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Identifying risk factors for bladder catheterization in Internal Medicine patients: can it be helpful for clinical practice?

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Background

Urinary tract infections are one of the most common nosocomial infections worldwide and the vast majority of it is indwelling catheter related.[1] Bladder catheterization is a very frequent procedure and it should be done strictly accomplishing the indications for it.[1] In many cases, catheters are placed inappropriately leading to unnecessary and prolonged use which can result in avoidable infections.[1-3] The morbidity, mortality and costs associated to catheter-associated urinary tract infections (CAUTI) are not negligeble.[4,5]

With this study, we aim to identify risk factors for bladder catheterization in patients admitted to an internal medicine ward that could help clinical reasoning and decision about catheter placement in addition to formal recommended indications.

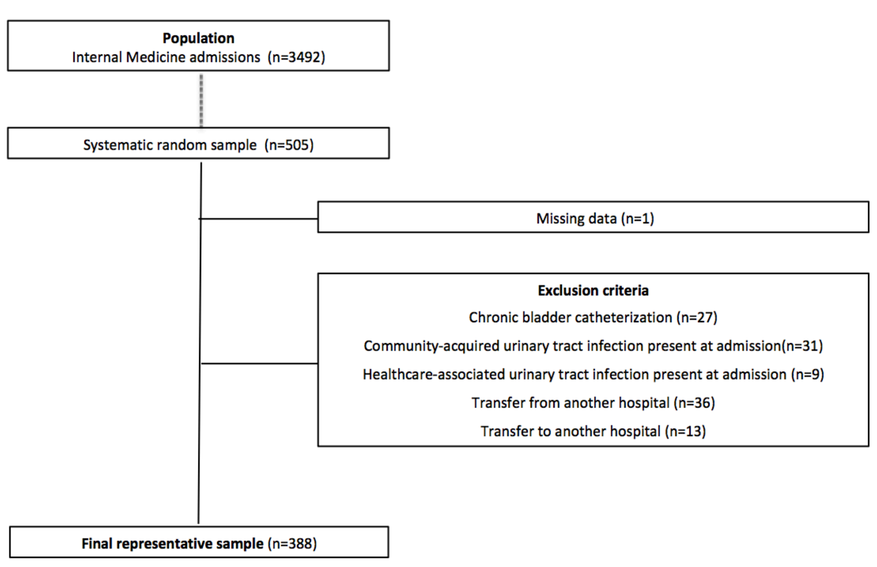
Methods

We performed a historical cohort study that included a systematic random sample of 388 patients, representative of the 3492 admissions occurred in a Portuguese internal medicine ward (93-beds) in 2014. Patients transferred from or to another hospital, as well as patients with admission diagnosis of urinary tract infection were excluded. Variables related to patient (age, sex, age adjusted Charlson comorbidity index[6,7], place of residency, functional[8] and nutritional status[9], sphincter incontinence, pressure ulcers), and to admission episode (department from admission, principal diagnosis and length of stay) were analyzed.

Univariate analysis was done to characterize the cohort. We performed a bivariate analysis to identify statistically significant variables that were associated to bladder catheterization. Binary Logistic Regression (enter method) was used to identify independent risk factors for catheter use and to develop the predictive risk model. *Odds Ratio* and 95% confidence intervals were calculated. We tested several consecutive models until the final one that only considered variables with p-value < 0.05 (value considered to be statistically significant in this study). We performed Hosmer and *Lemeshow* to test the goodness of fit of the model. The Receiver Operating Characteristic (ROC) curve was used as a measure of the model's predictive discrimination.[10] Statistical analysis was performed with SPSS IBM® Statistics Software (24th version).

Results

Figure 1 Cohort patients inclusion diagram



Bivariate analysis

Variables related to the Patient			Bladder Catheterization (n=96)	No Bladder Catheterization (n=292)	Relative Risk (CI 95%)	Odds Ratio (CI 95%)	p-value
Gender	woman	n (%)	56 (58,3%)	143 (71,9%)	1,32 (0,93-1,89)	1,45 (0,91-2,30)	p=0,111 §
	man	n (%)	40 (41,7%)	149 (51%)	1,0	1,0	
Age	< 65 Years	n (%)	7 (7,3%)	93 (31,8%)	0,22 (0,10-0,47)	0,16 (0,07-0,37)	**p<0,001** §
	65 or > 65 Years	n (%)	89 (92,7%)	199 (68,2%)	1,0	1,0	
Place of residence	Own home	n (%)	71 (74,0%)	259 (88,7%)	0,49 (0,34-0,71)	0,36 (0,20-0,64)	**p<0,001** §
	Institution	n (%)	25 (26,9%)	33 (11,3%)	1,0	1,0	
Diabetes Mellitus	Presence	n (%)	22 (22,9%)	53 (18,2%)	1,24 (0,82-1,85)	1,34 (0,76-2,3)	p=0,305 §
	Absence	n (%)	74 (77,1%)	239 (81,8%)	1,0	1,0	
Cancer	Presence	n (%)	14 (14,6%)	51 (17,5%)	0,84 (0,5-1,39)	0,86 (0,42-1,53)	p=0,512 §
	Absence	n (%)	82 (85,4%)	241 (82,5%)	1,0	1,0	
Imunossupression	Presence	n (%)	8 (8,3%)	27 (9,2%)	0,91 (0,48-1,73)	0,89 (0,39-2,03)	P=0,786 §
	Absence	n (%)	88 (91,7%)	265 (90,8%)	1,0	1,0	
Age adjusted Charlson Comorbidity Index	n.a	average (SD)	5,05 (±1,61)	3,53(±2,23)	n.a	n.a	**p<0,001** §§
		median (IQR)	5 (4-6)	4 (3-5)			
Nutritional Status	High Risk	n (%)	35 (25,2%)	67 (22,9%)	1,68 (1,13-2,28)	1,92(1,17-3,16)	**p=0,009** §
	Low Risk	n (%)	61 (70,8%)	225 (77,1%)	1,0	1,0	
Sphincter incontinence	Presence	n (%)	83 (86,5%)	121 (41,4%)	5,75 (3,32-9,97)	9,02(4,8-16,92)	**p<0,001** §
	Absence	n (%)	13 (13,5%)	171 (58,6%)	1,0	1,0	
Pressure Ulcers	Presence	n (%)	28 (29,2%)	38 (13,0%)	2,0 (1,4-2,8)	2,75(1,5-4,8)	**p<0,001** §
	Absence	n (%)	68 (70,8%)	254 (87,0%)	1,0	1,0	

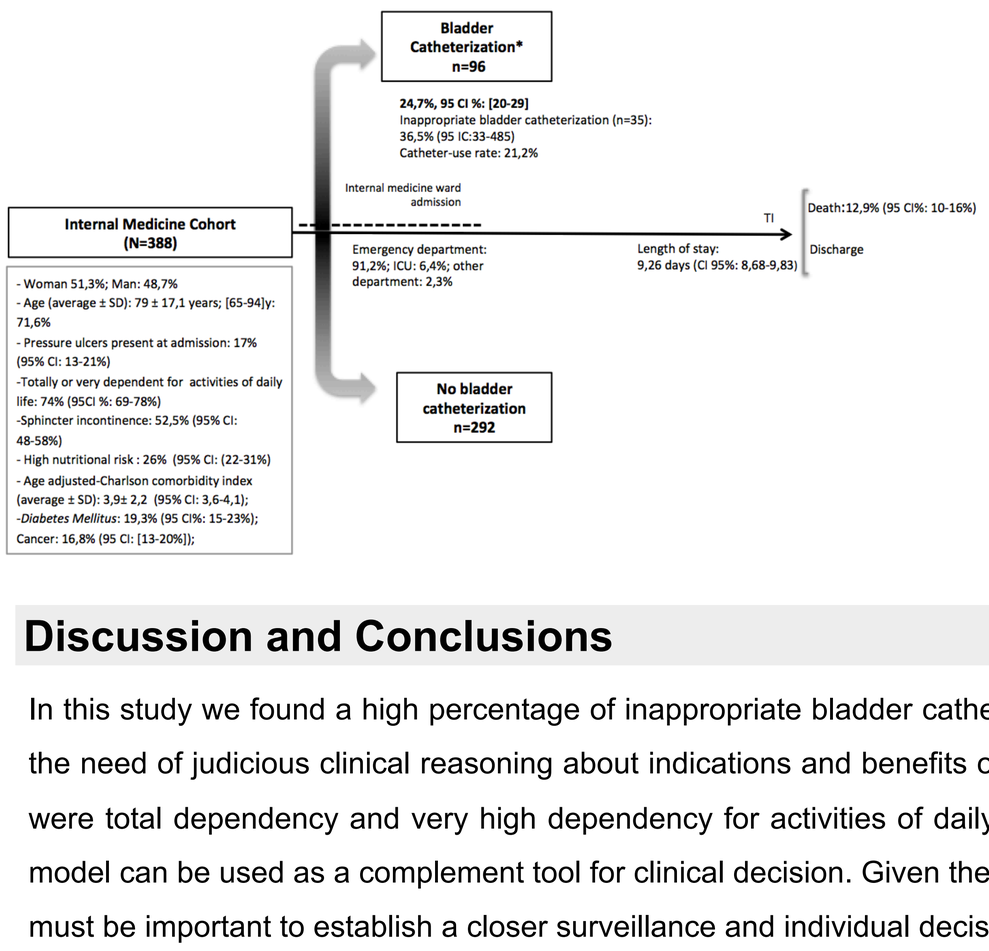
Legend: n.a – not applicable; SD – Standard deviation; IQR – Interquartile range; § - Qui-Square test; § § - Mann-Witney U Test

Bivariate analysis

Variables related to admission episode			Bladder Catheterization (n=96)	No Bladder Catheterization (n=292)	Relative Risk (CI 95%)	Odds Ratio (CI 95%)	p-value
Department from admission	urgency	n (%)	82 (85,4%)	272 (93,2%)	1,04(0,32-3,51)	1,05(0,21-5,17)	p=0,6 §
	ICU	n (%)	12 (12,5%)	13 (4,5%)	2,16 (0,59-7,82)	3,2 (0,55-18,71)	p=0,25 §§§
	other	n (%)	2 (2,1%)	7 (2,4%)	1,0	1,0	
ICD-10 Principal Diagnosis	Diseases of the circulatory system	n (%)	29 (30,2%)	84 (28,8%)	0,96 (0,59-1,56)	0,94 (0,48-1,84)	p=0,88 §
	Diseases of the digestive system	n (%)	4 (4,2%)	35 (12,0%)	0,38 (0,14-1,04)	0,31 (0,09-0,99)	**p=0,04** §§§
	Diseases of the respiratory system	n (%)	39 (40,6%)	98 (33,6%)	1,05 (0,66-1,68)	1,08 (0,57-2,03)	p=0,07 §
	Neoplams	n (%)	4 (4,2%)	20 (6,8%)	0,62 (0,23-1,64)	0,55(0,1-1,8)	p=0,33 §§§
	Others	n (%)	20 (20,8%)	55 (18,8%)	1,0	1,0	
Lenght of stay	n.a	average (SD)	12,05 (± 6,95)	8,34 (± 5,06)	n.a	n.a	**p<0,001** §§
		median (IQR)	10 (7,0-10,0)	7 (5,0-11,0			
Barthel Index for activities of daily life	Totally dependent	n (%)	54(56,3%)	58(19,9%)	24,3 (6,09-97,31)	46,1(10,83-196,09)	**p<0,001** §
	very dependent	n (%)	36 (37,5%)	82 (28,1%)	15,3 (3,77-61,68)	21,8 (3,77-61,68)	**p<0,001** §
	Partially dependent	n (%)	4 (4,2%)	53 (18,2%)	3,5 (0,66-18,75)	3,7 (0,66-21,07)	p=0,18 §§§
	Independent	n (%)	2 (2,1%)	99 (33,9%)	1,0	1,0	

Legend: n.a – not applicable; SD – Standard deviation; IQR – Interquartile range; § - Qui-Square test; § § - Mann-Witney U Test; § § § - Exact Fisher Test

Figure 2 Cohort characterization and main results

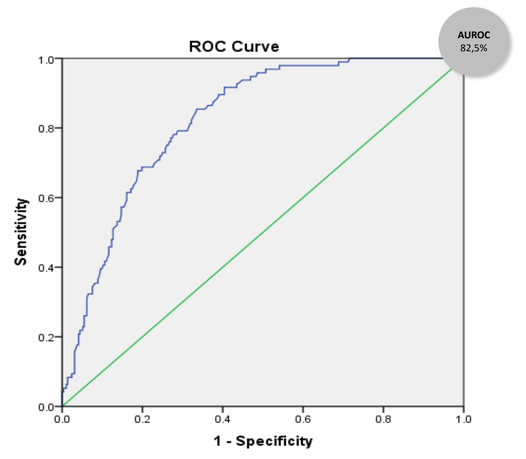


Multivariate analysis and predictive risk model

Variable	OR	OR CI 95%	p§
Barthel Index for activities of daily life	n.a	n.a	p<0,001
Totally dependent	24,47	[5,50-108,87]	p<0,001
very dependent	11,43	[2,56-50,93]	p=0,001
Age adjusted Charlson Comorbidity Index	1,19	[1,03-1,38]	P=0,017
Lenght of stay	1,08	[1,04-1,13]	p<0,001

Legend: n.a – not applicable; OR – Odds ratio; OR IC95% - Confidence Interval for Odds ratio; § - p-value, Wald Test
The variables with significant p-value (n=9) on the bivariate analysis were all initially introduced in the mode. The variables in the final model are the ones that figures in the upper table.

Multivariate Predictive model features	
Statistic Significance	p<0,001
Hosmer e Lemeshow goodness of fit test	p=0,887



Properties of the model	
Sensivity	34,4%
Specificity	92,5%
Positive predictive value	60,0%
Negative predictive value	81,1%
Accuracy	78,1%

Discussion and Conclusions

In this study we found a high percentage of inappropriate bladder catheterization (36,5%).[1,11,12] This finding, that deserves further study and improve quality initiatives, underscores the need of judicious clinical reasoning about indications and benefits of this procedure for each patient individually. The independent risks factors for bladder catheterization found were total dependency and very high dependency for activities of daily life on Barthel Index on admission, Age adjusted Charlson Comorbidity Index and length of stay. The risk model can be used as a complement tool for clinical decision. Given their characteristics (high specificity and low sensibility) it only can be used to identify patients at risk for whom it must be important to establish a closer surveillance and individual decision strategy, avoiding the procedure unless it is really necessary. As we know from the literature the best way to avoid CAUTI is to restrict the use of catheters and guarantee the implementation and accomplishment of prevention bundles.[1,3,12]

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