EHESP

The effects of an ageing population on the health system
The case of blood demand

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Summary

A c r o n y m s

ALD	Long-term chronic disease procedure (Affection de Longue Durée)
ANSM	National Agency for Drugs and Health Products Security
ATIH	French technical agency for hospitalization information
CépiDC	Center for Epidemiology on Medical Causes of Death
CNAMTS	National Health Insurance for Employees
CP	Platelets concentrate
DREES	Directorate of Research, Studies, Evaluation and Statistics
EFS	French Blood Service
EMIR	Adverse drug effects: risks and incidence
ER	Emergency room
ESPS	Health and welfare survey (Enquête Santé et Protection Sociale)
EU	European Union
FFP	Fresh Frozen Plasma
FNORS	National Federation of Regional Health Observatories
HAD	Home-based hospitalization
HAS	French National Authority for Health
HCAAM	High Council for the future of National Health Insurance
HCSP	High Council for Public Health
IGAS	General Inspectorate of Social Affairs
IRDES	French Institute for Research and Information in Health Economics
IIASA	International Institute for Applied Systems Analysis
INCA	French National Cancer Institute
INSEE	French National Institute of Statistics and Economic Studies
LFB	French state-owned company for plasma-derivated products
LBP	Labile Blood Products
MCO	Medicine, Surgery, Obstetrics
PMSI	Hospital information System
QALY	Quality Adjusted Life Year
RBC	Red Blood Cell Concentrate
SSR	Rehabilitation Care
WHO	World Health Organization

A r t i c l e

1 Introduction

1.1 Context

The world's population is globally ageing. In 2050, 80% of the people aged 60 and over will be living in current developing countries (Shetty 2012). Spectacular demographic changes are happening now in Cuba, Iran and Mongolia. In the Japan-Oceania region, 14% of the population will be aged 80 and over in 2050 (IIASA World Population Program Online Data Base). Therefore health of the elderly is currently a major center of interest throughout the world and WHO dedicated the World Health Day 2012 to "Ageing and Health".

In Europe, the phenomenon is not new. The age class of people aged 80 and over is currently growing the fastest (European Commission, 2010). The population is ageing at different paces in different countries and regions. The population of some countries such as Germany is already declining. The European Union is also concerned by this issue and made the year 2012, the European Year for Active Ageing and Solidarity between Generations. Population ageing comes with a range of problems but also a range of opportunities that EU wants to take advantage of.

In France, the population is ageing but is still growing slowly. Today, the very elderly represent 5.5% of the French population, of which two thirds are women (INSEE, 2006). In 2050, 7.3 million people will be over 80 in France (10% of the general population). The situation is different from one region to another and the population living in rural areas is still older than the one living in urban areas. Aging is a phenomenon resulting of multiple factors, both internal factors such as genetics and external factors. Hence the very elderly is a heterogeneous group of people ranging from the ones in great shape and to the very frail ones.

The very elderly are contributing to society. In France, institutionalization is postponed as long as possible. In 2008, 90% of people aged 80 and over still lived at home (SCORE SANTE data base). They watch TV daily, read regional newspapers and even if their political participation declines with age, 60% of people aged 80 still vote for elections (the participation rate is the highest between 50 and 70 years old: 80%). 28% of people aged 75 and over are members of at least one association (33% for overall French population) and some of them still practice physical activities (INSEE, 2003 a,b). The very

elderly may nevertheless face loneliness (43% of them live alone), poverty and dependency. The poverty rate in the elderly is low but increases with age (DREES, 2010). Women are much more exposed than men. When encountering health problems, it may be difficult to stay home. This is the main reason for institutionalization. Yet only 35% of residents say that they were entitled to their say in the institutionalization process (DREES, 2011b).

In 2010, life expectancy at birth was 78.1 years for men and 84.8 years for women in France (DREES, 2011a). Life expectancy at age 65 is among the highest in Europe: 22.8 years for women and 18.6 years for men. But the proportion of this life spent in good health is not the best. Only 41% of those years for women and 48% for men will be healthy life years (EUROSTAT database). Sweden for example does much better: 69% for women and 75% for men. So we may be concerned about the adequacy between our health system and the goals we want to reach.

1.2   Specific objectives of the study

In this global context of an ageing population, the ultimate goal of this study is to assess whether the age of patients is restructuring the health system, to explain how the health system is adapting and what it means for labile blood products (LBP) transfusion. The first part will be dedicated to the new societal challenges potentially caused by the recent demographic evolution: end of life housing, place of death, access to hospital and ageing patients in hospitals. The second part will describe what is specific about the very elderly health status and care management and why it is so complex. This complexity raises new challenges regarding efficiency, organization, coordination and security of care for older patients. Finally we will address the specific case of LBP transfusion. Whereas the growing number of people aged ≥80 has been seen as the main driver for increasing LBP use, many changes are in fact contributing. Even if the very elderly are often under antithrombotic medication, immunosuppressed, anemic, suffering from multiple chronic conditions, they are still undergoing a growing number of surgical procedures and aggressive treatments that can cause bleeding.

To meet our specific objectives, we conducted this study in three parts. First of all, we collected some background data about the very elderly in France and in the World to address the following questions: Who are they? Where do they live? How many are they now and how many will they be in the future? In a second part, we tried to understand how the elderly are currently using the health system, how this is impacting their health and what their unmet needs are. We then assessed what are the successes and failures

of our current health and social systems and what could be our health system in the future. Finally, using current transfusion data and its evolution in the last few years, we isolated changes that could deeply impact blood demand in the future.

1.3 Author's point of view

We choose the point of view of the health care system, medical practices and blood providers. Nevertheless social, political, ethical and economic perspectives would be of great value to complete this study. In fact, social and societal challenges are also raised by an ageing population with the question of how we are going to support the cost of pensions and dependency. Moreover, financial constraints lead governments to seek for the most cost-effective health care, health management and health procedures. The choices the society will make regarding what is covered by national health insurance for example can hugely modify the health system and the care for oldest patients. Besides ethical problems are raised inside the health system to define futile care, obtain consent and even take a medical decision in such complex situations.

2 Material and Method

To address our first objective, we collected all available information about the elderly's demographic characteristics, way of life, place of residency, consumption and citizenship. We also looked for prospective information about population structures in 2050 and other relevant changes in the society. We therefore consulted INSEE, Eurostat and IIASA publicly available data bases and reports. DREES publications and Score-Santé Database provided additional information on the elderly location: at home, in an institution or in a hospital.

Secondly, we found information about the health status in DREES, INSEE, Eurostat, INCA and Eco-santé databases and reports. Information on ambulatory care utilization was available in national health insurance databases (CNAMTS, MEDICAM), Score-Santé database (FNORS) and national publications (DREES, IRDES and The Court of Accounts). Institutionalized elderly are described in DREES and INSEE studies. Information about hospitalized elderly were extracted from hospitalization data bases of the ATIH (PMSI MCO, SSR and HAD) and HCAAM reports. The pharmacovigilance study (EMIR) provided prevalence of medication side effects. Finally, the CépiDC database and IGAS report supplied data about mortality and the location of death. Short literature reviews were performed to complete data about specific health status such as anemia or

everyday life accidents and to perform some comparison of health care utilization between countries.

Finally transfusion data were provided by the French Blood Service and hospitalization databases (PMSI). Each of these sources has specific advantages and drawbacks. In fact, EFS data are delivery and billing data and do not include data on health status of patients or hospitalization characteristics. PMSI data include associated diagnosis and specifics about hospitalization stays. Nevertheless, because hospital remuneration does not depend on PMSI coding for transfusion, only 55% of transfusion episodes are found in the PMSI database. Besides we conducted a literature review to complete the data on French and international transfusion practices and epidemiology of transfusion related diseases.

3 Results

3.1 The ageing population is creating new societal challenges

80% of French people want the dependent elderly to stay home (DRESS 2006) and most of them do. Institutionalization is the last resort when health is deteriorated. It is not the case in Japan for example where less than 40% of elderly want to stay home and 40% want to go to specialized institutions. Japan is currently increasing and diversifying medico-social services at the same time as reducing the cost and adapting it to real local needs (Japanese embassy).

In France, mortality is nowadays concentrated in old ages. The very elderly therefore represent more than half of the deaths registered in 2007 (34% for 80-89 years old and 19% for people aged 90 and older). Most people used to die at home but an increasing part of the population dies in hospital now : 40% of women and 50% of men aged ≥85 die in hospital, 30% die at home and 20% die in an institution (predominantly women) (IGAS 2010a). Diagnoses at the time of death are coded in France in two different categories: main diagnosis and associated diagnosis.

In hospitals, most deaths occur in MCO units (86%), 22% in services where comfort for patient and family is competing with high technical needs: reanimation units, intensive care units etc. People aged ≥80 represent 58% of death. 58% are women. In 2007, in MCO units, the main diagnosis was respiratory diseases for 15% of people aged ≥80 and vascular diseases for 28%.

12% of the elderly die in rehabilitation care (54% in palliative care) and 2% in home-based hospitalization. One out of ten patients dies in emergency rooms (ER). Actually a

growing number of patients reach emergency rooms at the very last moment of their life, while their death was predictable. Emergency rooms are not suited to welcome proper end of life care and death in a corridor is now becoming common (IGAS 2010a).

The very elderly have a high ER utilization rate (40%) but unlike the other patients, they are sent to the ER by their physicians (DREES 2003 a,b). Only 1/3 of them decide to go to emergency rooms by themselves (80% of all patients go by themselves). It is then surprising that they get to the ER inappropriately. A third of the elderly are getting to the ER by themselves to access faster other hospital units than with a direct call. 31% of the very elderly were not entitled to their say when taken to the ER.

3.2 Specific needs for the elderly regarding health system

3.2.1 Multiple chronic condition is the rule, not the exception

The prevalence of most frequent diseases is stable in France by age and sex from 2004 to 2008, especially for chronic conditions (DREES 2011a). Nowadays consequences of these conditions are reduced or delayed by appropriate care and severe incapacity occurs latter. We therefore live longer with the same chronic conditions and develop additional disorders (CépiDC database).

76% of the elderly have at least one chronic condition or long-term health problem in France. 87% and 84% of people aged ≥80 are suffering respectively from oral cavity and refraction disorders. 69% of them have circulatory issues (IRDES 2007, Annex 1). In France, the long-term disease (ALD) procedure exempts patients with long-term conditions from co-payments. In 2010, almost 2,300,000 ALD (21%) were dedicated to people aged ≥ 80. The percentage of ALD beneficiaries in an age class increases with age: about 50% for people aged ≥80 and about 80% of centenarians. The number of ALD is also increasing faster than the number of beneficiaries implying that each beneficiary has an increasing number of exempting chronic conditions. Cardiovascular diseases, malignancies, diabetes and psychiatric disorders are the main drivers of new beneficiaries with respectively 36%, 22%, 16% and 12% of new beneficiaries per year (DRESS 2011a).

Perceived health is globally better for people living at home. In institutions, almost all residents suffer from multiple chronic conditions (DREES 2011c). They have a mean of 6 concomitant diseases, 6.6 for people aged ≥80. Half of them have 4 to 8 chronic conditions. 82% of residents have at least one psychiatric or neurologic disease (Annex 2). 36% have dementia. 75% of residents have cardiovascular diseases (mostly hypertension, heart failure and cardiac rhythm disorders).

3.2.2 Elderly Interactions with the health system are diverse

At home, most people access to general practitioners, liberal or hospital specialists, home-nursing services, pharmacists and physical therapists. 28% of general practitioners visits are addressed to patients aged 70 and over in 2002 (DREES 2004). 2006 ESPS (Health and welfare survey, IRDES 2008) results lead us to think that half of people aged ≥80 consult their general practitioner every month and 88% of them take meds every day, on average 4.4 different one. They most likely have at least monthly contact with pharmacists. In 2008, about 80,000 patients aged 75 and over are receiving home nursing services.

When health status worsens, institutionalization is considered. 24% of institutionalized people come directly from their home but most of them come from hospital (23% for a first admission and 47% return from hospitalization) (PLEIAD study, unpublished, Annex 4). A minority of people who leave an institution return home (15%) or change for another institution (15%). Most of them head to the hospital. 62% are addressed to the ER by a physician.

ER use is high among the very elderly: 40% reach the ER each year and half of them need to be hospitalized. They wait an average of 3.5 hours to be transferred to another unit (mean waiting time is 2h37 for the general population). If they need to be transferred to rehabilitation care or long-term care they wait longer (5h50, 6h40 for long-term care in the same hospital and 13h30 in another hospital). For the very elderly, the ER is a gateway to unscheduled hospitalization (DREES 2003 a,b).

French people aged 80 to 84 years old spend on average 11.5 days per year in hospital and it increases with age. After 85 years old, they have 20% chances of being hospitalized more than once each year (HCAAM 2010). Most hospitalized elderly are transferred within the same day of their admission mainly from MCO units to SSR units. It is not the case for younger people who tend to have more single hospitalizations.

The main drivers of hospitalization for the very elderly (DREES 2011d) are cardiovascular diseases (20%) and injuries and poisoning (11%).

In SRR, one third of patients are aged 80 and over. 23.5% of home-based hospitalizations are for patients aged 75 and over. Home-based hospitalization services are not evenly distributed across the territory especially for chemotherapy and blood transfusion.

In France, ambulatory surgery is less developed as in some other European countries. While the ambulatory surgery rate is higher than 50% in Denmark, Norway, Netherlands, UK and Sweden, it is only 36% in France (HAS, ANAP 2012).

3.2.3 People's behavior and health care complexity can cause morbidity

In 2008, two-thirds of mortality from personal accidents occurred among people aged 75 and over in France (INVS 2011). In one year, 25% of residents fell at least once in 2007 (DREES 2011c). According to the Epac survey 2002-2003 (permanent survey on personal accidents causing the use of the ER), 61% of elderly's accidents occurred at home and 7% in institutions. When age increases, percentages of accidents occurring at home and in institutions both increase (66% and 20%) and percentage of accidents occurring outside decreases. In 84% of cases, the accident is a fall. The consequence of the accident is a fracture in 35% of cases and a wound in 21%. 32% of accidents resulted in a hospitalization (INVS 2005). The very elderly are also at risk of having road traffic accidents. In fact, 40% of killed pedestrians are aged ≥75 and the number of elderly killed in road accidents is decreasing less rapidly than the overall number of persons killed in road accidents (ONISR 2011). Having an active life is encouraged by public health campaigns about nutrition and physical activities. The number of injuries and fractures among the elderly is therefore susceptible to increase in the coming years. It is a source of mortality, morbidity and health care utilization.

Moreover, the widespread use of some drugs can worsen the consequences of accidents. In fact, the very elderly take a mean of 4.4 drugs per person and per day and 88% of people aged 80 and over consume drugs daily (IRDES 2008). It is worse in institutions where they take an average of 6.5 different drugs per day (DREES 2011c). Since the prevalence of cardiovascular diseases is so high, antithrombotic drugs are very common. Public health insurance reimbursed almost 9 million boxes of anticoagulant drugs (vitamin K antagonists) in 2010 (MEDICAM database). Antithrombotic drugs are responsible for significant bleeding in case of injury. It is important to manage antithrombotic treatments when patients are undergoing surgery to reduce bleedings and avoid causing other morbidities such as anemia.

But drugs themselves are susceptible to cause morbidity. 4% of Canadian elderly suffering from chronic conditions report at least one mistake regarding the prescription or delivery of meds during the current year. 41% of them report that this mistake caused a quite serious or a serious problem (ICIS 2011). In 2007, in French institutions (DREES 2011c), 3% of residents suffered from at least one iatrogenic accident (10% in long-term care units). Besides, 5% of hospitalizations for people aged ≥65 are due to side effects of drugs. One third is avoidable (National Commission of Pharmacovigilance March 25, 2008). In the general population, a study of drug sides effects (CRVP Bordeaux, EMIR Survey of Adverse drug effects incidence and risks 2007) revealed that 26% of them are due to central nervous system drugs, 22% to cardiovascular drugs, 17% to antineoplastic and immunomodulating agents, 13% to blood and hematopoietic organs drugs.

Anticoagulant drugs are suspected to be the cause of about 17,000 hospitalizations every year (ANSM website). In a similar study in the US (Budnitz, Lovegrove et al. 2011) warfarin, insulin, antiplatelet drugs and oral hypoglycemic agents caused respectively 33%, 14%, 13% and 11% of emergency hospitalizations, alone or in association. The most common side effects were hemorrhages and hypoglycemia. Almost every accident was caused by unintentional overdoses.

Transfers between hospital services or between hospitals, institutions and patient home are one cause of discontinuity of treatment. As we saw before, the elderly are often transferred within hospitals. In institutions, the PLEIAD study (unpublished, Annex 4) found that ¼ of residents were transferred in the last 3 months. At each transfer and when patients are released from hospitals, the risk of treatment error is increased and even more when no electronic medical records are in place. It leads to unnecessary change in the treatment, errors, interruption of treatment and duplication of treatment. The concept of "seamless care" is now growing and experiments are in progress throughout the world, responding to WHO High 5s project for patient safety (in Lunéville, France, for example with the Standard Operating Protocol MEDication REConciliation: SOP Med'Rec). It should minimize the impact of duplication of consultations and overlapping in care for all patients.

The HAS and ANSM publish recommendations regarding drugs and blood products use. These recommendations permit the development of a culture of good practices and are very interesting to contain products misuse. Nevertheless, these recommendations are intended for the general population and don't consider the specificity of the very elderly. Hence strictly following these recommendations without taking into account the specificity of the patients may lead to inappropriate care or to a large variability in practices. A few specific recommendations for the elderly exist (how to prevent falls, how to fight against medicine-related illnesses for example) but there is no comprehensive approach. Recent HAS publications in May 2012, about patients "care pathways" for a few chronic diseases promote global multidisciplinary approaches for chronic patients, not yet reaching the ultimate "health pathway" for the very elderly.

3.3 Transfusion in France

3.3.1 The French Blood Service is facing public health and industrial challenges

The French Blood Service (EFS, Etablissement Français du Sang) is a public establishment. It was founded in 2000, after the "contaminated blood issue", as the last stage of a global national restructuration of blood transfusion. EFS is the unique operator

for Labile Blood Products (LBP) collection, preparation and delivery in France. It is made up of 1 national headquarters and 17 regional centers. EFS supplies 1,900 hospitals with labile blood products and the LFB, the French state-owned company for plasma-derivated products, with plasma raw material. Labile blood products used for clinical purposes are red cell concentrates, platelet concentrates and fresh frozen plasma from apheresis. EFS has 153 fixed collection facilities and organizes about 40,000 mobile blood collections each year. 3,044,924 blood donations have been handled by EFS in 2010 including 571,154 apheresis and 2,471,421 whole blood donations. 2,360,299 red cells concentrates (RBC), 275,779 platelet concentrates (CP) and 380,707 fresh frozen plasma (FFP) units were delivered to health centers the same year. Red cell concentrates represent 80% of LBP delivered to health centers. Because of the quantity delivered, the quality and the specificity of the products, the French blood service has a dual responsibility and faces both public health and industrial challenges.

The first major challenge is to ensure national self-sufficiency with voluntary non-remunerated donations. In fact, the amount of blood collected depends on people's generosity. EFS is then exposed to all societal events and to public awareness and perception of needs, reputation… Moreover labile blood products have a short life expectancy: 42 days for RBC, 1 year for FFP and 5 days for CP. Therefore there is a constant need for blood. It creates a permanent feeling of shortage. Call for donors is consequently never ending.

Another important challenge is to guarantee the best quality of products with limited financial resources. Indeed measures to provide the best quality of products are in place at all stages of blood management. First blood donors are selected with questionnaires, excluding all donors that could have a potential risk factor, for example for blood transmissible infectious diseases. Then, blood undergo a large battery of tests including last to date detection techniques (Nucleic Acid Amplification Testing – NAT– for instance). Simultaneously, the blood is prepared with securing techniques such as leucocyte depletion, pathogen reduction etc. When delivering the product, security is ensured by controlling the matching properties of the blood delivered with the blood of the patient. Transfusion advice is also provided by the EFS. Donors are followed and if one of them develops a sporadic Creutzfeldt-Jakob disease, for instance, all products (including plasma-derivated products) are withdrawn from the market. Blood is consequently an expensive product.

Finally, the French Blood Service is organized to answer emergency needs for blood and has the logistic capacity to provide blood wherever and whenever needed.

3.3.2 French blood utilization for the elderly has several specificities

A)   Specific profile of French blood use

France has a low but increasing consumption of blood products. The national use of LBP decreased in the 90s following the "contaminated blood use" and is increasing ever since. Nevertheless, it stays among the lowest in Europe, comparable to the Netherlands, the UK or the Spanish consumption. Consumption of LBP varies widely across Europe. While France uses 36 RBC per 1,000 inhabitants, Denmark has the highest use with 60 RBC per 1,000 inhabitants. The same happens with platelet concentrates and Fresh Frozen Plasma (EBA European Blood Alliance Data, 2009). However the gaps between French consumption of LBP and the biggest consumers are narrowing: French use is increasing annually from 4 to 5% for RBC and 8 to 10% for Fresh Frozen Plasma (FFP), while blood use in the Netherlands is decreasing. This increase is not fully understood but demography and the regained trust in product safety may be a part of the explanation. Inside the country, there are large discrepancies between the levels of LBP prescriptions: the Alsace region prescribes almost 50 RBC per 1,000 inhabitants whereas the Centre-Atlantique region prescribes 30 RBC per 1,000 inhabitants (IGAS 2010b). At the scale of one single teaching hospital in Bordeaux, 6.3% of patients were transfused in 2006 (de Pommerol, Gilleron et al. 2010).

All blood transfusions in France take place in hospitals or clinics. 95% of hospital stays registered in the PMSI in Franche-Comté region took place in public hospitals (ORS Franche-Comté, 2009). According to the study conducted on all transfusions on June 13th 2006 (Quaranta, Berthier et al. 2009), medical units (excluding oncohematology) transfuse 35% of patients; oncohematology and surgery transfuse 25% of patients each. Emergency rooms and obstetric units are often seen as large consumers of LBP but they transfused only 3% and 0.8% of patients respectively. Oncohematology uses almost half of LBP and 75% of platelets. Actually, French blood is mainly used for chronic patients and there is no ambulatory transfusion. Some rare services are developing transfusion in home-based hospitalization, such as the Vichy hospital (Auvergne), in order to avoid the fatigue caused by moving the patient to the hospital.

For the overall population, the mean number of products delivered per patient seems to stay relatively stable from 2005 to 2010: about 5 for RBC, 4.5 for CP and 6.5 for FFP. The biggest variation in the number of products prescribed per patients is seen for FFP.

Inadequate prescriptions, both in number of blood products per patient and in type of blood products, are reported at national level. Indeed, a multicenter retrospective study conducted in 2009 highlighted the fact that only 10% of prescriptions were for one RBC unit (Gouëzec, Berger et al. 2010). The median transfused units were 2. So a part of patients who need only one blood product are transfused two blood products according to the old habit of transfusing "two RBC or nothing". Another inadequacy in prescription is reported regarding blood phenotyping and matching. 34% of RBC prescriptions were not complying biological matching characterictics and 80% of non-complying prescriptions were due to an excess of phenotyping (Gouëzec, Berger et al. 2010).

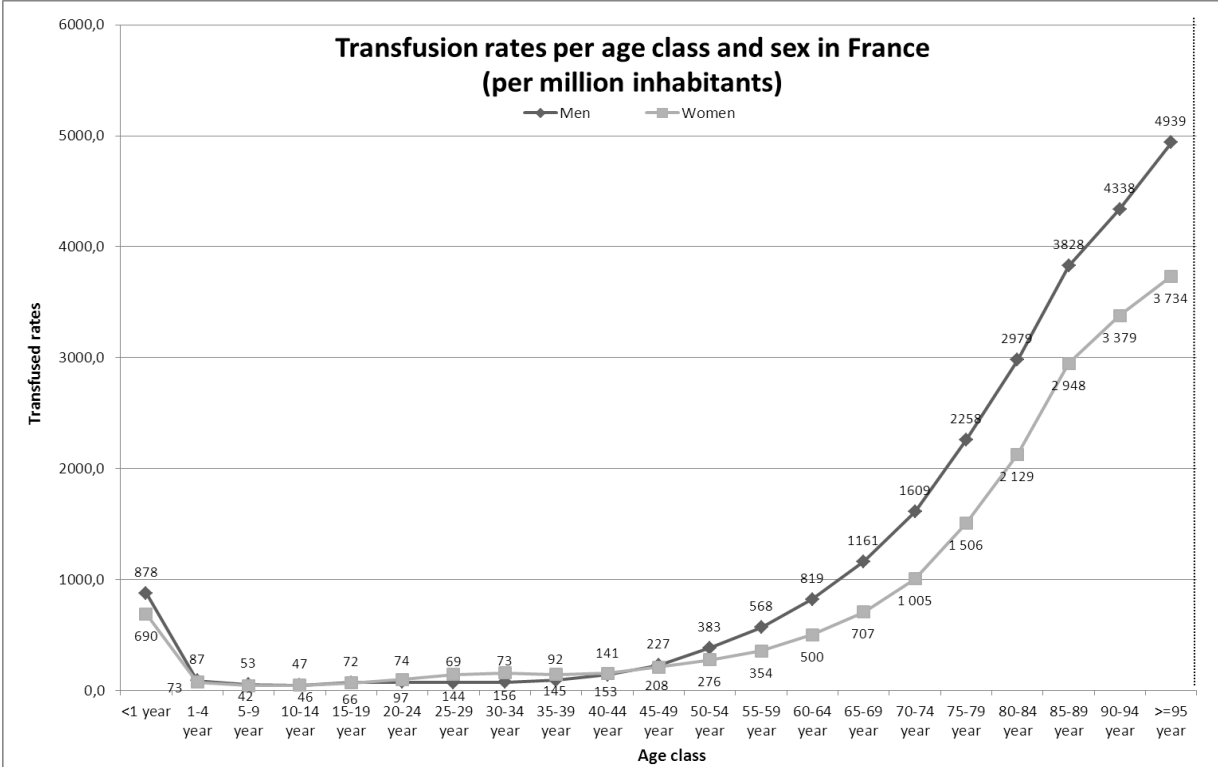B)   Specific profile of elderly blood use

Figure 1: Rate of transfused patients in France per age class and per sex (FNORS data, PMSI-MCO 2009, unpublished data)

The rate of transfused patients increases with age (Figure 1). Using the hospital information system (PMSI), we see that transfusion rate is particularly low after the first year of life and until 45 years old and increases sharply for older ages. When comparing PMSI-MCO data with exhaustive delivery data for the Ile de France Region, we find 54% of patients of all ages. For the elderly, we find a smaller proportion of transfused patients. For instance, for people aged 80 to 84, the transfusion rate is around 2,000 per 100,000 inhabitants using the PMSI-MCO data for the Ile de France region (Annex 5). EFS data show a rate of 4,000 transfusions per 100,000 inhabitants. For people aged 95 and over, the corresponding figures are about 4,000 for PMSI-MCO and 10,000 for EFS. In reality

transfusion rate must be between both estimations, given that EFS data are probably overestimating the number of transfused patients.

The mean age of patients for whom LBP were delivered in 2010 is 68 years-old. It varies widely between overseas departments like Reunion and central regions of mainland France: respectively 53 years old and 71 years old. The mean age is older for patients receiving RBC than for those receiving FFP or CP (56 and 57 years old).

In 2005, 32% of the 395,390 patients who were delivered RBC were aged 80 and over. In 2010, 38% of the 475,844 patients who received RBC were very elderly. Keeping in mind that only 5.5% of the French population is aged ≥80, we can see that blood products use is to some extent concentrated among the elderly: in 2010, they receive 38% of RBC, 13% of CP and 15% of FFP. The total number of transfused patients and the proportion of people aged 80 and over are increasing simultaneously. The biggest concentration of the very elderly occurs for RBC. The situation is also widely different across regions: again Reunion has the lowest percentage of transfused elderly (14%) and the Bourgogne-Franche-Comté and Centre-Atlantic regions have the biggest (more than 40% of transfused elderly). When comparing the distribution of transfused elderly with the distribution of the elderly across the country, there are no striking differences. So the regions that have the more elderly transfuse more elderly patients and vice-versa (Annex 6).

When analyzing the number of RBC transfused per patient for different age classes, we notice a decrease of transfused units per patient except at age 85 and over (IGAS 2010b).

Type of blood product	Number of products	Number of patients	Mean Age	Patients aged < 66 years (%)	Patients aged 66 to 80 years (%)	Patients aged >80 years (%)
Red Blood Cells	2,327,102	475,844	69	35	30	38
Platelets	273,671	61,434	58	57	30	13
Fresh Frozen Plasma	364,505	56,971	57	57	28	15
All products	**2,967,181**	**492,105**	**68**	**36**	**30**	**37**

Table 1: Types of blood products delivered per age class in France in 2010, EFS data

For people older than 75 years, the most common conditions with a mention of blood transfusion are: hematologic diseases (myelodysplastic syndrome, myeloid leukemia and anemia), orthopedic conditions (hip fracture, gonarthrosis, coxarthrosis) and cardiac failure.

ICD Code (PMSI)	Diagnosis	Number of hospital stays for transfused patients (all ages)	Number of hospital stays for transfused patients aged ≥75	% of hospital stays for people aged aged ≥75
C92	Myeloid leukemia	23 040	7 726	34%
D46	Myelodysplastic syndromes	43 799	28 798	66%
D50	Iron deficiency anemia	24 617	15 900	65%
D63	Anemia in chronic diseases classified elsewhere	33 594	14 438	43%
D64	Other anemia	18 618	10 976	59%
I50	Heart Failure	6 189	4 763	77%
M16	Osteoarthritis of hip	7 337	4 365	59%
M17	Osteoarthritis of knee	6 432	3 782	59%
S72	Fracture of femur	15 882	13 246	83%

Table 2: Most common diagnoses related to transfusion in 2009 (FNORS data, PMSI-MCO 2009, unpublished data)

In France, transfusion short-term adverse reactions are closely monitored by hemovigilance. In contrast, mid-term and long-term effects of transfusions are not seen with the same interest. From 2002 to 2008, about 7,600 adverse effects per year were declared for LBP recipients (about 500,000 recipients per year), 3,700 for people aged ≥65. Half of the adverse effects for the elderly were likely or certainly linked to blood transfusion, two-thirds were not serious. A mean of 9 deaths, at least likely linked to blood transfusion are annually reported for this age class. Adverse effects incidence rate is larger for people aged 65 and over than for the general population (1.5 versus 1.1) due to the emergence of irregular antibodies (39%) and an increase in the volume overloads with age (even with no other concomitant disease) (ANSM 2009).

People aged 80 and over comprised 21% of declared adverse reactions in 2008 when they received 35% of labile blood products.

3.3.3 Practices and number of patients for the common diseases responsible for transfusion are changing

A)   Hematological disorders and cancers

The prevalence of anemia is estimated to be around 10% for people aged 65 and over who live at home, 30% in institution and 50% in the hospital. It is a quite common cause of morbidity for the very elderly but is not systematically screened for. We can expect an increase in cases in the following years due to an increase in screening.

2,400 to 3,000 people are diagnosed with myelodysplastic syndromes each year in France. 30% to 40% myelodysplastic syndromes evolve to acute myeloid leukemia. A cross-sectional study was conducted in 2008 by the Francophone Group for Myelodisplasia. Median age of the 907 patients was 74 years old. 26% of patients were aged ≥80 and 40% of patients were transfused (a median of 2 RBC per month).

In opposition to old ways, we now tend to diagnose and treat cancer for older and older patients. Incidence of cancer increases with age and the development of screening procedures. Incidence of cancer is then increasing in France to one of the highest levels in Europe (HCSP 2012) with 358,000 new cases in 2010 (INCA 2010). People aged ≥85 represented, in 2008, 6.1% of cancer incidence among men and 9.9% among women, respectively 12,649 and 14,540 new cases (while they represent 3% of the overall population) (INCA 2009). In old ages the most common cancers are breast, prostate, lung and colon-rectum cancers. The French National Cancer Institute predicts an increasing incidence of cancer among people aged ≥85 (Annex 3). An increase of treated cancers implies an increase in aplasia caused by cancer treatments. In PACA-Corse for instance, 10% of patients receiving chemotherapy are transfused (EFS unpublished report) and a large-scale audit in the UK (Barrett-Lee P J 2000) revealed that pretreatment Hb concentration < 11g dL^{-1} is a significant risk factor for transfusion. In France, 270,000 patients received chemotherapy in 2009 (INCA 2010). Between 2005 and 2010, the number of patients receiving chemotherapy increased by 24%.

Anemia in cancer is mostly treated with EPO but some questions about EPO risk-benefit ratio are still being discussed. EPO permits to save blood but have side effects that may cause mortality, such as thromboembolic accidents and effects on the development of the cancer itself (*Le Moniteur Hospitalier* n°242, janvier 2012). This leads clinicians to be very careful with EPO use in cancer patients. Hence we are expecting both an increase in cancer patients and an increase in blood transfusion use for cancer patients.

B)   Injuries, orthopedic disorders and surgery

50% of French women aged ≥80 have osteoporosis (DREES 2011a).The main complication of osteoporosis is femur fracture, causing handicaps and incapacity. About 35,000 people aged ≥85 were hospitalized in 2008 for a femoral neck fracture. Nevertheless an important part of these fractures are avoidable by preventing osteoporosis and falls.

Data on the prevalence of arthritis in France is scarce but prevalence increases with age. Coxarthritis and gonarthritis are responsible for long-term functional limitations. Hip and knee can be replaced by prosthesis to improve patient quality of life. According to a British study, orthopedic surgery accounts for 10% of total RBC used in hospitals. Total hip replacement alone accounts for 4.6% (Stanworth, Cockburn et al. 2002). The mean age of patients is 69 years in national studies in the UK and Denmark. About 60% are female. The national audit of blood use in elective primary unilateral total hip replacement surgery in the UK found an overall prevalence of 25% transfused patients from 28 days before surgery to 14 days afterwards (Boralessa, Goldhill et al. 2009). The average percentage of transfused patients varies widely between hospitals from 0% to 100%.

The type of procedure seems to impact the percentage of transfused patients. In fact, a national Danish study in 2008 (Jans, Kehlet et al. 2011) found higher transfusion rates for patients undergoing elective revision of total hip arthroplasty (RTHA) than for patients undergoing primary total hip arthroplasty (THA) (61% versus 24%). Transfusion rates were also increasing with age. 75% of patients older than 85 undergoing RTHA and 59% of those undergoing THA were transfused. The risk of transfusion was higher for women than for men. Health centers with higher volume of THA had a significantly lower transfusion rate but it was not the case for RTHA.

The pre-operative hemoglobin level seems important to predict transfusion rates. In the UK, 29% of patients did not have a pre-operative hemoglobin measurement (28 days before surgery). 15% of those who got pre-tested went for surgery with a hemoglobin level less than 12d/dL (anemic patients). The transfusion rate for patients undergoing surgery with an Hb < 12.0 g/dl was almost three times higher than for patients with an Hb ≥ 12 g/dl.

In orthopedic surgery, early red cell transfusion (during surgery or the day of the surgery) is, most likely, due to blood loss during surgery. While only 1/3 of British patients were transfused early, in Denmark 47% of THA patients and 73% of RTHA patients were transfused early. This difference may be caused by more liberal triggers for transfusion in Denmark, but also highlights the variability in surgical techniques and variability of blood loss. Nevertheless, it cannot be proved because volume of intra-operative blood loss was reported for only 37% of the patients and postoperative blood loss for 51% in the UK. If we want to reduce blood loss, it is important to know current practices. Strategies to reduce blood loss are in place in most hospitals: intra-operative or postoperative cell salvage methods were available in 61% of the hospitals who responded. Even if 22% of patients were on antiplatelet drugs, 91% of hospitals stated that there was a system for stopping anti-platelet medication before surgery. Taking patients off non-specific non-steroidal anti-inflammatory drugs may also reduce blood loss during surgery and blood transfusion needs.

Transfusion threshold is a cornerstone of blood management. In UK, surgeons use higher mean transfusion thresholds than anesthetists and are more likely to transfuse two or more units (Young SW 2008). Among those who were transfused, 7% were given a single unit and 67% two units. In Denmark, mean RBC units transfused was 2.2 for THA and 3.2 for RTHA. Moreover, only 47% of British hospitals had a transfusion policy and only 19% of those transfusion policies recommended a transfusion threshold <8g/dL. A retrospective study revealed that strict adherence to a threshold of 8 g/dl and a single-unit transfusion strategy resulted in a mean of 1.51 RBC saved per patient who underwent hip or knee arthroplasty (Ma, Eckert et al. 2005).

The use of blood in orthopedic surgery is steadily increasing with the ageing population. Any change in policy regarding who is prescribing or what the thresholds for transfusion are can impact transfusion rates. But more importantly, changes in practices regarding pre-operative anemia screening and treatment, and techniques to reduce blood loss during surgery could balance this increase.

C)   Cardiac disorders and surgery

Cardiovascular disease mortality is low in France because of widespread effective treatments. Nevertheless most of the elderly have cardiovascular diseases. The number of people registered in the long-term disease procedure n°5 (ALD 5) for heart failures and rhythm disorders is increasing.

Heart failures caused about 14,000 deaths among people aged ≥85 in France in 2008 (DREES 2011a). Its age adjusted incidence has remained stable over the past 20 years but the prevalence is increasing. People tend to develop the disease later and die later than before (McMurray and Pfeffer). Common causes of heart failure include ischemic heart disease (including myocardial infarction), hypertension, valvular heart disease, and cardiomyopathy. Acute decompensated heart failures are frequently causing hospitalization for the elderly. The very elderly is responsible for 65,700 hospital stays for heart failure in 2008. An important part of these hospitalizations can be prevented with adequate management of the disease.

A retrospective cohort study including Medicare patients who underwent coronary artery bypass graft surgery in Michigan from 2003 of 2006 found that 92% of patients aged ≥80 were transfused. Nevertheless there was a high variability in proportion of transfused patients between hospitals. The authors attributed 30% of this variability to hospital sites (Rogers M, 2009).

D)   Drug consumption

Some very common drugs are risk factors for bleeding or falls and fractures, especially for the very elderly. In fact, antithrombotic drugs (anticoagulant drugs and antiplatelet drugs for instance) can cause bleeding, especially when people fall or undergo surgery. Long term non-steroidal anti-inflammatory drugs treatment (NSAID) or NSAID treatment without gastric protectors can cause intestinal bleeding. The risk of fall and fractures is increased with some psychotropic treatments such as the association of two neuroleptic drugs and long half-life or long term benzodiazepine treatments.

France has a relatively high level of drug consumption (DREES 2007) and in 2005, 90% of general practitioner consultations ended with a prescription of at least one drug (IPSOS 2005). 1% of the population takes vitamin-K antagonists (HAS). NSAID medication is very common and some of them are sold over the counter. A study conducted in PACA region, France, reported inappropriate prescriptions for people aged ≥70 in 2008, based on health insurance reimbursement data (Jardin, Bocquier et al. 2012). 11.6% of the elderly had long term NSAID treatment, 14.6% had long half-life benzodiazepine treatment, 21.5% had long term benzodiazepine treatment and 28.1% had NSAID treatment without gastric protector.

E)   Other elements

Some other elements could impact blood use. First of all, 20,500 patients are in the long-term procedure (ALD) n°19 dedicated to nephropathies. While incidence of renal failure is stable for people aged <75, it is increasing among people aged 75 and over : 16% increase between 2005 and 2009 (DREES 2011a).

Then, for some diseases that need frequent blood transfusions, patients who used to die very young are now ageing: it is the case for example of sickle cell disease. Nevertheless, we could also find a cure that doesn't include blood transfusions and blood demand would drastically decrease.

Finally, if we encounter blood shortage, prescription practices would change. We may decide to keep blood for the youngest patients with longer life expectancy for example.

3.4 Predicting future blood needs

Several teams in several countries studied the effect of demographic changes on future blood supply and demand. They were able to quantify the demographic effect on recent evolutions of blood demand. A large part of the changes can't be explained by demographics and we have to turn towards other explanations: changes in medical

practices, changes in indications of LBP and guidelines, changes in the health system structure, changes in blood management policies…

3.4.1 The German model in Mecklenburg-Pomerania (Greinacher, Fendrich et al. 2007)

Using data from in-hospital RBC transfused patients in 2005 and demographic data, this team constructed a model to predict blood demand for 2020. The model, implying a stable age-related transfusion rate, predicts an increase of in-hospital blood transfusion demand of 25%. They tested the model on data from the land's hospital for 1997 to predict RBC transfusion demand for 2007. The overall predicted demand was only 1.2% smaller than the actual blood demand in 2007. Nevertheless, the model overestimated blood demand for younger groups by 16% and underestimated this demand for older groups by 10%.

Germany is a high-level blood consumer and has already an aging and declining population. Demographics could predict most of the increase in blood demand in Germany but this may not be the case in France, which is a low-level blood consumer with an ageing but still increasing population. Moreover the imprecision of the model reminds us of the importance of blood management policies (the overestimated blood demand can be explained by a blood conservation program) and the importance of medical practices (the underestimation can be partly explained by more intensive therapies for older patients), not to mention that these data are only for hospital transfusion. The place where transfusion takes place is also important: out of hospital transfusion, in Germany, is performed mainly for chronic conditions such as anemia, which are very frequent in old ages. Hence this model may strongly underestimate blood demand growth for older groups.

3.4.2 The Dutch national model (Borkent-Raven, Janssen et al. 2010)

The authors used data on blood recipients from the PROTON data set to create mathematical models and predict RBC demand in 2015.

The first model is based on demography only and assumes that transfusion rates per age and sex are constant over time. It predicts that RBC demand will increase over time. They used data from the years 1997 and 2006 as a reference to predict past and future demand. The retrospective estimates were not good for the years 1999 to 2006 but using 1997 data as a reference, estimates were very good for the years 1984 to 1998. Hence the demographic model was a good fit before 1998. Around 1997, blood utilization tended toward "optimal use" and the demographic model is no longer a good fit.

The second model is based both on demography and changes in clinical practices over time. The authors created an additive model using data from 1997 to 2006 where transfusion rates are a function of age, sex and time. It predicts a decrease in blood

demand of 8% for 2015. The retrospective estimates for the years 1999 to 2006 are much better than the estimates of model 1.

This study indicates that we need to take into account both demographic and clinical practice changes to predict future blood demand. Nevertheless the authors used past and present trends in clinical practice to predict the future. So model 2 only shows us what could happen if the trends in clinical practice stay the same. We don't know what new techniques or treatments could help save blood or on the contrary provoke a large increase in blood demand in the future.

3.4.3   A Regional model in Alpes-Mediterranée, France (unpublished)

Comparing EFS transfusion data for RBC with data on demographic change, the authors were able to identify the portion of blood demand increase due to population change and the portion due to clinical practices changes for the years 2004 to 2008. They constructed a model using 3 variables: the evolution of the population, impact of the clinical practices and mean number of transfused units per age class. 3 hypotheses were tested with the same evolution of the population and the same mean of transfused units per age class to predict RBC demand until the year 2012. The first hypothesis took into account only the evolution of the population, the second hypothesis added a decreasing impact of practices over time and the last hypothesis had an impact of practices equal to the impact calculated for the year 2008.

Because we are now in 2012, we can retrospectively compare their results with real data and all hypotheses overestimated the increase of blood demand in Alpes-Méditerranée region.

3.4.4   The French National model

The French blood service is willing to create a prospective model to predict the evolution of future blood demand. It gathered national data on blood demand and on the evolution of the population for the period 2002-2010 and tried to differentiate the increase in blood demand due to demographic change from the one due to clinical practices. A model based only on demographic evolution has been used to predict blood demand in 2020. The present document constitutes a preliminary work to contribute to the elaboration of a more complex model taking into account changes in clinical practices.

4 Discussion

A)   End of life issues

In France, most elderly want to stay home and institutionalization is postponed as far as possible. The French elderly enter institutions mostly when their health is too deteriorated and they have no other choice. In many cases, they are not entitled to their choice. Unplanned transfers from institutions to hospitals, especially to the ER, are very frequent and have consequences on the health of the elderly: increase of psychotropic drugs consumption, increase of falls and dependency, etc. The late demand for institutionalization may be linked to an overall negative perception of those institutions in the French society especially regarding quality or relevance of services provided. In addition there are problems of accessibility and affordability.

Moreover whereas most French elderly want to stay home, they frequently die in inappropriate services in the hospital. A growing number of them get to the ER at the very last moment of their life and a large part of them are not involved in this decision. This reveals a real gap in our system regarding end of life issues.

Furthermore, in the context of multimorbidity, it is difficult to know what the main cause of death is. Perhaps we should reform our coding system for cause of death, taking into account the fact that, for most elderly, many causes are simultaneously involved: we don't really know what they really died from.

B)   Multimorbidity issues

When the elderly's health status is worsening, healthcare and medico-social care use are increasing irrespectively of age. The number of professionals involved in the patient's care also soars. Most elderly are suffering from multiple chronic conditions and are accessing healthcare as any other citizen. However, the specificity of their situations creates more uncertainty on best clinical practices and modalities for care are much more numerous and complex.

At home and in part of the institutions, the general practitioner is supposed to coordinate the different actors. Nevertheless, in real life he or she faces a lot of difficulties to do so. Firstly, he or she is mainly paid on a "fee for services" basis. He or she consequently lacks time to properly enter in a comprehensive approach for each context. New forms of payments are currently implemented or tested (pay for performance, lump sums…). CLICs (Local Centre for Information and Coordination) were created to help coordinating health care and medico-social care but are unequally distributed across the country and are unequally helping the elderly (HCAAM 2010). It would be interesting to create a new kind of health professionals, only dedicated to organizing patient-centered

coordination of care (such as case-managers in the Netherlands or in the US). The health and medico-social professionals also lack evidence based guidelines and appropriate information systems to properly work in a multidisciplinary coordinated team. New guidelines are nevertheless currently released by French health authorities and address part of the problem. Some authors explore the possibility of individualized guidelines for treatment. The DMP (Personal Medical File) is also a step to share information systems but is not fully implemented yet.

The inadequate organization of primary care for the very elderly is further highlighted by the fact that the elderly use the ER as a gateway for unscheduled hospitalization instead of being taken directly to the appropriate unit. They wait long hours to be transferred to the appropriate units and spend on average more than 10 days per year in the hospitals. Hospitals are structured around simple disease care and encounter difficulties to take care of people who need multidisciplinary comprehensive care. One first answer to these difficulties is to avoid as far as possible hospitalization for the elderly with a strong primary care network. In addition, we have a great opportunity to further develop ambulatory surgery: it is proven to decrease nosocomial infections and creates minimal disturbance in the daily life of the elderly. A complementary approach is to support initiatives such as "seamless care" to decrease discontinuity, mistakes and overlapping of treatments. In fact, it is important to guarantee continuity of treatment regardless of the type and number of transfers between institutions, hospitals and homes. After hospitalization, it is also important that the return home or the institution is organized regarding medical treatment and/or home nursing services and home-help. Systematic geriatric assessment by general practitioners, hospital or institution professionals could greatly benefit the elderly too. Perhaps all health professionals should have a geriatric training.

Each drug has been tested for a single disease and obtained its marketing authorization (AMM) in a specific indication. Because most elderly have multiple chronic conditions, they are under an increasing number of drugs. Neither the combination of these drugs, nor the effect of these drugs on an old organism has been studied. But drugs are responsible for 5% of hospitalization among the elderly and 4% of Canadian elderly report mistakes regarding their treatment. So to provide the best care to the elderly, it is important to prevent treatments errors and drug side effects as far as possible. Moreover, it would be very useful to conduct randomized clinical trials including multimordid elderly patients. It would provide knowledge on the effects of combined drugs in this context and permit the development of evidence-based treatment guidelines. Maybe even a specific

marketing authorization should be created for elderly patients, just as was recently implemented for pediatric patients.

C) Limits in the scope of this article

Regarding the impact of the ageing population on the health system, we are not addressing the impact of dependency. Nevertheless, it is a structural component for medico-social care and the problem of how to finance dependency help has to be addressed.

We did not consider either the impact of socio-economical background. People living in the most deprived areas develop multimorbidity earlier. Their life expectancy and disability-free life expectancy is shorter as highlighted by the office for national statistics in the UK (ONS 2012). So it is important too that we address this social problem and help all citizens reach old ages with the same health status regardless of their economic background.

Finally we did not study the effect of all political and financial constraints. We analyzed health needs and what would be best for the very elderly. Then political choices need to be taken accommodating financial possibilities and developing new financing schemes. Nevertheless we believe that making our health system more efficient for the very elderly would not increase the costs but on the contrary contain these raising costs. In fact, chronic multimorbid patients are the ones that use the health system the most but mostly need primary care which is less expensive than specialized care. A more efficient system would lead to less medical errors, duplication and fragmentation of care and a delay in dependency and incapacity appearance. Multidisciplinary work could also reduce cost by permitting, for instance, a delegation of tasks performed by physicians today toward nurses without reduced quality of care. Moreover this efficient health system would not only benefit the elderly but also the entire population as shown in a recent article in the Lancet (Barnett, Mercer et al., 2012). Even if the oldest have more multimorbidities, the absolute number of people suffering from multiple chronic conditions at present in a representative sample of the Scottish population is bigger for people under 65 years old than for the elderly. Besides most people with a long term disorder are multimorbid.

D) Transfusion issues

For the specific case of blood transfusion, the ageing population implies both an increase in potential patients and a decrease in potential donors. So the French Blood Service aims at reducing the irregularity of blood donation to secure blood supply. EFS is currently working on donor's behaviors to increase donor's retention. It is also developing new collecting strategies that facilitate donation (fixed infrastructures in city centers providing appointments and extended opening hours rather than occasional mobile

collection in rural areas for instance). But to guarantee sufficient blood supply, all further exclusions from blood donation need to be anticipated: the epidemiology of potentially blood transmissible diseases is closely monitored. Moreover, these potential exclusions need to be evaluated to take into account the risk-benefit ratio between having less blood (maybe not enough for all patients) and having more blood that has a given risk to transmit diseases.

Clearly in France, after the "contaminated blood issue", all existing safety measures have been implemented. As a result, blood transfusion safety measures regarding the prevention of blood-transmitted infections are among the highest in cost per QUALY for a health product (more than 1 million Euros per QUALY). It is comparable to nuclear plants and civil aviation safety measures. This needs to be taken into account if we want to implement other safety measures. At the same time, other risks have been less in focus (immunological aspects, implementation of good prescription practices…) and their cost-effectiveness may be higher.

When talking about transfusion, most people think that emergency and obstetrics units are the main blood consumers. In fact, while these medical specialties are structural components of our blood delivery network (where there are emergency or obstetric units, there is a need to have blood close by), they only use 3% and 1% of blood in France. So our whole system for blood delivery is based on emergencies, which is very effective but costly whereas most of the blood is used for chronic diseases and planned transfusions. Maybe we should create distinct delivery networks with different approaches, capable of responding both emergency and planned chronic needs.

E)   The elderly in transfusion

In absence of evidence-based guidelines, clinicians used to transfuse 2 RBC or nothing. Some clinicians are now questioning this practice, especially in the case of elderly patients with high risk of volume overloads. Nevertheless, the high percentage of transfused patients that receive two blood units seems to indicate that the old habit is still widespread. In Australia, the same problem of "2 RBC or nothing" called the attention of the National Health and Medical Research Council (Clinical Excellence Commission 2007). Clinicians were deeply interviewed: they mostly believe that they were prescribing according to the Australian guidelines (even when they are not) and that only young non-experimented clinicians are responsible for the 30% of inappropriate use of LBP. In France, ANSM transfusion guidelines are 10 years old now and contain no specific evidence-based recommendation for the elderly.

We should also question the place where transfusion takes place. All transfusions are performed during hospitalization in France, rarely in home-based hospitalization. Hospitals are sometimes far away from the patient residence. For the very elderly, it could be more comfortable to be transfused at home, in institutions or in local ambulatory transfusion centers, such as it seems to be possible in Germany (internal benchmarking study, EFS).

Finally, in France, hemovigilance records all reported sides effects of transfusion. Half of transfused patients are elderly and most of them are under various medications. So facing a side effect, it could sometimes be difficult to determine if the event is caused by one disease itself, a drug or the transfusion. Pharmacovigilance and hemovigilance experts should be working together to increase knowledge about combined effects of drugs and blood transfusion. We also need more information on mid-term and long-term effects of blood transfusion to give clinicians hindsight to choose the most suitable treatment for the patient.

F) Blood demand in the future

Regarding blood transfusion prediction for future years, we can see that a lot of parameters must be taken into account and closely monitored. It is the case for antithrombotic drug consumption, transfusion threshold and triggers, changes in practices: management of pre-operative anemia, reduction of blood loss, change in qualification of the prescriber, availability of guidelines … All policies, professional recommendations, new scientific discoveries or emerging diseases that impact one of these parameters could have a significant impact on blood demand. Change in economic background and emergence of new markets for blood could also impact the way we treat blood as a resource. Finally, societal choices regarding risk-benefit and cost-benefit thresholds for transfusion could impact both the amount of available blood and the choice of patients that could benefit from it.

5 Conclusion

In conclusion, we need to design our health systems to provide the largest amount of healthy life years and not only the largest amount of years to French citizens. Nevertheless, healthy life may not mean the same for all people. Indeed, with regard to the findings of this research, we could redefine "good health" for the very elderly as a state where individuals are suffering from multiple chronic conditions that are properly managed to guarantee the best quality of life (Y.Charpak, *Libération*, Friday 20th of January 2012).

It is likely that our future health care system will provide comprehensive and patient-centered care, mainly ambulatory. So we need to support current initiatives that are heading toward this type of care and properly evaluate the benefit of it.

In the light of this research, it is possible to make the following propositions for progress:

- increase research in health care systems to find the best way to manage the very elderly and implement it
- develop clinical trials for the multimorbid elderly to provide specific evidence-based AMM (just as the pediatric AMM)
- provide all clinicians and health professionals with geriatric training and promote better cooperation between those in charge of the elderly
- develop ambulatory services, including ambulatory transfusion (such as in Germany), to avoid the very elderly the discomfort of hospitalization
- educate blood prescribers regarding blood management strategies, including specific focus on good transfusion practices for the elderly (yet to be formalized).

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A n n e x e s

Annex 1: Perceived health of people living at home

	80 ans et plus	
	Nombre de malades	Malades pour 100 personnes
Maladies de la bouche et des dents	920	87,01
Troubles de la réfraction	915	84,23
Maladies de l'appareil circulatoire	719	68,17
Maladies du système ostéo-articulaire, des muscles et du tissu conjonctif	503	49,53
Maladies de l'oreille et de l'apophyse mastoïde	461	43,33
Maladies endocriniennes, nutritionnelles et métaboliques	353	33,11
Symptômes, signes et résultats anormaux d'examens cliniques et de laboratoire, non classés ailleurs	240	23,96
Maladies de l'oeil et de ses annexes hors troubles de la réfraction	222	21,82
Maladies de l'appareil digestif hors bouche et des dents	165	16,42
Maladies de l'appareil respiratoire	142	13,89
Maladies du système nerveux	130	12,85
Tumeurs	81	7,91
Troubles mentaux et du comportement	71	7,16
Facteurs influant sur l'état de santé et motifs de recours aux services de santé	70	6,37
Maladies de l'appareil genital	61	5,76
Lésions traumatiques, empoisonnements et certaines autres conséquences de causes externes	52	5
Maladies de la peau et du tissu cellulaire sous cutané	50	4,83
Maladies de l'appareil urinaire	42	3,84
Certaines maladies infectieuses et parasitaires	26	2,38
Maladies du sang et des organes hématopoïétiques et certains troubles du système immunitaire	14	1,4
Causes externes de morbidité et de mortalité	7	0,62
Malformations congénitales et anomalies chromosomiques	5	0,31

Annex 2: Health of institutionalized patients

Pathologies	Proportion de résidents atteints de cette pathologie
Affections cardiovasculaires	**75**
Insuffisance cardiaque	23
Hypertension artérielle	52
Troubles du rythme	22
Affections neuropsychiatriques	**82**
Troubles du comportement	26
Etat dépressif	34
Etat anxieux	27
Syndrome démentiel	36
Affections broncho-pulmonaires	**18**
Broncho-pneumopathies (dont BPCO)	11
Pathologies infectieuses	**10**
Affections dermatologiques	**10**
Affections ostéo-articulaires	**47**
Pathologie de la hanche	18
Pathologie vertébro-discale	17
Polyarthrite ou autre affection articulaire	16
Affections gastroentérologiques	**40**
Affections endocriniennes et métaboliques	**28**
Diabète	14
Affections uro-néphrologiques	**40**
Incontinence urinaire	32
Affections hématologiques ou cancérologie	**16**
Anémie	7
Cancer	8
Hémopathie maligne	1
Pathologie oculaire	**20**
Etat régressif	**10**
Etat grabataire	**17**
Etat terminal	**1**
Absence de pathologie	**1**

Les personnes âgées en institution DREES n°22 2011

Annex 3: Evolution of cancer (INCA 2009)

Figure 5 / Évolutions observées tous cancers

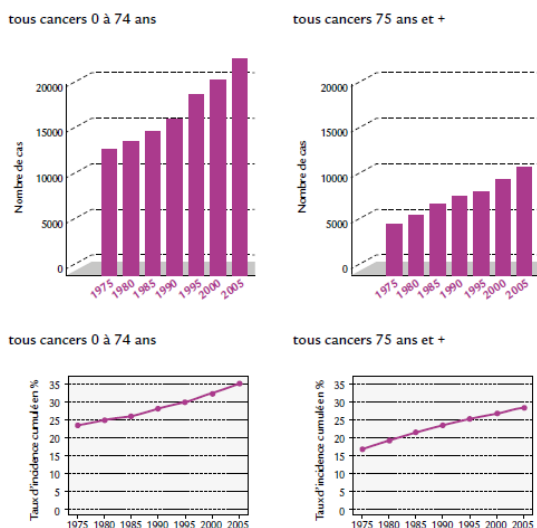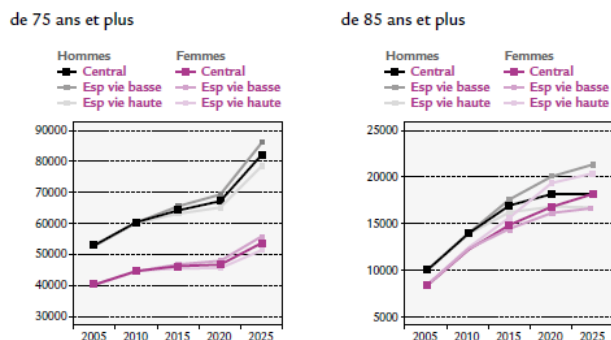Évolution du nombre de cas et du taux cumulé

Figure 4 / Évolution du nombre de cas de cancers dans la population jusqu'en 2025 en fonction des scénarios d'évolution de la population + hypothèse de maintien des taux par âges estimés pour 2005

Annex 4: PLEIAD study results, posters presented in the 31th Annual Day of the French Geriatric and Gerontology Society (4th to 6th october 2011, CNIT – Paris)

Tableau 1 : Caractéristiques socio-démographiques des résidents

		N=2231
Sexe	Homme	661 (30%)
	Femme	1560 (70%)
Age (en années)	*Moyenne*	*85.7 ± 7.4*
	Min-Max	*53-104*
Statut marital	Marié	397 (18%)
	Seul	1832 (82%)
Ancienneté dans l'établissement (en mois)	*Moyenne*	*18.2 ± 34.6*
	Minimum-Maximum	*1-377*
Bénéficiaire de l'aide sociale	Oui	259 (12%)
Diagnostic de démence	Oui	1005 (45%)
Score MMSE	*Moyenne (ET)*	*13.3 ±7.4*
Nombre d'hospitalisations au cours des 3 derniers mois	*Moyenne*	*1.2 ± 0.4*
	Aucune	1325 (59%)
	Au moins une fois	905 (41%)
	2 fois et plus	133 (6%)

Tableau 2 : Caractéristiques de la dernière hospitalisation des résidents ayant été hospitalisés au moins une fois

		TOTAL (N=905)
Décision d'hospitalisation	Programmée	237 (26%)
	En urgence de jour	561 (62%)
	En urgence de nuit	81 (9%)
	Non précisé	6 (1%)
Initiateur de l'hospitalisation	Médecin traitant	339 (38%)
	Médecin de garde	186 (21%)
	Médecin du SAMU	125 (14%)
	Médecin coordonnateur de l'EHPAD	64 (7%)
	Autres	154 (15%)
	Non précisé	38 (4%)
Motif de l'hospitalisation	Pathologie somatique	659 (73%)
	Pathologie traumatique	139 (15%)
	Pathologie neuro-psychiatrique	88 (10%)
	Non précisé	19 (2%)
Durée totale d'hospitalisation	Moyenne (en jours)	11.1
	Médiane (en jours)	7.4
Service hospitalier d'accueil des résidents hospitalisés	Patients adressés à un seul service	432 (42%)
	Dont : Urgences	97 (11%)
	Gériatrie	70 (8%)
	Chirurgie	76 (8%)
	Patients adressés à 2 services dont les urgences	425 (47%)

https://epidemiologie-france.aviesan.fr/catalog/sheet/detail.jsp?id=179&langSheet=fr&vid=1&readOnlyForcedContrib

Annex 5: Rates of transfused patients in Ile de France region using both PMSI-MCO and EFS data (FNORS data)
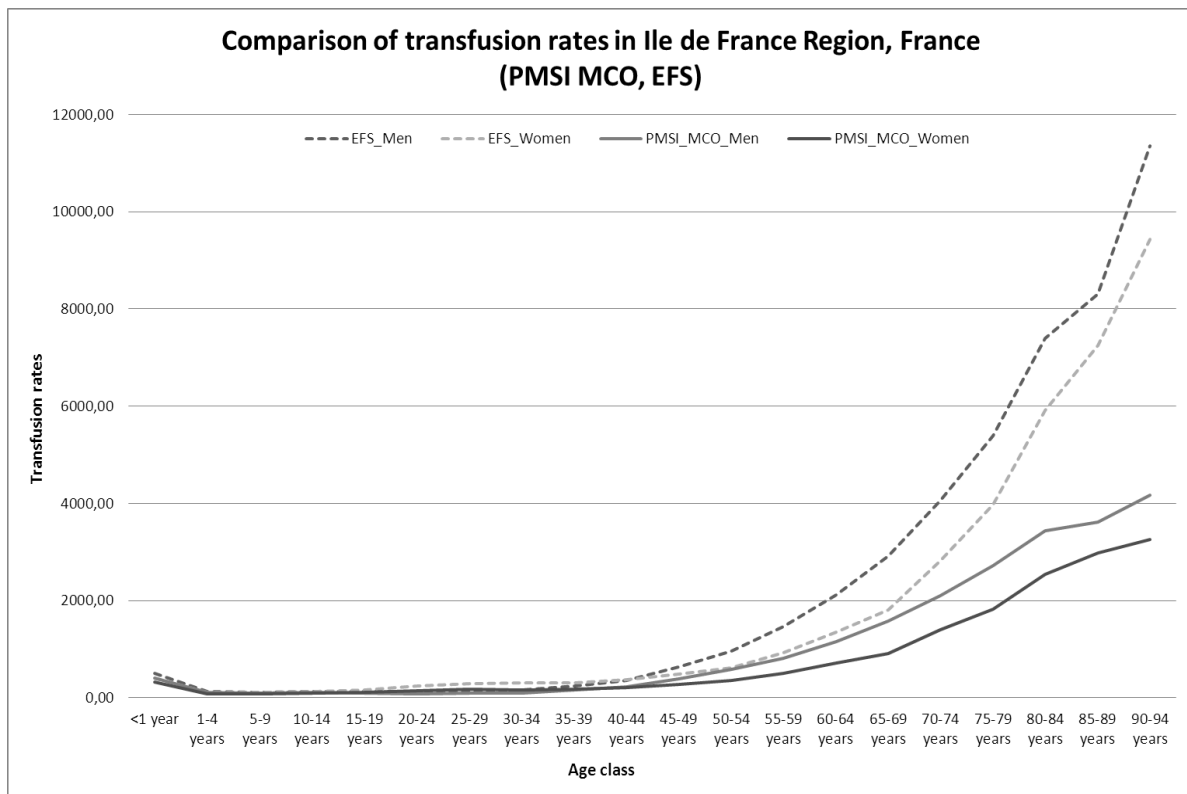
Annex 6: Distribution of percentage of very elderly and transfused very elderly population across the country (INSEE and ESF data for 2010)
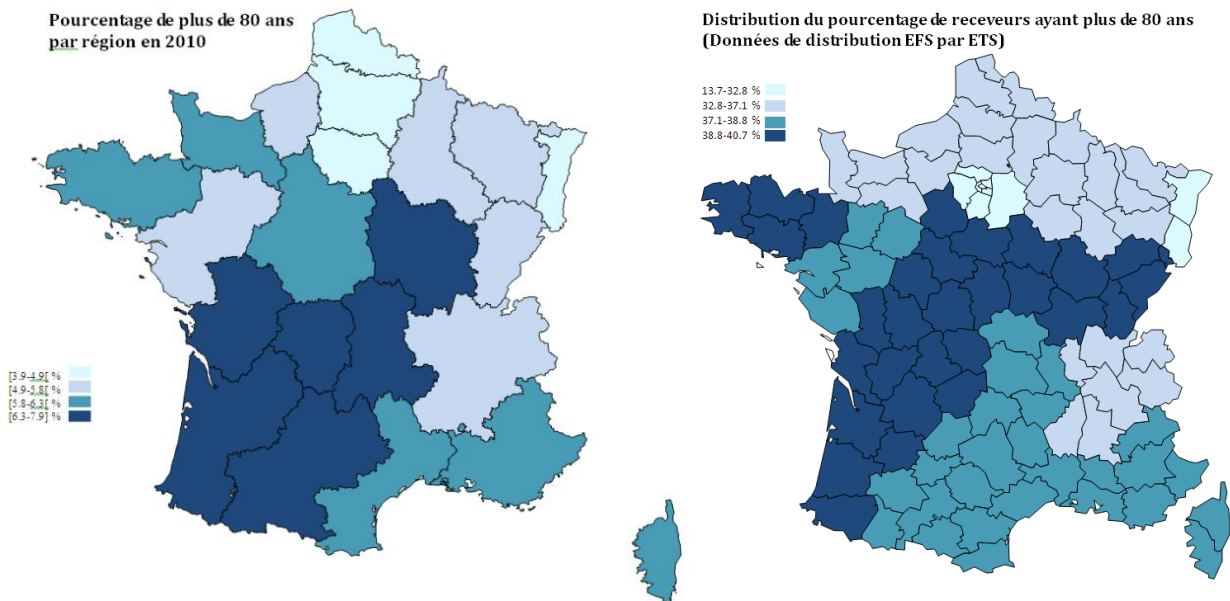
Abstract

In the context of an increasing number of very elderly people in our society, this study aims at assessing whether the age of patients is restructuring the health system and what it implies for labile blood products transfusion (BT).

All available data bases and reports concerning demography, health of the very elderly, health care utilization and place for death were consulted. Hospital transfusion data and French Blood Service delivery data were also studied and compared. Then, we conducted short literature reviews to deepen specific topics regarding clinical practices and epidemiology of BT related diseases.

While the French elderly want to stay home, they frequently die in hospital, in inadequate places. They access institutions when they have no other choice. When their health status worsens, their health care and medico-social care use increases. They frequently use emergency rooms and are frequently transferred within hospital or between hospitals and home or institutions. The suboptimal coordination of care causes discontinuity of treatment, duplications and errors. There are no specific evidence-based guidelines for the treatment of the very elderly.

In opposition to common belief, blood recipients are mostly the elderly and 32% of them are aged ≥80. Blood is also predominantly used for chronic medical conditions (60%) including oncohematology. In this context, demography has been used to predict future blood demand. Nevertheless, half of the increase in blood demand in France is explained by other factors such as changes in clinical practices.

The ageing population is restructuring our health system towards more comprehensive, patient-centered and ambulatory care. In this context, the way certain services are provided, their benefit, appropriateness and societal acceptability need to be reconsidered: it is the case for blood transfusion.

Keywords: blood transfusion, demography, very elderly, aging, healthcare seeking behavior, chronic conditions, forecasting

| ZALAMBANI | **Aurélie** | **2 juillet 2012** |

Master de santé internationale

M2 2011-2012

IMPACT DU VIEILLISSEMENT DE LA POPULATION SUR LE SYSTEME DE SANTE. CAS PARTICULIER DE LA TRANSFUSION SANGUINE

Résumé :

La population française vieillit. Le système de santé doit donc prendre en charge un nombre croissant de personnes âgées et très âgées. Cette étude documentaire a été réalisée afin d'évaluer l'effet de l'âge des patients sur la structure du système de santé et ce que cela implique dans un exemple concret : la transfusion sanguine.

Dans une première partie, cette étude dresse un état des lieux des caractéristiques démographiques, de l'état de santé et de l'accès au système de santé des personnes âgées ainsi que des problématiques liées à la fin de vie. La seconde partie de l'étude décrit l'importance des personnes très âgées dans la transfusion sanguine et les spécificités de cette transfusion au grand âge. Enfin, la dernière partie s'intéresse aux facteurs pouvant influencer les futurs besoins en produits sanguins labiles (PSL). Plusieurs modèles de prévision des besoins en PSL ont été développés en s'appuyant sur l'évolution démographique. Cependant, l'évolution démographique n'explique que partiellement l'augmentation des besoins et d'autres facteurs doivent être pris en compte tels que l'évolution des pratiques cliniques.

Mots clés : **personne âgée, phénomène démographique, système de santé, vieillissement, filière soins, besoin santé, état santé, fin vie, recours soins, transfusion sanguine, prospective**