

# Assessing the Decrease in the Surgical Population of the University of Puerto Rico–Affiliated Hospitals

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**Objective:** To evaluate the magnitude of the decrease in the surgical population of the University of Puerto Rico (UPR)–affiliated hospitals.

**Methods:** We examined all the surgical cases that were entered into the Surgical Database from January 1, 2013, through December 31, 2015. This database collects patient and procedural information from the surgical services of the UPR-affiliated hospitals. Thus, the number of surgical patients for the 3-year study period was determined and their characteristics recorded.

The group was subdivided into 3 subgroups, according to year: 2013, 2014, and 2015. All the variables studied were tabulated for the 3 subgroups and the values compared. The differences between subgroups were evaluated using the chi2 test or ANOVA, whichever was appropriate, with a p-value of less than 0.05 being considered significant.

**Results:** During the 3-year period, the Surgical Database collected information on 14,626 cases. The mean age of the group was 48 ( $\pm 23$ ) years. The gender distribution indicated that 55% of the sample members were women and 45% were men. A 14% decline in the number of surgical cases occurred from 2013 through 2015. The changes were not limited to a decline in numbers; the patients were sicker, as evidenced by a statistically significant ( $p < 0.05$ ) increase in the number of patients who presented with an American Society of Anesthesiologist (ASA) physical status classification of 3 or higher.

**Conclusion:** A moderately steady decline in the number of surgical cases at the UPR-affiliated hospitals was noted. We believe multiple factors are responsible for this trend, such as a decreasing population and the current economic and healthcare crises occurring in Puerto Rico. [*P R Health Sci J* 2017;36:232-236]

*Key words:* Population decline, Puerto Rico, Surgery

The surgical-patient population is affected by the demographic changes that occur in the general population of the region in which the members of that population reside. In Puerto Rico (PR), the population has been decreasing for nearly a decade, and the pace of that decline has accelerated in recent years (1). According to the US Census Bureau, the island's population was an estimated 3.47 million in 2015, which is a 7% decline from the 2010 population (2). Multiple factors are responsible for this trend, but the most frequently stated ones are the low birth rate (in PR) and the high migration rate of the island's younger population (3). As the effects of economic recession and high unemployment on the island take their toll, Puerto Ricans, increasingly, are moving to the US mainland (4).

In order to plan for future surgical healthcare needs, we evaluated the magnitude of the reduction in surgical cases at the University of Puerto Rico (UPR)-affiliated hospitals using the aggregate data of the past 3 years in the Surgical Database.

## Methods

For our study, we examined all surgical cases entered into the Surgery Database from January 1, 2013, through December 31,

2015. This database collects patient and procedural information from the surgical services of the UPR-affiliated hospitals (the University District Hospital, the University Pediatric Hospital, the UPR Carolina Hospital, the Dr. Isaac González Oncologic Hospital, the PR Cardiovascular Center [thoracic service], Pavía Hospital [colorectal service], and the Auxilio Mutuo Hospital [colorectal, oncologic, hepatobiliary, and transplant services]). The data were (and continue to be) obtained from the regular weekly reports, generated by residents, of the various surgical services at the participating hospitals. The pertinent details about the surgical procedures that were performed are extracted from the weekly report and aggregated into the

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database as reported in previous publications describing the Surgery Database (5). Quality control processes during the data collection and management phases included having the staff review (weekly) the collected data for clinical accuracy and having a single well-trained epidemiologist enter the data into the database. Post entry, the data were again reviewed to clean-up non-concordant or incorrect information and identify missing data.

The number of surgical patients for the 3-year study period was determined and their characteristics recorded; the resultant group was subdivided into 3 subgroups, according to year: 2013, 2014, and 2015. All the variables studied were tabulated for the 3 subgroups and the values compared.

For comparison with our data, we also collected, for the same 3-year period, data on the number of surgical cases reported by the Puerto Rico Trauma Hospital, a medical facility that provides emergency surgical care to trauma victims.

Statistical analyses were performed with the software program SPSS, version 22.0 (Chicago, Illinois). The study groups were compared using the chi-square test or ANOVA, whichever was appropriate. Differences between groups were considered to be statistically significant when the p-value was less than 0.05.

This database was reviewed and approved by the Institutional Review Board (IRB) of the University of Puerto Rico Medical Sciences Campus.

### Results

We explored the Surgical Database–collected data corresponding to the applicable 3-year study period, for which period there had been 14,626 surgical cases. The mean age of the patients in this group of cases was 48 (±23) years. The age group with the highest rate of surgery was that of 61 to 70 years (Figure 1). The gender distribution indicated that 55% were women and 45% were men.

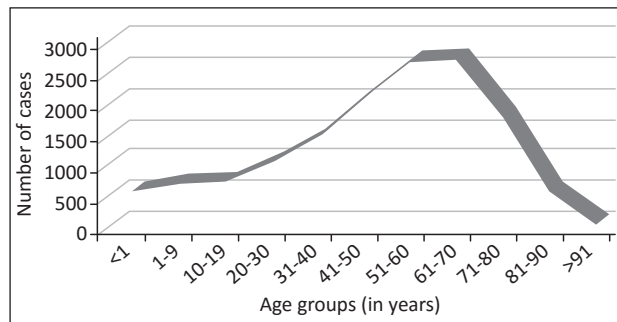


Figure 1. Age distribution of the cases from 2013 through 2015.

A decline in the number of surgical cases was noted to have occurred over the 3 years. In 2013 a total of 5,256 surgeries were performed, while in 2015, the number decreased to 4,530; a decline of 14% (Table 1). The Puerto Rico Trauma Hospital, though experiencing a small increase of 3.5% in 2014,

experienced an overall decline of 10% in the volume of patients from 2013 to 2015 (Table 1).

The demographic changes in our patient population are not limited to a decline in numbers; we also found that our surgical population is getting slightly older: The mean age was 48.21 (±23) years in 2013, and it increased to 49.47 (±22) years in 2015, a difference that is statistically significant (p<0.05) (Table 2).

Table 1. Total number of cases per year.

Year	Surgical Database n = 14,626	Percentage change from 2013	P	PR Trauma Hospital n = 4,259	Percentage change from 2013	P
2013	5,256	-		1,453	-	
2014	4,840	-8%	<0.05	1,504	3.5%	<0.05
2015	4,530	-14%		1,302	-10%	

We also found that surgical patients were presenting with higher ASA scores than had previously been the case, these scores tending to indicate that said patients were afflicted with severe systemic disease prior to their undergoing surgery (Table 2). The percentage of patients presenting with an ASA equal to or higher than 3 underwent a statistically significant increase.

The amount of inpatient surgery increased from 60.6% in 2013 to 64.5% in 2015, a difference that is statistically significant (p<0.05) (Table 2).

The wound classification indicated that there had been a slight increase in clean-contaminated cases, but the numbers of contaminated and dirty wounds are not higher than what has been reported in the US (6).

Though the overall percentage of surgical patients in our population who were overweight or obese fell, these 2 categories yet contained 67.7% of the total surgical population (Table 2).

The prevalences of different risk factors increased over the years being studied (Table 2). Hypertensive patients accounted for 43.5% of the surgical population in 2014, but in 2015, hypertensive patients accounted for 46.2% of that population, a difference that is statistically significant (p<0.05). The prevalence of diabetes increased in our surgical population from 21.0% to 22.7% in only 1 year, a difference that is slightly short of statistical significance, with a p-value of 0.06.

No significant difference was found in the percentage of smokers in the surgical population, remaining within the 9 to 10% range during the latter 2 years of the study (Table 2).

### Discussion

A steady decline in the number of surgical cases at the UPR-affiliated hospitals over the course of the 3 years (2013 – 2015) being scrutinized was noted in our study. We documented a 14% decrease in the number of cases entered into the Surgery Database. To determine whether this decline in surgical volume

**Table 2.** Characteristics of the surgical cases of the different years.

Age	2013 n = 5,256	2014 n = 4,840	2015 n = 4,530	P
<i>Mean age ± SD</i>	48.21±23.16	48.32±22.95	49.47±22.02	<0.05A
<1	224	210	157	<0.05B
1–9	292	260	168	
10–19	288	255	205	
20–30	350	347	365	
31–40	514	480	490	
41–50	751	691	692	
51–60	956	913	831	
61–70	1004	903	830	
71–80	651	563	573	
81–90	203	198	190	
≥91	11	19	25	
<i>Gender</i>				
Male	2384 (45.4%)	2156 (44.6%)	1988 (43.9%)	0.20B
Female	2865 (54.5%)	2677 (55.3%)	2534 (56.0%)	
<i>Admission status</i>				
Inpatient	3187 (60.6%)	2952 (61.0%)	2915 (64.5%)	<0.05B
Outpatient	2069 (39.3%)	1,885 (38.9%)	1,604 (35.4%)	
<i>Wound class</i>				
Clean	2671 (51.5%)	2253 (47.8%)	2097 (47.2%)	<0.05B
Clean-contaminated	1686 (32.5%)	1782 (37.8%)	1642 (36.9%)	
Contaminated	448 (8.6%)	247 (5.2%)	348 (7.8%)	
Dirty/Infected	288 (5.5%)	294 (6.2%)	228 (5.1%)	
Other	85 (1.6%)	136 (2.8%)	124 (2.7%)	
<i>Outcome</i>				
Uneventful	2857 (96.7%)	4649 (96.8%)	4365 (96.8%)	0.50B
Minor morbidity	39 (1.3%)	82 (1.7%)	73 (1.6%)	
Major morbidity	42 (1.4%)	47 (0.97%)	44 (0.97%)	
Mortality	14 (0.47%)	23 (0.47%)	27 (0.59%)	
<i>Surgery type</i>				
Elective	1458 (86.5%)	4150 (86.4%)	3939 (87.31%)	0.48B
Emergency	227 (13.4%)	650 (13.5%)	572 (12.68%)	
<i>American Society of Anesthesiology (ASA) classification*</i>				
ASA 1	--	1267 (32.9%)	959 (21.3%)	<0.05B
ASA 2	--	1881 (48.8%)	2415 (53.6%)	
ASA 3	--	604(15.6%)	906 (20.1%)	
ASA 4	--	93 (2.4%)	194 (4.3%)	
ASA 5	--	5 (0.1%)	27 (0.6%)	
<i>Body Mass Index (BMI) categories*</i>				
Underweight	--	147 (4.1%)	190 (4.4%)	<0.05B
Normal	--	866 (24.6%)	1191 (27.8%)	
Overweight	--	1535 (43.6%)	1812 (42.4%)	
Obese	--	970 (27.6%)	1083 (25.3%)	
<i>Risk factors</i>				
Diabetes*	--	857 (21.0%)	1,029 (22.7%)	0.06B
Hypertension*	--	1,681 (43.5%)	2,088 (46.2%)	<0.05B
Smoking*	--	408 (10.0%)	409 (9.1%)	0.15B
<i>Number of cases per surgical service</i>				
Cardiothoracic	286 (5.4%)	130 (2.7%)	50 (1.1%)	<0.05B
Colorectal (ASEM/Onco/Pavía)	617 (11.7%)	890 (18.4%)	709 (15.6%)	
Colorectal (Auxilio)	520 (9.9%)	386 (7.9%)	400 (8.8%)	
General Surgery (UDH)	631 (12.0%)	420 (8.7%)	522 (11.5%)	
General Surgery (Carolina)	1035 (19.7%)	1019 (21.0%)	990 (21.9%)	
Hetapobiliary Surgery (Auxilio)	82 (1.6%)	275 (5.7%)	350 (7.7%)	
Oncologic Surgery (Auxilio)	614 (11.7%)	559 (11.5%)	605 (13.4%)	
Oncologic Surgery (Onco Hosp)	504 (9.6%)	313 (6.5%)	170 (3.8%)	
Pediatric Surgery	616 (11.7%)	554 (11.4%)	414 (9.1%)	
Plastic Surgery	141 (2.7%)	126 (2.6%)	163 (3.6%)	
Vascular Surgery	210 (3.9%)	169 (3.5%)	157 (3.5%)	

AANOVA for p-value. BChi-squared test for p-value. \*Data not available for 2013.

was also occurring in other facilities, we used the Puerto Rico Trauma Hospital for comparison. This institution reported a 10% reduction in the number of cases. Since trauma cases are not elective and do not require pre-approval by medical insurance plans, their numbers tend to reflect actual population numbers, that is, the size of the existing population. As PR's population continues to decrease, so does the volume of patients in the island's hospitals. According to the US Census Bureau, the island's population experienced a 9% decline from 2000 to 2015, with three quarters of this population loss occurring since 2010 (2). The economic problems brought about by a decade of recession have resulted in a large outmigration, with the search for jobs being the primary driving force. Adding to the population loss, the birth rate on the island has declined in recent years (2, 7).

Our patient population is getting older, as well. Evaluation of the mean age of the cases in the Surgical Database showed a statistically significant increase in that age for each year of the study. As patients get older, they usually bring more chronic systemic conditions with them into surgery (8–11).

According to our study findings, the number of patients with an ASA equal to or higher than 3 increased significantly in the latter 2 years of the indicated time period; such scores provide evidence for that notion that even before undergoing surgery, these patients were already suffering from some form of severe systemic disease (12–14).

The amount of inpatient surgery significantly increased (to 64.5%), evidencing the fact that the members of our population often require care for pre-existing systemic disease at the time of surgery. Currently medical insurance companies have to pre-approve hospital admission prior to surgery. Only those patients who are very sick or who have high-risk pre-existing conditions are given approval for inpatient management by insurance companies. It is reasonable to infer that an increase in inpatient surgery means an increase in pre-existing conditions. We performed only 35.4% of

our procedures as outpatient surgeries. In the US, the reported mean utilization rate of ambulatory surgery is 54% (15).

Chronic conditions are increasing in our population. In 2015 our study indicated that 46% of the surgical patients were hypertensive and 23% were diabetic. By comparison, in the US, the prevalences of hypertension and diabetes were 30% (16) and 9% (17–19), respectively. However, smoking remained similar, reported by 10% of the patients in 2014 and by 9% of the patients in 2015. As of 2014, the percentage of the US population that smoked was 17%, according to the Centers for Disease Control and Prevention (20).

Among the limitations of the study, it should be noted, is that our database obtains information exclusively from the UPR-affiliated hospitals and from several services of the participating private hospitals; the database does not, however, comprehensively encompass our general population.

The changes witnessed in the surgical population are not the only ones affecting the healthcare situation in PR: In 2013, 2 senior cardiothoracic surgeons retired, leaving only 13 such surgeons to cover the entire island. Cardiothoracic surgery accounted for 5% of the total surgical volume in 2013, decreasing to 3% in 2014 and to 1% in 2015 (Table 2). This may account for as much as 4% of the observed decrease in surgical cases.

Nonetheless, this study shows that a decrease in the number cases has occurred in the UPR-affiliated hospitals.

## Conclusion

We saw a moderately steady decline in the number of surgical cases from 2013 through 2015 at the UPR-affiliated hospitals. Multiple factors such as the decreasing population and the economic and healthcare-related problems that PR is facing may be responsible for this trend.

## Resumen

**Objetivo:** Evaluar la magnitud de la disminución en la población quirúrgica de los hospitales afiliados a la Universidad de Puerto Rico (UPR). **Métodos:** Examinamos los casos quirúrgicos entrados a la Base de Datos entre el 1ro de enero del 2013 y el 31 de diciembre del 2015. Esta base de datos contiene información sobre los casos de cirugía realizados por los hospitales afiliados a la UPR. El número de pacientes quirúrgicos del período de 3 años fue determinado y sus características evaluadas. El grupo se subdividió por años: 2013, 2014 y 2015. Todas las variables estudiadas se compararon entre los tres subgrupos. Evaluamos diferencias entre subgrupos con la prueba de Chi<sup>2</sup> o ANOVA, según fuese apropiado, y consideramos  $p < 0.05$  estadísticamente significativo. **Resultados:** Durante los tres años la Base de Datos recolectó información sobre 14,626 casos quirúrgicos. La edad media de los pacientes fue de  $48 \pm 23$  años. La distribución por género fue: 55% mujeres y 45% hombres. Ocurrió una disminución de 14% en los casos de cirugía entre el 2013 y el 2015. Los cambios no se limitaron a una

disminución en volumen de casos, los pacientes se presentaron más enfermos a su cirugía, con un estadísticamente significativo ( $p < 0.05$ ) aumento en clasificación ASA  $\geq 3$ . **Conclusion:** Hemos notado una moderada pero persistente disminución en el número de casos quirúrgicos en los hospitales afiliados a la UPR. Pensamos que esto se debe a múltiples factores: el decrecimiento poblacional, la actual crisis económica y de cuidado de salud que tenemos en Puerto Rico.

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