems highlights AME system as the second most expensive system costing 2.5 billion euros from 2011 to 2021 just marginally below AMO. This is due to the very large number of stays compared to the patient count resulting from GHMs that requires reoccurring stays (mainly hemodialysis and all GHMs in *CMD Séances*)

Regarding mean stay cost, there are roughly the identical for AME, AMO and CMU-C at about 2500 euros. SUV stands out with a 1100 euros premium at 3600 euros mean stay cost. This difference can be thought of as illustrating the fragility of SUV's population.

In terms of big GHM blocks contribution to the total cost of each system, we notice a clear divide between the migrant target systems that have obstetrics/genecology making up the majority of their total cost with 60% for AME and up to 77% for SUV. CMU-C's total cost is splitted evenly across blocks whereas Oncology is predominant in AMO's total cost at about 60%. These observations are consistant with the fact that AMO's age distribution is skewed towards more senior people whereas SUV's and AME's is skewed towards a younger population.

The last chart just details this picture by underlyning the fact that most of AMO's oncology cost is due to chemotherapy and most of SUV's and AME's obstetrics/gynecology cost is made up by regular childbirths and caesarean section without complications.

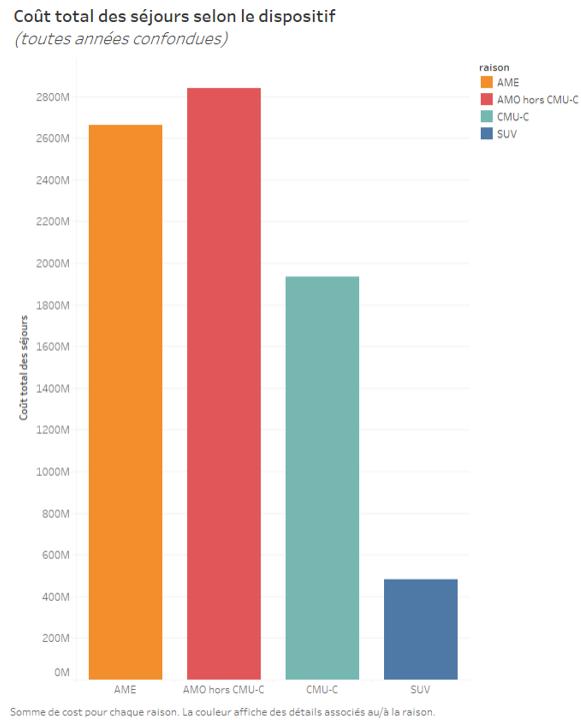


Figure 1.45: Total cost of stays (AC, AYI)

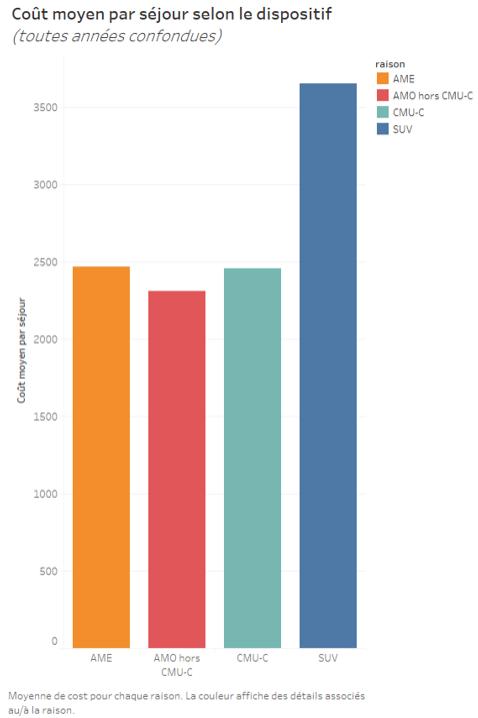


Figure 1.46: Mean cost of stays (AC, AYI)

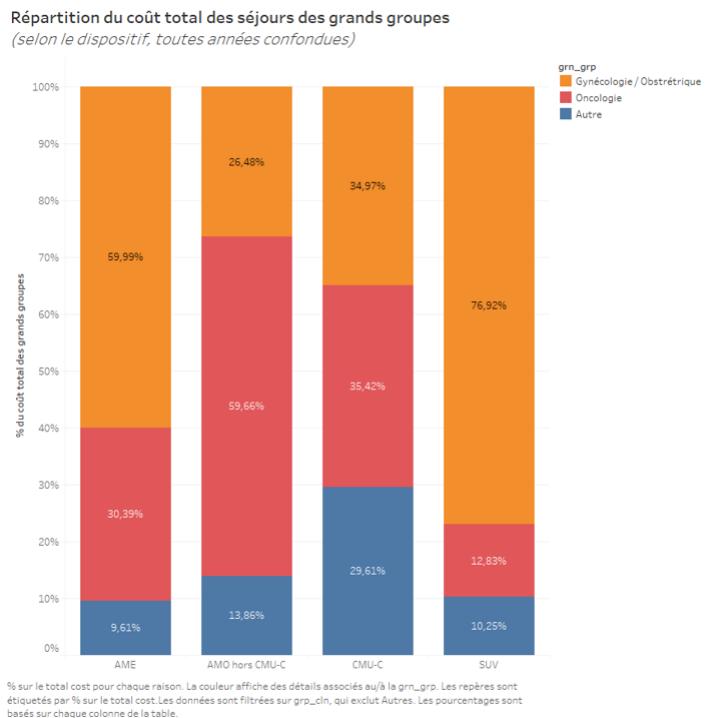


Figure 1.47: Total cost of the big GHM blocks (in term of stays, AC, AYI)

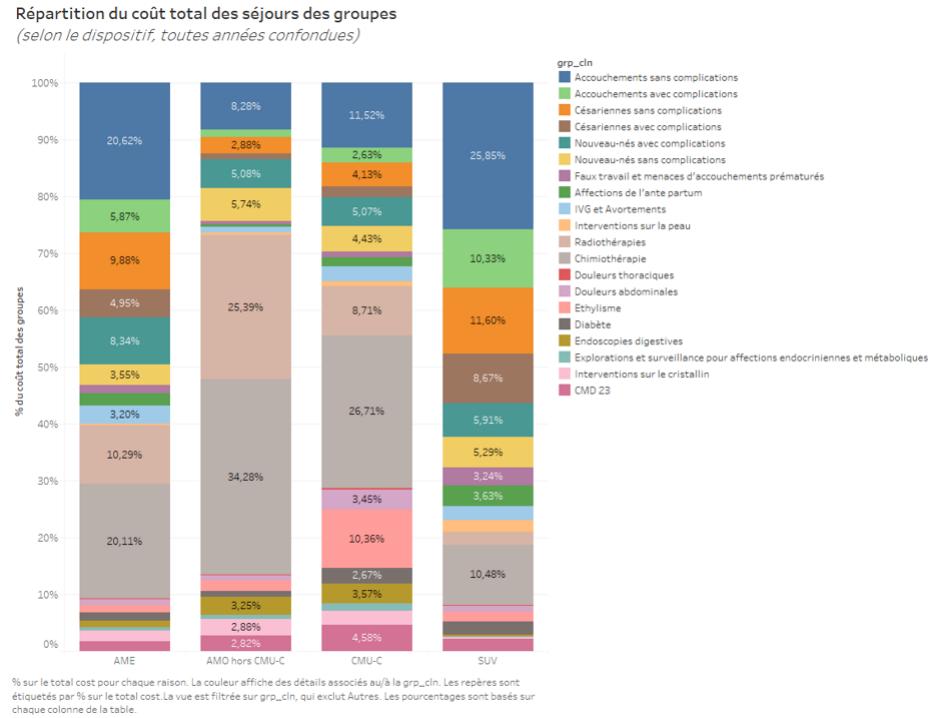


Figure 1.48: Total cost of the granular GHM blocks (in term of stays, AC, AYI)

## Dynamic

Total cost evolution is characterized by an increasing pattern across all systems. SUV went from about 20M euros in 2011 to over 40M in 2021. AME doubles its total cost from 120m euros to around 270M euros in 2021. AMO's envelope slightly whereas CMU-C's exhibits a peculiar evolution with a massive 180M euros drop from 2013 to 2014 and steady increase culminating at 300M euros in 2021.

Total cost yearly evolution is characterized by an increasing pattern across all systems. SUV went from about 20M euros in 2011 to over 40M in 2021. AME doubles its total cost from 120m euros to around 270M euros in 2021. AMO's envelope slightly whereas CMU-C's exhibits a peculiar evolution with a massive 180M euros drop from 2013 to 2014 and steady increase culminating at 300M euros in 2021.

Patient mean cost is relatively stable during the time period for all systems, with a convergence at 5000 euros per patient in 2021 for SUV that dwindled, AME and AMO. CMU-C lies behind and evolved from 4000 euros in 2012 to 4500 euros in 2021.

## CHAPTER 1. DESCRIPTIVE ANALYSIS OF HOSPITAL CARE ACCESS SYSTEMS

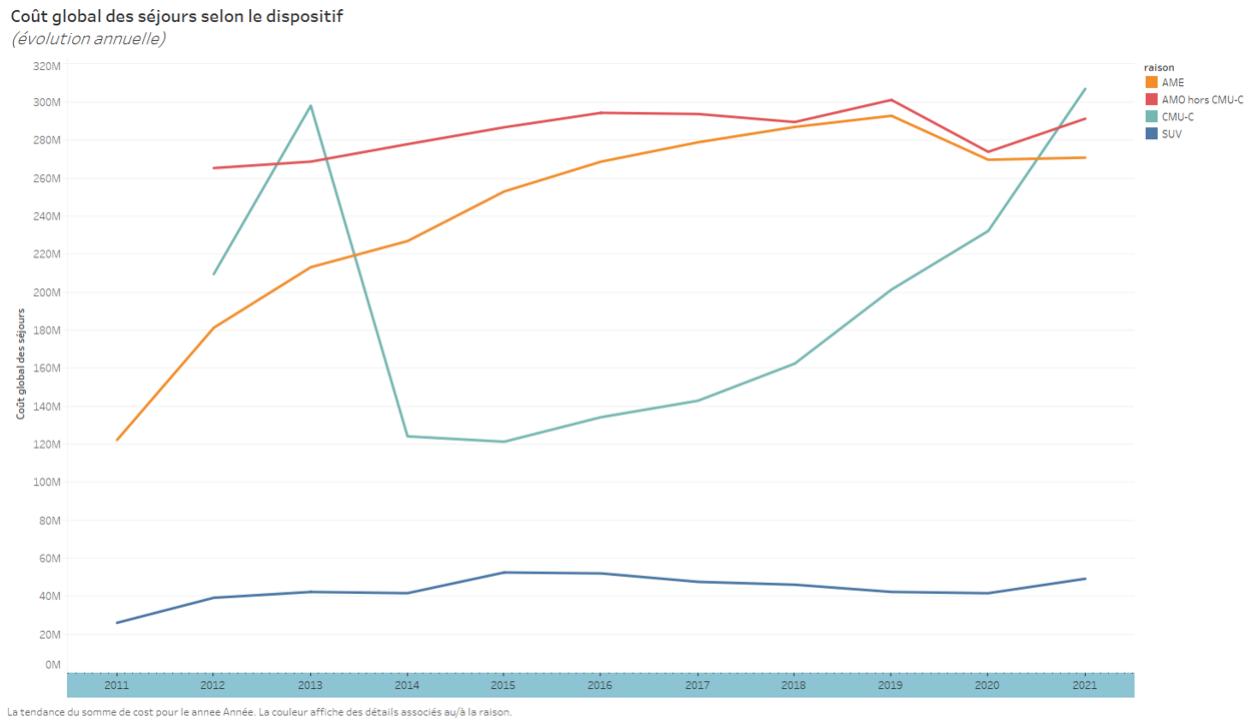


Figure 1.49: Total cost evolution (AC)

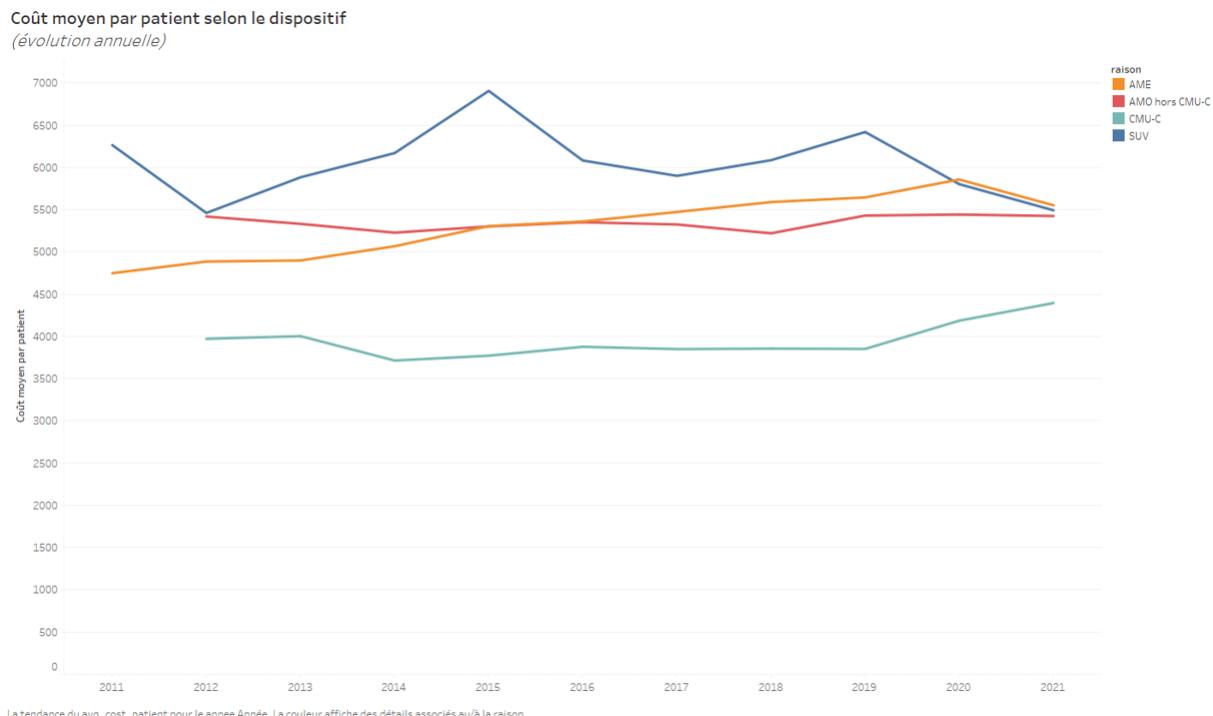


Figure 1.50: Mean cost evolution (AC)

### 1.3 Séances GHM focus

This section explores the CMD *Séances* pertaining to reoccurring care. Our analysis will be broken in two parts :

1. Understanding to what extend reoccurring stays differ from a system to another by scrutinizing the mean number of stays per patients as well as the mean duration of this stays across systems
2. Characterizing the total and mean cost of hemodialysis across systems and age class

#### Mean number of stays and mean duration of reoccurring stays across systems

AME stands out as being an outlier when it comes to the mean number of stays(mns). This system has the highest mns for every single subgroups of *CMD Séances*, hemodialysis contrasting the most with 86 mns per patient in the system. This underlines an important pattern in terms of population composition and care typology.

Regarding the mean stay duration(msd), AME's patients seems to have rather short stays. SUV exhibits the longest msd for chemotherapy at 0.76 days, CMU-C for hemodialysis at 0.6 days more than double that of AME.

#### Ventilation du *CMD Séances* sur le nombres de patients et séjours, pour chaque dispositif (toutes années confondues)

Libellé GHM (groupe)	SUV	AME	AMO hors CMU-C	CMU-C	
Chimiothérapie	1 695 (P) 5 747 (S) 3,39(SM)	13 577 (P) 99 813 (S) 7,35(SM)	23 741 (P) 174 559 (S) 7,35(SM)	10 863 (P) 56 375 (S) 5,19(SM)	2,61
	796 (P) 19 422 (S) 24,40(SM)	1 981 (P) 171 032 (S) 86,34(SM)	1 611 (P) 107 938 (S) 67,00(SM)	642 (P) 33 069 (S) 51,51(SM)	86,34
	126 (P) 1 706 (S) 13,54(SM)	2 887 (P) 58 779 (S) 20,36(SM)	6 984 (P) 130 188 (S) 18,64(SM)	1 360 (P) 22 562 (S) 16,59(SM)	
Autres	232 (P) 606 (S) 2,61(SM)	2 037 (P) 9 533 (S) 4,68(SM)	4 275 (P) 20 027 (S) 4,68(SM)	1 483 (P) 5 105 (S) 3,44(SM)	

(P): nombre de patients

(S): nombre de séances

(SM): séances moyennes par patient

Figure 1.51: CMD *Seances* mean number of stays (AC,AYI)

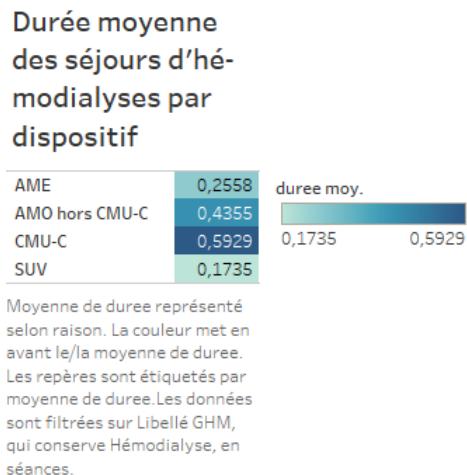


Figure 1.52: Hemodialysis mean stay duration (AC,AYI)

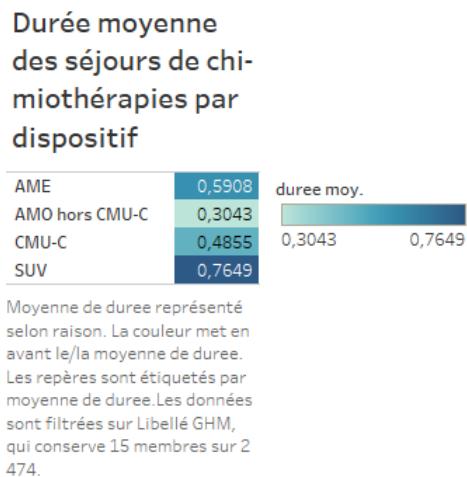


Figure 1.53: Chemotherapy mean stay duration (AC,AYI)

## Hemodialysis cost analysis

AME's total cost of hemodialysis illustrates the fact that this GHM is a defining factor for the population of this system. Despite having a lower contingent of patients, AME's cost is higher than the base system by a margin of 20M euros all years included. For the two other systems, the expense envelope is consistent with their population size.

When we focus on the mean cost (mc) of this GHM across age, we notice a logical increase of mc as the population gets older that is featured by all systems. The highest mc are surprisingly observed on the two general population systems, AMO from 0 to 35 year old and CMU-C from 36 to 89 year old.

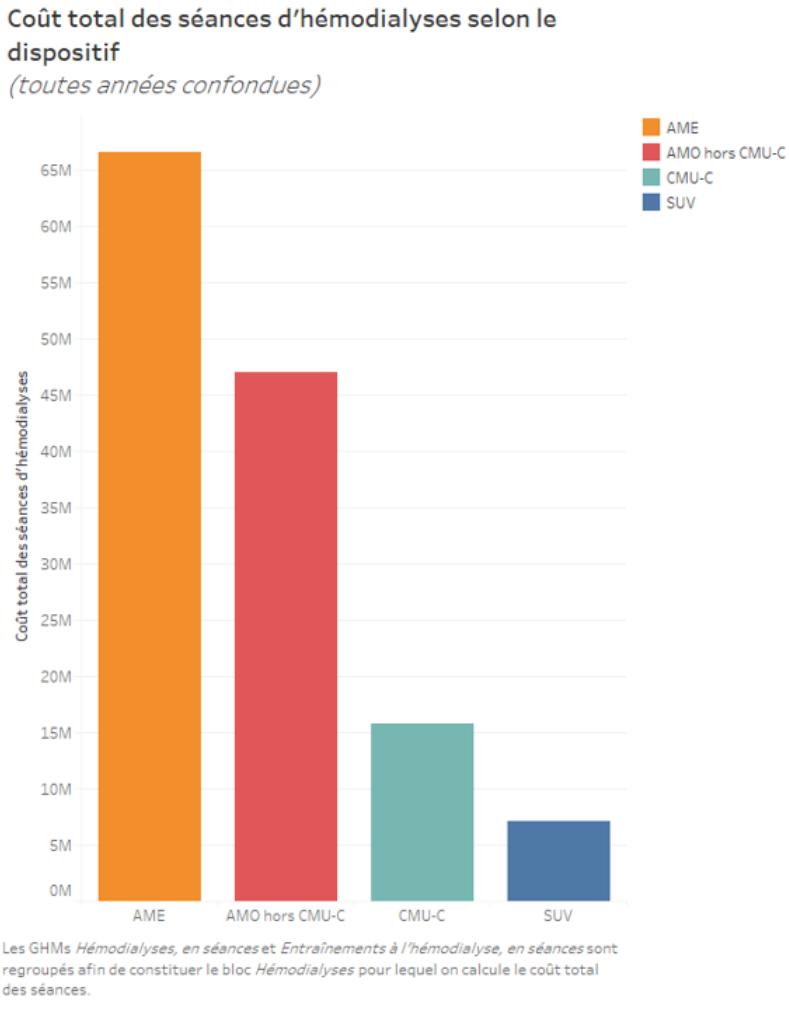


Figure 1.54: CMD *Seances* mean number of stays (AC,AYI)

Coût moyen des séjours hémodialyses (par séjour, selon le dispositif et toutes années confondues)

raison	age (classe)					cost moy.
	0 à 17 ans	18 à 35 ans	36 à 53 ans	54 à 71 ans	72 à 89 ans	
AME	337,5	375,3	387,7	389,1	406,4	318,8
AMO hors CMU-C	368,6	467,4	430,4	417,6	434,7	575,4
CMU-C	318,8	390,7	441,3	479,5	575,4	
SUV	318,8	376,2	354,7	362,0	318,8	

Moyenne de cost représenté selon age (classe) vs. raison. La couleur met en avant le/la moyenne de cost. Les repères sont étiquetés par moyenne de cost. Les données sont filtrées sur Libellé GHM, qui conserve Hémodialyse, en séances. La vue est filtrée sur age (classe), qui conserve 0 à 17 ans, 18 à 35 ans, 36 à 53 ans, 54 à 71 ans et 72 à 89 ans.

Figure 1.55: Hemodialysis mean stay duration (AC,AYI)

## Chapter 2

# Comparative analysis between social systems and the base system

In this section, we seek to quantify differences between systems through the computation of indicators pertaining to stays duration, critical care duration and overall stay cost. The main idea is to compare each of the social systems(SUV, AME, CMU-C) with base system (AMO) leveraging the notion of precariousness premium.

In other words, we aim at measuring how much more do social systems patients cost compared to the base system, how much more important their stays and critical care needs are as opposed to the base system. In addition to global mean difference across these indicators, we go further and propose a more sophisticated methodology. It consists in working on a GHM per GHM basis in order to qualify these differences for additional information regarding the clinical profile of patients. For each of the 2300 GHMs, we randomly match stays from the precarious system with stays from the base system on a 1:1 scheme. We then computed the differences (assuming social systems have higher values, and thus on the left part of the subtraction) and the associated 95% confidence intervals. We select a sub-sample of GHM where the global average *premium* is statistically significant by performing a Welch's t-test.

## **2.1 Stays duration analysis**

The number of GHMs for which the mean stay duration difference is statistically different is the following

1. 470 GHMs for SUV vs AMO
2. 453 GHMs for AME vs AMO
3. 212 GHMs for CMU-C vs AMO

This ranking clearly alludes to a gradation with regards to the precariousness of patient as opposed to the base system. The more targeted and specific the system, the more there is statistically significant differences with the general population.

In more details, we see that the most significant GHMs in terms of both mean difference in stay duration and confidence intervals across all social systems are related to surgical interventions (hip, leg, knee). For instance for SUV, we have an average *overduration* of stays of more than 35 days, ranging from about 15 to 95 days with a 95% confidence. An other interesting fact is the typical over representation of skin related condition GHMs for SUV system.

## CHAPTER 2. COMPARATIVE ANALYSIS BETWEEN SOCIAL SYSTEMS AND THE BASE SYSTEM

Difference in stay duration - AME vs AMO  
(mean days difference per GHM and 95% days difference confidence intervals)

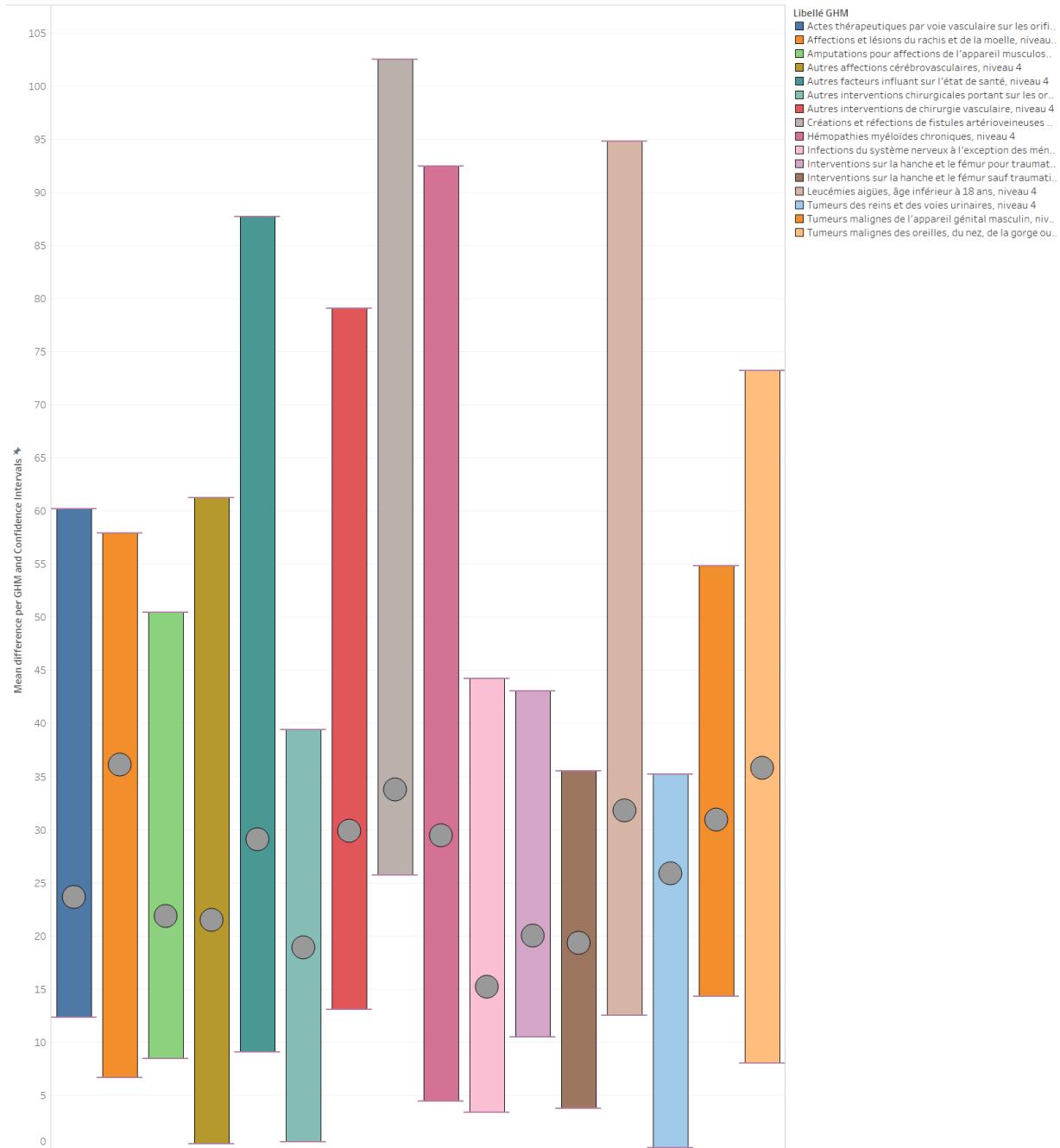


Figure 2.1: Difference in stay duration - AME vs AMO (AYI)

Difference in stay duration - SUV vs AMO  
(mean days difference per GHM and 95% days difference confidence intervals)

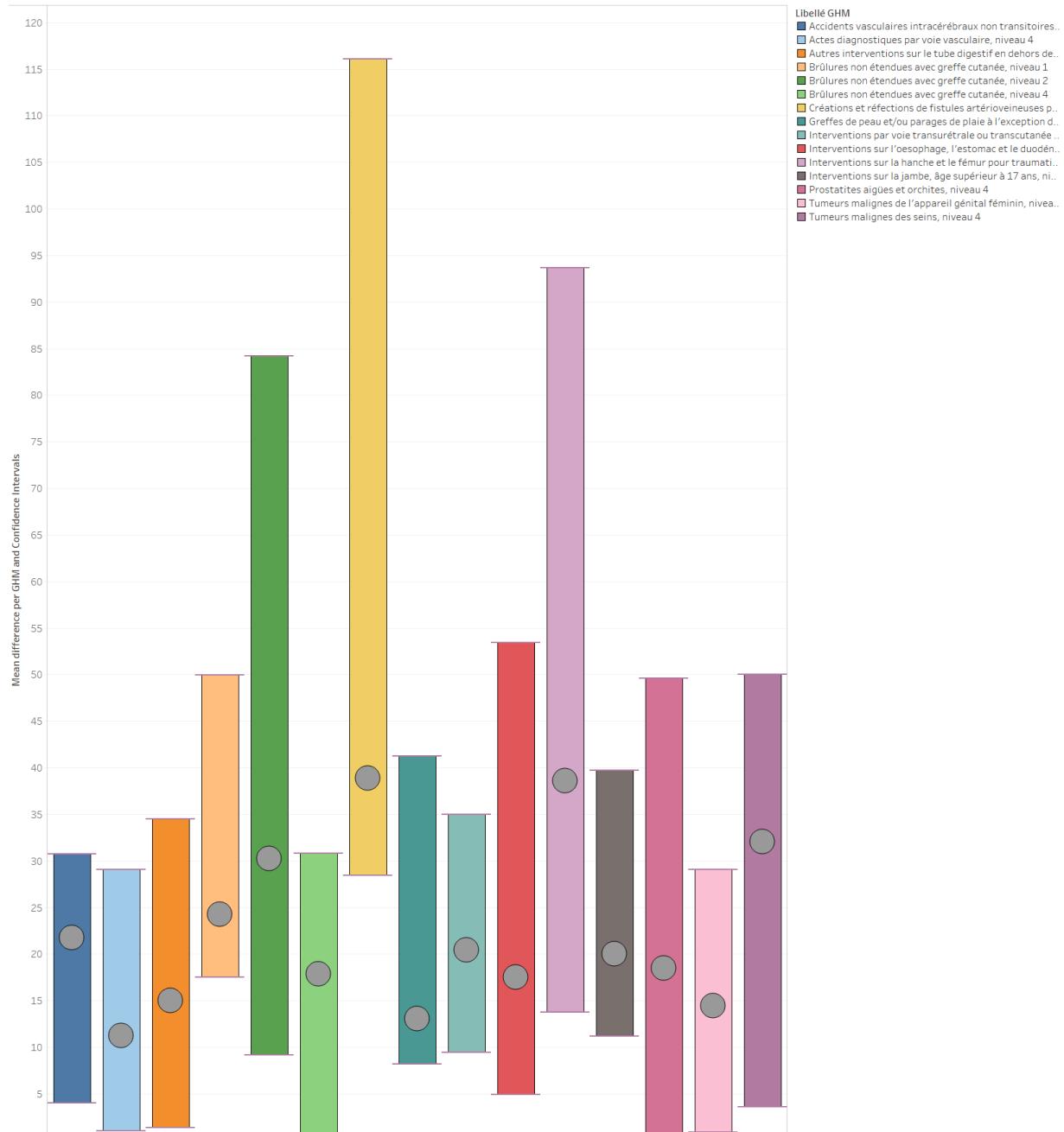


Figure 2.2: Difference in stay duration - SUV vs AMO (AYI)

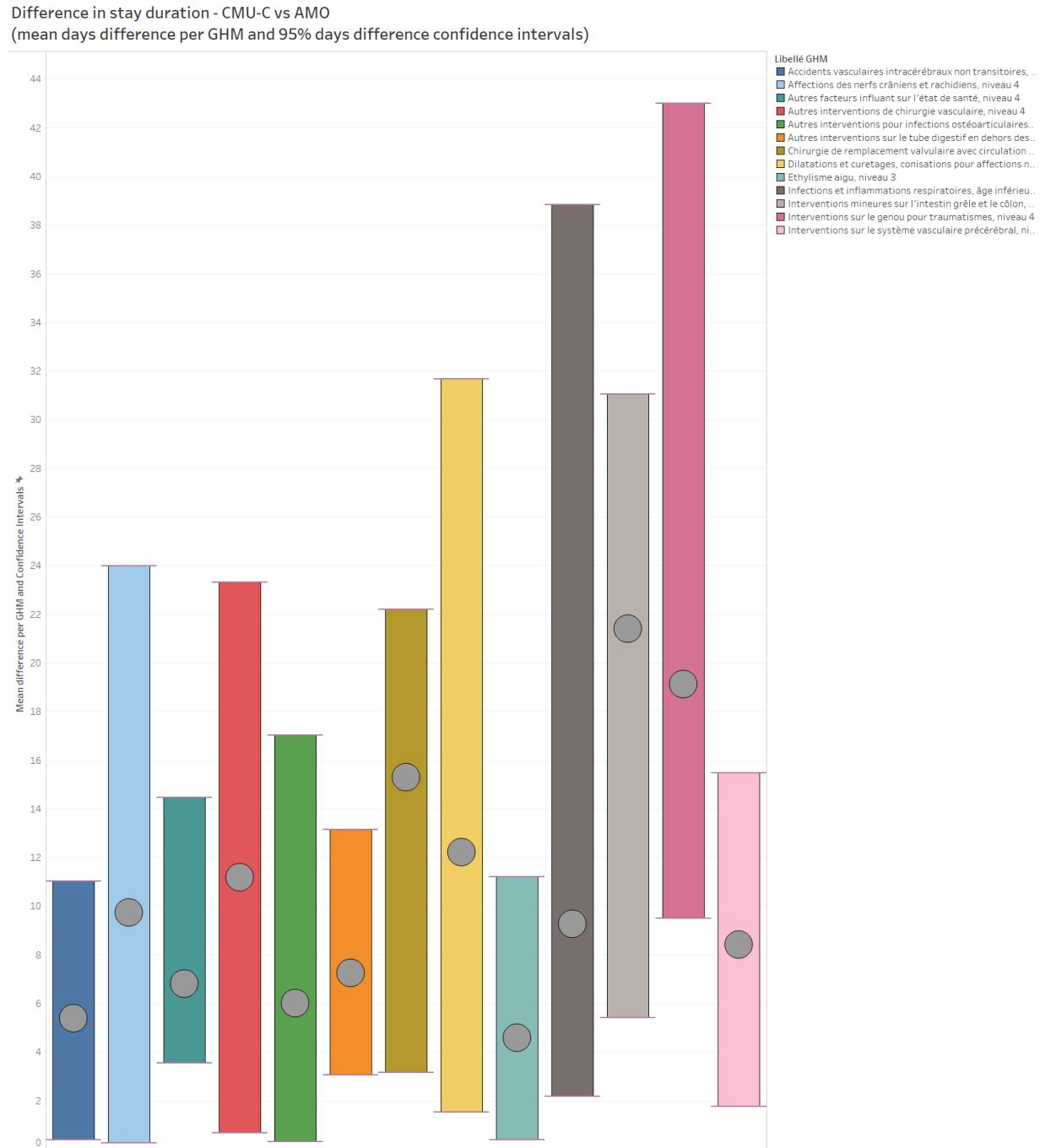


Figure 2.3: Difference in stay duration - CMU-C vs AMO (AYI)

## 2.2 Critical care duration analysis

By critical care duration we refer to all the supplement (in days) found in the PMSI that relate to some kind of complication : *intensive care units, continuous monitoring* etc. These have all been aggregated to create an indicator of critical care duration.

The number of GHMs for which the mean critical care duration difference is statistically different is the following

1. 63 GHMs for SUV vs AMO
2. 160 GHMs for AME vs AMO
3. 146 GHMs for CMU-C vs AMO

This ranking is not akin with the previous intuition. AME has the highest number of statistically significant differences, followed by CMU-C, SUV being largely behind. This suggests that even though SUV patients tend to have longer stays comparatively with other social systems, this is not due to the importance of critical care. It may reveal a structural bias in the way the stays are recorded in the public care IT systems.

Leveraging the charts, we can observe that the GHMs present for CMU-C are more fragmented than SUV and AME. The presence of acute level 4 alcoholism is particularly striking, with an average *overduration* of critical care 7 days ranging from less than a day to 21 days with a 95% confidence. We find acute leukemia GHM significant for both SUV and AME, with a greater mean and *overduration* range for SUV. The GHM structure is globally similar between these two systems as it relates especially to cancers and vascular interventions.

**CHAPTER 2. COMPARATIVE ANALYSIS BETWEEN SOCIAL SYSTEMS AND THE BASE SYSTEM**

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Difference in days of critical care - AME vs AMO  
(mean days difference per GHM and 95% days difference confidence intervals)

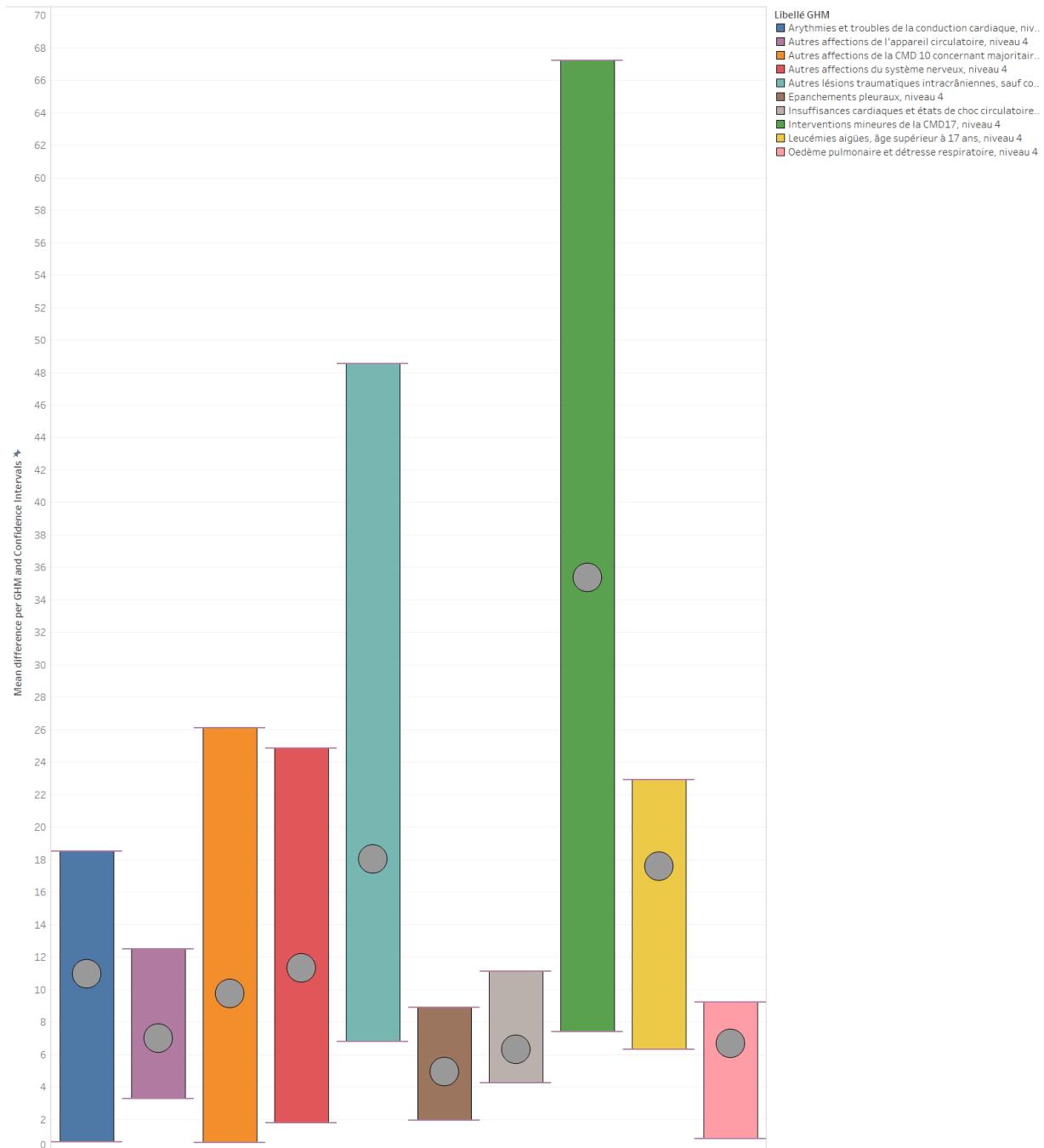


Figure 2.4: Difference in critical care duration - AME vs AMO (AYI)

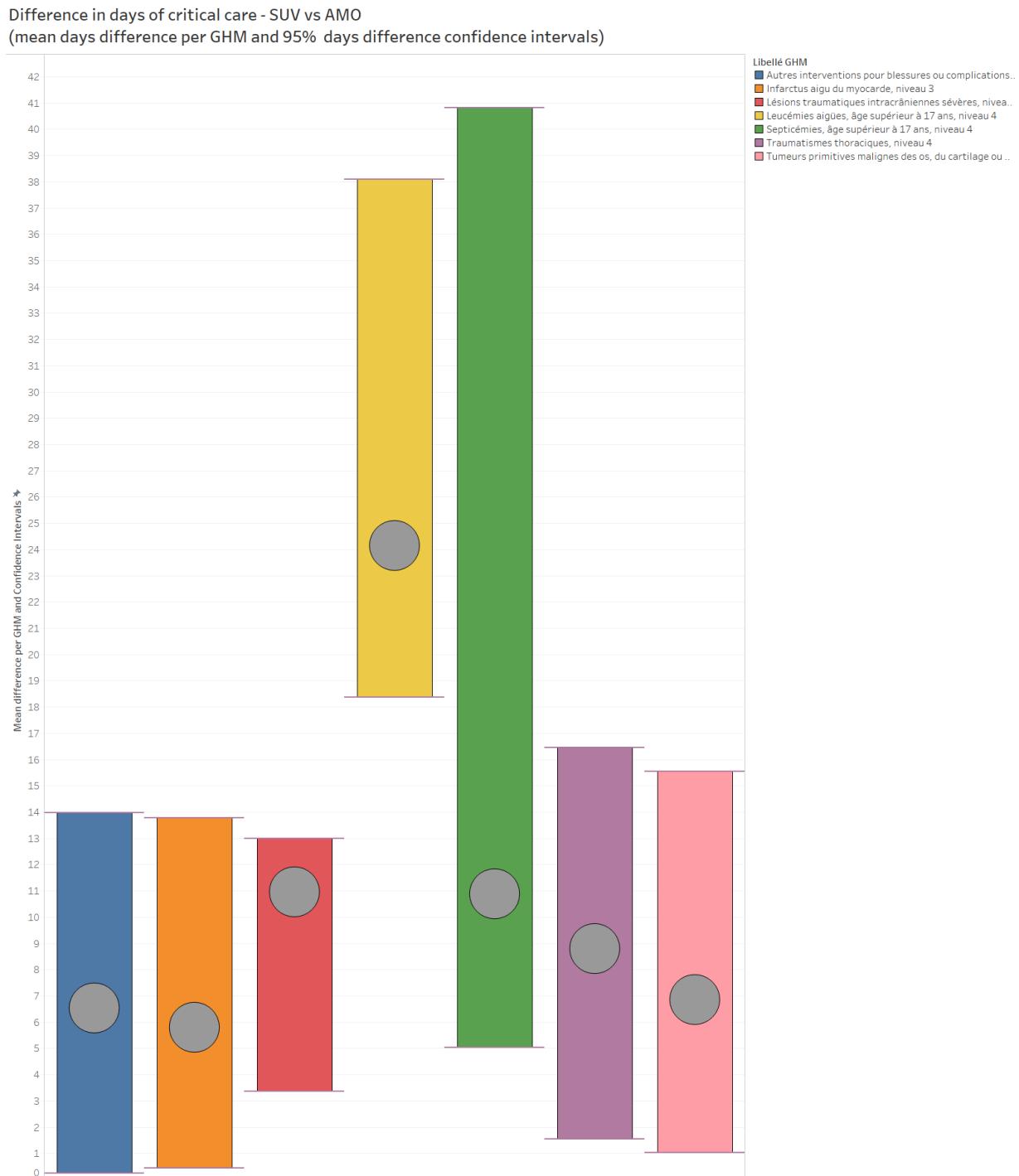


Figure 2.5: Difference in critical care duration - SUV vs AMO (AYI)

## CHAPTER 2. COMPARATIVE ANALYSIS BETWEEN SOCIAL SYSTEMS AND THE BASE SYSTEM

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Difference in days of critical care - CMU-C vs AMO  
(mean days difference per GHM and 95% days difference confidence intervals)

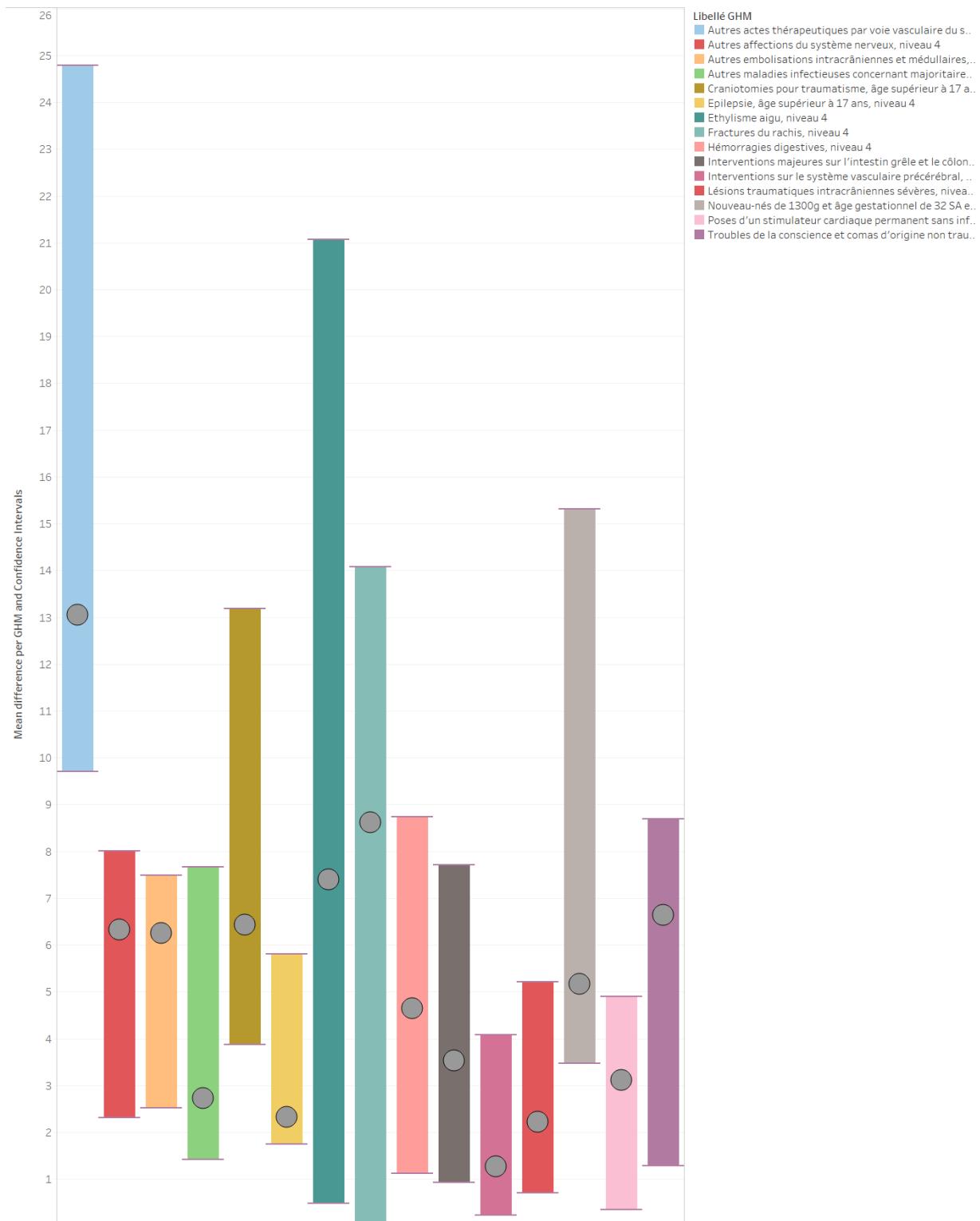


Figure 2.6: Difference in critical care duration - CMU-C vs AMO (AYI)

## 2.3 Stays Cost analysis

Stays cost computation being largely affected by stay duration, we expect to find largely similar results that the previous analysis.

The number of GHMs for which the mean stay cost difference is statistically different is the following

1. 460 GHMs for SUV vs AMO
2. 476 GHMs for AME vs AMO
3. 203 GHMs for CMU-C vs AMO

This is akin to the observation made for the differences in stays duration, both in term of ranking than in term of volume of statistically significant GHMs.

Going into the details provided by the charts, we can see that the GHMs present in each systems represent both what we observed for *overduration* of stays and critical care. For instance we see the presence of both leukemia and leg and hip surgical interventions for AME. This pattern of consolidation is repeated for SUV and CMU-C. Acute leukemia in the SUV overcost chart pictures the largest difference observed with the base system, with an average premium of about 30 000 Euros ranging from 17 000 euros to up 46 000 euros with a 95% confidence.

Overcost - AME vs AMO  
(mean cost difference per GHM and 95% cost difference confidence intervals)

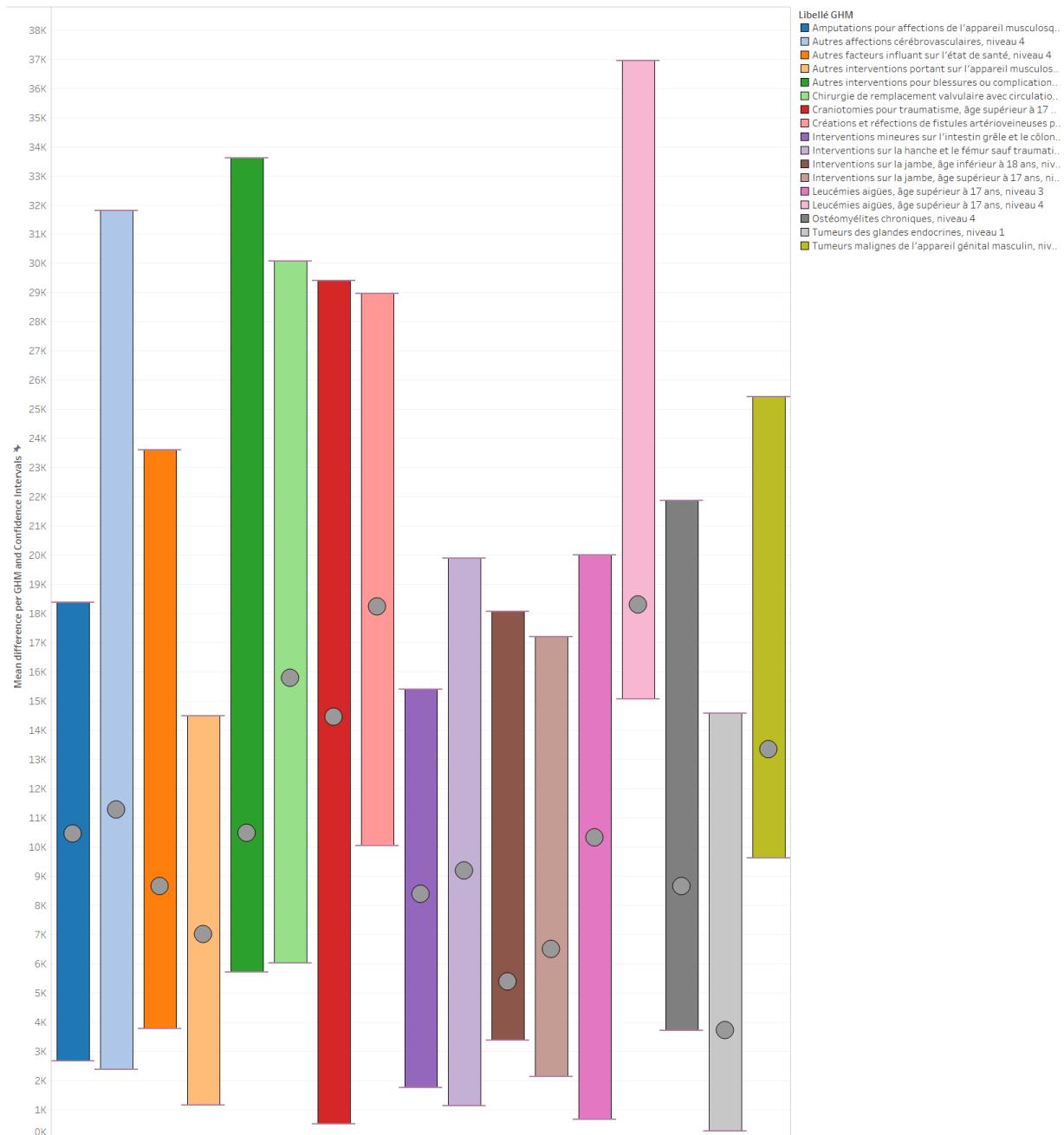


Figure 2.7: Stays Overcost - AME vs AMO (AYI)

Overcost - SUV vs AMO  
(mean cost difference per GHM and 95% cost difference confidence intervals)

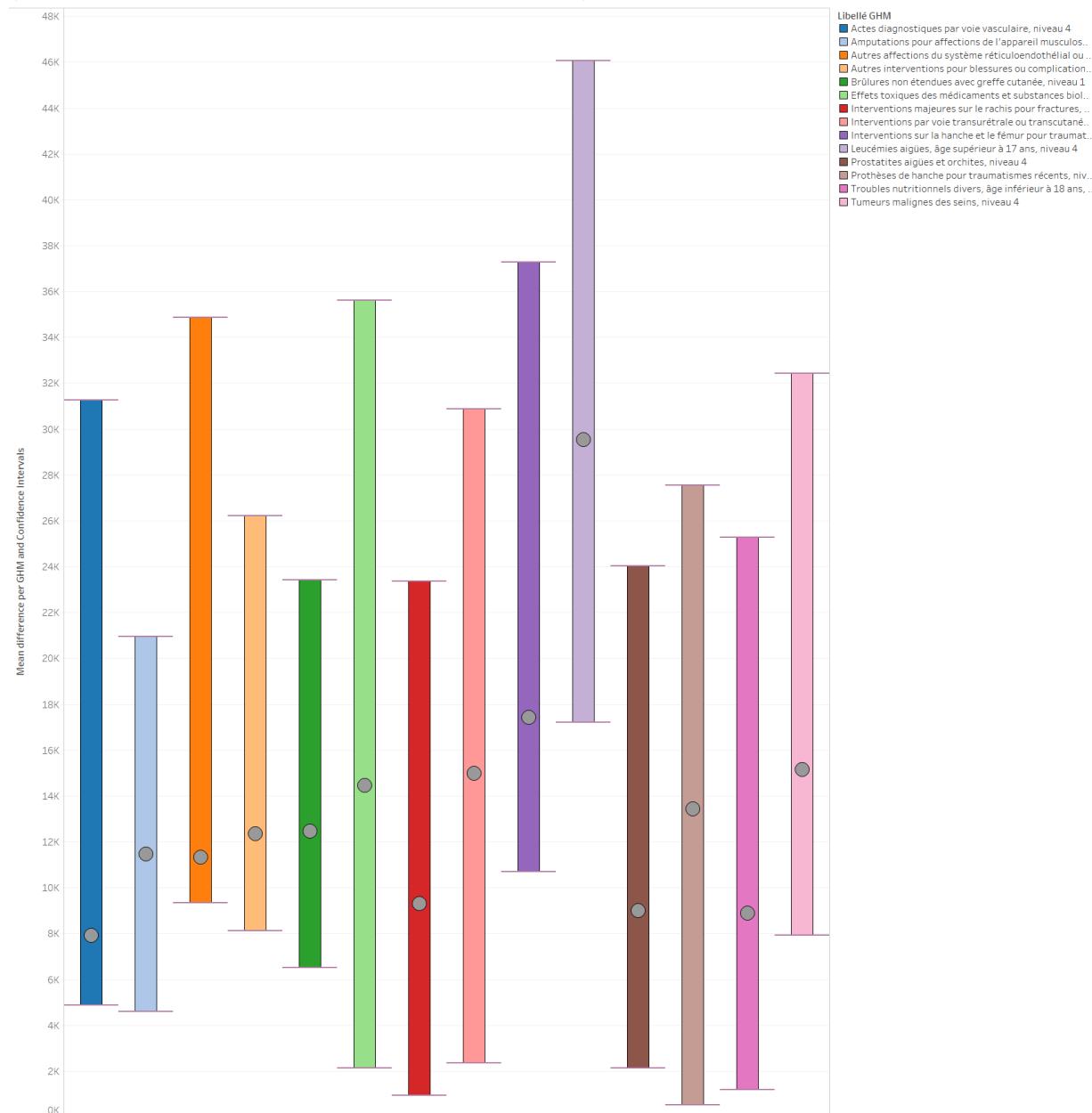


Figure 2.8: Stays Overcost - SUV vs AMO (AYI)

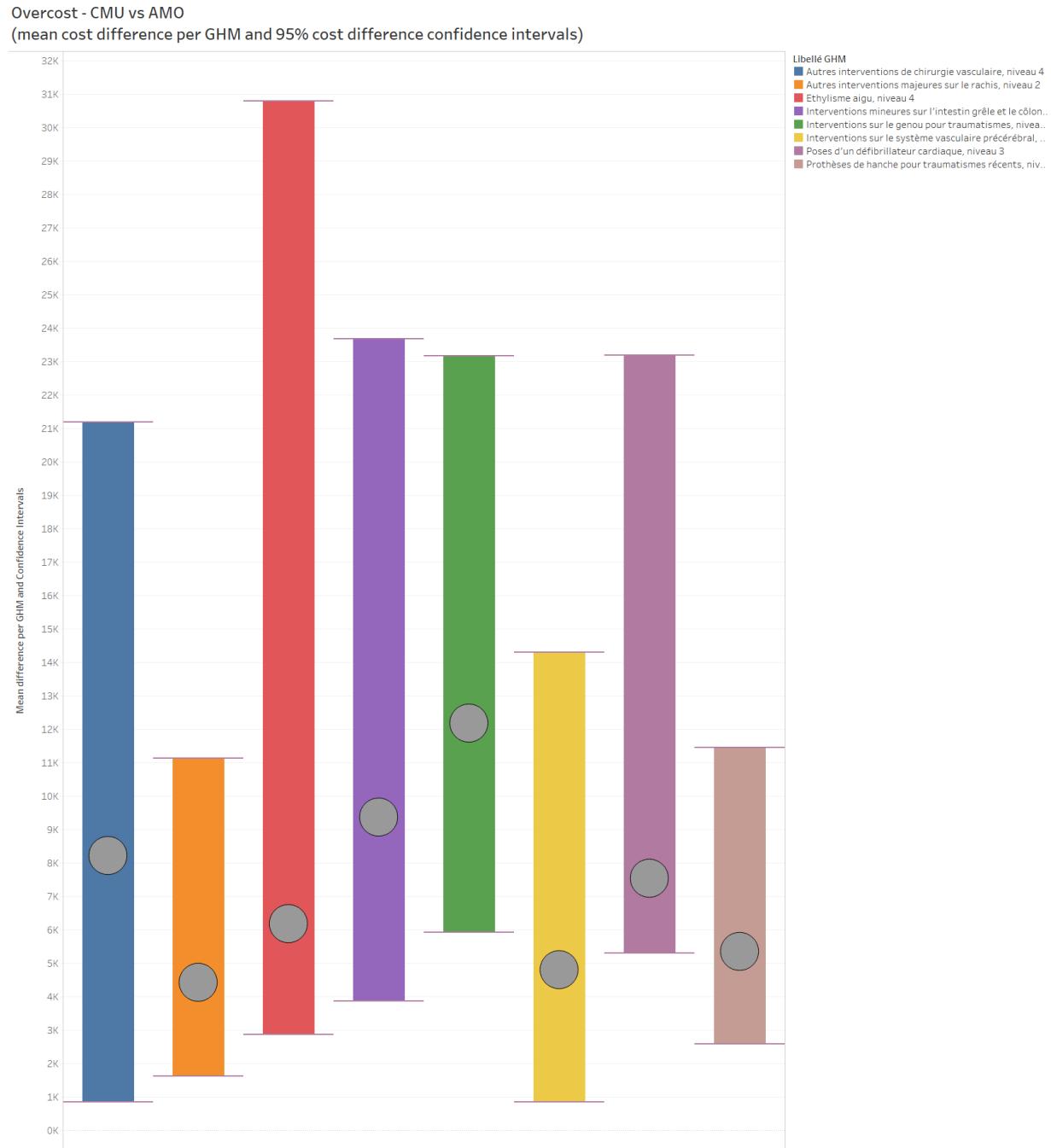


Figure 2.9: Stays Overcost - CMU-C vs AMO (AYI)

# Chapter 3

## Econometric modeling

In this chapter we go one step further in the quantification of the insights we can extract from the PMSI sample by specifying econometric models aimed at answering questions of interest. Our comparative analysis in term of precariousness premium and associated confidence intervals revealed a trend : AME, SUV, and CMU-C stays tend to be more expensive for more than 400 GHMs. Is this statement still holding true if we generalize our approach considering more data and controls ? In other words, is system membership decisive as a stay cost explaining factor ?

In a second time, we will investigate whether two specific public policies introduced during the 2011-2021 had a quantifiable impact the number of patients associated to each system. Indeed, it is assumed that the suppression of AME entry rights in 2013 as well as the introduction of a waiting period in 2020 for asylum seekers wishing to access to the general healthcare system generated an inflection in the incentives of AME and SUV beneficiaries leading to a modulation of systems patient volumes.

### 3.1 Cost explaining factors : is system membership decisive ?

After applying some data processing routines on our sample by :

1. Eliminating outliers using a statistical rule (stays having an abnormally high cost)
2. Generating useful control variables
3. Eliminating null values
4. Applying a Modified Park Test to select which underlying law corresponds to the cost distribution (found Poisson)

We fit the following General Linear Model:

$$\log(\text{cost}) = \beta_0 + \beta_d \mathbf{1}_{\text{Death}} + \beta_{\text{sex}} \mathbf{1}_{\text{Woman}} + \beta_s \mathbf{1}_{\text{GHMS}} + \beta_a \text{age} + \beta_{\text{asq}} \text{age}^2 + \sum_{k \in K} \beta_{cmd_k} \mathbf{1}_{cmd_k} + \sum_{s \in C} \beta_{CC_s} CC_s + \sum_{g \in T} \beta_{system} \mathbf{1}_{system_g} + \sum_{i \in R} \beta_{region_i} \mathbf{1}_{region_i} + \epsilon$$

Figure 3.1: GLM specification

We regresss the log cost on the following covariates :

1. death dummy indicating whether the stay ended up in an intra hospital death
2. sex dummy
3. age and age squared aimed at capturing the non linear effect of age on cost
4. GHMS : GHM severity dummy controlling whether the stay GHM is coded with a notion of severity (including all levels) or not
5. CMD dummy used to loosely control the typology of stay, CMD being general aggregates of GHM
6. Critical Care control dummy : leveraging critical care supplements, offers a gradation of criticality from 0 to 3
7. System membership dummy : the implicit dummy is AMO, allowwing for easier interpretation of coefficient
8. Regional control dummy

The regression results shown in the following figure comfort the idea that system membership has an impact on cost when we control for all the pre-cited covariates. All coefficients are statistically significant, and we even see a clear gradation on the coefficient giving SUV the highest dummy coefficient with respect to AMO (0.09), then AME (0.05) and CMU-C (0.007). In other words, being an SUV patient, ceteris paribus, implies an increase of 10% of the stay cost.

All other estimated coefficient are consistent with the previous analysis and intuition on the health care system. For example, we notice that the regions having the highest positive impact on stay costs are Mayotte and Guyane, generating respectively a 27% and 7.2% increase of stay costs all other things being equal.

	coef	std err	z	P> z	[0.025	0.975]
Intercept	6.8953	0.000	4.1e+04	0.000	6.895	6.896
sexe[T.2]	-0.0044	5.17e-05	-85.207	0.000	-0.005	-0.004
severity[T.Sévérité GHM]	1.0526	7.48e-05	1.41e+04	0.000	1.052	1.053
critical_care[T.CR1]	0.0711	0.000	508.276	0.000	0.071	0.071
critical_care[T.CR2]	0.3401	0.000	3196.871	0.000	0.340	0.340
critical_care[T.CR3]	0.5269	0.000	2927.056	0.000	0.527	0.527
death_status[TDead]	0.1220	0.000	825.874	0.000	0.122	0.122
raison[T.AME]	0.0576	6.87e-05	837.587	0.000	0.057	0.058
raison[T.CMU-C]	0.0074	6.33e-05	116.886	0.000	0.007	0.008
raison[T.SUV]	0.0987	0.000	920.395	0.000	0.098	0.099
cmd[T.1]	-0.4262	0.000	-2650.426	0.000	-0.427	-0.426
cmd[T.10]	-0.2132	0.000	-1111.461	0.000	-0.214	-0.213
cmd[T.11]	-0.3850	0.000	-2158.938	0.000	-0.385	-0.385
cmd[T.12]	-0.4135	0.000	-1333.438	0.000	-0.414	-0.413
cmd[T.13]	-0.2707	0.000	-978.937	0.000	-0.271	-0.270
cmd[T.14]	0.7605	0.000	4892.234	0.000	0.760	0.761
cmd[T.15]	0.8114	0.000	2158.133	0.000	0.811	0.812
cmd[T.16]	-0.1387	0.000	-697.259	0.000	-0.139	-0.138
cmd[T.17]	-0.0678	0.000	-183.265	0.000	-0.069	-0.067
cmd[T.18]	-0.3724	0.000	-1648.957	0.000	-0.373	-0.372
cmd[T.19]	-0.3371	0.000	-1689.401	0.000	-0.338	-0.337
cmd[T.2]	-0.4273	0.000	-1296.150	0.000	-0.428	-0.427
cmd[T.20]	-1.2381	0.000	-5549.379	0.000	-1.239	-1.238
cmd[T.21]	-0.4936	0.000	-2230.748	0.000	-0.494	-0.493
cmd[T.22]	0.0966	0.000	193.434	0.000	0.096	0.098
cmd[T.25]	1.0157	0.000	2505.715	0.000	1.015	1.017
cmd[T.26]	-0.0205	0.001	-32.765	0.000	-0.022	-0.019
cmd[T.27]	0.1951	0.005	41.272	0.000	0.186	0.204
cmd[T.28]	-0.4433	0.000	-894.056	0.000	-0.444	-0.442
cmd[T.3]	-0.4235	0.000	-2038.416	0.000	-0.424	-0.423
cmd[T.4]	-0.2826	0.000	-1838.588	0.000	-0.283	-0.282
cmd[T.5]	-0.3267	0.000	-2035.930	0.000	-0.327	-0.326
cmd[T.6]	-0.2581	0.000	-1645.676	0.000	-0.258	-0.258
cmd[T.7]	-0.0806	0.000	-444.797	0.000	-0.081	-0.080
cmd[T.8]	-0.1536	0.000	-964.145	0.000	-0.154	-0.153
cmd[T.9]	-0.4904	0.000	-2603.415	0.000	-0.491	-0.490
region[T.AUVERGNE-RHÔNE-ALPES]	-0.0482	9.01e-05	-535.380	0.000	-0.048	-0.048
region[T.BOURGOGNE-FRANCHE-COMTÉ]	-0.0597	0.000	-426.150	0.000	-0.060	-0.059
region[T.BRETAGNE]	-0.0392	0.000	-302.363	0.000	-0.039	-0.039
region[T.CENTRE-VAL DE LOIRE]	-0.0437	0.000	-324.712	0.000	-0.044	-0.043
region[T.CORSE]	-0.0627	0.000	-148.901	0.000	-0.064	-0.062
region[T.GRAND EST]	-0.0356	0.000	-352.225	0.000	-0.036	-0.035
region[T.GUADELOUPE]	-0.0471	0.000	-255.203	0.000	-0.047	-0.047
region[T.GUYANE]	0.0704	0.000	693.912	0.000	0.070	0.071
region[T.HAUTS-DE-FRANCE]	-0.0639	8.4e-05	-761.336	0.000	-0.064	-0.064
region[TLA RÉUNION]	-0.0457	0.000	-220.553	0.000	-0.046	-0.045
region[T.MARTINIQUE]	0.0116	0.000	43.790	0.000	0.011	0.012
region[T.MAYOTTE]	0.2442	0.000	751.221	0.000	0.244	0.245
region[T.NORMANDIE]	-0.0651	0.000	-471.325	0.000	-0.065	-0.065
region[T.NOUVELLE-AQUITAINE]	-0.0721	0.000	-720.358	0.000	-0.072	-0.072
region[T.OCCITANIE]	-0.0558	0.000	-504.601	0.000	-0.056	-0.056
region[T.PAYS DE LA LOIRE]	-0.0527	0.000	-448.545	0.000	-0.053	-0.052
region[T.PROVENCE-ALPES-CÔTE D'AZUR]	-0.0549	9.54e-05	-575.310	0.000	-0.055	-0.055
age	0.0050	3.31e-06	1495.480	0.000	0.005	0.005
np.power(age, 2)	1.736e-05	3.57e-08	486.594	0.000	1.73e-05	1.74e-05

Figure 3.2: GLM results

## 3.2 Patient volume per system: does public policy have an impact ?

In order to get a quantitative answer to this question, we will leverage the Difference-in-Difference framework. Due to the modest size of yearly volumes available ( 10 years per system), we put special attention into being within the assumptions of the model. To do so, we carefully tried to find trends allowing for such regression. We will distinguish global DID regressions including all regions and specifically regional volume trends that were aligned with the model assumptions.

We will assume an underlying General Linear Model with the following specification :

$$\log(volume) = \beta_0 + \beta_1 \mathbb{1}_{treat} + \beta_2 \mathbb{1}_{post} + \lambda \mathbb{1}_{treat} * \mathbb{1}_{post} + \epsilon$$

Figure 3.3: DID specification

1. Treat dummy corresponds to whether the system is directly impacted by the public policy
2. Post: time dummy corresponding to the introduction and effectiveness of the public policy

$\lambda$  is our coefficient of interest here as it capture the causal effect of the policy on the targeted group. We will divide this section according to the analysis of the 2013 and 2020 public policies impact on patient volumes per system.

### 3.2.1 2013 : removal of AME's entry rights

The most critical DID regression assumption is the parrallel trend assumption. Analyzing the yearly patients volume per system over time for the Guadeloupe, we observe a pre-treatment parrallel trend for AME and CMU-C at a year before the removal of AME's entry rights in 2013.

Thus, we perform a DID regression in order to estimate the causal effect of this policy on the AME contingent as we can assume that due to its population characteristics, it is the one being directly impacted by this measure. AME will consequently act as our treatment group, CMU-C being the control. Furthermore, we suppose that the public policy dynamic effect on patient volumes vanishes after 3 years.

We have statistically significant results, pointing us to a multiplication by a factor of 2.5 of the AME volume in Guadeloupe after the introduction of the public policy.

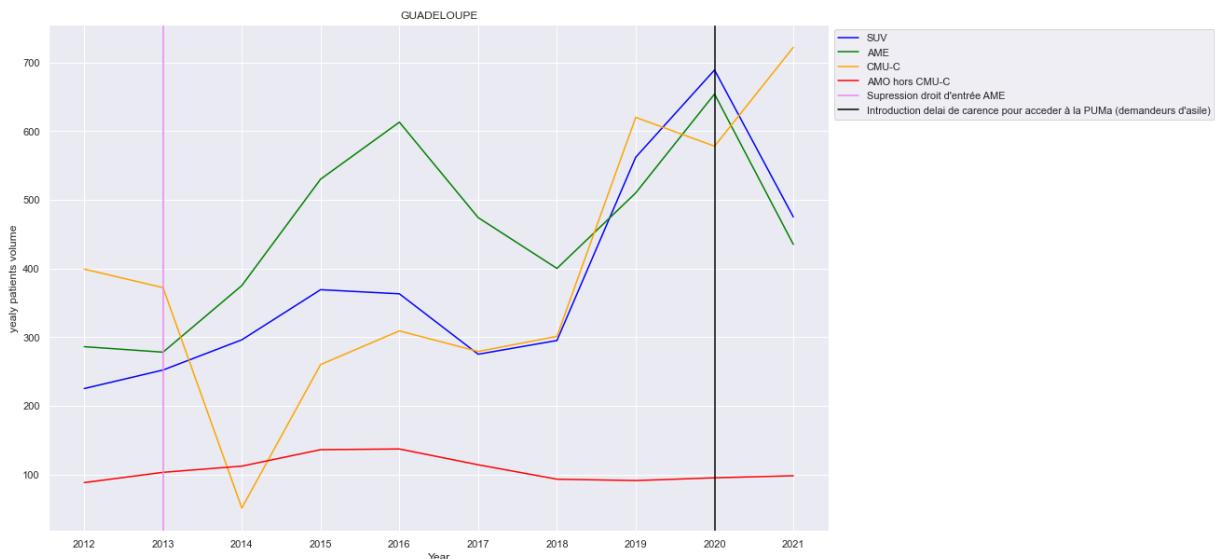


Figure 3.4: Yearly patient volume per system - GUADELOUPE

## Generalized Linear Model Regression Results

<b>Dep. Variable:</b>	volume	<b>No. Observations:</b>	10			
<b>Model:</b>	GLM	<b>Df Residuals:</b>	6			
<b>Model Family:</b>	Poisson	<b>Df Model:</b>	3			
<b>Link Function:</b>	log	<b>Scale:</b>	1.0000			
<b>Method:</b>	IRLS	<b>Log-Likelihood:</b>	-266.07			
<b>Date:</b>	Wed, 29 Jun 2022	<b>Deviance:</b>	456.71			
<b>Time:</b>	13:11:55	<b>Pearson chi2:</b>	386.			
<b>No. Iterations:</b>	4					
<b>Covariance Type:</b>	nonrobust					
	coef	std err	z	P> z	[0.025	0.975]
Intercept	5.9890	0.050	119.629	0.000	5.891	6.087
treat	-0.3330	0.077	-4.298	0.000	-0.485	-0.181
post	-0.4755	0.059	-8.022	0.000	-0.592	-0.359
treat:post	0.9266	0.087	10.651	0.000	0.756	1.097

Figure 3.5: DID regression results

### 3.2.2 2020 : introduction of a waiting period for asylum seekers for accessing the general healthcare system

All regions included

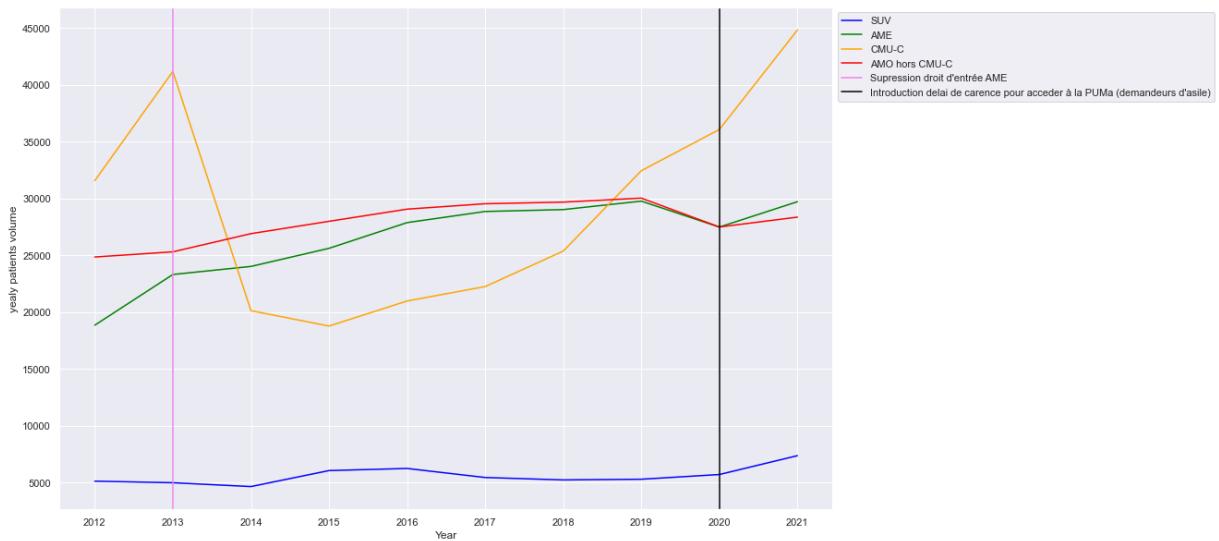


Figure 3.6: Yearly patient volume per system - All regions included

We observe a pre-treatment parallel trend for AME and AMO at least two years before the introduction of a waiting period for asylum seekers willing to access PUMa.

With the same framework as before we perform a DID regression considering AME as our treatment group, the base system AMO being the control.

We have statistically significant results for  $\lambda$ , revealing a global increase of 10% of AME patients after the 2020 public policy controlling the access of asylum seekers to the health care system.

Generalized Linear Model Regression Results

<b>Dep. Variable:</b>	volume	<b>No. Observations:</b>	20			
<b>Model:</b>	GLM	<b>Df Residuals:</b>	16			
<b>Model Family:</b>	Poisson	<b>Df Model:</b>	3			
<b>Link Function:</b>	log	<b>Scale:</b>	1.0000			
<b>Method:</b>	IRLS	<b>Log-Likelihood:</b>	-2652.6			
<b>Date:</b>	Wed, 29 Jun 2022	<b>Deviance:</b>	5064.3			
<b>Time:</b>	12:08:47	<b>Pearson chi2:</b>	4.89e+03			
<b>No. Iterations:</b>	4					
<b>Covariance Type:</b>	nonrobust					
	coef	std err	z	P> z	[0.025	0.975]
Intercept	10.2367	0.002	4836.871	0.000	10.233	10.241
treat	-0.0746	0.003	-24.451	0.000	-0.081	-0.069
post	0.0002	0.005	0.033	0.974	-0.009	0.009
treat:post	0.0985	0.007	14.734	0.000	0.085	0.112

Figure 3.7: DID regression results

## Guyane

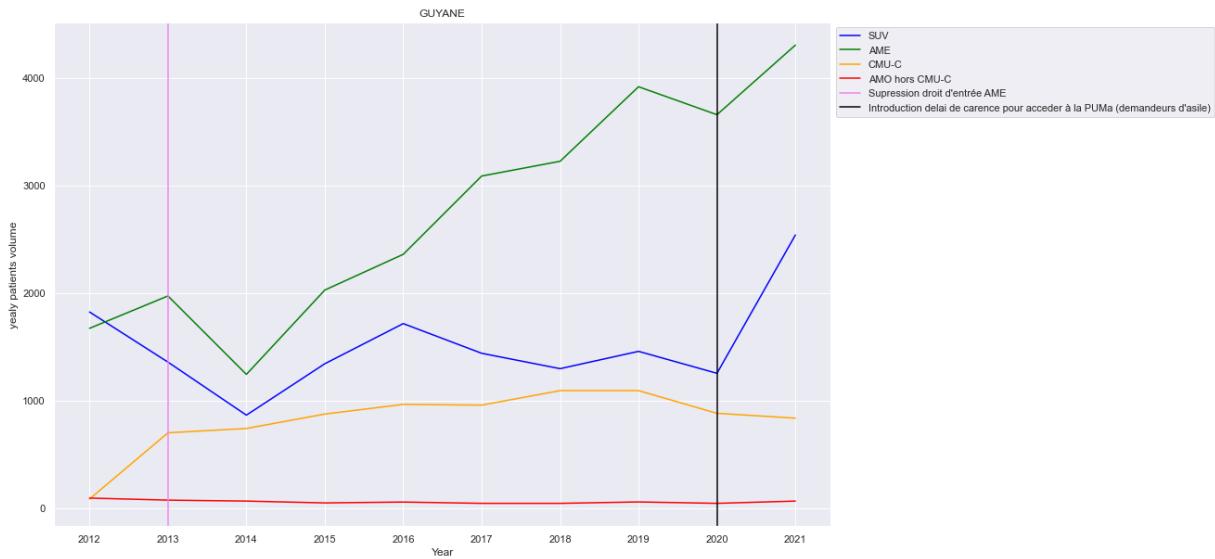


Figure 3.8: Yearly patient volume per system - Guyane

We observe a pre-treatment parallel trend for AME and CMU-C contingents in Guyane at least two years before the introduction of a waiting period for asylum seekers willing to access PUMa.

With the same framework as before we perform a DID regression considering AME as our treatment group, the base system CMU-C being the control.

We have statistically significant results for  $\lambda$ , revealing an increase 53% of AME patients in Guyane after the 2020 public policy controlling the access of asylum seekers to the health care system.

## Generalized Linear Model Regression Results

<b>Dep. Variable:</b>	volume	<b>No. Observations:</b>	20			
<b>Model:</b>	GLM	<b>Df Residuals:</b>	16			
<b>Model Family:</b>	Poisson	<b>Df Model:</b>	3			
<b>Link Function:</b>	log	<b>Scale:</b>	1.0000			
<b>Method:</b>	IRLS	<b>Log-Likelihood:</b>	-1935.1			
<b>Date:</b>	Wed, 29 Jun 2022	<b>Deviance:</b>	3689.4			
<b>Time:</b>	13:15:26	<b>Pearson chi2:</b>	3.29e+03			
<b>No. Iterations:</b>	5					
<b>Covariance Type:</b>	nonrobust					
	coef	std err	z	P> z	[0.025	0.975]
Intercept	6.6993	0.012	539.911	0.000	6.675	6.724
treat	1.0990	0.014	76.705	0.000	1.071	1.127
post	0.0547	0.027	2.014	0.044	0.001	0.108
treat:post	0.4359	0.030	14.419	0.000	0.377	0.495

Figure 3.9: DID regression results