

# Defining Ambulatory Care Sensitive Conditions for adults in Portugal

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## Research article

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## Abstract

**Background** Ambulatory Care Sensitive Conditions (ACSCs) are health conditions for which adequate management, treatment and interventions delivered in the ambulatory care setting could potentially prevent hospitalization. Which conditions are sensitive to ambulatory care varies according to the scope of health care services and the context in which the indicator is used. The need for a country-specific validated list for Portugal has already been identified, but currently no national list exists. The objective of this study was to develop a list of Ambulatory Care Sensitive Conditions for Portugal.

**Methods** A modified web-based Delphi panel approach was designed, in order to determine which conditions can be considered ACSCs in the Portuguese adult population. The selected experts were general practitioners and internal medicine physicians identified by the most relevant Portuguese scientific societies. Experts were presented with previously identified ACSC and asked to select which could be accepted in the Portuguese context. They were also asked to identify other conditions they considered relevant. We estimated the number and cost of ACSC hospitalizations in 2017 in Portugal according to the identified conditions.

**Results** After three rounds the experts agreed on 34 of the 45 initially proposed items. Fourteen new conditions were proposed and four achieved consensus, namely uterine cervical cancer, colorectal cancer, thromboembolic venous disease and voluntary termination of pregnancy. In 2017 133,427 hospitalizations were for ACSC (15.7% of all hospitalizations). This represents a rate of 1,685 per 100,000 adults. The most frequent diagnosis were pneumonia, heart failure, chronic obstructive pulmonary disease/chronic bronchitis, urinary tract infection, colorectal cancer, hypertensive disease atrial fibrillation and complications of diabetes mellitus.

**Conclusions** New ACSC were identified. It is expected that this list could be used henceforward by epidemiologic studies, health services research and for healthcare management purposes. ACSC lists should be updated frequently. Further research is necessary to increase the specificity of ACSC hospitalizations as an indicator of healthcare performance.

## Background

Ambulatory Care Sensitive Conditions (ACSCs) are health conditions for which adequate management, treatment and interventions delivered in the ambulatory care setting could potentially prevent hospitalization. Early efforts on analyzing ACSC to measure access, quality and performance of health services were introduced in the United States<sup>1</sup> and later expanded to other countries. Which conditions are sensitive to ambulatory care varies according to the scope of health care services and the context in which the indicator is used.<sup>2,3</sup> Consequently, different methods to identify such hospitalizations have been developed worldwide. Different ACSCs lists have been developed since Billings et al<sup>1</sup> in 1993, such as Caminal et al<sup>4</sup>, Brown et al.<sup>5</sup>, Canadian Institute for Health Information (CIHI)<sup>6</sup>, Page et al<sup>7</sup>, Purdy et al<sup>3</sup>, Alfradique et al<sup>8</sup>, Freund et al<sup>9</sup>, Sundmacher et al<sup>10</sup> and the United States Agency for Healthcare Research and Quality<sup>11</sup>.

The process of defining ACSC lists usually starts with a literature review seeking to identify conditions with a potential relation to ambulatory care, followed by processes of discussion and validation with experts. This method aims to reach a consensus on which conditions are sensitive to ambulatory care according to the organization of care, disease mechanisms and prevalence, socioeconomic and cultural characteristics of the population and the patient course within the health system.<sup>2,3</sup>

Additionally, the inclusion of conditions usually follows specific criteria, being the Solberg and Weissman the most commonly used.<sup>12,13</sup> These criteria include: (i) the existence of previous studies, (ii) clarity in the definition and coding of diagnoses, (iii) relevance for public health (a hospitalization rate of least 1/10,000 population), (iv) if the diagnosis is potentially avoidable by timely and effective ambulatory care and (v) the necessity of hospitalization.

The need for a country-specific validated list for Portugal has already been identified<sup>14</sup>, but currently no national list has been developed yet. Previous studies in Portugal have used different methodologies.<sup>15-18</sup> Some studies have indicated that, according to the list developed by Caminal et al for Spain, rates of ACSC hospitalizations have increased during the last years in Portugal.<sup>18-20</sup> However, according to the CIHI List, the rates have declined.<sup>16,20</sup> The reason for such difference is in the methodology applied: while

the Spanish list includes acute and chronic conditions, the CIHI list only contains chronic conditions. There is variation on rates of hospitalizations for ACSCs according to which conditions are selected and analysed.<sup>3,14,21,22</sup>

It is estimated that ACSCs represented 12.3% of all hospitalizations registered in mainland Portugal in 2013.<sup>19</sup> These hospitalizations were concentrated in five main conditions: pneumonia, congestive obstructive pulmonary disease (COPD), heart failure, hypertensive heart diseases and kidney and urinary tract infections. Around 7.3% of the hospitalizations for ACSCs were of repeated patients.<sup>23</sup> There is evidence of an increased risk of hospitalization for ACSCs with the presence of multiple chronic conditions<sup>24</sup> as well as with other factors outside the control of health services delivery, such as socio-economic status.<sup>17</sup>

Despite the complex framework of ACSCs determinants, this is a valuable tool for health care assessment; it has been increasingly discussed not only at the academic level but also adopted by national health systems and international organizations as an indicator of performance.<sup>6,11,25-27</sup> In Portugal, it is included in the pay-for-performance and monitorization process for primary health care and local health units.<sup>28</sup> A locally validated would be useful to adjust the analysis to the peculiarities of the regional contexts.

The objective of this study was to develop a list of Ambulatory Care Sensitive Conditions for Portugal. A secondary goal was to identify ACSC hospitalizations based on the developed list.

## Methods

A modified Delphi panel approach was designed, in order to determine which conditions can be considered ACSCs in the Portuguese adult population. It was web-based and asynchronous, being the answers submitted by each expert via a web-based form during a specified period of time. The experts were selected according to the following criteria:

- a) Specialist in General and Family Medicine (GP) or Internal Medicine (IM);
- b) Clinically active in the National Health Service;
- c) Preferably with an active academic collaboration;

We designed the mix of experts to be 75% GP and 25% IM. The experts were selected, according to the defined criteria, by the most important scientific societies of each specialty, namely the Portuguese Association of General and Family Medicine (APMGF) and the Portuguese Society of Internal Medicine (SPMI). A total of 84 experts were invited to participate through a letter which included a description of the panels' objective and methods. After agreeing to participate each expert was sent a link to a web-based form and the panel lasted from September 2017 to May 2018.

Firstly, a brief conceptual framework of ACSC and the difference between avoidable and adequate hospitalization was delivered. The first question then was "*In your opinion, and given the current legis artis, would you consider possible to avoid the need for hospital admission in Portugal in the following clinical conditions?*". Experts were presented with a list of all previously identified ACSCs, for which a *yes/no/don't know* box was available to be ticked as well as a commentary box, should the experts wish to discuss their answer. This list of conditions was compiled in a preparatory stage by systematically searching *Pubmed* with the keywords "Ambulatory Care Sensitive Conditions", "Avoidable admissions", and "Avoidable hospitalizations". Relevant grey literature was also reviewed.

The second question was "*In your opinion, and given the current legis artis, would you consider possible to avoid the need for hospital admission in Portugal in any other clinical condition not previously mentioned?*". Experts had an open answer box to fill. In each round, there was a final commentary box available for questions not directly related to specific conditions.

The consensus level was defined as 75% after a maximum of three rounds. The percentual level of consensus was calculated by dividing the frequency of answers by the number of respondents in each round, multiplied by 100. To allow for the items marginally over the consensus limit to still be discussed in the following rounds the clinical conditions with a level of consensus lower than 85% were included in the following rounds. After the first and second rounds, each expert was sent an individual spreadsheet with the aggregate results of the entire panel as well as his/her answers for each clinical condition. In the second and third rounds, each non-consensual condition was accompanied by a summary of the experts' comments on the previous round. These summaries were convened after discussion between two researchers (JS and RS) and were anonymised. The clinical conditions not present in previous lists were identified by experts in the first round and still submitted to three rounds of discussion before the end of the panel.

After the experts validated the list, we identified hospitalizations for ACSC in Portugal in 2017, for the population aged 18 years or older, according to the principal diagnosis. We used the database of hospitalizations provided by the Portuguese Central Administration of the Health System [*Administração Central dos Serviços de Saúde- ACSS*]. We compiled two lists. The core list is composed by the conditions that fulfilled the criteria ii to iv proposed by Solberg and Weissman.<sup>12,13</sup> The extended list includes all conditions agreed by the experts, despite not fulfilling all Solberg and Weissman criteria.

## Results

Of the 55 invited GPs, 28 accepted to participate (50.9%) and 25 completed all the rounds (89.3%). Regarding the Internal Medicine physicians, 29 were invited, 5 accepted to participate (17.2%) and 4 completed all rounds (80%).

Table 1 shows the panel results. In the first round, there was consensus (over 85%) in 22 of the 45 items (48.9%). In the second round, 7 further items achieved consensus. Finally, after three rounds, consensus (over 75%) was achieved for 34 items, leaving 11 non-consensual items (22.2%).

Table 1  
Results from Delphi Panel, previously identified ACSCs

Condition	1st round	2nd round	3rd round
Acute myocardial infarction	22,86%	20,00%	48,28%
<b>Acute otitis media</b>	<b>97,14%</b>		
<b>Acute pharyngitis</b>	<b>97,14%</b>		
<b>Acute poliomyelitis</b>	62,86%	<b>86,67%</b>	
<b>Acute sinusitis</b>	<b>91,43%</b>		
<b>Acute Skin Infections</b>	<b>88,57%</b>		
<b>Acute Tonsillitis</b>	<b>97,14%</b>		
Appendicitis with complications <sup>a</sup>	20,00%	10,00%	
<b>Asthma</b>	<b>88,57%</b>		
<b>Atrial fibrillation</b>	71,43%	76,67%	<b>82,76%</b>
<b>Chronic obstructive pulmonary disease / chronic bronchitis</b>	<b>88,57%</b>		
<b>Dehydration / Hydroelectrolytic Changes</b>	80,00%	83,33%	<b>86,21%</b>
<b>Dementia</b>	62,86%	70,00%	<b>75,86%</b>
<b>Dental and oral cavity pathology</b>	<b>91,43%</b>		
<b>Diabetes mellitus (acute and chronic complications)</b>	<b>85,71%</b>		
<b>Diphtheria</b>	71,43%	<b>93,33%</b>	
Epilepsy and seizures	57,14%	53,33%	48,28%
<b>Folate deficiency anemia</b>	<b>91,43%</b>		
Gangrene	25,71%	43,33%	72,41%
<b>Gastroenteritis</b>	<b>91,43%</b>		
<b>Heart failure</b>	82,86%	<b>90,00%</b>	
<b>HBV acute infection</b>	77,14%	<b>90,00%</b>	
<b>HBV chronic infection</b>	<b>85,71%</b>		
<b>Hypertensive disease</b>	<b>97,14%</b>		
<b>Infectious Parotitis</b>	82,86%	<b>86,67%</b>	
<b>Influenza</b>	<b>88,57%</b>		
<b>Iron deficiency anemia</b>	<b>91,43%</b>		
Ischemic myocardial disease	65,71%	70,00%	65,52%
<b>Measles</b>	82,86%	<b>86,67%</b>	
Meningitis by h. influenzae	48,57%	63,33%	48,28%
Nutritional deficiencies	82,86%	73,33%	68,97%
Pelvic Inflammatory Disease	65,71%	66,67%	55,17%

<sup>a</sup> 90% of experts rejected this condition in the second round, and it was not presented again in the third round.

HBV – Hepatitis B virus

<b>Condition</b>	<b>1st round</b>	<b>2nd round</b>	<b>3rd round</b>
Perforated / bleeding digestive ulcer	37,14%	40,00%	65,52%
Periamygdaline abscess	60,00%	56,67%	51,72%
<b>Pneumonia</b>	<b>88,57%</b>		
Rheumatic fever	65,71%	76,67%	68,97%
<b>Rubella</b>	<b>88,57%</b>		
<b>Syphilis</b>	<b>97,14%</b>		
<b>Tetanus</b>	68,57%	<b>86,67%</b>	
<b>Tuberculosis</b>	77,14%	83,33%	<b>89,66%</b>
<b>Upper respiratory tract infection</b>	<b>97,14%</b>		
<b>Urinary Tract Infections</b>	<b>88,57%</b>		
<b>Urinary tract infections in pregnancy</b>	<b>85,71%</b>		
<b>Vitamin B12 deficiency anemia</b>	<b>91,43%</b>		
<b>Whooping cough</b>	80,00%	83,33%	<b>79,31%</b>
<sup>a</sup> 90% of experts rejected this condition in the second round, and it was not presented again in the third round.			
HBV – Hepatitis B virus			

Insert Table 1 here.

Table 2 shows the potentially new ACSCs suggested by the experts. Out of fourteen new conditions, four achieved consensus (over 75%) after three rounds and were included as ACSCs.

Table 2  
Results from Delphi Panel, additional proposed conditions

Condition	1st round	2nd round	3rd round
Abortion Complications	46,67%	55,17%	34,48%
Alcoholic liver disease	70,00%	82,76%	72,41%
Bipolar disorder	70,00%	62,07%	58,62%
<b>Colorectal cancer</b>	50,00%	68,97%	<b>75,86%</b>
Hepatitis C	73,33%	82,76%	68,97%
HIV infection	76,67%	75,86%	68,97%
Lung cancer	50,00%	68,97%	62,07%
Melanoma	60,00%	65,52%	55,17%
Occupational Accidents	56,67%	48,28%	48,28%
Occupational diseases	63,33%	58,62%	62,07%
Schizophrenia	66,67%	58,62%	55,17%
<b>Thromboembolic venous disease*</b>	56,67%	62,07%	<b>82,76%</b>
<b>Uterine cervical cancer</b>	56,67%	75,86%	<b>75,86%</b>
<b>Voluntary termination of pregnancy</b>	80,00%	79,31%	<b>86,21%</b>
*excluding pulmonary thromboembolism			

Insert Table 2 here.

Table 3 shows the estimation of hospitalizations for ACSCs in Portugal in 2017, for population aged 18 years or older, the hospitalization rate per 10,000 people and the ICD10 codes used for this identification. The conditions that fulfill the criteria ii to iv by Solberg and Weissman are in bold, and those compose the core list. In 2017, there were 847,609 hospitalizations of people aged 18 years or older; out of these, 136,626 were for ACSC (16.1% of all hospitalizations). This represents a rate of 1,540 hospitalization per 100,000 adults. The most frequent diagnosis were pneumonia, chronic obstructive pulmonary disease/chronic bronchitis, heart failure, hypertensive disease, colorectal cancer, atrial fibrillation, urinary tract infections and complications of diabetes mellitus.

Table 3  
Portuguese ACSCs lists Core (in bold) and extended, ICD 10 codes and frequency of diagnosis, Portugal 2017.

Condition	ICD 10	N of ACSCs	Hospitalization rate (per 10,000 population)
Acute otitis media <sup>a</sup>	H650, H651, H660, H661	204	0.23
Acute pharyngitis <sup>a</sup>	J02	28	0.03
Acute poliomyelitis <sup>a</sup>	A80	1	0.00
Acute Sinusitis <sup>a</sup>	J01	111	0.13
<b>Acute Skin Infections</b>	<b>L01-L04, L08</b>	<b>4,164</b>	<b>4.69</b>
Acute Tonsillitis <sup>a</sup>	J03	366	0.41
<b>Asthma</b>	<b>J45, J46</b>	<b>1,516</b>	<b>1.71</b>
<b>Atrial fibrillation</b>	<b>I48</b>	<b>6,228</b>	<b>7.02</b>
<b>Uterine cervical cancer<sup>b</sup></b>	<b>C53</b>	<b>929</b>	<b>1.05</b>
<b>Chronic obstructive pulmonary disease / chronic bronchitis</b>	<b>J20, J40-J44, J47</b>	<b>20,078</b>	<b>22.64</b>
<b>Colorectal cancer<sup>b</sup></b>	<b>C18, C19, C20, C21.8</b>	<b>9,664</b>	<b>10.90</b>
<b>Dehydration / Hydroelectrolytic Changes</b>	<b>E86</b>	<b>1,724</b>	<b>1.94</b>
<b>Dementia</b>	<b>F01, F03</b>	<b>1,294</b>	<b>1.46</b>
<b>Dental and oral cavity pathology</b>	<b>K02, K04-K06, K08, K12, K13</b>	<b>1,344</b>	<b>1.52</b>
<b>Depression</b>	<b>F32, F33</b>	<b>3,064</b>	<b>3.45</b>
<b>Diabetes mellitus (complications)</b>	<b>E10.0, E10.1, E10.5, E10.6, E10.7, E10.9, E11.0, E11.1, E11.5, E11.6, E11.7, E11.9, E12.0, E12.1, E12.5, E12.6, E12.7, E12.9, E13.0, E13.1, E13.5, E13.6, E13.7, E13.9, E14.0, E14.1, E14.5, E14.6, E14.7, E14.9, E15, E16.0</b>	<b>5,613</b>	<b>6.33</b>
Diphtheria <sup>a</sup>	A36	0	0.00
Folate deficiency anemia <sup>a</sup>	D52	35	0.04
<b>Gastroenteritis</b>	<b>A00 - A09</b>	<b>2,636</b>	<b>2.97</b>
<b>Heart failure</b>	<b>I50, J81</b>	<b>16,283</b>	<b>18.36</b>
HBV acute infection <sup>a</sup>	B16	23	0.03
HBV chronic infection <sup>a</sup>	B18.0, B18.1	58	0.07
<b>Hypertensive disease</b>	<b>I10 - I15</b>	<b>12,144</b>	<b>13.69</b>
<sup>a</sup> Do not fulfill criteria iii			
<sup>b</sup> Suggested by experts			

Condition	ICD 10	N of ACSCs	Hospitalization rate (per 10,000 population)
Infectious Parotitis <sup>a</sup>	B26	41	0.05
Influenza <sup>a</sup>	J10, J11	509	0.57
<b>Iron deficiency anemia</b>	<b>D50</b>	<b>1,592</b>	<b>1.79</b>
Measles <sup>a</sup>	B05	4	0.00
<b>Obesity</b>	<b>E66</b>	<b>2,635</b>	<b>2.97</b>
<b>Pneumonia</b>	<b>J13, J14, J15.3, J15.4, J15.7, J15.8, J15.9, J16.8, J18.0, J18.1, J18.8, J18.9</b>	<b>37,302</b>	<b>42.05</b>
Rubella <sup>a</sup>	B06	1	0.00
Syphilis <sup>a</sup>	A50 - A53	114	0.13
Tetanus <sup>a</sup>	A33 - A35	1	0.00
Thromboembolic venous disease <sup>b</sup>	I80, I82.2, I82.3, I82.8, I82.9	231	0.26
Tuberculosis <sup>a</sup>	A15-A17	781	0.88
Upper respiratory tract infection <sup>a</sup>	J06	254	0.29
<b>Urinary Tract Infections</b>	<b>N10-N12</b>	<b>6,218</b>	<b>7.01</b>
Urinary tract infections in pregnancy <sup>a</sup>	O23	617	0.70
Vitamin B12 deficiency anemia <sup>a</sup>	D51	109	0.12
<b>Voluntary termination of pregnancy<sup>b</sup></b>	<b>Z332</b>	<b>973</b>	<b>1.10</b>
Whooping cough <sup>a</sup>	A37	2	0.00
<sup>a</sup> Do not fulfill criteria iii			
<sup>b</sup> Suggested by experts			

Insert Tabel 3 here.

Table 4 compares the list obtained by this study with some of the lists previously developed and in current use in other countries. It is important to mention that this table contains the broader identification of diagnostics, but specific ICD codes may vary between lists.

Table 4  
Comparison of Portuguese list with previous lists

Conditions	Portugal	Alfradique	AHRQ	Billings	Caminal	CIHI	Freund	Page	Purdy	Sundmacher
Acute otitis media		X		X				X	X	X
Acute pharyngitis		X		X				X	X	X
Acute poliomyelitis					X		X	X	X	X
Acute sinusitis		X								X
Acute skin infections	X	X		X			X	X	X	X
Acute tonsillitis		X		X				X	X	X
Angina		X		X	X	X	X	X	X	
Asthma	X	X	X	X		X	X	X	X	X
Atrial fibrillation	X						X			
<b>Uterine cervical cancer</b>	X									
Chronic obstructive pulmonary disease / chronic bronchitis	X	X	X			X	X	X	X	X
<b>Colorectal cancer</b>	X									
Dehydration / Hydroelectrolytic Changes	X	X	X		X		X	X	X	X
Dementia	X									X
Dental and oral cavity pathology	X			X			X	X	X	X
Depression	X									X
Diabetes mellitus (acute and chronic complications)	X	X	X		X	X	X	X	X	X
Diphtheria		X			X		X	X	X	
Epilepsy		X		X		X	X	X	X	
Folate deficiency anemia										X
Gangrene					X		X	X	X	
Gastroenteritis	X	X		X			X			X
Heart failure	X	X	X	X	X	X	X	X	X	X
HVB acute infection		X					X	X	X	X
HVB chronic infection							X	X	X	X
Hypertension	X	X	X		X	X	X	X	X	X
Infectious Parotitis		X						X	X	X
Influenza							X	X	X	X
Iron deficiency anemia	X	X		X			X	X	X	X

Conditions	Portugal	Alfradique	AHRQ	Billings	Caminal	CIHI	Freund	Page	Purdy	Sundmacher
Measles		X					X	X	X	X
Obesity	X									X
Pelvic inflammation		X		X	X		X	X	X	X
Perforated/bleeding ulcer		X			X		X	X	X	X
Pneumonia	X	X	X	X	X		X	X		X
Rubella		X					X	X	X	X
Syphilis		X			X					X
Tetanus		X		X	X		X	X	X	X
<b>Thromboembolic venous disease</b>	X									
Tuberculosis		X		X	X			X		X
Upper respiratory tract infection		X		X				X	X	X
Urinary Tract Infections	X	X	X		X				X	X
Urinary tract infections in pregnancy		X								X
Vitamin B12 deficiency anemia										X
<b>Voluntary termination of pregnancy</b>	X									
Whooping cough		X					X	X	X	X

Insert Tabel 4 here.

## Discussion

This paper's discussion will firstly focus on its methods followed by the results' discussion. To finalize we will briefly discuss its contribution to science and healthcare, as well as important underlying questions about using ACSCs as an indicator.

Regarding methods we have developed the list for the Portuguese context using the Delphi Panel method. All lists of ACSC have been developed using experts opinion, being the Delphi panel method the most used.<sup>4,8,10</sup> The reason for this is the necessary evaluation of comprehensive and complex disease mechanism and diagnostic/treatment pathways in order to determine if a condition can be avoided and/or treated in the ambulatory setting. No other valid method is described. The experts' selection process is extremely important for the panels' conclusions. Therefore, we intentionally mixed GPs with IM since their perspectives are complementary. While the first are responsible for most ambulatory care in Portugal, therefore understanding the resources available in the ambulatory setting, the latter are the most responsible for hospital admission decisions and have the end-of-the-line perspective on the pathways that lead to an ACSC hospitalization. To ensure the experts quality we defined clear selection criteria and arranged for a peer-selection by the most relevant Portuguese scientific societies in each speciality. The difference in the invitation acceptance rate between GPs (50.9%) and IMs (17.2%) is very likely related to the higher familiarity with the concept of ACSC by GPs, once these are used as a performance indicator of primary care by local, regional and national authorities. The final mix of 86% GPs was higher than initially designed. However, the IM were fairly active during the several rounds and positively contaminated the discussion on several items.

In terms of results the experts proposed fourteen new ACSCs having four conditions achieved consensus, namely uterine cervical cancer, colorectal cancer, thromboembolic venous disease and voluntary termination of pregnancy. For both type of cancers, the experts referred to the screening undertaken in primary care as the technology that might avoid the necessity of hospitalization. The reasoning is that early detected conditions might obviate the need for more complex interventions that require hospital admission. This does not, however, mean that all cancers and therefore all admissions for cancer are avoidable. Regarding thromboembolic venous disease, experts identified the early diagnosis and treatment as capable of avoiding hospitalizations. Finally, voluntary termination of pregnancy was considered avoidable if effective and timely family planning is accessible. All of these conditions verified the relevance for Public Health criterion proposed by Solberg and Weissman (hospitalization rate higher than 1/10.000 hab) being colorectal cancer, in fact, the fifth highest rate of ACSC hospitalization in Portugal in 2017. Although these criteria have been widely accepted, we do not agree that Public Health relevance should be strictly reduced to a hospitalization rate. For this reason, we propose two lists of ACSC, the core list including only the conditions that verify the hospitalizations rate criterion, and the extend list where all conditions considered ACSC by experts are included.

It is also noteworthy that other four conditions strongly related to behavioural and lifestyle decisions were newly proposed and almost reached consensus, namely alcoholic liver disease, hepatitis C, HIV infection and lung cancer. The health promotion capacity of primary care was identified as the technology that might prevent the onset of these diseases and therefore the need for hospitalization. It is also relevant to discuss that the recent pharmacological innovation for the treatment of HIV and hepatitis C viruses infection might render the need for hospitalization growingly residual.

Another important discussion topic is the consensus in not considering appendicitis with complication an ACSC and the lack of consensus in further nine previously considered conditions. This fact elicits the discussion on the context specificities to which is important to adapt the ACSC lists. This may also reflect the limitation of using experts' opinion to define ACSCs. In summary, the influx and efflux of conditions considered ACSC reflects the importance of regularly updating the lists. Nearly all the previous lists used in the comparison in Table 4 were developed more than 10 years ago. The constant development of knowledge, technology and healthcare design demands that the ACSC lists are updated more regularly.

The rates of hospitalization in this paper are in line with previous studies regarding the most frequent ACSCs in Portugal being pneumonia, COPD, cardiovascular diseases, urinary tract infection and diabetes. Using the developed list, we identified that 16.1% of all hospitalizations were for ACSC. This is higher than what was found in previous studies, due to the inclusion of more conditions. Previous studies identified 4.4%<sup>20</sup>, 9.9%<sup>15</sup> and 12.3%<sup>19</sup> between 2012 and 2015. These studies used different lists, therefore the differences between results.

The development of a validated list for the Portuguese context is important, as the use of a common methodology can standardize results, enhancing comparability within the country. The use of the country-specific list can also better reflect the health system organization and population characteristics of Portugal, therefore with a higher specificity to the Portuguese context. It does however hinder international comparability. Having validated an ACSC list for the Portuguese setting it is expected that henceforward official authorities and academic research use this list when measuring ACSC hospitalizations.

Finally, it is important to address some limitations inherent not only to this paper, but also to the concept and operationalization of ACSC as an indicator of access and quality of care.

The use of experts' opinion in the definition of ACSCs is subject to several biases, as well as the process of translating conditions into diagnosis codes. Furthermore, the use of administrative databases intended for financial purposes and subject to coding quality variations also recommends precaution in the interpretation of the results herein described. However, these variations should not be relevant enough to compromise the big picture, but should be taken into account when trying to zoom in to lower levels of aggregation. For example, while at the national and regional level this indicator is useful to identify Public Health priorities it might not be adequate at the local and individual level to evaluate specific providers' access and quality once the aforementioned biases may cause an important lack of specificity. The regional and local use should also take into account several determinants of ACSC hospitalizations, such as socioeconomic status, hospital distance and rurality<sup>29-32</sup>, disease and multimorbidity prevalence<sup>24</sup>, in order to achieve a necessary risk adjustment of results.

## Conclusion

We have developed a list of ACSCs for Portugal. This list includes conditions not identified in previous methodologies and excludes others previously identified thus increasing the specificity to the Portuguese context. Using this list to identify ACSC hospitalizations in Portugal, we have found a higher number of hospitalizations than what was estimated by previous studies. It is expected that this list could be used henceforward by epidemiologic studies, health services research and for healthcare management purposes. The identification of four new conditions contributes to the update of ACSC definition.

## Abbreviations

ACSC – Ambulatory Care Sensitive Conditions

ACSS - Administração Central dos Serviços de Saúde

APMGF - Association of General and Family Medicine

COPD - congestive obstructive pulmonary disease

CIHI – Canadian Institute for Health Information

GP – General practitioners

HBV – Hepatitis B virus

HIV – Human immunodeficiency virus

ICD10 – International Classification of Diseases 10th Version

IM – Internal Medicine physicians

JS – João Sarmento

SPMI - Portuguese Society of Internal Medicine

RS – Rui Santana

## Declarations

### Ethics approval and consent to participate

Once the participation of experts implied repeated answering of online questionnaires, the consent to participate was implicit should an answer be provided. No formal consent was required for this reason.

Ethics approval is not applicable since anonymized patient-level data was used in the study. The utilization of the data for the present study was authorized.

The approval to use the data was obtained both from the Portuguese Central Administration of the Health System and the National School of Public Health.

### Consent for publication

All authors consent for publication.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## Competing interests

The authors declare that they have no competing interests.

## Funding

None to declare.

## Authors' contributions

JS: Research design; Literature review; Original data collection; Manuscript writing reviewing and editing

JVMR: Literature review; Manuscript writing reviewing and editing

RS: Research design; Original data collection; Manuscript writing reviewing and editing

All authors have read and approved the manuscript.

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