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A multicenter study on the appropriateness of hospitalization in obstetric wards:

application of Obstetric Appropriateness Evaluation Protocol (Obstetric AEP)

Studio multicentrico sul protocollo di revisione dell'uso dell'ospedale in ostetricia:

applicazione dello PRotocollo dell'Uso dell'Ospedale in Ostetricia (PRUO ostetrico)

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Index

1. INTRODUCTION

The current use of hospital resources is partly inadequate, either because provided healthcare does not result into health benefits for patients or because healthcare services could be provided at different institutional levels with a consequent costs reduction [1]. Healthcare provided by hospitals is characterized by a significantly variable level of inappropriateness, due to unjustified admissions and/or length of stay [2]. As showed by the available scientific evidences, 10–30% of hospital admissions are not necessary. Thus, optimizing the use of hospital resources, through costs rationalization and reduction, without compromising the quality of care provided should become the goal of all healthcare providers [3]. In this perspective, the evaluation of the use of hospital resources allows to identify organizational problems and define the actions needed to correct them [1].

The Appropriateness Evaluation Protocol (AEP), introduced in 1981 in the USA by Gertman and Restuccia in order to evaluate the potentially unnecessary admissions or hospital days of care, represents, to date, a widely used assessment tool, characterized by satisfactory validity and high reproducibility [4,5]. It has been tested more widely and is used, both in the United States and in many European countries, as an indicator of systemic problems in the organization of healthcare delivery [6,7]. The AEP, which was designed to be a diagnosis independent tool for patients in adult medicine, surgery and gynaecology, consists of criteria based on objective measures of severity of disease and required level of care [3,6]. After its translation, testing and adapting to the Italian context, it has been applied to different clinical care settings and it is usually indicated by the term PRUO (Protocollo Revisione Utilizzo Ospedale, Review Protocol of Hospital Use) [8-18].

The aim of the present study has been to carry out a multicenter study on the appropriateness of hospitalization in obstetric wards by applying the "Obstetric PRUO" proposed in 2009 by Poppa G et al. [2], which is a tool specifically designed to monitor the use of hospitals and the allocation of

resources related to the obstetric setting. It has been tested within the Pediatric Hospital "Regina Margherita" and the Obstetrics and Gynecology Teaching Hospital "S. Anna" in Turin showing to be useful for analyzing the main determinants of inappropriate admissions and hospital stays [2]. This study has been based on the implementation of the Obstetric PRUO within seven Italian hospitals in order to determine the extent of inappropriate hospital admissions and days of stay and to identify the main related variables.

2.METHODS

Study design and sample size

A cross-sectional study was carried out according to the STROBE checklist (19, 20).

It was conducted by analyzing the clinical records (CRs) of seven different hospitals in Italy: one in the North of the Country, two in the Center (both of them were Teaching Hospitals) and four in the South (one of which was a Teaching Hospital). The hospitals enrolled in the study were: "S. Anna" in Turin (Northern Italy), "Gemelli" and "Umberto I" Teaching Hospitals in Rome (Center Italy), "SS. Filippo e Nicola" in Avezzano (Center Italy), "P. Giaccone" Teaching Hospital in Palermo (Southern Italy), "Maria Immacolata" in Sapri in the district of Salerno (Southern Italy), and "M. Scalato" in Salerno (Southern Italy).

The study protocol and the consensus to examine the CRs were approved by the Ethics Committee and the Medical Direction of the coordinator hospital (Umberto I Teaching Hospital). The consensus was shared with the Medical Directions of the other engaged hospitals.

The CRs were related to hospitalizations occurred in 2009.

The number of CRs needed was determined with the following assumptions:

- significant level was set at 0.05 and power at 0.8;

- prevalence of inappropriateness was set at 3.3%, according to literature (Poppa et al.);

- the farthest result from the prevalence of inappropriateness that was accepted was fixed at ±2%.

- for each obstetric ward the total number of hospitalizations in 2009 was counted (Table 1).

The sampling days were rotated so that all days of the week were equally represented during a seven-week period. The same approach was adopted for the sampling seasons.

Table 1. Characteristics of the hospitals enrolled.

Hospitals	N. of hospitalizations 2009	N. of Beds 2009	N. of stretchers 2009
Teaching Hospital Umberto I Rome	2767	24	15 max
Hospital S. Anna Torino	11.082 RO (total days stay 49.537)	151	0
Teaching Hospital A. Gemelli, Rome	4720	75	0
Teaching Hospital of Palermo	1575	20	0
Hospital "SS.Filippo e Nicola" (Avezzano)*	700	18	0
Sarno's hospital "Villa Malta*	700	18	0
Scafati's hospital "Mauro Scarlato"*	400	15	0

* University of Salerno, Facoltà di Medicina e Chirurgia, was the reference Group.

Appropriateness evaluation protocol tool

The "Obstetric PRUO", published by Poppa et al [2], was chosen as a tool to assess the hospital admissions and days of stay for ordinary hospitalizations.

The protocol included 49 criteria divided in two sections, the first one for admission day (from code number 1 to code number 28), and the second one for hospital stay days (from code number 29 to code number 49) (Figure1-3).

Figure 1. Data collection form of Obstetric PRUO.

Page 1

SCHEDA di RILEVAZIONE
PRUO Ostetrico

N. progressivo
della scheda
nell'inserimento
dati
………………

Dati relativi alla struttura

1. Nome dell'Azienda………………………………………………
2. Città dove si trova ubicata l'azienda ………………………………
3. Tipo di presidio: ospedaliero(0) < >   policlinico universitario(1) < >

Dati del paziente all'ammissione

4. Età al ricovero …………..
5. Cittadinanza   ………………………………………
6. Comune di residenza…………………………………………………
7. Comune di domicilio …………………………………..
8. Stato civile   coniugata(0) <>   altro(1) <>
9. Istruzione …………………………………………………………………
10. Condizione professionale attuale …………………………………………………

Dati relativi al ricovero

11. Numero cartella clinica …………………………………….
12. Codice reparto (solo se vi sono più reparti)…………………..
13. Data ammissione ….../….../…….. (mm/gg/aaaa)
    14. se possibile sottolineare anche quale giorno della settimana era:
        lun(1) mar(2) mer(3) giov(4) ven(5) sab(6) dom(7)
15. Data di dimissione ….../….../……… (mm/gg/aaaa)
16. Durata della degenza (numero digg) …………………..
17. Diagnosi di ingresso ………………………………………………………
18. Tipo di ammissione (o modalità di ricovero): programmato(0) <> urgente(1) <>

Page 2

Dati relativi all'appropriatezza

Indicare se la giornata è appropriata meno e accompagnare il giudizio, in entrambi i casi da un solo codice che si trova alla fine della scheda (alla pag 2).

RACCOMANDAZIONE PER L'INSERIMENTO DATI

Per i giorni di degenza inutilizzati inserire il valore "2" al posto di "0" ed "1" nell'appropriatezza.

Per es. se il ricovero è di 3 giorni inserire all'ammissione e al due gg degenza "0" oppure "1", dal 3° al 30° giorno di degenza inserire "2" e non compilare la voce codice.

Giorno di ammissione:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 1 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 2 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 3 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 4 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 5 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 6 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 7 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 8 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 9 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 10 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 11 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 11 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 12 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 13 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..

Page 3

Giorno 14 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 15 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 16 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 17 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 18 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 19 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 20 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 21 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 22 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 23 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 24 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 25 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 26 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 27 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 280 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 29 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..
Giorno 30 di degenza:	appropriato(0) <> inappropriato(1) <> codice (inserire solo 1) …………..

Note sull'appropriatezza da fare presente per l'analisi dei dati:
…………………………………………………………………………………

Page 4

Anamnesi presenti:
    familiare   si(1) <> no(0) <>
    fisiologica   si(1) <> no(0) <>
    remota   si(1) <> no(0) <>
    prossima   si(1) <> no(0) <>

Esame obiettivo: completo(2) <>   parziale(1) <>   assente(0) <>
Diario clinico: indicare il numero di giornate compilate …………..
Lettera di dimissione: presente(1) <> assente(0) <>
Firma del responsabile: presente(1) <> assente(0) <>

Figure 2. Codes for the admission day (from 1 to 28).

CODICI per L'AMMISSIONE

CRITERI DI APPROPRIATEZZA

Condizioni del paziente

   1. Pressione arteriosa: sistolica <90 o >140 diastolica <60 o >90

   2. Temperatura ascellare > 38°C per 5 gg

   3. Sanguinamento dai G.E.in atto o nelle ultime 48h

   4. Perdita di liquido amniotico dai G.E.

   5. Riscontro di attività contrattile uterina da 1 ora (3 contrazioni in 10')

   6. RCTG/AFI che non soddisfa i criteri

   7. Riscontro di dilatazione cervicale ad epoca gestazionale < 34 W

   8. Dolore toracico e/o epigastrico acuto con alterazioni emodinamiche

   9. Squilibrio idroelettrolitico, acido base e metabolico

   10. Dolore addome/pelvi che necessita di terapia antalgica E.V.

   11. Presenza di turbe respiratorie, neurologiche, circolatorie, sensitive, motorie

Prestazioni nelle prime 24 ore

   12. Osservazione medica/ostetrica (3 o più volte) nelle 24 ore

   13. Osservazione e prestazioni ostetriche/infermieristiche (4 o più volte) nelle 24 ore

   14. Monitoraggio dei parametri vitali – BCF (3 o più volte)

   15. Procedure diagnostiche e/o terapeutiche invasive e/o utilizzo di sala operatoria – sala parto e/o applicazione

   di   sostanze inducenti il parto o l'aborto il giorno stesso o il giorno successivo

   16. Controllo di terapie e/o effetti collaterali

   17. Somministrazione e.v. ripetute nelle 24 ore

MOTIVI DI INAPPROPRIATEZZA

   20. Esecuzione esami diagnostici

   21. Esecuzione interventi terapeutici medici

   22. Esecuzione intervento chirurgico/ attesa espletamento parto

   23. Assistenza ostetrica/infermieristica di base

   24. Assistenza ostetrica/infermieristica terapeutica

   25. Clinica complessivamente critica

   26. Situazione familiare critica

   27. Situazione sociale critica

   28. Altro (specificare)

Figure 3. Codes for hospital stay days (from 29 to 49).

CODICI PER LE GIORNATE DI DEGENZA

CRITERI DI APPROPRIATEZZA

Prestazioni mediche

29. Procedure in sala operatoria/sala parto nel giorno

30. Procedure in sala operatoria il giorno successivo, ma che richiedono consulti o valutazioni preoperatorie extra routine

31. Osservazione medica/ostetrica almeno tre volte.

32. Prima giornata postoperatoria post partum

Prestazioni ostetriche/infermieristiche

33. Monitoraggio dei parametri vitali/BCF più volte al giorno

34. Ferite chirurgiche problematiche e/o drenaggi controllati nel giorno

35. Somministrazione e.v. più volte nel giorno

36. Attento controllo ostetrico/infermieristico (4 o più volte) nel giorno

Condizioni del paziente

37. Pressione arteriosa elevata (sistolica > 140mmHg e/o diastolica >90 mmHg)

38. Temperatura >38° C nelle ultime 48 ore

39. Sanguinamento in atto nel giorno. o nelle ultime 24-48 ore

40. Presenza di attività contrattile uterina in un ora (3 contrazioni in 10 minuti)

41. Perdita di liquido amniotico dai G.E.

42. RCTG AFI che non soddisfa i criteri di reattività

MOTIVI DI INAPPROPRIATEZZA

43. Paziente in attesa di intervento – espletamento parto

44. Paziente in attesa di eseguire esami

45. Paziente in attesa di visita specialistica

46. Paziente in attesa di esito di esami

47. Altri motivi riferibili all'Ospedale (specificare) _____

48. Motivi socio - ambientali

49. Altro(specificare, specie se trattasi di esecuzione terapia medica e/o fisica/riabilitativa) _____

A preliminary meeting with an obstetrician researcher was called with each working group, in order to harmonize the knowledge and the practical aspects.

The CRs were all assessed independently by two professionals (researchers or young resident doctors in Public Health) using the Obstetric PRUO. After the assessment the two reviewers compared their judgments and in case of discrepancy they found an agreement in order to obtain a single evaluation document (ED) for each CR.

The reason of appropriateness/inappropriateness for each day of hospitalization has been indicated from the operator with a number on the basis of the information reported in the CR.

In addition the socio-demographic variables and characteristics of hospitalization were collected: age, civil status, type of hospitalization (Planned/Emergency), hospitalization during the weekend (Yes/No), hospitalization during the Autumn/Winter (versus Spring/Summer), Teaching Hospital (Yes/No), geographical area (North/Center/South) and number of hospital beds (<30 or ≥30).

Every center sent the EDs to the Department of Public Health and Infectious Diseases of the "Sapienza" University, which was the Coordinator Unit.

Statistical analysis

A centralized data entry was performed using DB IV software.

All analyses were carried out using SPSS for Windows (Statistical Package for the Social Sciences, Version 19; SPSS, Inc., Chicago, IL, USA).

The qualitative variables were described as frequencies and percentages and recoded into dummies if needed, while the continuous ones (age, percentage of inappropriateness and length of hospitalization) as mean and Standard Deviation (SD).

The outcomes examined were:

a) appropriateness/inappropriateness of admission;

b) percentage of inappropriateness (number of inappropriate days/length of hospitalization).

To evaluate the possible associations between outcomes and categorical covariates, the Chi-square test or the Fisher's Exact test whenever the sample sizes were rather small, were used.

The Odds Ratios (ORs) with corresponding Confidence Intervals at 95% (95%CI) were calculated in order to estimate the risk of inappropriateness for dichotomous variables.

According to the sample size and the normality distribution, t-student test (assumed equal or unequal variances as appropriate) and one-way ANOVA followed post hoc analysis (Tukey's test) were used to compare continuous variables. The Kolmogorov-Smirnov's test to check the normality was applied.

A multivariate logistic regression model was performed to study the outcome inappropriate admission, while a multivariate linear regression to study the percentage of inappropriateness.

The inclusion of any covariate in the models was decided on the basis of the univariate analysis (p-value lower that 0.25).

All models were adjusted for: geographical area of the hospital, type of hospital, type of hospitalization, length of hospitalization, number of hospital beds, day of week and season.

Stepwise with backward elimination of not significant variables (probability to entry $p < 0.05$) was subsequently used to generate a minimal model.

The goodness of fit for the models was assessed with Hosmer and Lemeshow's test for the logistic model [21] and with R^2 for the linear one.

Significance threshold was set at $p < 0.05$ (2-tailed) for all analyses.

3.RESULTS

The total of CRs reviewed were 2196: 29% in the North, 51% in the Center and 21% in the South of Italy.

The mean age of patients was 32 years (SD=5.8; min=15 and max=51), the 66% of them were married and 88% lived in same province of the hospital and 54% in the same city.

The length average of hospitalization was 5 days with SD=3.9. The mean percentage of inappropriateness (n. inappropriate days/ length in days x 100) for one hospitalization was 22%(about one fifth). The inappropriateness distribution for the first ten days is showed in figure 4: the maximum percentage was obtained in correspondence of 4rd and 5th hospitalization stay day, 42% in both of cases.

Figure 4. Distribution of appropriateness and inappropriateness percentages for the first ten days of hospitalization in the sample.
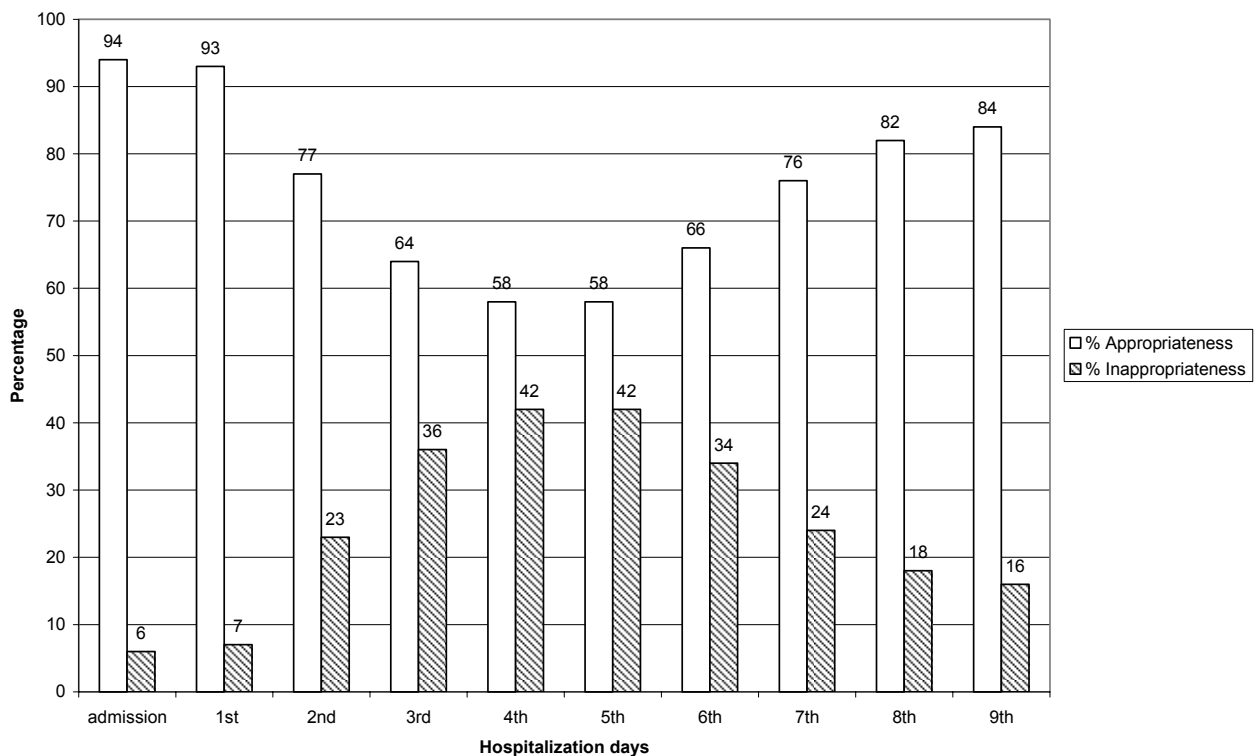
In table 1 the characteristics of the sample stratified by appropriateness of admission are shown. Significant associations were found between inappropriateness and type of admission, type of hospital, geographical area, day of the week, percentage of inappropriateness and season (p<0.05). In particular the emergency admission was a protective factor of inappropriated admission, OR= 0.23 95%CI (0.16-0.35). To be hospitalized in a Teaching Hospital, in a hospital with ≥30 beds and to be admitted during the Winter/Autumn and in the workweek were risk factors of

inappropriateness, respectively with OR=3.50 95%CI(2.30-5.34), OR=2.04 95%CI(1.41-2.97), OR=2.14 95%CI(1.41-2.97) , OR=1.85 95%CI(1.12-3.04).

Moreover, the admission in Center of Italy hospitals was more likely to have risk of inappropriateness admission (p<0.001).

Table 1. Distribution of the appropriateness of admission day by hospitalization characteristics and features of patients.

Variables		Appropriateness[a] (N=2071) n(%)	Inappropriateness[a] (N=121) n(%)	p[b]
Admission (missing=175)	Planned	389(87.0)	5813.0)	<0.001
	Emergency	1521(96.6)	53(3.4)	
Type of hospital	Hospital	1110(97.4)	30 (2.6)	<0.001
	Teaching hospital	961 (91.3)	91 (8.7)	
Geographical area	North	618 (99.0)	6 (1.0)	<0.001
	Center	1026 (91.7)	93 (8.3)	
	South	427 (95.1)	22 (4.9)	
Admission during the workweek	No	530(96.5)	19(3.5)	0.016
	Yes	1541 (93.8)	102 (6.2)	
Admission during the Winter/Autumn	No	1163 (95.5)	55 (4.5)	0.021
	Yes	908 (93.2)	66 (6.8)	
Number of hospital beds	<30	1222 (96.1)	50 (3.9)	<0.001
	≥30	849(92.3)	71 (7.7)	
Length of hospitalization	Mean (SD)	5.1 (3.9)	5.7 (3.9)	0.097[c]

[a] total missing value=2. [b] p-value of χ² test. [c] p-value of two Sample t-tests with unequal variances.

Table 2 shows that the greater percentage of inappropriateness was found to be associated with planned admission (29%, SD=28, p<0.001), type of hospital (25%, SD=24, p<0.001), number of beds ≥30 (33%, SD=24, p<0.001), inappropriated admission (65% SD=30, p<0.001) and admission during the Winter or Autumn (23, SD=26, p<0.011). In addition the post hoc multiple analysis

(Tukey's test) showed that the North geographical area was characterized by a higher percentage of inappropriateness (31%) in comparison with the Center (21%) and South (11%).

Table 2. Univariate analysis for the percentage of appropriateness in comparison to the hospitalization and patients characteristics.

Variables		Percentage of inappropriateness [a]	
		%mean (SD)	p
Admission	Planned	29 (28)	
	Emergency	20 (23)	**<0.001**[d]
Type of hospital	Hospital	25 (24)	
	Teaching hospital	18 (25)	**<0.001**[b]
Number of beds in obstetric ward	<30	13 (22)	
	≥30	33 (24)	**<0.001**[d]
Geographical area of the hospital	North	31 (21)	
	Center	21 (25)	
	South	11 (23)	**<0.001**[c]
Admission during the weekend	Yes	21 (24)	
	No	23 (25)	0.067[b]
Admission during the Winter or Autumn	Yes	23 (26)	
	No	20 (24)	**0.011**[d]
Inappropriate admission	Yes	65 (30)	**<0.001**[d]
	No	19 (22)	

[a] =(number of inappropriate days/length of hospitalization) *x100*. [b] p-value of two Sample t-tests with equal variances.
[c] p-value of ANOVA one-way test. [d] p-value of two Sample t-tests with unequal variances.

The multivariate regression models are illustrated in table 3.

The first one, a logistic model, showed that the emergency admission was a protective factor of inappropriate admission (OR=0.40, CI95%[0.25-0.62]), while a higher number of beds was a risk factor (OR=5.12 CI95% [3.23-8.11]). The Hosmer Lemeshow's statistic had a p-value of 0.167, which also suggests that the model cannot be rejected with any acceptable level of statistical significance.

14

The linear model underlined that the percentage of inappropriateness was increased in inappropriate admission (b= 0.45, p<0.001) and in obstetric wards with ≥30 beds (b=0.29, p<0.001). On the other hand the admission in a Teaching Hospital and the hospitalization in South or in North Italy were inversely associated to the percentage of inappropriateness (respectively: b=-0.16, p<0.01; b=-0.13, p<0.001). The R^2 coefficient was 0.367, suggesting that the model was quite respectable in comparison with the high significant levels of covariates.

Table 3. Multivariate regression models for inappropriate admission and percentage of appropriateness outcomes.

Independent Variables		Outcomes				
		Inappropriate Admission (yes/no)			percentage of inappropriateness	
		OR	95CI%		β	p
			Low	Upp		
Admission	Planned[a]	**1**	**0.25**	**0.62**	-0.23	0.818
	Emergency	**0.40**				
Type of hospital	Hospital[a]	1	0.56	2.10	**-0.16**	**<0.001**
	Teaching Hospital	1.08				
Number of hospital beds	<30[a]	**1**	**3.23**	**8.11**	0.29	<0.001
	≥30	**5.12**				
Geographical area of the hospital in Italy	Center[a]	1	0.46	1.99	**-0.13**	**<0.001**
	North/South	0.96				
Admission during the workweek	Yes	1.44	0.82	2.51	-0.02	0.464
	No[a]	1				
Admission during the Winter or Autumn	Yes	1.33	0.87	12.03	0.04	0.097
	No[a]	1				
Inappropriate admission	Yes	-	-	-	**0.45**	**<0.001**
	No[a]					
Goodness of fit		0.167[b]			0.367[c]	

a Reference group. b Hosmer and Lemeshow's test. c R^2 . - Not included in the model, because is the dependent variables.

Tables 4, 5 and 6 show the distribution of the criteria of appropriateness and the reasons of inappropriateness for the admission and the first five day of stay.

The higher percentage of inappropriateness was due to: "Patient waiting diagnostic tests" followed by "Patient waiting surgical intervention/carrying out childbirth" for the admission; "Patient waiting diagnostic tests" for the first day of stay; "other causes (specifying, especially if it's dealing with performance of medical/physical/rehabilitation therapy)" for the second day; "Patient waiting surgical intervention/carrying out childbirth" for the third day; and "other causes" for the fourth and fifth days.

Table 4. Distribution of criteria/causes for admission day stratify by Italian geographical areas.

ADMISSION DAYCODE		Total (Missing =4)		North (Missing=0)		Center (Missing=3)		South (Missing=1)	
		N	(%)	N	(%)	N	(%)	N	(%)
Appropriate criteria	1. Blood pressure: systolic <90 or >140, diastolic <60 or >90	62	3.08	27	4.37	34	3.33	19	4,74
	2. Armpit temperature >38°C for 5 days	8	0.40	4	0.65	3	0.29	11	2,74
	3. Bleeding in act from external genitalia or in the last 48h	140	6.95	26	4.21	83	8.12	31	7,73
	4. Loss of amniotic fluid from external genitalia	56	2.78	8	1.29	41	4.01	7	1,75
	5. Finding of uterine contractile activity from 1 h (3 contractions in 10')	150	7.45	25	4.05	102	9.98	23	5,74
	6. CTG/AFI not satisfying reactivity criteria	47	2.33	10	1.62	35	3.42	2	0,50
	7. Finding of cervical dilatation at gestation time < 34 weeks	10	0.50	4	0.65	6	0.59	0	0,00
	8. Acute thoracic or epigastria pain with hemodynamic alterations	8	0.40	3	0.49	5	0.49	0	0,00
	9. Hydro-electrolytic, acid-base or metabolic imbalance	58	2.88	28	4.53	27	2.64	3	0,75
	10. Abdominal/pelvic pain that need pain-killer i.v. therapy	61	3.03	19	3.07	31	3.03	11	2,74
	11. Presence of breathing, neurological, circulating, sensitive, motor illness	28	1.39	12	1.94	16	1.57	0	0,00
	12. Medical/obstetric observation (3 times or more) in 24 h	131	6.51	2	0.32	91	8.90	38	9,48
	13. Midwifery/nursing observation (4 times or more) in 24 h	34	1.69	3	0.49	27	2.64	4	1,00
	14. Monitoring vital parameters/FHR (3 times or more)	41	2.04	1	0.16	37	3.62	3	0,75
	15. Invasive diagnostic/therapeutic procedures in O.R or delivery room	1139	**56.58**	441	**71.36**	473	**46.28**	**225**	**56,11**
	16. Therapy and side effects control	2	0.10	0	0.00	2	0.20	24	5,99
	17. I.V. administration in 24 h	38	1.89	5	0.81	9	0.88	19	4,74
	TOTAL OF APPROPRIATE ADMISSION DAYS	2013	100.00	618	100.00	1022	100.00	401	100.00
Inappropriate	20. Execution of diagnostic tests	72	**57.60**	1	16.67	58	**60.42**	13	**56.52**
	21. Execution of medical therapeutic interventions	12	9.60	2	**33.33**	8	8.33	2	8.70
	22. Execution of surgical intervention, childbirth waiting	21	16.80	1	16.67	18	18.75	2	8.70
	23. Basic obstetric/nursing assistance	13	10.40	2	**33.33**	8	8.33	3	13.04
	25. Overall critic clinic situation	4	3.20	0	0.00	3	3.13	1	4.35
	28. Other	3	2.40	0	0.00	1	1.04	2	8.70
	TOTAL OF INAPPROPRIATE ADMISSION DAYS	125	100.00	6	100.00	96	100.00	23	100.00

Bold: maximum percentage.

Table 5. Distribution of criteria/reasons for the firth stay days stratify by Italian geographical areas.

1st DAY STAY	Total		North		Center		South	
CODE	N	(%)	N	(%)	N	(%)	N	(%)
Appropriate criteria 29. Procedures in operating room or delivery room in the day	511	27.53	202	21.54	201	34.60	108	32.05
30. Procedures in O.R. in the next day, but requiring pre-operative consultations or valuations extra-routine	40	2.16	19	2.03	7	1.20	14	4.15
31. Medical/obstetrician observation at least three times	187	10.08	112	11.94	34	5.85	41	12.17
32. First post-partum/post-surgical day	658	**35.45**	337	**35.93**	209	**35.97**	112	**33.23**
33. Monitoring vital parameters/FHR more times in a day	132	7.11	111	11.83	11	1.89	10	2.97
34. Complicated surgical wounds and/or drains controlled in the day	3	0.16	2	0.21	0	0.00	1	0.30
35. Administration I.V. more times in a day	93	5.01	59	6.29	22	3.79	12	3.56
36. Careful midwife/nursing control (four times in a day)	163	8.78	56	5.97	89	15.32	18	5.34
37. High blood pressure (systolic>140mmHg and/or diastolic>90 mmHg)	5	0.27	4	0.43	0	0.00	1	0.30
38. Temperature >38 °C in the last 48 h	1	0.05	0	0.00	1	0.17	0	0.00
39. Bleeding in act in the day, or in the last 24/48 h	45	2.42	25	2.67	2	0.34	18	5.34
40. Presence of contractile uterine activity in 1 h (3 contractions in 10')	5	0.27	4	0.43	1	0.17	0	0.00
41. Loss of amniotic fluid from external genitalia	6	0.32	2	0.21	4	0.69	0	0.00
42. CTG/AFI not satisfying reactivity criteria	7	0.38	5	0.53	0	0.00	2	0.59
TOTAL OF APPROPRIATE DAYS OF STAY	1856	100.00	938	100.00	581	100.00	337	100.00
Inappropriate reasons 43. Patient waiting surgical intervention/carrying out childbirth	26	17.22	18	21.18	0	0.00	8	34.78
44. Patient waiting diagnostic tests	45	**29.80**	33	**38.82**	0	0.00	12	**52.17**
45. Patient waiting specialist examination	15	9.93	8	9.41	5	11.63	2	8.70
46. Patient waiting tests results	21	13.91	3	3.53	18	**41.86**	0	0.00
47. Other causes depend to the Hospital (specifying)	7	4.64	3	3.53	3	6.98	1	4.35
48. Social-environmental causes	3	1.99	1	1.18	2	4.65	0	0.00
49. Other causes (specifying, especially if it's dealing with performance of medical/physical/rehabilitation therapy)	34	22.52	19	22.35	15	34.88	0	0.00
TOTAL OF INAPPROPRIATE DAYS OF STAY	151	100.00	85	100.00	43	100.00	23	100.00

Bold: maximum percentage

Table 6. Distribution of criteria/reasons for the firth stay days

DAYs STAY 2nd-5th		2nd day		3rd day		4th day		5th day	
CODE		N	(%)	N	(%)	N	(%)	N	(%)
Appropriate criteria	**29.** Procedures in operating room or delivery room in the day	123	8.57	60	6.23	29	5.09	17	5.25
	30. Procedures in O.R. in the next day, but requiring pre-operative consultations or valuations extra-routine	14	0.97	8	0.83	6	1.05	2	0.62
	31. Medical/obstetrician observation at least three times	326	22.70	335	**34.79**	175	**30.70**	88	**27.16**
	32. First post-partum/post-surgical day	476	**33.15**	111	11.53	58	10.18	33	10.19
	33. Monitoring vital parameters/FHR more times in a day	121	8.43	77	8.00	55	9.65	42	12.96
	34. Complicated surgical wounds and/or drains controlled in the day	14	0.97	15	1.56	5	0.88	5	1.54
	35. Administration I.V. more times in a day	148	10.31	151	15.68	98	17.19	53	16.36
	36. Careful midwife/nursing control (four times in a day)	169	11.77	171	17.76	117	20.53	65	20.06
	37. High blood pressure (systolic>140mmHg and/or diastolic>90 mmHg)	3	0.21	5	0.52	6	1.05	6	1.85
	38. Temperature >38 °C in the last 48 h	2	0.14	2	0.21	4	0.70	2	0.62
	39. Bleeding in act in the day, or in the last 24/48 h	29	2.02	20	2.08	11	1.93	5	1.54
	40. Presence of contractile uterine activity in 1 h (3 contractions in 10')	1	0.07	2	0.21	0	0.00	1	0.31
	41. Loss of amniotic fluid from external genitalia	4	0.28	3	0.31	3	0.53	3	0.93
	42. CTG/AFI not satisfying reactivity criteria	6	0.42	3	0.31	3	0.53	2	0.62
	TOTAL OF APPROPRIATE DAYS OF STAY	1436	100.00	963	100.00	570	100.00	324	100.00
Inappropriate reasons	**43.** Patient waiting surgical intervention/carrying out childbirth	27	6.16	175	**34.05**	0	0.00	12	4.11
	44. Patient waiting diagnostic tests	45	10.27	58	11.28	0	0.00	29	9.93
	45. Patient waiting specialist examination	15	3.42	55	10.70	5	11.63	8	2.74
	46. Patient waiting tests results	34	7.76	5	0.97	18	41.86	11	3.77
	47. Other causes depend to the Hospital (specifying)	50	11.42	98	19.07	3	6.98	60	20.55
	48. Social-environmental causes	4	0.91	117	22.76	2	4.65	4	1.37
	49. Other causes (specifying, especially if it's dealing with performance of medical/physical/rehabilitation therapy)	263	**60.05**	6	1.17	15	**34.88**	168	**57.53**
	TOTAL OF INAPPROPRIATE DAYS OF STAY	438	100.00	514	100.00	43	100.00	292	100.00

Bold: maximum percentage

4. DISCUSSION

The findings of this multicenter study showed that the length of the hospitalization and the planned admission are the main drivers for inappropriateness of admission . These results confirm those reported by Poppa et al, 2009 [2], in which the Obstetric PRUO Protocol was implemented within the Pediatric Hospital "Regina Margherita" and the Obstetrics and Gynaecology Teaching Hospital "S. Anna" in Turin.

The higher level of inappropriate admissions or days of hospital stay may be due to the size of the hospital (number of beds) and to the type of admission.

The current study showed an inverse association between the hospitalization in South Italy and the percentage of inappropriateness. This geographical difference could depend on the fact that patients from the South part of Italy often are admitted in hospitals located either in Northern or Central Italy

Likewise the study by Poppa et al. [2], the planned admission resulted to be a significant risk factor of inappropriateness (OR=4.2 versus OR=2.9). Concerning the following five days of stay in hospital, there is an exponential increase in the percentage of inappropriate days reaching a maximum value of 42% in accordance to Poppa et al. [2]. This is likely to be due to the specificity of obstetrics: both child birthing and abortion and other complications of pregnancy are resolved in 24-48 hours of stay in hospital, making appropriate hospitalization during this time period.

The main reasons of inappropriateness resulted to be related to the patient waiting for tests or results (44%) in contrast to those found in the study by Poppa et al. in which the main reason of inappropriateness was "Other causes depending to the Hospital") (94%).

The present research has some typical limits of the multicenter studies. The assessment of the CRs could be characterized by an information bias, because of the different reviewers engaged, even if a preliminary meeting was called. Indeed the Obstetric PRUO is an interesting evaluation tool but an

effective application of the methodology requires a careful training of all the reviewers before starting the project(it is not by chance that the present study has been characterized by missing values, for inappropriateness reasons and criteria, in the data collection and analysis). On the other hand, in reviewing and assessing some CRs more than one criteria of appropriateness or inappropriateness could be adopted.

Moreover, the contents of the CR are not always easy to understand e, consequently, to evaluate. However, the sample size, the independent review performed by two operators and the validated Obstetric PRUO tool encourage the reliability of the results and satisfy the aim of the project. Furthermore, in the present study the implementation of the Obstetric PRUO in different Italian context confirmed its replicability.

Therefore, it is possible to conclude that the Obstetric PRUO is a practical and smart tool to carry out an evaluation of the CR and, consequently, to assess the appropriateness of hospital use both in terms of admission and days of hospital stay.

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