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## Original article

Four years experience with the AEC residents E-Book<sup>☆</sup>

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## A B S T R A C T

**Introduction:** The introduction of the Spanish Association of Surgeons resident's electronic book (AEC-E-Book), has meant that we can perform particular and overall assessments of each resident. The objective of this article has been to find out the mean health care, scientific, and surgical activities according to the speciality program.

**Material and method:** A register of the activities of residents in the AEC-E-Book. The overall activity per year and per rotation has been measured. The relationships of assisted interventions performed and their level of complexity have been analysed. The mean scientific and health care activities and the mean on-call periods per month.

**Results:** A total of 8 residents have registered their activity in the AEC-E-Book since the year 2004. They assisted in a mean of 1514 operations, of which 922 were performed as surgeon (62%). They assisted in 185 laparoscopic interventions, of which they performed 72 (39%). As surgeon, 864 (94%) of the 922 procedures 64% were level 1, 75% level 2, and 53% were level 3. They were on-call a mean of 5.75 times per month. They attended a total of 21 courses and congresses during residency. They took part in 24 presentations and posters, as well as in 6 journal publications during residence.

**Conclusions:** The AEC-E-Book enables the activity of the resident to be continually assessed. We have been able to find out the mean activities carried out by each resident during a particular rotation and year, thus being able to know exactly if they have fulfilled the defined minimums

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## Cuatro años de experiencia con el libro informático del residente de la AEC

## R E S U M E N

## Palabras clave:

Evaluación de residentes

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Libro del residente

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MIR

**Introducción:** La introducción del libro informático del residente, de la Asociación Española de Cirujanos (LIR-AEC), nos ha permitido realizar evaluaciones particulares y generales de cada residente. El objetivo ha sido conocer la media de actividades asistenciales, científicas y quirúrgicas según el programa de la especialidad.

**Material y método:** Registro de la actividad de los residentes en el LIR-AEC. Se ha cuantificado la actividad general por año y por rotación. Se ha analizado la relación de intervenciones

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asistidas y realizadas y según grados de complejidad. La media de actividades científicas y asistenciales y la de guardias al mes.

**Resultados:** Desde 2004, 8 residentes han registrado su actividad en el LIR-AEC. Asisten a una media de 1.514 intervenciones, de las cuales realizan como cirujano 922 (62%). Asisten a 185 intervenciones laparoscópicas, de las que realizan 72 (39%). Como cirujanos, 864 (94%) de los 922 procedimientos son de los niveles 1, 2 y 3 (el 64, el 75 y el 53%, respectivamente). Realizan una media de 5,75 guardias por mes. Acuden de media durante la residencia a un total de 21 cursos y congresos. Participan en un total de 24 comunicaciones y pósters, así como en 6 publicaciones de media en la residencia.

**Conclusiones:** El LIR-AEC permite una evaluación continua de la actividad del residente. Hemos podido conocer la media de actividades que realiza cada residente durante una rotación y un año determinados, esto permite conocer con exactitud si se cumplen los mínimos definidos.

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## Introduction

The assessment of the residents during their training has always been a pending matter. In May 2007, the Spanish Official Journal published the new Training program for the speciality of General and Digestive Tract Surgery (*Programa formativo de la especialidad de Cirugía General y del Aparato Digestivo*, PECGAD).<sup>1</sup> This program stipulates that resident activity should be measured and evaluated and lays prime importance to the resident book. Annex 8 of the programe<sup>1</sup> points out that this activity, whether health care, teaching or research, should be monitored using the resident book and supervised by the tutor.

The introduction to our service of the resident electronic book (E-Book)<sup>2</sup> in 2004, granted to the Spanish Association of Surgeons (AEC-E-Book), has allowed us to answer to the demands of the new program of the speciality, by means of the facility for uniting all the surgical, health care and scientific activities through independent indicators. Likewise, it has allowed us to gather together all these activities and carry out individual assessments of each resident and overall assessments of the service to date. After its application, it has enabled us to establish activity standards of the residents.

Annex 6 of the programe<sup>1</sup> indicates the minimum number of surgical interventions that should have been performed by residents by the end of their residency. We have no objective data that indicates the real mean activity our residents carry out during their training period nor similar published results that could be compared.

The main aim has been to know the average of surgical, health care and scientific activity of the residents in our speciality of general and digestive tract surgery (GDTs). The secondary aim was to know the surgical activity average, by level of surgical, health care and scientific complexity of the residents per year of residency and rotation. In accordance, real minimums that should be fulfilled can be determined, which would work in aid of homogenisation of resident training. Knowledge of these figures allows us to compare them with those of other centres.

## Material and method

Prospective observational study of the surgical, health care and scientific activity of the residents of the General and Digestive Tract Surgery Department of the Parc Tauli Sanitary Corporation through the AEC-E-Book.<sup>2</sup> All our residents have followed our department's training program, based on the PECGAD,<sup>1,2</sup> regarding the surgical, health care and training activity.

From July 2004 to June 2008, 8 residents registered their activity in the AEC-E-Book. From the start of their training, they have been instructed in the method of introducing their activities in their own AEC-E-Book, supervised by the tutor and their more veteran colleagues. Every 6 months, the tutor and chief of residents have prepared the exposition of the AEC-E-Book activity of all the residents in the general sessions of the department, aimed at assessing their work and motivating both the residents and staff to keep up a register of the activities. The level of complexity of the surgical interventions registered are based on the PECGAD<sup>1</sup> (Table 1).

The general activity throughout the residency and the average per year and rotation of the residents was measured. The following variables were analysed:

- Surgical activity: list of interventions as surgeon and assistant in emergency/programmed surgery, interventions of major outpatient surgery (MOS), laparoscopic surgery, surgical procedures as surgeon or assistant during the different internal and external rotations of the department and all according to the level of complexity.
- Mean of general scientific activities during the residence per year.
- Mean of health care activities per year: rotations carried out, and average of monthly on-calls.

The description of the variables and the statistical analysis were carried out with the SPSS version 12 program. The description of the measurable variables was carried out giving

**Table 1 – Guiding scale for the appraisal of the level of complexity of the surgical interventions of the program in the speciality of general and digestive tract surgery**

Level of complexity	Surgical interventions
Group 1	Surgical cleansing and suturing of a traumatic injury. Exeresis of a cutaneous and subcutaneous lesion. Laparotomy and suturing. Temporary artery biopsy. Ganglionic biopsy. Mammary lump exeresis. Axillary or inguinal hydroadenitis exeresis. Minor amputation. Thoracic punction
Group 2	Anal sphincterotomy. Haemorrhoidectomy. Pilonidal cyst exeresis. Perianal abscess drainage. Inguinal, crural and umbilical herniorrhaphy. Open appendectomy. Insertion of laparoscopic trocars. Gastroileostomy. Pyloroplasty. Perforated ulcer suturing. Open cholecystectomy. Segmentary enterectomy. Tracheostomy
Group 3	Anal fistulectomy. Simple mastectomy. Laparoscopic appendectomy. Laparoscopic cholecystectomy. Open Nissen Fundoplication. Splenectomy. Colostomy. Ileostomy. Haemorrhoidectomy. Segmentary colectomy
Group 4	Right hemicolectomy. Left hemicolectomy. Main bile duct surgery. Biliodigestive deviations. Partial gastrectomy. Modified radical mastectomy. Partial/total thyroidectomy. Heller myotomy. Parathyroidectomy. Laparoscopic Nissen fundoplication. Cervical oesophagus approach. Open adrenalectomy
Group 5	Oesophagectomy. Total gastrectomy. Abdominoperineal amputation. Cephalic duodenopancreatectomy. Major hepatic resection. Ileoanal reservoir surgery. Advanced laparoscopic surgery (bariatric, adrenalectomy, etc). Liver transplant. Pancreas transplant

mean and standard deviation values when the distribution was considered normal according to the Kolmogorov-Smirnov test. Otherwise, the median and interval values were given. The categorical variables are given in absolute numbers and percentages.

## Results

Table 2, itemises the results of the mean surgical activities during our residents' 5 years of training. Of the 2889 average interventions that are annually performed in the department, they assist a mean of 1514 (52.4%) interventions, of which 922 (62%) were performed as surgeon. In elective surgery,

**Table 2 – Average surgical activity during the training years**

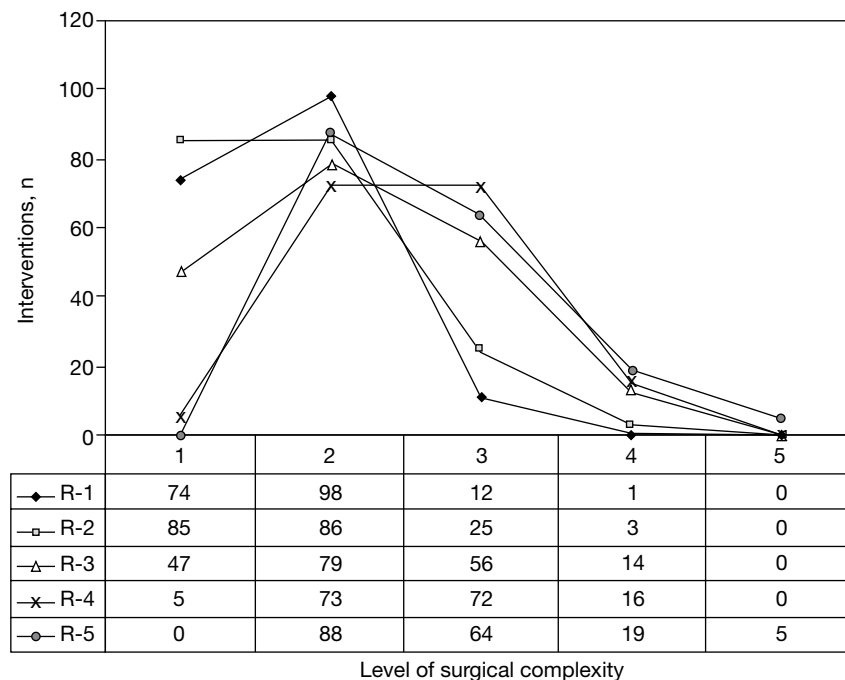
	General per residency year		Elective interventions		Emergency interventions		Laparoscopic surgery		MOS	
	Assisted	Surgeon	%	Assisted	Surgeon	%	Assisted	Surgeon	%	Surgeon
R-1	371 (45)	185 (20)	49	225 (23)	102 (9)	45	50 (4)	62 (11)	33 (7)	53
R-2	283 (22)	199 (17)	70	147 (18)	93 (7)	72	18 (2)	66 (10)	61 (9)	92
R-3	311 (25)	196 (25)	63	191 (22)	100 (8)	52	26 (4)	18 (6)	12 (5)	66
R-4	277 (32)	166 (15)	60	183 (20)	88 (12)	48	49 (7)	27 (3)	18 (2)	67
R-5	272 (23)	176 (14)	64	153 (14)	87 (10)	73	42 (6)	22 (3)	18 (2)	81
Total	1514 (183)	922 (107)	62	899 (95)	485 (53)	54	185 (22)	195 (24)	142 (18)	73

Data stated in mean (standard deviation).

MOS indicates mayor outpatient surgery; R-1, first-year resident; R-2, second-year resident; R-3, third-year resident; R-4, fourth-year resident; R-5, fifth-year resident.

1853 are performed, an average of 899 (48.5%) procedures are assisted and 485 (54%) are carried out as surgeon. A total of 1036 interventions of emergency surgery are performed, assisting in 614 (60%), of which they run 436 (71%) interventions. They assisted in 185 laparoscopic interventions, of the 412 (45%) performed in the department (programmed and emergency of the different services) and carried out 72 (39%). In the MOS service, an average of 578 were performed, assisting 195 (34%) procedures, of which they carry out 142 (73%).

Given that from the third year of specialisation, residents are not obliged to register grade 1 interventions (in general, procedures with local anaesthesia); the number of patients assisted and intervened does not increase progressively throughout the years of training. This is detailed in Figure 1, where we can observe the different levels of surgical complexity that the residents perform throughout their training period. During the first 2 years, most of their activity is of grades 1 and 2. In the last 2 years of residency, we do not



**Figure 1 – Interventions as surgeon by level of complexity. R-1 indicates first-year resident; R-2, second-year resident; R-3, third-year resident; R-4, fourth-year resident; R-5, fifth-year resident.**

	July	August	September	October	November	December	January	February	March	Apri	May	June
R-1	Emergencies				Coloproctology				Oesophagogastric wall			
	Asistidas: 87 Cirujano: 48 (55%)				Assisted: 62 Surgeon: 21 (34%)				Assisted: 87 Surgeon: 48 (55%)			
R-2	Urology			COT	ICU and resuscitation		RX	Vascular surgery			Thoracic surgery	
	Assisted: 34 Surgeon: 23 (67%)							Assisted: 22 Surgeon: 4 (18%)			Assisted: 42 Surgeon: 8 (19%)	
R-3	Hepato-bilio-pancreatic				Head-neck-breast-melanoma				Coloproctology			
	Assisted: 75 Surgeon: 56 (74%)				Assisted: 64 Surgeon: 24 (37.5%)				Assisted: 35 Surgeon: 20 (55%)			
R-4	Oesophagogastric wall				Hepato-bilio-pancreatic				Head-neck-breast-melanoma			
	Assisted: 48 Surgeon: 25 (52%)				Assisted: 36 Surgeon: 22 (61%)				Assisted: 99 Surgeon: 41 (41%)			
R-5	Coloproctology				Oesophagogastric wall				Hepato-bilio-pancreatic			
	Assisted: 87 Surgeon: 30 (54%)				Assisted: 61 Surgeon: 35 (57%)				Assisted: 45 Surgeon: 22 (49%)			

**Figure 2 – Average surgical activity of the different rotations in the training program. R-1 indicates first-year resident; R-2, second-year resident; R-3, third-year resident; R-4, fourth-year resident; R-5, fifth-year resident.**

observe grade 1 registers and we can observe that most of their activity is in interventions of complexity grades 3 and 4. Grade 5 is limited to the final year of specialisation.

Figure 2 describes the internal and external rotations as well as the mean surgical activity of the resident during the 5 years of specialisation. In the figures registered for each period, those performed in MOS and laparoscopic surgery are included, although emergency surgical procedures are not included. The reason that more substantial increases in activity as the years of training pass are not noted is due to the previously mentioned fact. In the final years, the residents progressively assist and perform more complex interventions (Figure 1).

In Figure 3 we can observe that 894 (94%) of the 952 procedures performed by our residents are of grades 1, 2, and 3 (as surgeon, in 64%, 75%, and 53% of the cases, respectively). The 58 (6%) remaining procedures are of grades 4 and 5, with 33% (grade 4) and 5% (grade 5).

Our residents had an average of 5.75 on-calls per month. Ordinarily, 5-6 on-calls per month and in 7-8 on occasion in summer. These were distributed at 1 per week and 1-2

on-calls at the weekends. There are no manifest differences during the training years (Table 3).

The courses and congresses attended by our residents are the result of their pre-established plan, based on the PECGAD,<sup>1</sup> so they attend on average a total of 21. They participate in a total of 24 communications and posters, as well as 6 publications on average throughout their residency. The academic activity is complemented with the mandatory requirement of carrying out a minimum of 2 annual internal sessions, and they reach an average of 15 sessions during their training period (Table 3).

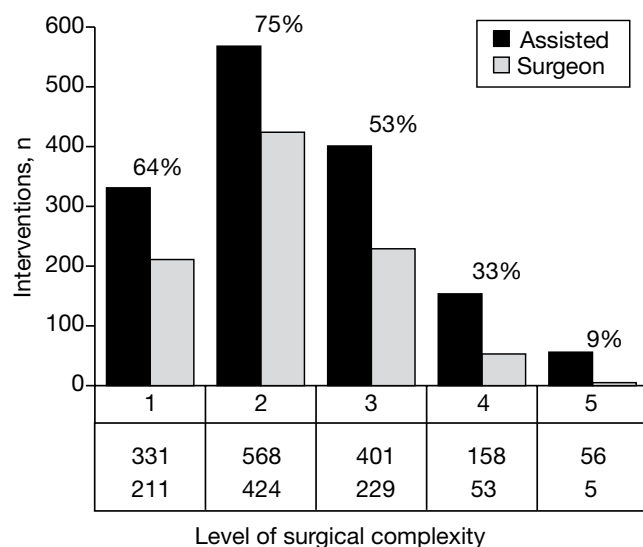
## Discussion

The new program for our speciality, in its Annex 8,<sup>1</sup> indicatively shows the data that should be included in the Resident Book. The AEC-E-Book was designed to account for and evaluate resident activity in their health care, scientific, and surgical aspects; which, although it was created before the PECGAD,<sup>1</sup> it responds to the needs of registering that said Annex mentions.

When the E-Book was published in 2006, with all its features and implementation possibilities, 2 future objectives were established<sup>2</sup>:

1. The continued application of the E-Book would allow us to obtain an average of procedures that each resident should perform during each year of their residency and with a certain rotation, as well as the annual mean scientific and health care activity. It would then be possible to follow-up their training evolution to avoid deviations and in the event of them arising, correct them. This allows us to have precise knowledge of whether the minimums defined in the PECGAD<sup>1</sup> are being met. This point is the main aim of the study presented.
2. Knowledge of this information in a representative sample of the different hospital centres divided by geographical areas and different hospital levels. To know the real average activity of residents in our country. Project in implementation stage.

After our study, we have been able to assess that the scope of surgical activity that the residents carry out over



**Figure 3 – Ratio of assisted interventions and interventions carried out according to their level of complexity.**

**Table 3 – Average health care and scientific activity**

	On-calls/month	Courses and congresses	Communications and posters	Internal and external sessions	Publications
R-1	6.5 (1.4)	3	2	2	0
R-2	5.5 (1.2)	3	2	2	0
R-3	5.5 (1.3)	4	4	2	1
R-4	5.75 (1.4)	5	7	4	2
R-5	5.5 (1.1)	6	9	5	3
Total	5.75 (1.2)	21	24	15	6

Data stated in mean (standard deviation).

R-1 indicates first-year resident; R-2, second-year resident; R-3, third-year resident; R-4, fourth-year resident; R-5, fifth-year resident.

the whole training period reaches almost one thousand procedures (922 [107]). They act as surgeons in over half of the interventions (62%). The PECGAD<sup>1</sup> establishes a minimum of interventions that should be performed in emergency surgery (200 procedures), we have established that our residents reach more than double this (436 [49]).

We consider it appropriate that they participate in more than half of the interventions of elective surgery as surgeons (60%; 899/1514), although it would be preferable that the percentage of interventions performed were greater in elective surgery (54%) than in emergency surgery (71%). The residents should be trained in appropriate situations, with conventional patients of programmed surgery and not under the pressure of an emergency. However, this is a generalised fact in most centres.

Laparoscopic surgery is one of the specific aims of the PECGAD,<sup>1</sup> with a minimum of 30 procedures. We have observed that the average performed is 72, although with a percentage as surgeon, with respect to assistance, lower than the general mean (39%). MOS, as a type of clinical management, should be known through this system by residents as far as its organisation and implementation of procedures is concerned.<sup>3</sup> Manifest of their implication is health care at close to 200 procedures (195 [24]) in our centre, 73% as surgeon.

In the activity of our department, a low percentage of residents is observed in the surgical activities. This manifests that there is only 1 resident per year; however, we have approval for 2009 for 2 residents.

Figure 2 indicates the average activity of our residents by different internal and external rotations of the department, based on the PECGAD,<sup>1</sup> as shown in its Annex 1. After 4 years registering these activities, this data allows us to appraise the activity average, in each rotation, and if this is adequate according to the minimums which should be carried out.

The levels of complexity residents should deal with must be in accordance with their experience and always under the supervision of the surgical staff.<sup>1</sup> Our results (Figure 1) show that during the first 2 years of residency, the majority of their interventions are of grade 1 and 2 complexity. These grades increase proportionally in the following years. We consider that the aim of residency is not for the resident to finish with the maximum number of grade 5 interventions, but to proportionally perform a high number of grades 1, 2, 3, and 4 procedures, which are those that are basically required for core training.<sup>3</sup>

We consider the observation in Figure 3 of great importance, where the percentage of interventions progressively decreases according to the grade of complexity. An error that can easily be made is that with the eagerness for our residents to perform many interventions, they do not attend as assistants. It is vital that they participate as second and, above all, first assistant before performing certain procedures. It is important that residents do not act in a mechanical manner, but when they perform procedures, it should be conscientiously and responsible for the surgical strategy being carried out. Therefore, as they perform more complex interventions, the proportion of the assisted procedures should be greater than those performed. Thus, from 229/401 (53%) grade 3 procedures

performed, we go on to 53/158 (33%) grade 4, and to 5/56 (9%) grade 5 procedures. The PECGAD<sup>1</sup> requires assistance to a minimum of 20 grade 5 interventions.

Our residents had an average of 5.75 on-calls per month. We consider that the ideal for resident training is to have 4 on-calls on working days and one on holidays. The balance between emergency surgery and having time for other training is not simple. To be on-call less than 4 times a month will impede the resident from having sound experience in acute patients and over 7 on-calls, after free time, will not allow them to perform many more tasks. The PECGAD<sup>1</sup> recommends 4 to 6 on-calls per month, our aim is for our residents to have an average closer to 5 than to 6 on-calls.

The health care, surgical and continuing education activities should coexist together with the on-calls, in a balance that the residents should handle with the least number of deviations possible. Accordingly, we believe that residents should follow a pre-established program of the courses and congresses to which they should attend at the start of their training, as stated in the PECGAD,<sup>1</sup> along with the commitment to the lines of clinical research they should carry out. We cannot afford to train merely technical or extremely learned residents with no practical experience. The results on Table 3 follow our position, since the residents are involved in courses, congresses and presentations of communications over the minimum required by the PECGAD.<sup>1</sup> As for published articles, they are just within the recommendation.

Among the weak points of this tool is the need to continually register the activities. The figure of the resident tutor, that motivates the continued registering of the data to allow correct follow-up of training and the demand of the department chief of its presentation in general sessions are 2 key points that favour fulfilment of the of the register and the creation of an ideal environment for feed-back so that the staff surgeons can get directly involved in training.

Another aspect for improvement in the AEC-E-Book is that it does not include outpatient and ward consultation activity. We are currently undertaking modifications to include these activities which will allow registration of the first and second outpatient visits. For activities on hospital wards, patient admittance and discharge reports will be noted.

We have not found any specific articles that document the real activity carried out by residents in European countries or the United States. Both the American Board of Surgery (ABS)<sup>4</sup> as well as the European Board of Surgery Qualification (EBSQ)<sup>5</sup> propose a minimum of 750 procedures, as surgeon to be performed during residency in the 5 years of training. In the study presented, we can observe that these minimums are surpassed, with an average of 922 procedures.

In conclusion, with this method we have established the average of activities carried out by each resident during a certain rotation and by year, which will allow us to know with precision if the minimums defined by the PECGAD<sup>1</sup> are met. However, this is an aspect of the general evaluation of the residents that should be contemplated together with the assessment of their knowledge of theory, ability and attitude.

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