# **APPLICATION OF NEW INDICATORS OF ANTIMICROBIAL AGENTS** USE BASED ON CONSUMPTION IN A TERTIARY HOSPITAL

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### What was it done?



The creation of a tool for calculating new indicators of antimicrobial agents based on consumption using Defined Daily Dose per 100 hospital stays (DDD/100s).

## Why was it done?

Spanish Society of Hospital Pharmacy (SEFH) proposed 13 indicators (bibliography: Gutiérrez-Urbón JM, Gil-Navarro MV, Moreno-Ramos F, Núñez-Núñez M, Paño-Pardo JR, Periáñez-Párraga L. Indicators of the hospital use of antimicrobial agents based on consumption. Farm Hosp. 2019;43(3):94-100) which could help to improve the quality of antimicrobial use.





Lower value



## How was it done?

What has been achieved?

We built an Excel tool to input required data in order to calculate the indicators with the formulas defined for their automated estimation:

Overall consumption of antifungals 2   Consumption of carbapenemics 3   Consumption of fluoroquinolones 3   Ratio macrolides-p/fluoroquinolones-p 5   Ratio metronidazole-p/piperacillin-tazobactam+carbapenemics - beieto 000 establisher - 000 of the stable o		Overall antibacterial consumption	1	INDICADORES	Justificación	indicador/	Datos necesarios para indicadores	2018	2019	2020	2021	2022
Overall consumption of antifungals   2     Consumption of carbapenemics   11/22   10/22   1				Consumo global de Consumo global de antifúngicos Consumo de carbanenémicos		Indirecto	DDD antibacterianos	07,082 2,646	13,125	83,453 E 010	4 590	2,665
Consumption of carbapenemics association instance recording. instance recording. instance recording. instance recording.   Ratio macrolides-p/fluoroquinolones-p 5   Ratio macrolides-p/fluoroquinolones-p 5   Ratio macrolides-p/fluoroquinolones-p 5   Ratio macrolides-p/fluoroquinolones-p 6   Fosfomycin consumption 7   Fosfomycin consumption 7   Sequential therapy 8   Ratio anti-SRSA/anti-MRSA agents 9   Ratio amoxicillin/amoxicillin-clavulanic acid 10   Ratio amoxicillin/amoxicillin-clavulanic acid <td>Overall consumption of antifungals</td> <td>2</td> <td>Antibióticos de amplio espectro</td> <td>Indirecto</td> <td>DDD androngicos DDD iminenem</td> <td>1578</td> <td>4 100</td> <td>4 261</td> <td>0.305</td> <td>0,310</td>		Overall consumption of antifungals	2		Antibióticos de amplio espectro	Indirecto	DDD androngicos DDD iminenem	1578	4 100	4 261	0.305	0,310
Consumption of carbapenemics 3 Consumption of fluoroquinolones 1/49 1/20 1/60 1/20 <td></td> <td></td> <td rowspan="2"></td> <td rowspan="2">impacto ecológico.</td> <td rowspan="2"></td> <td>DDD meropenem</td> <td>4,535</td> <td>4,540</td> <td>4,230</td> <td>5,963</td> <td>4,728</td>					impacto ecológico.		DDD meropenem	4,535	4,540	4,230	5,963	4,728
Consumption of fluoroquinolones   Consumption of fluoroquinolones   Accidato conselection ce existervias   Indices   Consumption of fluoroquinolones   Constrestreprint of fluoroquinolones <thconstre< td=""><td>Concumption of carbanonamics</td><td>2</td><td>DDD ertapenem</td><td>1,419</td><td>1,620</td><td>1,620</td><td>1,333</td><td>2,299</td></thconstre<>		Concumption of carbanonamics	2				DDD ertapenem	1,419	1,620	1,620	1,333	2,299
Consumption of fluoroquinolones   4   Consume de fluoroquinolones   Assi dasson seleción de valences   Indienes   Discretionación de valences   Other de fluoroquinolones   Assi dasson seleción de valences   Discretionación de valences <td>consumption of carbapenenics</td> <td>5</td> <td></td> <td></td> <td></td> <td>DDD carbapenémicos</td> <td>7,532</td> <td>10,260</td> <td>10,111</td> <td>7,601</td> <td>7,224</td>		consumption of carbapenenics	5				DDD carbapenémicos	7,532	10,260	10,111	7,601	7,224
Consumption of fluoroquinolones 4   Ratio macrolides-p/fluoroquinolones-p 5   Ratio metronidazole-p/piperacillin- tazobactam+carbapenemics 6   Fosfomycin consumption 7   Fosfomycin consumption 7   Sequential therapy 8   Ratio anti-SRSA/anti-MRSA agents 9   Ratio anoxicillin-clavulanic acid/piperacillin-tazobactam 100   Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 100   Ratio anoxicillin-clavulanic acid/piperacillin-tazobactam 100   Fosfomycin consumption 7   Sequential therapy 8   Ratio amoxicillin-clavulanic acid 10   Pip Teceb teachapenemics 100   Pip Teceb teachapenemics 100   Pip Teceb teachapenemics 100   Pip Teceb teachapenemica 100   Pip Teceb teachapenemica 1000   P				Consumo de fluoroquinolonas	Asociados con selección de	Indirecto	DDD ciprofloxacino	4,510	4,530	3,788	4,836	4,371
Ratio macrolides-p/fluoroquinolones-p 5   Ratio macrolides-p/fluoroquinolones-p 5   Ratio metronidazole-p/piperacillin- tazobactam+carbapenemics 6   Fosfomycin consumption 7   Sequential therapy 8   Ratio anti-SRSA/anti-MRSA agents 9   Ratio anti-SRSA/anti-MRSA agents 9   Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 100   Consume fosfonicina V0 de elector no atiti no comeleda eV on post-vide on post		Consumption of fluoroguinolones	4		resistencias		DDD norfloxacino	0,058	0,100	0,077	0,065	0,075
Ratio macrolides-p/fluoroquinolones-p 5   Ratio metronidazole-p/piperacillin- tazobactam+carbapenemics 6   Fosfomycin consumption 7   Fosfomycin consumption 7   Sequential therapy 8   Ratio anti-SRSA/anti-MRSA agents 9   Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 100   Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 100   Consumo fosfomicina Vide eleccin en stifts no consimulation on the speerfor antibidics on therapenemics 3360 587   Fatio amoxicillin-clavulanic acid/piperacillin-tazobactam 100 <td< td=""><td></td><td></td><td></td><td></td><td></td><td>DDD = ================================</td><td>1,677</td><td>8,130</td><td>5,353</td><td>4,445</td><td>4,694</td></td<>							DDD = ================================	1,677	8,130	5,353	4,445	4,694
Ratio metronidazole-p/piperacillin- tazobactam+carbapenemics   Ratio metronidazole-p/piperacillin- tazobactam+carbapenemics   Director (100) floorequinolonas resp IV (100) floorequinolonas resp I		Ratio macrolides_n/fluoroquinolones_n	5					0,133		0,012		
Ratio metronidazole-p/piperacillin- tazobactam+carbapenemics Patio macrólidos IVI fluorequinolonas rep IV Suuzo aproxima al uso combinado en neumoríaz, previene el uso de cuinolonas Directo		Natio macionues-p/nuoroquinorones-p	5				DDD fluoroquipolonas	12 400	12 870	9,290	9.433	9,000
Ratio metronidazole-p/piperacililin- tazobactam+carbapenemics 6 Huoroquinolonas resp IV neumonas, previene el uso de quindonas 000 actomotina IV 0.055 0.002 0.009				Ratio macrólidos IV/	Su uso aproxima al uso combinado en	Directo	DDD eritromicina IV	1,492	4,297	3,658	0,042	0,109
kazobactam+carbapenemics   b   guinoknas   DDD darcmions IV   0.005   0.002   0.008     Fosfomycin consumption   7   Image: Consumption   7   Image: Consumption   7     Sequential therapy   8   Ratio anti-SRSA/anti-MRSA agents   9   Antibitico anerobio selectivo. Su uso previne el consumo de antibisico en complicade er V en costa da molisicado at V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en costa da molisicado at V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en costa da molisicado at V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en costa da molisicado at V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en costa da molisicado at V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en costa da molisicado at V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antibitos en cisitia no complicade er V en contina attentes; decritical apresion antinestentes; decritical apresion antibitos en cisita no contina at		Ratio metronidazole-p/piperacillin-		fluoroquinolonas resp IV	neumonías, previene el uso de		DDD azitromicina IV	0,055	0,032	0,174	0,090	0,189
Image: A state in a constraint of the second of the sec			6		quinolonas		DDD claritromicina IV	0,110	0,009	0,002	0,008	0,013
Fosfomycin consumption 7   Fosfomycin consumption 7   Sequential therapy 8   Ratio anti-SRSA/anti-MRSA agents 9   Consume fosfomicina Out elección anticitas preserve Directo Directo Directo   ODDerbrational designational designation designates designates designates designation designation designates design		tazobactam+carbapenemics					DDD macrólidos IV	1,657	4,338	3,834	0,140	0,311
Fosfomycin consumption 7   Fosfomycin consumption 7   Sequential therapy 8   Ratio anti-SRSA/anti-MRSA agents 9   Ratio amoxicillin/amoxicillin-clavulanic acid 10   Consumo fosfonicina VD deelection e noibitis no complicade IV en combinación como to de infecciones multire sistentes; do de infecciones multire sistentes; do de infecciones multire sistentes; do de infecciones multires sistentes; do complicade IV de increase a la functiona vO de antibilitationa vO de infecciones multires sistentes; do complicade IV de increase a la functiona vO de infecciones multires sistentes; do complicade IV de increase a la functiona vO de infecciones multires sistentes; do complicade IV de increase a la functiona vO de infecciones multires sistentes; do complicade IV de increase a la functiona vO de infecciones multires sistentes; do complicade IV de increase a la functiona vO de infecciones multires sistentes; do complicade IV de increase a la functiona vO de infecciones multires sistentes; do complicade IV de informationa vO de informeter vO de informationa vO de informeteres v							DDD levofloxacino IV	1,545	1,663	1,516	1,249	0,928
Postionmychnicki consumption 7   Antibioticon 100 stormychnicki consumption 100 stormychnicki		Eastomycin consumption	7				DDD moxifloxacino IV (no)	1 5 4 5	1,000		1.240	
Ratio anti-SRSA/anti-MRSA agents 9   Ratio amoxicillin/amoxicillin-clavulanic acid/piperacillin-tazobactam 100   Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 000 <td>i osiomychi consumption</td> <td>· ·</td> <td></td> <td></td> <td></td> <td>Batio macrólidos Wifluoroquipolonas resp. W</td> <td>1,345</td> <td>2,609</td> <td>2 529</td> <td>0 112</td> <td>0,320</td>		i osiomychi consumption	· ·				Batio macrólidos Wifluoroquipolonas resp. W	1,345	2,609	2 529	0 112	0,320
Sequential therapy 8 Pip-Tazobroarbapenémicos DDD piperacilinaitazobactam 6.378 6.378 7.248 8.386   Ratio anti-SRSA/anti-MRSA agents 9 Pip-Tazobroarbapenémicos 7.532 10.260 10.111 7.601   Ratio anti-SRSA/anti-MRSA agents 9 Consumo fosfonicina V0 de elección en cistits no complicada e IV en combinación como to de infecciones multirresistentes; cliversifical a presión antibiótica DDD fosfonicina DDE fosfonicina Directo DDD fosfonicina 0.061   Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 11 Terapia secuencial Asociado con paso a V0 de antibiótica Directo DDD anoti-celosu 0.0237 0.316 0.235 0.306   De estromicina V0 0.175 0.217 7.91 2.054 0.217 7.91 2.054				Batio metronidazol iv/	Antibiótico anaerobio selectivo. Su uso	Directo	DDD metronidazol IV	0.894	1.242	0.820	0,972	0.831
Image: Description of the second sector Differences of the second sector		Sequential therapy	8	Pip-Tazob+carbapenémicos	previene el consumo de antibióticos de		DDD piperacilina/tazobactam	6,376	6,189	7,248	8,366	8,875
Ratio anti-SRSA/anti-MRSA agents 9 Image: DDD Pip-Tazob y catbagenémicos 13,908 16,449 17,359 15,967   Ratio anti-SRSA/anti-MRSA agents 9 Image: DDD Pip-Tazob y catbagenémicos 10 Image: DDD Pip-Tazob y catbagenémicos 10,064 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.066 0.06					amplio espectro		DDD carbapenémicos	7,532	10,260	10,111	7,601	7,224
Ratio amoxicillin/amoxicillin-clavulanic acid 10   Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 11   Terapia secuencial 11   Terapia secuencial 10   Datia flue anno significando complicada e lo en cistificando complicada e lo en combinación como tro de infecciones multiresistentes; diversifica la presión antibiótica 000 fosfomicina 0,001 0,004 0,007 0		Ratio anti-SRSA/anti-MRSA agents	9				DDD Pip-Tazob y carbapenémicos	13,908	16,449	17,359	15,967	16,099
Ratio amoxicillin/amoxicillin-clavulanic acid 10 Consumo fosfomicina V0 de elección en cistitis no complicada e IV en combinación como to de infecciones multiresistentes; diversifica la presión antibiótica Directo Directo Directo N <		Ratio anti SRS/ y anti Millo/ ( agents				_	Ratio metronidazol iv/Pip-Tazob+carbapenémic	0,064	0,076	0,047	0,061	0,052
Ratio amoxiciiin/amoxiciii/amoxicii/amoxiciii/amoxiciii/amoxiciii/amoxiciii/amoxiciii/amoxiciii/amoxiciii/amoxiciii/amoxiciii/amoxicii/amoxi		Datia ana aviaillin /ana aviaillin alayyylania aaid	10	Consumo fosfomicina	VO de elección en cistitis no	Directo						
Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 11   Terapia secuencial Asociado con paso a VO de antimicrobianos con misma eficacia, menos RA y menor coste Directo DDD anticina 0,297 0,316 0,295 0,306   137 0,217 0,146 0,216		Ratio amoxicilin/amoxicilin-clavulanic acid	TO		tto de infecciones multirresistentes:							
Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam 11 Terapia secuencial Asociado con paso a VO de antimicrobianos con misma eficacia, menos RA y menor coste Directo DDD amoxi-clav VO 0,217 0,217 0,146 0,217					diversifica la presión antibiótica		DDD fosfomicina	0.297	0.316	0.295	0.306	0.267
antimicrobianos con misma eficacia, menos RA y menor coste DDD azitromicina VO 1,137 0,217 7,091 2,054		Ratio amoxicillin-clavulanic acid/piperacillin-tazobactam	11	Terapia secuencial	Asociado con paso a VO de	Directo	DDD amoxi-clav VO	5,828	6,557	6,445	6,655	6,844
menos RA y menor coste 1,137 0,217 7,091 2,054					antimicrobianos con misma eficacia,		DDD eritromicina VO	0,175	0,217	0,146	0,216	0,241
		Patio fluconazolo/oquinocandine	12		menos RA y menor coste		DDD azitromicina VO	1,137	0,217	7,091	2,054	1,932
		Ratio nuconazoie/equinocanums	12				DDD claritromicina VO	0,065	0,032	0,035	0,082	0,053
							DDD macrolidos VU	1,377	0,466	2.434	2,352	2,225
DD options acing volume 1,20 3,337 2,434 3,200 0.058 0		Diversification of anti-pseudomonas beta-lactam:					DDD cipronoxacino VO	0.058	0.096	0.076	0.065	0.075
$\frac{0.000}{0.000} = \frac{0.000}{0.000} = \frac{0.000}{0$			10				DDD levofloxacino VO	6,133	6,666	3,785	3,196	3,766
0.15 0.113 0.068 0.087		%anti-pseudomonal carbapenemics, %piperacillin-tazobactam	13				DDD moxifloxacino VO	0,155	0,113	0,068	0,087	0,127
							DDD ofloxacino VO	0,000	0,000	0,000	0,000	0,000
and %anti-pseudomonal cephalosporins+aztreonam		and %anti-pseudomonal cephalosporins+aztreonam					DDD quinolonas VO	9,466	10,212	6,363	6,608	7,031

DDD/100s for the years 2018-2022 were calculated in order to see the annual evolution. Required data: antibiotic (ATC Group: J01) and antifungal (ATC) Group:J02) consumption by drug and route of administration (oral (o), parenteral (p) and others). Calculation of DDD/100s according to grams consumed (obtained with Hospital Pharmacy software) and ATC/DDD-Index. Organizat



- We realized that our hospital improved by decreasing consumption of antibacterial, antifungal, carbapenemics and fluoroquinolones; and so, an early parenteral-oral switch.
- However, the other ratio-based indicators are stable or worsening yearly: macrolides-p/fluoroquinolones-p, metronidazole-p/piperacillin-tazobactam +carbapenemics, fosfomycin consumption, anti-SRSA/anti-MRSA agents, amoxicillin/amoxicillin-clavulanic acid, amoxicillin-clavulanic acid/piperacillintazobactam, fluconazole/equinocandins and diversification of anti-pseudomonas beta-lactam.

#### What next?

- These indicators provide possible improvement actions to enhance the use of antimicrobial agents. Consumption of fosfomycin or amoxicillin/amoxicillin-clavulanic acid ratio should be cautiously analyzed due to outpatient (or in emergencies) management of uncomplicated infections.
- As improvement actions in our hospital, increase the use of metronidazole-p in anaerobic infections or cloxacillin and cefazolin deescalation can be promoted as soon as sensitivity is confirmed by antibiogram-test. Diversify antibiotic pressure on pseudomonas, trying to reduce piperacillin-tazobactam by prescribing ceftazidime or cefepime, and reserving aztreonam for beta-lactams allergics. Similarly, decrease piperacillin-tazobactam use by prescribing amoxicillin-clavulanic acid if anti-pseudomonal coverage isn't necessary.



