

A MODEL FOR ESTIMATING MENTAL HEALTH SERVICE NEEDS IN SOUTH AFRICA

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Objective. To develop a model for estimating the services and human resources needed to care for people with severe psychiatric conditions in a hypothetical population of 100 000 people in South Africa.

Method. Annual mental health service needs were estimated in terms of numbers of daily patient visits (DPV) in ambulatory care, the number of beds required, and staffing. Developed within a spreadsheet format, the model allows for the adjustment of key service variables according to estimated or existing service data.

Results. At 100% coverage, 87 DPV, 28 acute beds, and 10 medium-long stay beds are necessary for a population of 100 000 people. This would require 35.2 full-time equivalent mental health staff: 21.3 for inpatient care, 12.0 for ambulatory care, and 1.9 for management.

Conclusion. Because the model can produce a range of service recommendations, the assumptions that inform it should be clearly stated and justified. This method makes the assumptions on which services are planned explicit and allows for a rational approach to decision making.

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There have been several attempts in recent years to develop hypothetical models to estimate the mental health service needs and consequent human resource implications in a given population. In Australia, for example, the Tolkien Report¹ provided a conceptual shift in service planning by utilising epidemiological data in conjunction with information on existing services. Using similar principles, others have attempted to develop estimations of human resource requirements based on patients' needs.^{2,3} Building on the

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Tolkien Report, the World Health Organisation (WHO)⁴ developed a method to calculate service needs for national mental health programmes for people with 'severe mental disorders' by drawing exclusively on epidemiological data.

In post-apartheid South Africa, large-scale national projects have estimated mental health service needs for primary health care (PHC)⁵ and hospitals.⁶ However, no attempts have been made to estimate the service needs of people with severe psychiatric conditions in keeping with current health policies. These policies emphasise the short-term management of patients in inpatient settings and the concerted rehabilitation and treatment of patients in the community.

In this paper we present a modification of the WHO method that addresses South African realities. This model is the first attempt to calculate annual mental health service needs for South Africans with severe psychiatric conditions.

METHODS

There are few generally accepted assumptions about mental health service needs. It has been shown elsewhere² that the adjustment of service assumptions significantly affects the outcome of any modelling process. For this reason assumptions need to be stated clearly and justified in models used for service planning and management. We adopted a spreadsheet format for this model to allow for adjustment of assumptions regarding population size, age distribution, prevalence, levels of coverage, annual attendances at ambulatory care facilities, daily patient visits (DPV) at ambulatory care facilities, ambulatory care workloads, beds (acute and medium-long stay), staff/patient ratios, staff/bed ratios, lengths of stay, admission rates, and bed occupancy rates. These variables can be adjusted using hypothetical or existing service data. The model therefore allows for a combination of existing service data and estimates of need or service provision to calculate beds and staffing requirements.

At this stage no community residential facilities have been considered. The goal of this model is the provision of minimal hospital inpatient beds and concerted community-based ambulatory care rehabilitation programmes.

Step 1. The modelling process begins with a hypothetical population. The WHO model⁴ specifies that the population should fall within an authentic 'natural' or administrative area; should be large enough to make services cost effective while providing a range and variety of services; should be small enough to be managed easily; and should be such that services are easily accessible to the entire population, with ease of transport a priority.

Using these criteria, we selected a hypothetical population of 100 000 people for the following reasons. First, the population of 500 000 suggested by the WHO is too large for areas in South Africa with low population densities where access to

services and transport are limited. Second, preliminary guidelines for the catchment population of health services in South Africa recommend 10 000 for clinics and between 100 000 and 180 000 for major health centres providing 24-hour care.⁵ Although exact sizes of districts vary considerably, the figure of 100 000 approximates a district in many instances. Third, a population of 100 000 is large enough to make services cost effective and to provide a range of services, with the possible exceptions of medium-long stay and forensic inpatient services. Fourth, numerically, the figure of 100 000 is easy to convert to exact district, regional and provincial figures in the use of this model as a planning and management tool. Fifth, most of the literature on psychiatric bed needs and much of the literature on staffing and admission rates report figures per 100 000 population.

The population aged 15 years and over is particularly important in the study of severe psychiatric conditions since the peak age of onset for many such conditions is 15 - 25 years.⁷ In South Africa, 63.65% of the population is aged 15 years or older,⁸ corresponding to 63 650 people in a hypothetical population of 100 000.

Step 2. Prevalence estimates for severe psychiatric conditions associated with severe functional impairment and disability are necessary. We obtained prevalence estimates from the National Co-morbidity Survey (NCS)⁹ because suitable South African data are not available;¹⁰ the WHO model recommends using these figures;⁴ the NCS findings report 12-month prevalence rates; the NCS study is recent; and it has high-quality methodology in terms of instrumentation, sampling strategy and sample size. In our hypothetical population, mental health services for severe psychiatric conditions should be available to at least 3 004 people (3%) in a year (Table I).

This 3% prevalence rate is an underestimate since conditions such as substance-induced psychotic disorder, brief psychotic disorder, mental disorders due to a general medical condition, post-traumatic stress disorder (PTSD) and obsessive-compulsive disorder are excluded. Nevertheless, this figure is in keeping with other findings¹¹ in the developing world which report prevalence rates for severe psychiatric disorder of 1 - 3% among the general population.

Step 3. In keeping with the guidelines for PHC services in South Africa,⁵ we recommend two levels of service delivery: a minimum level of 30% coverage, below which services would be unacceptable; and a goal of 100% coverage. Each of these levels is applicable for ambulatory (or outpatient) and inpatient care.

Expected annual attendances at ambulatory care facilities were calculated using the following formula: Annual visits = prevalence × target population × coverage × minimum annual visits/person; where the minimum annual visits/person is 12 visits per annum, as recommended by the South African Guidelines for PHC services.⁵



Table I. Expected severe psychiatric conditions for people aged 15 years and over in a population of 100 000*

Disorder	One-year prevalence (%)	Expected in population (N)	Severe cases (%)	Expected severe cases (N)
Non-affective psychosis [†]	0.5	318	100	318
Bipolar affective disorder [‡]	1.3	828	100	828
Major depression [§]	10.3	6 556	20	1 311
Anxiety disorder [¶]	17.2	10 948	5	547
Total	29.3	18 650	—	3 004

* Based on figures from the National Comorbidity Study,⁶ using *DSM III-R*.

[†] Non-affective psychosis includes schizophrenia, schizophreniform disorder, schizo-affective disorder, delusional disorder, and atypical psychosis.

[‡] The figure reported here indicates the prevalence of a manic episode.

[§] The figure reported indicates the prevalence of a major depressive episode.

[¶] This includes panic disorder, agoraphobia without panic disorder, social phobia, simple phobia, and generalised anxiety disorder.

DPV, namely the average number of patients who make use of an ambulatory care service per day, were calculated using the following formula: $DPV = \text{total annual visits} \div \text{working days per year}$.

In keeping with the WHO model, we divided inpatient services into acute beds and medium-long stay beds. Acute beds are intended for short-term management of patients in a state of crisis or relapse, with a view to stabilising patients to a point where treatment can be continued on an outpatient basis. We assume that a limited number of medium-long stay psychiatric beds are necessary for the management of severe chronic conditions.¹² The number of beds required was calculated using the following formula: $\text{Beds} = \text{No. of severe cases} \times \% \text{ needing hospitalisation} \times (\text{ALOS} + 365) \times \text{rotation factor}$; where ALOS = average length of stay, calculated as the median days of admission, and the rotation factor allows for a period when the bed is unoccupied between discharge and a new admission. The WHO model recommends a rotation factor of 1.15 for acute beds, and 1.05 for medium-long stay beds, implying bed occupancy rates of 85% and 95% respectively.⁴ The WHO model concedes that the percentage of patients that will require hospitalisation during a year can be adjusted according to local findings, and does not give a source for its own figures. The estimated percentage of patients that would require hospitalisation during a year is broadly consistent with the epidemiologic catchment area (ECA) prospective 1-year prevalence rates for disorders and services.¹³

In calculating the number of beds for medium-long stay facilities, we followed the assumption of the WHO⁴ that 5% of patients suffering from schizophrenia will need medium-long stay beds, with an average length of stay of 180 days. We added patients suffering from bipolar disorder, assuming that 15% would need medium-long stay beds. This is consistent with previous estimates of the percentage of chronic patients that require ongoing long-term care.^{14,15}

Step 4. In keeping with the WHO model, we calculated human resources for professional staff only. Maintenance, kitchen, laundry, cleaning and clerical staff should be added to the recommended figures. In South Africa, public mental health

services at primary and secondary level are frequently integrated with general health care and delivered by general health workers. To calculate the amount of time a generalist health worker spends on psychiatric work, the percentage of time generalists spend delivering a psychiatric service is multiplied by the total number of generalist staff. When this is added to the number of full-time mental health workers, this gives the total number of full-time equivalent (FTE) mental health workers.

Workload for psychiatric staffing has been calculated by some researchers according to standard time estimates for specific treatment procedures.² This approach has received criticism in South Africa⁵ (and Gray AL. *Staffing Norms Research Project: Pilot Study Report*. Durban: unpublished report prepared for the Interim Pharmacy Council of South Africa, 1988) because of the variability of the procedures, skill level and experience of staff in clinical work. Instead, we based calculations on workload, i.e. numbers of beds covered and numbers of patients seen. Although this method is relatively crude compared with those developed elsewhere,³ it is the most feasible within the constraints of South African mental health service information systems at present.

For ambulatory care services, human resources can be calculated using the following formula: $\text{FTE staff} = (\text{DPV} \times \text{staff working days per year}) \div (\text{consultations per day} \times \text{actual working days per year})$.

We obtained values for these calculations from South African workload studies at primary care level.⁵ We calculated staff working days per year after holidays and sick leave. Consultations per day were calculated assuming, from observations of work patterns,⁵ that 44.3% of staff time is spent in direct patient contact. These estimates do not cover home visits, follow-ups of missed appointments or outreach. This work is essential within the framework of community-based care with an emphasis on rehabilitation of patients with severe psychiatric conditions. We have adopted the WHO model's suggestion that a further 30% of staff be added for home visits and other outreach activities.



For inpatient services, we calculated human resources for nursing staff at nurse/bed ratios of 0.5 (acute) and 0.3 (medium-long stay). These ratios and the numbers of other clinical staff are drawn from the WHO staff distribution recommendations.⁴ FTE nursing staff for inpatient care are therefore calculated as follows: FTE inpatient nursing staff = number of beds \times staff/bed ratio.

The WHO model makes human resource recommendations for a 45-bed medium-long stay unit. Medium-long stay beds per 100 000 could not be served in isolation, since bed numbers would be too low for a feasible functional unit.⁶ It would therefore be necessary to combine the bed needs of several districts/regions. For this modelling process we have combined the needs of five such districts or regions.

RESULTS

Ambulatory care services

Using the above prevalence and population figures, we calculated the following numbers of annual visits: No. of visits per year = $0.03 \times 63\,650 \times 0.3 \times 12 = 6\,874$ (30% coverage), and no. of visits per year = $0.03 \times 63\,650 \times 1.0 \times 12 = 22\,914$ (100% coverage).

From the annual visits, a total of 26 DPV (30%) and 87 DPV (100%) can be calculated, assuming that there are 264 working days per year.

Inpatient services

We calculated that 28 acute and 10 medium-long stay inpatient beds per 100 000 population are needed (Table II). Combining estimated beds for acute and medium-long stay facilities gives a total of 38 beds per 100 000 population for patients with severe psychiatric conditions. (Thirty per cent coverage of these bed numbers yields figures of 3 medium-long stay beds, 8.4 acute beds and a total of 11.4 beds per 100 000 population.)

Human resources

For ambulatory care, the numbers of FTE staff required are as follows: FTE = $(26 \times 225) \div (11 \times 264) = 2.78$ (30% coverage), and FTE = $(87 \times 225) \div (11 \times 264) = 9.27$ (100% coverage).

With the additional staff to cover home visits and other outreach activities, this gives a total of approximately 12 ambulatory care staff at 100% coverage and 4 at 30% coverage to meet the ambulatory care needs of the 3 004 people with severe psychiatric conditions. The breakdown of this total according to professional categories (Table III) is guided by the recommendations of the WHO model and existing services in South Africa.¹⁶

In calculating the human resource requirements for the 28 acute beds that are necessary for our hypothetical population (Table II), we adapted the WHO recommendations for a 30-bed acute unit with around ten 17-day admissions per week (Table III) (30% coverage of the total acute FTE staff is 5.1).

For the 50-bed medium-long stay unit, a total of 21 clinical staff would be needed to serve 500 000 people. This total can be divided according to the following staff categories: 0.5 unit heads (psychiatrists), 1.0 registrar or medical officer (MO), 1.0 psychologist, 1.0 social worker, 0.5 occupational therapists (OTs), 2.0 occupational therapy assistants (OTAs), and 16.0 nurses (nurse/bed ratio: 0.3).⁴ Table III provides conversions to FTE staff per 100 000 population (30% coverage of the total medium-long FTE staff is 1.3).

The WHO model's recommendations for managerial staff for a population of 500 000 can be adapted to a population of 100 000 as follows: 0.2 chief regional mental health professionals (psychiatrist, psychologist or psychiatric nurse), 1.0 nurse, 0.2 quality assurance professionals (from any relevant profession), and 0.5 co-ordinators of mental health information (from any relevant profession). In addition to managerial and administrative functions, the role of a quality assurance professional and information co-ordinator would be

Table II. Beds needed for acute psychiatric care per 100 000 population

Facility	Disorder	Needing hospitalisation			Rotation factor	Beds (N)
		Severe cases (N)	per year (%)	ALOS* (days)		
Acute	Non-affective psychosis	318	50	21	1.15	11
	Bipolar affective disorder	828	30	14	1.15	11
	Major depression	1 311	5	30	1.15	6
	Anxiety disorder	547	5	2	1.15	0
	Sub-total	3 004	-	17	-	28
Medium-	Non-affective psychosis	318	5	180	1.05	8
	Bipolar affective disorder	828	0.5	180	1.05	2
	Sub-total	-	-	180	-	10
Total	-	-	-	-	38	

* Average length of stay.



Table III. Total human resources needed for a district/region of 100 000 people

Type of professional	Inpatient		Ambulatory care	Managerial	Total	WHO total*
	Acute	Medium-long				
Nurses	14	3.1	7	1	25.1	24
OT	–	0.1	0.5	–	0.6	2
OTA	–	0.4	1.5	–	1.9	–
Social workers	1	0.2	1	–	2.2	3
Clinical psychologists	–	0.2	1	–	1.2	2
Psychiatrists	1	0.1	0.25	0.2	1.55	4
Registrars (residents)/MO	1	0.2	0.75	–	1.95	–
Education/info	–	–	–	0.5	0.5	–
Quality assurance	–	–	–	0.2	0.2	–
Total	17	4.3	12	1.9	35.2	36

* Figures as calculated from WHO model.⁴ The WHO publication reports slightly lower figures, but these include arithmetical errors which were corrected to produce the figures in this table.
OT = occupational therapist; OTA = occupational therapist assistant; MO = medical officer.

to assist in the planning and monitoring of services. Because a region/district of 100 000 is too small to support a full-time professional in this role, we propose a fraction of an FTE. We envisage that co-ordinators of information and quality assurance would take responsibility for several regions or districts.

DISCUSSION

The bed numbers and staffing figures proposed by this model are marginally lower than those proposed by the WHO model (Table III). Discrepancies arise from different age distributions; different methods of calculating ambulatory care attendances and staff ratios at ambulatory care level; less emphasis on care by specialised staff such as psychiatrists and psychologists, given integrated health care policy in South Africa; and more emphasis on the provision of rehabilitation staff (including OTAs) in South African mental health services. The differences highlight the way in which assumptions shift the results of any such modelling process.

The pattern and level of existing services in South Africa are significantly different from those recommended by this model. There are currently fewer acute beds (13 per 100 000 (range across provinces: 6 - 18 per 100 000)) than those recommended by the model. However, there are considerably more long-stay beds (35 per 100 000 (range: 0 - 83 per 100 000)), with gross maldistribution of resources between provinces.¹⁶ The model proposes a shift away from an institutionally based custodial pattern of care, to community-based care. This implies an emphasis on the short-term treatment of patients in inpatient settings, and the concerted management of patients in the community.

Mental health clinical staff in South Africa total 19.5 FTEs per 100 000 (range 11.3 - 31.5 per 100 000 population). There are 5.6 nurses, 0.4 OTs, 0.5 OTAs, 0.5 social workers, 0.3

psychologists, 0.4 psychiatrists, 0.4 registrars (residents) and 0.4 MOs per 100 000 population. The model proposes a shift towards the development of rehabilitative staff, while highlighting the inadequacies of present staffing resources.

Caution should be exercised in interpreting the recommendations of this model. First, the calculation of service needs is not an exact science, and the conclusions it reaches are highly dependent on the assumptions upon which the model is based. These assumptions should be clearly stated and justified. Where appropriate, alternative scenarios should be explored. Second, in addition to the available resources, the nature of the service is highly dependent on the quality of service delivery. To this end a clear set of service standards should accompany the recommendations of any modelling process. Third, the credibility and possible implementation of these recommendations must be informed by consultation with service providers, service users, professional bodies and provincial service management.

Insofar as these cautions are adhered to, the model described in this paper provides a potentially valuable planning and management tool, both for calculating resource needs, and for lobbying for better service provision through a conceptualisation of the service needs of patients. At minimum the model allows for a more rational approach to decision making than has previously occurred and makes the assumptions on which services are planned more explicit.

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