

PERSPECTIVE



Minimum and optimal numbers of psychiatric beds: expert consensus using a Delphi process

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The required minimum number of psychiatric inpatient beds is highly debated and has substantial resource implications. The present study used the Delphi method to try to reach a global consensus on the minimum and optimal psychiatric bed numbers. An international board of scientific advisors nominated the Delphi panel members. In the first round, the expert panel provided responses exploring estimate ranges for a minimum to optimal numbers of psychiatric beds and three levels of shortage. In a second round, the panel reconsidered their responses using the input from the total group to achieve consensus. The Delphi panel comprised 65 experts (42% women, 54% based in low- and middle-income countries) from 40 countries in the six regions of the World Health Organization. Sixty psychiatric beds per 100 000 population were considered optimal and 30 the minimum, whilst 25–30 was regarded as mild, 15–25 as moderate, and less than 15 as severe shortage. This is the first expert consensus on minimum and optimal bed numbers involving experts from HICs and LMICs. Many high-income countries have psychiatric bed numbers that fall within the recommended range. In contrast, the number of beds in many LMIC is below the minimum recommended rate.

Molecular Psychiatry; <https://doi.org/10.1038/s41380-021-01435-0>

INTRODUCTION

Psychiatric inpatient bed capacities vary between countries [1] and international consensus is lacking on how many psychiatric beds should be available for optimal functioning of mental health systems. The bed rates in low (median 1.9 beds per 100,000), lower-middle (median 6.3 beds per 100,000), and upper-middle-income (median 24.3 beds per 100,000) countries (LMICs) are, on average, much lower than in high-income (median 52.6 beds per 100,000) countries (HICs) and in the OECD (mean 62 beds per 100,000) [1, 2]. Variations in the provision of psychiatric beds, even among OECD member countries [3], can only partially be explained by geographical location and income levels [4]. Several contextual factors may have an impact on this variation. These include demographic characteristics of the population [5, 6], mental health budgets [7], morbidity levels, migration, and local poverty [8], the availability of social support services [9, 10], incarceration rates [11], availability of psychiatric outpatient and residential services, mental health stigmatization levels and the continuity of mental health care across sectors [12]. Especially home treatment, such as multidisciplinary crisis resolution teams,

and assertive outreach treatment may reduce the need for hospitalization in highly resourced care systems.

The expert consensus approaches may serve as guidance when strict epidemiological estimations are impractical. It is a valuable resource as a basis for decision-making where experimental evidence is not available or when the subject is not easy to study otherwise [13]. This is especially the case in the complex area of resource utilization in mental health care [14]. The required number of psychiatric beds is still a matter of debate and attempts to find a consensus among experts have been limited to HICs [15, 16]. On the basis of expert opinion, Canadian and American organizations have recommended a target of 50 publicly funded psychiatric beds per 100,000 population [15, 17]. However, the recommendations do not specify how the experts arrived at their consensus estimates and do not consider the situation in LMICs [18].

Therefore, the aim of this study was to reach a global expert consensus on the minimum and optimal psychiatric bed numbers. We also aimed to explore factors that may be considered relevant for local planning.

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Received: 29 September 2021 Revised: 8 December 2021 Accepted: 23 December 2021

Published online: 21 January 2022

METHODS

This study (ISRCTN10786216) used structured and sequential questionnaires with controlled feedback as per the Delphi method. A Scientific Advisory Board with 13 members from different WHO regions was formed. Members were selected—based on relevant contributions to mental health research—to advise on the survey design and procedures as well as data processing and analyses. They also proposed experts who were invited to be part of the Delphi panel. At least two survey rounds were considered. Consensus as defined below was the criterion to stop the Delphi process [19, 20].

Recruitment and survey design

The members of the Board were asked to propose at least 12 professionals with experience in the field of psychiatric service development, especially researchers with published scientific articles related to the topic, and mental health service managers at a local (institutional) or regional/national level. Board members were asked to consider experts from different disciplines (i.e., psychiatrists, psychologists, mental health nurses, administrators, user- and family-organizations) and from all WHO regions.

Based on proposals by Board members, 158 potential experts were sent two invitations via email between August 5 and August 31, 2020 to be part of the Delphi panel. Of the 158 experts invited, 83 declined to participate or did not respond to the invitation. A panel of 75 members was formed and were contacted for the second round. We established a priori that only rounds with at least 30 participants would be included in the analyses.

Online surveys

The surveys were hosted on the online platform SurveyMonkey, and links to respond were delivered to Delphi panel members via email. The first-round survey was open between September 3, 2020 and October 2, 2020; the second-round survey was open between November 9, 2020 and January 4, 2021. We used an electronic informed consent form to be completed by the participants. The form was reviewed and approved by the Ethics Committee of the Diego Portales University, Santiago, Chile. Panel members were asked to provide optimal and minimum numbers per 100,000 population, as well as ranges for mild, moderate, and severe shortages if minimum numbers were higher than zero. The concept of “psychiatric bed” provided in the section heading was based on WHO’s definition [1]. This included mental hospital short-term and long-stay services, general hospital psychiatric units, community-based psychiatric inpatient units, and forensic inpatient units. The definition also included both public and private nonprofit and for-profit facilities, mental hospitals for children and adolescents only, and those for other specific populations (e.g., old age). However, the definition excluded facilities that treat only people with alcohol and substance use disorders or intellectual disability without accompanying mental disorder diagnoses, community residential facilities, and services exclusively providing recovery and rehabilitation treatments. Panel members were also invited to identify contextual factors in open textboxes, that may specify or modify recommendations on psychiatric bed numbers at the local or regional level based on their personal experience and evidence in the scientific literature. All factors given in the first round were submitted to thematic analysis [21]; the resulting statements were sent to the panel members in the second round who scored each statement on Likert-type five-point scales (Not relevant, Not very important, Very important, Essential, and Don’t know/depends).

Multiple-choice questions to characterize the Delphi panel were also included in the surveys. The income level of the countries where the panel members were working was based on the World Bank classification [22]. The geographical distribution was based on the six WHO regions [23]. Because of important cultural and socio-economic differences, the Region of the Americas

Table 1. Characterization of the Delphi panel members in the first and second rounds.

	First round (N)	Second round (N)
Total	63	61
Age range		
34 or younger	3	2
35–44	18	17
45–54	16	17
55–64	16	13
65+	9	11
WHO region		
AFRO	7	6
EMRO	8	8
EURO	13	13
PAHO Latin	10	9
PAHO North	9	9
SEARO	4	4
WPRO	12	12
Income		
High	30	30
Upper-middle	18	16
Lower-middle	13	13
Low	2	2
Gender		
Male	36	35
Female	27	26
Profession		
Psychiatrists	42	40
Other professionals	21	21
Area of expertise		
Academia/research	20	22
Administration/policy/other	16	14
Clinician	27	25

AFRO African region, EMRO Eastern Mediterranean region, EURO European region, PAHO Pan American health organization, SEARO South-East Asian region (SEARO), WPRO Western Pacific region.

(Pan American Health Organization [PAHO]) was divided into two subregions: PAHO North America (including the United States and Canada) and PAHO Latin America and the Caribbean (including all the remaining countries of PAHO). Professional background (psychiatrist, other mental health professional, or other professions), areas of expertise (clinical, research/academia, administration, and policy), gender, and age were all recorded.

Data analysis

Regarding the numbers that were requested, we did not expect normal distribution. Therefore, median values and IQR, as well as mean and standard deviation (SD), were calculated for each indicator. Median values and interquartile ranges (IQR) resulting from the first round were provided to panel members in order to reconsider their response in an effort to improve consensus. The consensus was considered to be reached if at least 85% of the responses from the last round fell between the first and third quartiles of the answers given in the first round [24]. Extreme outliers were retrospectively identified and excluded based on the 3*IQR rule [25]. Second round responses were also assessed by income group and WHO region.

Table 2. Optimal, minimum, and shortage levels of psychiatric beds per 100,000 inhabitants recommended by the Delphi panel: median and mean rates and distribution based on income group and WHO region of the countries, in which the panel members are based.

	First round					Second round			
	Optimal	Minimum	Mild shortage ^a	Moderate shortage	Severe shortage	Optimal	Minimum	Moderate shortage	Severe shortage
Overall responses	N 63					N 61			
Median (IQR)	50 (58)	30 (36)	30 (35)	20 (27)	10 (21)	60 (20)	30 (15)	25 (13)	15 (10)
Minimum value	0	0	0	0	0	0	0	0	0
Q1	25	14	10	8	4	50	25	20	10
Q3	83	50	45	35	25	70	40	33	20
Maximum value ^b	2000	1000	1500	1000	400	100	65	60	50
Mean (SD)	59 (44)	33 (25)	34 (28)	24 (20)	16 (15)	61 (17)	34 (13)	26 (12)	15 (9)
No. (%) of second-round responses between Q1 and Q3 of first round	NA	NA	NA	NA	NA	59 (97)	58 (95)	58 (95)	59 (97)
Income level									
High-Income Countries	N 30 (1 extreme outlier)					N 30			
Median (IQR)	50 (50)	40 (30)	40 (30)	30 (25)	20 (20)	60 (23)	40 (20)	30 (17)	15 (10)
Mean (SD)	65 (39)	38 (23)	43 (30)	30 (20)	20 (13)	64 (15)	38 (13)	29 (13)	17 (11)
Lower- and Middle-Income Countries (combined)	N 33 (3 extreme outliers)					N 31			
Median (IQR)	50 (65)	20 (34)	20 (30)	10 (25)	5 (19)	60 (20)	30 (20)	20 (10)	10 (10)
Mean (SD)	52 (47)	28 (26)	25 (24)	18 (19)	12 (15)	58 (19)	30 (12)	23 (10)	14 (7)
Upper-Middle-Income Countries	N 18 (1 extreme outlier)					N 16			
Median (IQR)	15 (45)	10 (36)	9 (25)	6 (19)	4 (11)	50 (14)	28 (10)	20 (8)	10 (6)
Mean (SD)	41 (48)	25 (24)	22 (25)	16 (19)	11 (24)	54 (14)	28 (10)	20 (8)	12 (6)
Lower-Middle-Income Countries	N 13 (2 extreme outliers)					N 13			
Median (IQR)	60 (75)	20 (20)	20 (24)	10 (20)	5 (15)	60 (30)	30 (15)	30 (15)	10 (10)
Mean (SD)	66 (48)	31 (29)	26 (24)	18 (19)	10 (14)	60 (24)	30 (13)	30 (15)	10 (9)
Low-Income Countries	N 2					N 2			
Median (IQR)	70 (10)	40 (10)	43 (3)	35 (5)	35 (15)	68 (8)	40 (0)	28 (8)	20 (5)
Mean (SD)	70 (14)	40 (14)	44 (4)	35 (7)	35 (21)	68 (11)	40 (0)	28 (11)	20 (7)
WHO region									
AFRO	N 7 (1 extreme outlier)					N 6			
Median (IQR)	55 (70)	25 (44)	33 (36)	23 (34)	15 (34)	73 (24)	35 (25)	38 (5)	20 (11)
Mean (SD)	62 (56)	36 (38)	33 (30)	25 (24)	20 (22)	61 (33)	32 (19)	32 (16)	18 (11)
EMRO	N 8 (1 extreme outlier)					N 8			
Median (IQR)	60 (55)	20 (38)	25 (20)	15 (18)	10 (15)	55 (13)	23 (16)	20 (15)	10 (9)
Mean (SD)	74 (64)	35 (34)	35 (31)	25 (24)	15 (17)	51 (11)	27 (10)	19 (8)	11 (5)
EURO	N 13					N 13			
Median (IQR)	50 (30)	25 (27)	30 (22)	20 (20)	10 (24)	60 (20)	40 (20)	30 (15)	15 (10)
Mean (SD)	67 (47)	38 (27)	38 (37)	28 (26)	18 (17)	60 (17)	35 (15)	30 (13)	19 (12)
PAHO North America	N 9 (1 extreme outlier)					N 9			
Median (IQR)	70 (45)	50 (30)	40 (16)	30 (9)	20 (5)	60 (15)	50 (15)	30 (5)	20 (10)
Mean (SD)	66 (29)	37 (16)	48 (27)	33 (14)	21 (9)	69 (17)	43 (9)	29 (7)	18 (8)
PAHO Latin America and the Caribbean	N 10					N 9			
Median (IQR)	10 (33)	8 (29)	7 (4)	5 (2)	3 (2)	50 (10)	25 (10)	20 (10)	10 (5)
Mean (SD)	23 (21)	17 (16)	12 (12)	9 (10)	6 (8)	54 (14)	27 (9)	19 (8)	11 (6)

Table 2. continued

	First round					Second round			
	Optimal	Minimum	Mild shortage ^a	Moderate shortage	Severe shortage	Optimal	Minimum	Moderate shortage	Severe shortage
SEARO	N 4 (1 extreme outlier)					N 4			
Median (IQR)	30 (46)	20 (8)	8 (2)	5 (1)	1 (1)	55 (18)	35 (13)	25 (13)	13 (15)
Mean (SD)	46 (48)	15 (9)	8 (3)	5 (1)	1 (1)	63 (19)	38 (10)	23 (10)	13 (9)
WPRO	N 12					N 12			
Median (IQR)	63 (50)	48 (33)	50 (30)	30 (23)	20 (20)	60 (16)	30 (16)	20 (19)	10 (15)
Mean (SD)	65 (34)	40 (19)	39 (18)	29 (15)	19 (13)	62 (15)	34 (14)	27 (15)	14 (9)

NA not applicable, AFRO African region, EMRO Eastern Mediterranean region, EURO European region, PAHO Pan American health organization, SEARO South-East Asian region, WPRO Western Pacific region.

^aThe category *Mild shortage* was defined as the range between the minimum number and the cut off point for moderate shortage in the second round. Therefore, no value was retrieved for this category in the second round.

^bFour extreme outliers were excluded from analyses of the first round.

In the second round, the percentage of each response (Not relevant, Not very important, Very important, Essential, and Don't know/depends) to each contextual factor was calculated. The contextual factors were sorted within each thematic group based on the sum of Very Important and Essential responses, and the mean percentages for those responses in each thematic group were calculated. Consensus on contextual factors was a priori defined as at least 85% of the panel rating the item as Essential or Very Important. Raw data are available upon reasonable request from the corresponding author.

RESULTS

In the first round we received 63 responses and in the second round 61 responses from respondents from 40 different countries representing all six WHO regions. Composition of the Delphi panel in the first and second round was similar although four panel members responded to the first round but not the second one, and two panel members only responded to the second round without having answered the first one. The characteristics of the panel are shown in Table 1. More details on the panel members are provided in the supplementary material (Table S1).

Median and mean numbers of psychiatric beds recommended by the panel are provided in Table 2. In the first round, the respondents were asked to provide five numerical values: optimal and minimum numbers of psychiatric beds, and three cut-off points to define mild, moderate, and severe levels of shortage. However, the median numbers for minimum level and the cut-off point to define mild shortage were identical, so for the second round, we only asked for four rates: two numbers for an "adequate range" of beds between an optimal and a minimum number and two cut-off numbers (an upper one delineating mild and moderate shortage and a lower one separating moderate and severe shortage). Four extreme outliers defined as all responses over 232 beds per 100 000 population (3*IQR rule) were excluded from the analyses provided for the first round. The outliers were from four different WHO regions, including HIC and LMIC. No extreme outliers were observed in the second round (Table 2). None of the 61 respondents skipped the questions in this section.

In the second round, more than 85% of responses for all four indicators fell between the first and third quartiles of the first round. Consequently, the high dispersion of responses found in the first round was reduced in the second round, which was evidenced in the proximity of means and medians of the second round and in the IQR and SD values (Fig. 1). The consensus was reached that 30 to 60 psychiatric beds per 100,000 population was an acceptable range, with 30 as a minimum and 60 an optimal rate. Rates between 25 and 30 were defined as mild

shortage, while 15 to 25 defined moderate shortage. Rates lower than 15 beds per 100,000 were considered a severe shortage of psychiatric beds.

Respondents from HICs provided a higher median rate of 40 per 100,000 population as a minimum, compared to 30 in LMICs. The differences observed for countries from different income groups or geographic regions also tended to diminish between rounds. The most notable case was the region of PAHO Latin America, where the medians for an acceptable range of beds increased from 7.5–10 to 25–50 per 100,000 inhabitants, which still was the lowest among the six WHO regions. Median values for Upper-Middle-Income countries also increased from 10–15 to 27.5–50 beds per 100,000 population between rounds.

Non-psychiatrist professionals tended to propose higher estimates for bed ranges than those provided by psychiatrists (40–70 beds per 100 000 vs 30–60 in the second round). There were no significant differences in the median rates with respect to the gender distribution of the respondents, nor for the area of expertise.

The panel provided 1408 responses for factors that should be considered for planning psychiatric bed numbers. After removing duplicate concepts, 471 contextual factors remained that were subjected to a thematic analysis. They were grouped into 60 codes representing comprehensive factors within six thematic groups that were fed back to the panel in the second round. Consensus was reached on 29 out of the 60 factors (85% responses of very important or essential), which are reported in the Online Supplement (Supplementary Table S2). The factors Comprehensive community care and continuity of care, Quality and standards of mental health care, and Mental health budget reached the highest consensus (97% responses of very important or essential).

DISCUSSION

We provide the first expert consensus regarding minimum and optimal bed numbers with a global scope, involving experts from HICs and LMICs. The recommendation for an appropriate range of psychiatric bed rates was 30–60 beds per 100,000 population (30 as the minimum and 60 as the optimal number). We also established a consensus for two cut-offs between mild and moderate shortage and between a moderate and severe shortage of psychiatric beds. Mild shortage was defined as rates between 25 and 30 beds per 100,000 population, while moderate shortage corresponded to 15 to 25 per 100,000 inhabitants. Rates lower than 15 beds per 100,000 were considered a severe shortage of psychiatric beds.

Previous expert consensus studies had smaller panels, were more regional in scope, and only considered HICs [17, 26, 27]. An expert consensus conducted in 1973 in Switzerland retrieved the

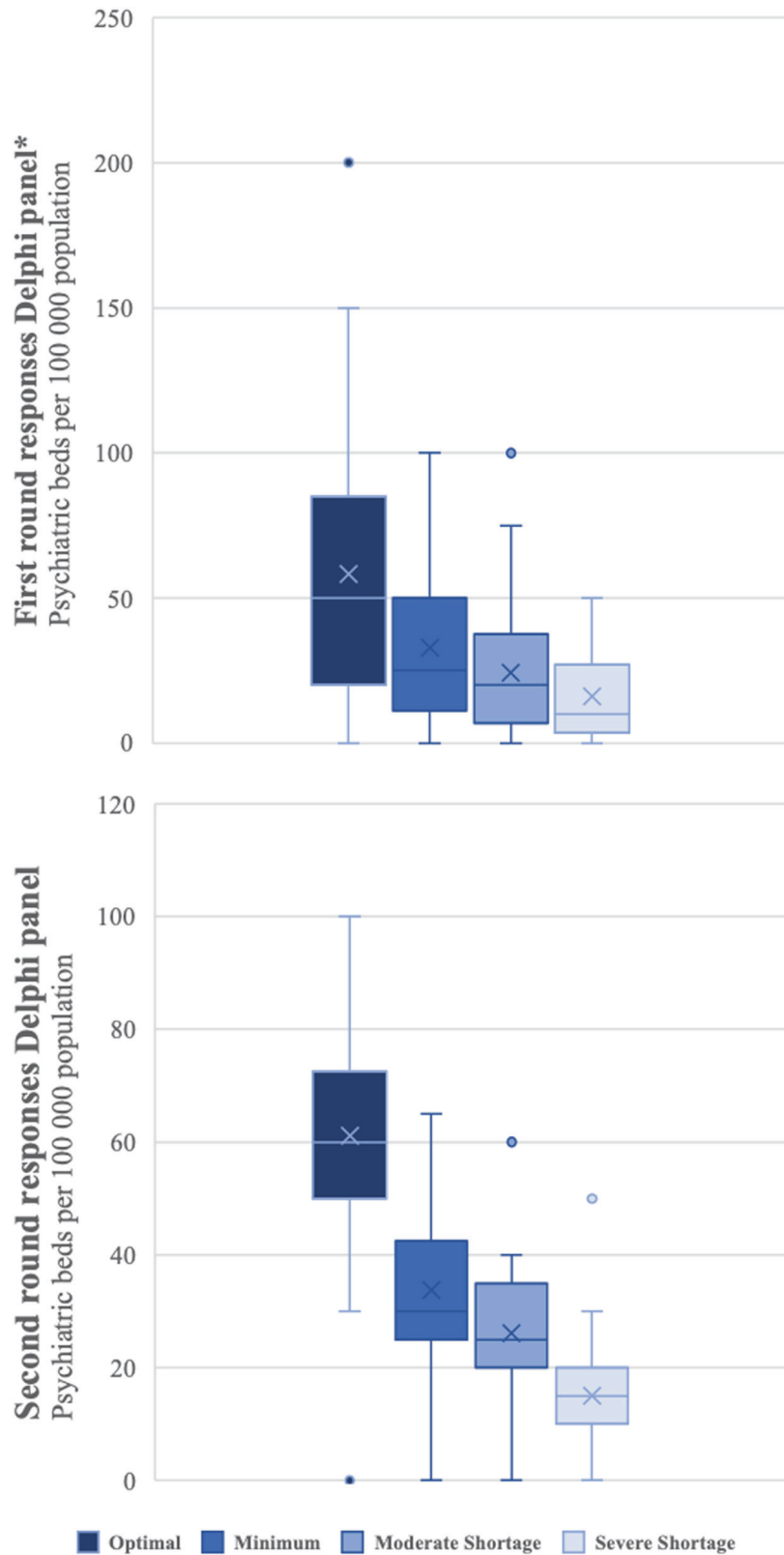


Fig. 1 Distribution of estimates for optimal, minimum, and shortage levels of psychiatric beds in the first and second round of a Delphi process. *Four extreme outliers were removed in the first round.

opinions of psychiatrists from six Western high-income countries [16]. The study included rates of psychiatric beds and other resources necessary for proper service functioning. Based on the seven responses from 18 participants, the study concluded that a

mean of 100 inpatient psychiatric beds were appropriate per 100,000 population. The relatively high number could best be explained by the time of the investigations that was early to mid-deinstitutionalization in Western Europe. Recommendations

established by our panel were more similar to those from the Treatment Advocacy Center (TAC) in the US (a non-peer-reviewed document based on the opinion of 15 experts who recommend a range of 40–60 publicly funded psychiatric beds per 100,000 population for the US) [15], which has been especially influential in many HICs [26, 28–30]. However, the minimum psychiatric bed rate of 30 established by our panel was lower than that reported by the TAC group [18]. This could indicate that expert opinions reflect real developments to lower recommendations over time. The global approach in our study may also have resulted in more suitable estimates for LMICs, and the range of psychiatric beds considered appropriate by our global panel (30–60 beds per 100,000 population) was higher than the actual provision of psychiatric beds for many countries, especially LMICs [4, 31, 32].

There was a global consensus on the role of efficient discharge planning and the capacities of outpatient and residential services for the capacity planning of inpatient mental health facilities [33, 34]. The quality and standards of mental health care were a major concern, especially in LMICs, probably reflecting the concern for minimum standards of care that apart from the physical infrastructure of the bed also lack sufficient human resources, availability of medication and equipment to run existing facilities [35, 36]. The mental health budget was another major consensus factor for psychiatric bed planning. Low budgets can account for both shortage and inefficient distribution of mental health resources [37, 38]. Similar contextual factors had been identified in a recent systematic review on expert arguments for trends of psychiatric beds [39]. However, the present study provides a hierarchy of importance for the expert arguments.

Our study has several strengths. This is the first study with a global scope to reach expert consensus on appropriate psychiatric bed rates. The study achieved diversity of geographical representation with representation from 40 countries across all WHO regions, and more than half of the expert panel based in LMICs. The panel was representative of diverse professional backgrounds, included both psychiatrists and non-psychiatrist mental health and public health professionals, encompassing clinicians, researchers, and policymakers. Additionally, the expert panel was larger than in previous consensus attempts. Finally, there was a high retention level between sequential rounds, and high rates of valid responses.

There are also several limitations. The diversity of Scientific Advisory Board members and their role in the nomination of the members of the Delphi panel was intended to mitigate the selection bias. However, given the nature of the study and the need to recruit suitable experts, selection bias cannot be ruled out. Less than half of the nominated experts (65 out of 158, 41%) participated. The South-East Asia Region (SEARO) with four experts and low-income countries with two experts may have been underrepresented on the panel. Delphi processes usually take two to three rounds in health care research [19, 20]. Since consensus was obtained for the numerical outcomes, we decided to limit the process to two rounds in this study. Further rounds could have explored the importance of specialized inpatient units for populations with specific needs, such as children and adolescents, forensic populations, older people, and people with substance use problems or intellectual disabilities.

Our study provides a global framework for recommendations on psychiatric bed numbers as a point of reference for service planning that for the first time includes LMICs. Levels of shortage in specific countries can also be assessed based on this study, especially in LMIC and policies may be developed to address this shortage. The conversion of public psychiatric beds to serve COVID-19 patients in the context of the ongoing pandemic may have further limited the capacity to offer quality acute inpatient care in many places. Mental health agencies may advocate for health policies and governmental funding of public psychiatric beds in situations of shortage. Where governments are unlikely

to provide adequate numbers, international organizations and donors can now consider the provision of psychiatric beds for their agendas based on this study. The consensus provided here is unlikely to end the debates about the required minimum and optimal bed numbers, but it may inform and guide them.

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ACKNOWLEDGEMENTS

This study had funding by the Agencia Nacional de Investigación y Desarrollo, Chile, FONDECYT Regular 1190613. The funder financed research assistance to coordinate the research network and data collection. The funding agency had no influence in the design of this study or in the analysis and interpretation of the data, nor in the writing or the decision to submit this article for publication. The authors would also like to acknowledge the members of the expert panel for having shared

their expertise and dedicated time to this study: Alma Dzubur Kulenovic, Amanda Cotton, Ana María Peñuela, Ángel Almánzar, Ashvini Nath, Avinash Desousa, Balogun Osunbiyi, Barbara Kane, Ben Beaglehole, Briggite Khoury, Dan Siskind, David Copolov, David Ndetei, Dennis Daliri, Dermont Hurley, Desree Karen Providence, Domenico Giacco, Dominic Sisti, Dusica Lecic-Tosevsky, Elena Molchanova, Elizabeth Sinclair Hancq, Eugenia Xatse, Farid Talih, Fuad Ismayilov, Giuseppe Guaiana, Harischandra Gambheera, Isabel Perera, Jeffrey Looi, Jimmy Lee, John Bohorquez, Juan Camilo Martínez, Juliet Mwale Musabala, Lena Flyckt, Luciano Grosso, Luis Taboada, Majda Cheour, Maris Taube, Maritza Troya, Martha Shumway, Maureen Maduagwu, Medhat Elsabbahy, Mohammad Akmar Paiman, Muzafami Mizuno, Nasser Loza, Nina Kerimi, Olga Karpenko, Peter Tyrer, Rani Hoff, Roger Ng, Roumen Milev, SM Yasir Arafat, Sammy Ohene, Sherry Chan, Shih Ku Lin, Sim Kang, Simon Judkins, Santosh Kumar Chaturvedi, Swapna Verma, Tarek Okasha, Tsirisoa Hary Sehen, Vesna Svab, Victoria Bird, Vinay Lakra, Walid Sarhan, and Yury Razvodovsky.

AUTHOR CONTRIBUTIONS

APM, ERS, MI, and SP conceived of the study; APM and ERS wrote the protocol and designed the survey; MI, SP, ROR, SA, TB, SM, AK, AG, JE-K, S-CP, and LC critically revised the survey and nominated Delphi panel members; APM and ERS conducted the data collection, data analyses, and drafted the manuscript; all authors critically revised the manuscript and approved the final version.

CONFLICT OF INTEREST

The authors declare no competing interests.

ADDITIONAL INFORMATION

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1038/s41380-021-01435-0>.

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