

## Clinical evolution of adult, elderly and very elderly patients admitted in Intensive Care Units

Verônica Cunha Rodrigues de Oliveira<sup>1</sup>

Lílian de Souza Nogueira<sup>2</sup>

Rafaela Andolhe<sup>3</sup>

Katia Grillo Padilha<sup>4</sup>

Regina Marcia Cardoso de Sousa<sup>5</sup>

This study compared clinical outcomes among adult, elderly and very elderly patients admitted to Intensive Care Units (ICUs) located in São Paulo, Brazil. This retrospective, longitudinal and comparative study included 279 adult ( $\geq 18$  and  $< 60$  years), 216 elderly ( $\geq 60$  and  $< 80$  years) and 105 very elderly ( $\geq 80$  years) patients. Adult patients differed from other groups regarding the unit to which they were referred and severity, according to the Simplified Acute Physiology Score II. Adults were most frequently sent to hospitalization wards; elderly and very elderly patients who survived hospitalization in critical units showed sharper improvement before discharge. There were differences in relation to mortality between adult and elderly patients, with a higher rate in the elderly group; however, the mortality rate of very elderly and adult patients was similar. In general, the results indicated that older age was not associated with undesirable outcomes in ICUs.

Descriptors: Age Groups; Severity of Illness Index; Intensive Care Units; Aged; Aged, 80 and over.

<sup>1</sup> RN, M.S.c in Nursing, Escola de Enfermagem, Universidade de São Paulo, SP, Brazil. E-mail: vcr@usp.br.

<sup>2</sup> RN, Doctoral Student in Nursing, Escola de Enfermagem, Universidade de São Paulo, SP, Brazil. Scholarship holder from Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP). E-mail: lilianogueira@usp.br.

<sup>3</sup> RN, Doctoral Student in Nursing, Escola de Enfermagem, Universidade de São Paulo, SP, Brazil. Scholarship holder from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). E-mail: rafaelaandolhe@usp.br.

<sup>4</sup> RN, Ph.D. in Nursing, Full Professor, Escola de Enfermagem, Universidade de São Paulo, SP, Brazil. E-mail: kgpadilh@usp.br.

<sup>5</sup> RN, Ph.D. in Nursing, Associate Professor, Escola de Enfermagem, Universidade de São Paulo, SP, Brazil. E-mail: vian@usp.br.

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### Corresponding Author:

Verônica Cunha Rodrigues de Oliveira  
Universidade de São Paulo. Escola de Enfermagem  
Av. Dr. Enéas de Carvalho Aguiar, 419  
Bairro: Cerqueira César  
CEP: 05403-000, São Paulo, SP, Brasil  
E-mail: vcr@usp.br

## **Evolução clínica de adultos, idosos e muito idosos internados em Unidade de Terapia Intensiva**

O estudo comparou a evolução clínica de adultos, idosos e muito idosos, internados em Unidades de Terapia Intensiva, localizadas em São Paulo, Brasil. Trata-se de estudo retrospectivo-longitudinal, do tipo comparativo. Participaram 279 adultos ( $\geq 18$  e  $< 60$  anos), 216 idosos ( $\geq 60$  e  $< 80$  anos) e 105 muito idosos ( $\geq 80$  anos). Os adultos diferiram dos outros grupos em relação à unidade de destino e evolução da gravidade, segundo Simplified Acute Physiology Score II. Foi mais prevalente o encaminhamento dos adultos para unidades de internação, porém, os idosos e muito idosos, sobreviventes à internação na unidade crítica, apresentaram melhora mais acentuada antes da alta. Entre adultos e idosos ocorreu diferença em relação à mortalidade, com maior taxa no grupo mais velho; entretanto, a mortalidade dos muito idosos e adultos foi similar. Em geral, os resultados indicaram que a idade mais avançada não foi fator associado aos desfechos indesejáveis da assistência intensiva.

Descritores: Grupos Etários; Índice de Gravidade de Doença; Unidades de Terapia Intensiva; Idoso; Idoso de 80 Anos ou mais.

## **Evolución clínica de adultos, ancianos y muy ancianos internados en Unidades de Terapia Intensiva**

El estudio comparó la evolución clínica de adultos, ancianos y muy ancianos internados en Unidades de Terapia Intensiva localizadas en Sao Paulo, Brasil. El estudio fue retrospectivo longitudinal, del tipo comparativo. Participaron 279 adultos ( $\geq 18$  y  $< 60$  años), 216 ancianos ( $\geq 60$  y  $< 80$  años) y 105 muy ancianos ( $\geq 80$  años). Los adultos difirieron de los otros grupos en relación a la unidad de destino y evolución de la gravedad, según Simplified Acute Physiology Score II. Fue más frecuente el encaminamiento de los adultos para unidades de internación, sin embargo los ancianos y muy ancianos sobrevivientes de la internación en la unidad crítica presentaron mejoría más acentuada antes del alta. Entre adultos y ancianos ocurrió diferencia en relación a la mortalidad, con mayor tasa en el grupo más viejo; entretanto, la mortalidad de los muy ancianos y adultos fue similar. En general, los resultados indicaron que la edad más avanzada no fue factor asociado a los resultados indeseables de la asistencia intensiva.

Descriptorios: Grupos por Edad; Índice de Severidad de la Enfermedad; Unidades de Terapia Intensiva; Anciano; Anciano de 80 o más Años.

## **Introduction**

Intensive Care Units (ICUs) care for severe and recoverable patients requiring continuous care, offering physical, material and specialized human resources to enable the reversal of disorders that put the lives of patients at risk<sup>(1)</sup>. These resources have become increasingly sophisticated in recent years and, consequently, increasingly expensive.

The fact that the world population is aging brings with it medical and socioeconomic challenges to governments and societies. As demographic changes occur with

increased expectancy of life, the increase of the elderly population is also observed, including within ICUs<sup>(2)</sup>.

Studies indicate that whatever the health indicator analyzed, results show a greater proportion of disorders among those older than 60 years of age accruing from chronic diseases that should be identified early, treated and monitored to reduce mortality and costs from healthcare<sup>(3-4)</sup>.

Even though the aging process is considered to be physiological, it is depicted by a progressive reduction

in organic functional reserve. In situations when the body is overloaded, the homeostatic balance is harmed, which makes an elderly individual more susceptible to disorders and diseases<sup>(3,5)</sup>. Additionally, elderly patients' responses to treatment, when compared to younger patients, may be harmed given a low physiological reserve, inherent to the aging process.

Therefore, identifying how these individuals, increasingly more expressive in the population, presenting distinct physiological characteristics and at a greater risk of worsening conditions or of death, progresses within ICUs. Such information can show outcomes, the quality of care delivered in these units and enable the supply of the resources necessary for continuing treatment after patients are discharged from the ICU.

Many parameters can be used to characterize this evolution. In this study we chose mortality, readmission to the ICU during the same hospitalization, the patient's condition worsening while in the ICU, and unit to which the patient is referred after discharge from the ICU.

Mortality is a frequent indicator of quality of care in an ICU, which in the analysis process cannot be detached from the severity of the patient's condition<sup>(6-7)</sup>. In this study the following severity indicators were used: Simplified Acute Physiology Score II (SAPS II) and the Logistic Organ Dysfunction Score (LODS)<sup>(9)</sup>; both are frequently used in the literature and easy to apply. Early readmissions are an acknowledged indicator of the quality of intensive care associated with premature discharges from hospitalization units<sup>(10)</sup>.

The "unit to which the patient is referred" and "evolution of severity of the patient in the ICU" are also important parameters to facilitate the management of services to provide indications on how to proceed with a patient's treatment.

In summary, this study compares the clinical evolution of adult, elderly and very elderly patients hospitalized in an ICU. This proposal intends to seek support to qualify the treatment and structural planning of intensive care under the light of potential specificities of these age groups.

## Methods

This is a retrospective-longitudinal study of the comparative type. This study's primary source was the electronic databases of patients hospitalized in four ICUs of two public and private hospitals. The patients included in these databases were monitored from admission to

the hospital through discharge in order to obtain data from the first and last 24 hours of hospitalization in these units and identify any readmissions.

The study's settings met the following criteria: medium size, large or extra large hospitals located in the city of São Paulo, SP, Brazil with ICUs and Semi-intensive Units with more than five active beds; general ICUs with a number of beds above 6% of the total number of hospital beds<sup>(11)</sup>. The units caring for specifically pediatric clientele were excluded from this selection.

The sampling size was based on the literature addressing readmissions and mortality in ICUs in the city of São Paulo, SP, Brazil. Aiming to obtain a sample of at least 40 cases in which patients were readmitted, we estimated the need for 400 survivals with a rate of 10% of readmission<sup>(12)</sup>. The average mortality of 33% observed in ICUs in the city of São Paulo<sup>(13)</sup> required an increase of approximately 200 patients to the number of survivals, totaling an estimated 600 patients.

All patients 18 years old or older admitted to the selected ICUs at the time of data collection and who consented to participate in the study were selected. Data collection began in August 2006 and was conducted daily until 150 patients per hospital were achieved in January 2007.

The patients were divided into three categories: 279 adults ( $\geq 18$  and  $< 60$  years old), 216 elderly patients ( $\geq 60$  and  $< 80$  years old) and very elderly patients ( $\geq 60$  and  $< 80$  years old).

The severity or Risk of Death (RD) of the analyzed patients was measured by SAPS<sup>(8)</sup> and LODS<sup>(9)</sup>. The severity of all patients' conditions was evaluated according to these two indexes and this evolution was estimated by the result of the difference between the RD on the first and last day of hospitalization of the patient in the ICU (RD SAPS II admission - RD SAPS II discharge or death and RD LODS admission - RD LODS discharge or death).

Scores in SAPS II are assigned to 12 physiological variables (heart rate, systolic blood pressure, temperature, blood oxygen pressure divided by the fraction of inspired oxygen, urine output, urea serum, leukocytes, serum potassium, serum sodium, serum bicarbonate, bilirubin and Glasgow Coma Scale) in addition to age, time of admission (scheduled surgery, unscheduled surgery, or medical hospitalization) and chronic disease (AIDS, metastatic carcinoma and hematologic malignancy)<sup>(8)</sup>. LODS evaluates RD and the organic function of patients in ICU using physiological variables and identifies

from one to three levels of dysfunction for six organic systems: neurological, cardiovascular, renal, pulmonary, hematologic and liver<sup>(9)</sup>.

In the computation of SAPS II and LODS, each variable is scored (which varies according to the patient's data) and at the end these scores are summed up and a total score is obtained; the higher the score the greater the condition's severity. The total sum can be translated in RD.

The Chi-square test was used to analyze the nominal variables (mortality, readmission into ICU and the unit where the patient was referred to). This test was initially applied to jointly analyze the three groups. When the results showed statistically significant differences ( $p \leq 0.05$ ), a complementary analysis was performed to identify what differed among the three groups, between pairs of groups: adults *versus* elderly patients, elderly patients *versus* very elderly patients and adults *versus* very elderly patients.

The numerical variables were first analyzed according to the type of distribution through the Kolmogorov-Smirnov test. The ANOVA one-way test was applied in the case of normal distribution ( $p > 0.05$ ) and the Kruskal-Wallis test was used in the case of non-normal distribution ( $p \leq 0.05$ ). When this test was applied and a statistically significant difference was observed among the three groups, the Kruskal-Wallis

multiple comparison test was performed to identify what differed among the pairs of groups.

Data were processed in STATA for Windows 8.0 and SPSS 13.0 for Windows and all the analyses considered a level of significance at 5%. The study project was approved by the Ethics Research Committee at the University of São Paulo, School of Nursing (nº 845/2009/CEP-EEUSP).

## Results

Age among the 600 studied patients ranged from 18 to 97 years old and when the groups of patients 60 years old or older were totaled we found out that most (53.5%) patients were either elderly or very elderly patients. The average age of patients composing the sample was 60.8 years old and the median was 62 years old. The average time of hospitalization in ICUs was 8.9 days (SD=10.9), with a median of five days and ranged from one to 79 days. The patients most frequently originated from the surgical center (36.1%) or emergency department (35.4%). The average RD, according to SAPS II and LODS, at admission was 25.5% and 21.4% respectively. The average RD, according to SAPS II and LODS, at admission computed by groups was: 15.3% and 19.2% respectively for adult patients, 32.2% and 22.4% for elderly patients, and 38.3% and 25.2% for very elderly patients.

Table 1 – Distribution of patients according to age, mortality (n=600) and readmission at the unit (n=473\*). São Paulo, SP, Brazil, 2006-2007

Variable	Categories	Age groups						p <sup>†</sup>
		Adults (≥18 and <60 years old)		Elderly (≥60 and <80 years old)		Very Elderly (≥80 years old)		
		N	%	N	%	N	%	
Mortality	Yes	44	15.8	55	25.5	21	20.0	0.03
	No	235	84.2	161	74.5	84	80.0	
Readmission	Yes	19	8.3	16	10.0	8	8.7	0.84
	No	210	91.7	144	90.0	84	91.3	

\*Missing: six in the age group between ≥18 and <60 years old, 1 between ≥60 and <80 years old

<sup>†</sup> Chi-square test

The rate of mortality among the 600 patients was 20.0%. Data provided in Table 1 shows that there was a statistically significant difference among the analyzed age groups in relation to mortality ( $p=0.03$ ) and in the comparison of pairs of groups through Chi-square test, only elderly patients presented significant difference in relation to adults ( $p=0.01$ ); mortality was more prevalent among the elderly group than the adult group.

Only 43 patients were readmitted in ICU during the same hospitalization, representing a total of 9.1% of patients who survived hospitalization in the unit. According to what is observed in Table 1, there was no significant difference among the age groups in relation to readmission into an ICU and the incidence of these readmissions was very similar among the groups.

Table 2 – Distribution of patients who survived hospitalization in ICU (n=480) according to the age group and units to which the patients were referred after being discharged from ICU. São Paulo, SP, Brazil, 2006-2007

Referral units	Age groups						p*
	Adults (≥18 and <60 years old)		Elderly (≥60 and <80 years old)		Very Elderly (≥80 years old)		
	N	%	N	%	N	%	
Units of hospitalization	97	41.3	41	25.5	20	23.8	0.00
Semi-Intensive	129	54.9	119	73.9	63	75.0	
Others	9	3.8	1	0.6	1	1.2	

\*Chi-square test

A total of 158 patients, out of the 480 who were discharged from the ICU were sent to the hospitalization unit. 311 were sent to the semi-intensive unit and 11 were referred to other places (ten to other hospitals and one was sent home). More than half of patients in all age groups were sent to the semi-intensive unit.

Data presented in Table 2 shows a significant difference among age groups and the unit to which patients were sent after being discharged from the ICU (p=0.00). The comparative analysis of pairs of groups through the Chi-square test showed that adult patients were more frequently sent to the hospitalization unit than elderly (p=0.00) and very elderly patients (p=0.01).

Table 3 – Evolution of patients hospitalized in ICUs (n=600) according to SAPS II and LODS, non-survivors (n=120) and survivors (n=480). São Paulo, Brazil, SP, 2006-2007

Difference admission/discharge	Index	Age groups						P
		Adults (≥18 and <60 years old)		Elderly (≥60 and <80 years old)		Very Elderly (≥80 years old)		
		Average (SD)	Median	Average (SD)	Median	Average (SD)	Median	
Survivors and non-survivors	SAPS II	+0.1 (18.1)	0.0	+2.6 (24.1)	+3.6	+6.5 (21.8)	+3.2	0.01*
	LODS	+0.5 (19.1)	0.0	-0.2 (22.2)	0.0	+2.8 (18.3)	0.0	0.91*
Non survivors	SAPS II	-16.5 (31.6)	-8.2	-15.6 (33.2)	-8.6	-5.8 (30.4)	-6.6	0.42†
	LODS	-21.6 (27.3)	-21.6	-16.2 (32.5)	-17.6	-5.8 (22.6)	0.0	0.13†
Survivors	SAPS II	+3.2 (12.0)	+0.8	+8.8 (16.0)	+5.3	+9.6 (18.0)	+3.9	0.00*
	LODS	+4.6 (13.7)	0.0	+5.3 (13.8)	0.0	+5.0 (16.6)	0.0	0.54*

\* Kruskal-Wallis test

† Anova One-Way test

Table 3 presents the descriptive measures concerning the patients evolution and shows that the group of those who died had in average an increase in their RD during hospitalization in ICU, regardless of their age (RD at admission – RD death, presenting negative result), while those who survived presented diminished risk (results of this difference was positive). The very elderly patients presented a sharper decrease in RD than adults during hospitalization in ICU. Considering the group as a whole and the survivors, we verified that the age groups presented a significantly different evolution according to the RD established by SAPS II (p=0.01 and p=0.00, respectively).

The test of multiple comparison showed that improvement in the clinical condition of adults in the global sample was significantly lower than that observed

among the very elderly (p=0.01) and this less sharper improvement of adults observed in the analysis of survivors was observed both in relation to elderly patients (p=0.00) and very elderly patients (p=0.00).

## Discussion

The ages of the participants in this study corroborate with other studies that indicate a predominantly elderly clientele in ICUs<sup>(14-15)</sup>. Expectancy of life in Brazil has progressively increased<sup>(4,16)</sup> and consequently the aging of the population has led to a larger number of hospitalizations of elderly patients in ICUs. A study conducted in Switzerland reaffirmed this assumption when it comparatively analyzed the characteristics of 35,327 inpatients in ICUs between 1980 and 1995 and

showed that the average age of patients significantly increased in the period<sup>(17)</sup>.

This study showed that elderly patients present a greater incidence of death (25.5%) in relation to adults (15.8%) and very elderly (20.0%) patients though a significant difference was observed only between adults and elderly patients. One study that analyzed the rate of mortality between two groups, case (>90 years elderly) and control (20-69 years elderly), corroborate this observation revealing that there was no significant difference between these groups<sup>(18)</sup>. These results suggest that extreme ages do not differ in relation to mortality in ICUs. Additionally, other studies have shown that mortality is not isolated associated with age but also with the clinical conditions of the patients and associated factors such as: severity of acute dysfunction, comorbidities, and the patients' functional condition before being admitted in ICU<sup>(19-20)</sup>.

A total of 9.1% of patients from the studied sample were readmitted in ICU during the same hospitalization and no differences were found among the groups in relation to this variable. The percentage of readmission found in this study was similar to the study that investigated 4,684 patients admitted in a clinical ICU during five years (9.6%)<sup>(21)</sup> and also close to that observed in a clinical ICU in the city of São Paulo, SP, Brazil 10.7%<sup>(12)</sup>.

Various factors can contribute to the readmission of patients in the ICU and among them the following stand out: evolution of the disease, inappropriate care delivered to patients in hospitalization units and inappropriately early discharges. Age was not a factor associated with readmission in ICU in this study; 64.8% of the survivors were sent to the semi-intensive unit and 32.9% to the hospitalization unit after being discharged from ICU.

In the comparative analysis of groups, the adults differed from the elderly patients and the very elderly patients in relation to the unit to where they were referred to, while the percentage of hospitalization in the semi-intensive unit was higher in the last two groups. This higher percentage is probably associated with a greater need of surveillance among these groups as a consequence of the aging process itself.

One study that analyzed patients older than 60 years old admitted in the ICU of a hospital without intermediate care revealed a frequency of 68.8% of patients sent to the hospitalization ward and a higher average time of hospitalization in ICU, 13.9 days<sup>(22)</sup> compared to 8.9 and 8.1 days in the groups of elderly and

very elderly patients in this study. The findings suggest the importance of semi-intensive units to continue the treatment of patients admitted in ICU satisfactorily collaborating in turnover and optimization of resources and avoiding the incidence of readmission of elderly and very elderly patients in this unit.

The scores obtained in LODS at admission increased as age increased, similar to SAPS II. The aging process may be seen as a dynamic and progressive process; functional changes that follow morphological and structural changes progressively interfere in the body and make it become susceptible to intrinsic and extrinsic aggression<sup>(5)</sup>.

Nevertheless, no difference was found among groups in the analysis of the LODS evolution, both in the specific and total samples (survivors and non-survivors) showing that according to this instrument, the difference in the behavior of patients was not sufficiently large and can be attributed to chance.

Even though LODS is like SAPS II, an important index to measure severity and foresee results in intensive care, it differs from SAPS II in its conception because it evaluates organic failures of patients hospitalized in ICUs. This difference of LODS may have contributed to the results observed in this study and indicate that the evolution of organic failures of elderly and very elderly patients during hospitalization in ICU may not present the same rhythm as severity progress.

LODS and SAPS II are indexes that allow comparing observed and expected mortality rates in ICUs, hence we stress that the average risk of death among the very elderly (38.3% and 25.2% according to SAPS II and LODS, respectively) was greater than the mortality observed in the group, 20.0%. RD among elderly patients according to the SAPS II was also higher (32.2%) in relation to the percentage of observed deaths (25.5%); these values were close in LODS: 22.4% and 25.5% respectively. Such results indicate the quality of care delivered to these groups in the studied ICUs and also the benefits of hospitalizing elderly patients and very elderly patients in these units.

Elderly and very elderly patients who survived presented a statistically significant and sharper improvement during hospitalization in an ICU than did adult patients while worsening conditions were similar among the three groups. These results contradict the perception that the response of elderly patients to therapeutic measures is weaker<sup>(20,23)</sup>. However, it is important to consider that the elderly and very elderly patients were admitted to ICUs with an indication of

greater RD and required a sharper improvement in order to achieve a level of physiological stability that allowed being discharged from ICU.

In this context, it is worth noting that the average time of hospitalization in an ICU of the three groups was between the 8 and 9 days and older ages were not associated with prolonged stays. Therefore, the results indicate that advanced age was not an essential factor for undesirable outcomes of intensive care. The low physiological reserve of elderly patients probably worked in concert with the greater severity of their condition at the time they were admitted into an ICU, however the resources and quality of care provided in these units compensated for the physiological imbalances that were initially observed.

## Conclusions

Advanced age was not directly related to increased mortality in ICUs. Even though readmissions occurred in a similar fashion among the three age groups, elderly and very elderly patients were frequently sent to semi-intensive units, reinforcing the importance of this type of unit in Brazilian hospital facilities given the exponential growth of the elderly population in the country. The fact that elderly and very elderly patients presented a sharp improvement during hospitalization in an ICU, according to SAPS II, jointly with the analysis of the relationship between expected and observed mortality, according to LODS and SAPS II, shows that with the advance of age, people tend to significantly benefit from intensive care.

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