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The Penrose hypothesis in 2004: Patient and prisoner numbers are positively correlated in low-and-middle income countries but are unrelated in high-income countries

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Objective. To examine the relationship between the numbers of psychiatric hospital beds and prisoners using recent statistics.

Design. An analysis of published data from 158 countries.

Methods. Multiple linear regression techniques were used to examine the relationship between per capita measures of income and numbers of psychiatric hospital beds and the dependant variable of per capita prison populations, in high and low-and-middle-income countries.

Results. Prison and psychiatric populations were positively correlated in low-and-middle-income countries. There was no relationship between the number of psychiatric hospital beds and prison populations in high-income countries.

Conclusions. In low-and-middle income countries the association between prison and psychiatric hospital populations may depend on the ability of governments to pay for custodial institutions as well as differences in cultural attitudes towards abnormal and criminal behaviour. In high-income (HI) countries psychiatric and prison populations are not related and probably determined by separate social and political factors.

In an early edition of the *British Journal of Medical Psychology*, now published as *Psychology and Psychotherapy: Theory, Research and Practice*, Penrose (1939) made the influential observation that there was an inverse relationship between the number of prison inmates and the number of psychiatric hospital beds in 18 European countries.

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Central to a causal interpretation of Penrose's finding is the idea that there is a small and relatively fixed proportion of any population that requires institutional care or control. This hypothesis, sometimes even referred to as the Penrose effect (Conacher, 1996) or the Penrose law (Gunn, 2000; Kelly, 2007), has been re-examined using longitudinal and cross-sectional data in several HI countries in which psychiatric hospital populations had declined. Most of these studies found that a fall in available psychiatric hospital beds occurred over the same time frame as a rise in prisoner numbers. This observation was made in Australian states in 1968 (Biles & Mulligan, 1973), in the United States of America over several periods between 1924 and 1996 (Palermo, Smith, & Liska, 1991; Raphael, 2000; Steadman, Monahan, Duffee, Hartstone, & Robbins, 1984), in the United Kingdom between 1982 and 1997 (Gunn, 2000), in England, Germany, The Netherlands, Spain, and Sweden between 1990 and 2002 (Priebe *et al.*, 2005) and most recently in Ireland between 1963 and 2003 (Kelly, 2007).

Most of the authors of most of these studies concluded that the decline in psychiatric hospital populations was a cause of increased prison populations (Biles & Mulligan, 1973; Kelly, 2007; Palermo *et al.*, 1991; Raphael, 2000). They suggest the same people who may have been hospitalized at one time were later imprisoned. Other authors observed the same inverse relationship, but concluded that the changes were determined by separate factors or were only indirectly related (Gunn, 2000; Priebe *et al.*, 2005; Steadman *et al.*, 1984).

In most countries the decline in psychiatric hospital beds has exceeded the growth in prisoner numbers (Priebe *et al.*, 2005), although the reverse was true in the United Kingdom (Gunn, 2000) and the United States (Palermo *et al.*, 1991). Priebe and associates recently reviewed statistics from six European countries and concluded that 'general attitudes to risk containment in a society' may be an important explanation for increases in prison populations, while Conacher (1996) concluded that the closure of hospitals and the building of prisons were due to 'a lack of compassion for the disadvantaged in society'. In the only country reported to have had an increase in psychiatric hospital beds (in Italy between 1990 and 2002) prisoner numbers also increased (Priebe *et al.*, 2005).

Despite the regular publication of national statistics for prisoners and psychiatric hospital patients, we were unable to locate a study that used a cross-sectional examination of international prison and hospital statistics in a way that replicated Penrose's international comparison of 1939.

Our aim was to examine the current relationship between prison populations in 158 countries including the countries examined by Penrose (1939). We also examined the association in 38 high income (HI) and 120 low-and-middle income (LAMI) countries.

Methods

We used international per capita figures for prison populations between 2002 and 2005 (Warmsley, 2005), the total of all types of psychiatric beds in 2004 (World Health Organization, 2007) and gross domestic product purchasing power parity (GDP ppp) for 2004 (International Monetary Fund, 2007) from 38 HI and 120 LAMI countries, as defined by the World Bank.

An initial analysis of the per capita psychiatric hospital beds and prison populations in all available countries was performed using a Pearson correlation coefficient. The relationship was also examined in subsets of 120 LAMI and 38 HI countries.

Multiple linear regression was used in a second analysis that included GDP ppp as a co-variable, as this measures the local cost of goods and services, such as would be incurred in providing institutional care. The variables were $\log_{10}$ transformed, as the samples were not normally distributed and would have violated the assumptions needed for linear regression (skew of psychiatric hospital beds per head of population = 6.25, skew or prisoners per head of population = 1.67, skew of GDP ppp per capita = 1.75). A minimum value of one psychiatric bed per million was assumed in LAMI countries that had either no or very few psychiatric beds in 2004.

We were able to obtain uniformly collected total crime statistics for 37 countries (35 developed western countries, Japan, and South Africa; Barclay, Tavares, Sally Kenny, Siddique, & Wilby, 2003) and included these in a final multiple linear regression analysis. Statistics were performed using SPSS (2006).

Results

We re-analysed the data published by Penrose in 1939, which confirmed his original conclusions. Since the 1930s there has been an average fall in per capita psychiatric hospital beds of 61% and an average increase in the per capita prison population of 35% in the European countries examined by Penrose (1939). Instead of an inverse relationship, in 2004 there was non-significant positive relationship between the prisons and psychiatric hospital populations in these countries (Table 1).

Table 1. Data from 1939 reported by Penrose and the same countries in 2004

	Number of regions	Mean number of prisoners/1,00,000 (*SD*)	Mean number of psychiatric beds/1,00,000 (*SD*)	Correlation coefficient	R^2	*F*	*p*
1939	18*	92 (80)	277 (170)	−.61	.37	9.4	<.007
2004	16†	124 (71)	107 (47)	.10	.01	0.143	.711

*Data from Penrose (1939) analysed using SPSS (2006).

†Reduced *N* because Scotland and Northern Ireland are included in the United Kingdom.

There was a significant correlation between per capita psychiatric hospital beds and prisoner numbers in the 158 countries ($R = .269$, two-tailed $p < .01$) and the subgroup of 120 LAMI countries ($R = .518$, two-tailed $p < .01$). Within the 38 HI countries there was no significant correlation between per capita hospital beds and prisoner numbers ($R = .008$, two-tailed $p < .96$).

When the sample of 158 countries were examined with linear regression, GDP ppp explained half of the variability in per capita psychiatric hospital beds ($R = .726$, $R^2 = .527$, $F = 173.8$, $p < .001$) and was significantly associated with the number of prisoners ($R = .353$, $R^2 = .125$, $F = 22.2$, $p < .001$). However, a multivariate analysis found that GDP ppp was not independently associated with the number of prisoners, and instead there was *a significant positive relationship* between the number of psychiatric beds and the prison population (Table 2).

The positive association between psychiatric hospital beds and prison populations was present in the subgroup of 120 LAMI countries (Table 3), but there was no significant association within the sample of 38 HI countries (Table 4).

Table 2. The association between psychiatric beds per head and the prison population per head in 158 countries in 2004

	Model summary			
	R	R^2	Adjusted R^2	Standard error
	.492	.242	.232	0.324

	ANOVA				
	Sum of squares	*df*	Mean square	*F*	*p*
Regression	5.205	2	2.603	24.699	.000
Residual	16.333	155	0.105		

	Coefficients				
	B	Standard error	β	*T*	*p*
Constant	1.616	0.221		7.324	.000
Log_{10} psychiatric beds	0.268	0.051	0.530	5.213	.000
Log_{10} GDP ppp	−0.041	0.076	−0.055	−0.542	.588

Table 3. The association between total psychiatric beds per head, GDP ppp and the prison population per head 120 LAMI countries in 2004

	Model summary			
	R	R^2	Adjusted R^2	Standard error
	.617	.380	.370	.314

	ANOVA				
	Sum of squares	*df*	Mean square	*F*	*p*
Regression	7.123	2	3.561	35.908	.000
Residual	11.604	117	0.099		

	Coefficients				
	B	Standard error	β	*T*	*p*
Constant	0.834	0.304		2.746	.007
Log_{10} psychiatric beds	0.266	0.054	0.481	4.916	.000
Log_{10} GDP ppp	0.188	0.102	0.180	1.842	.068

There was wide variation in the ratio of prisoners to psychiatric patients between the HI countries. Japan, Canada, and 14 European countries had more psychiatric beds than prisoners, while the United Kingdom, New Zealand, and Australia had 2–3 times more prisoners, and the United States of America had nine times more prisoners than psychiatric hospital beds. The ratio of prisoners to psychiatric hospital beds was also high in many low-income countries, typically in association with very low numbers of psychiatric hospital beds.

Total crime rates were not found to be associated with the per capita prison population in an analysis of statistics from 35 developed western countries, Japan, and South Africa (Table 5). This suggests that a high crime rates was not an explanation for high per capita prison populations in these countries.

Table 4. The association between total psychiatric beds per head, GDP ppp and the prison population per head 38 HI countries in 2004

	Model summary			
	R	R^2	Adjusted R^2	Standard error
	.270	.073	.02	0.271

	ANOVA				
	Sum of squares	*df*	Mean square	*F*	*p*
Regression	0.202	2	0.101	1.376	.266
Residual	2.573	35	0.074		

	Coefficients				
	B	Standard error	β	*T*	*p*
Constant	4.329	1.356		3.193	.003
Log_{10} psychiatric beds	−0.049	0.127	−0.063	−0.386	.702
Log_{10} GDP ppp	−0.475	0.303	−0.256	−1.568	.126

Table 5. The association between total psychiatric beds per head, GDP ppp, total crime per million and the prison population per head 37 western countries, Japan, and South Africa

	Model summary			
	R	R^2	Adjusted R^2	Standard error
	.453	.205	.133	0.256

	ANOVA				
	Sum of squares	*df*	Mean square	*F*	*p*
Regression	0.558	3	0.186	2.834	.053
Residual	2.167	33	0.066		

	Coefficients				
	B	Standard error	β	*T*	*p*
Constant	4.107	0.902		4.551	.000
Log_{10} psychiatric beds	0.073	0.179	0.066	0.408	.686
Log_{10} GDP ppp	−0.499	0.198	−0.405	−2.516	.017
Total crime per million	0.000	0.000	−0.175	−1.091	.283

Discussion

This re-examination of the Penrose hypotheses using recent statistics and more modern statistical methods showed a positive correlation between psychiatric hospital beds and prison populations in LAMI countries. As the numbers of psychiatric inpatients and prisoners are both associated with GDP ppp, the cost of building and maintaining prison and hospital facilities may be an important factor in determining the overall number of institutional places in these countries.

Although the Penrose hypothesis has been supported by most national studies of prison and psychiatric hospital populations, this cross-sectional study using similar

methods to those employed by Penrose found no association between psychiatric hospital and prison populations in HI countries.

Hence, we believe that any observed negative correlation between the two types of institutional and custodial care within countries may not be causal. Improved psychiatric treatment, a greater recognition of the rights of the mentally ill and the perceived cost of in-patient care may have contributed to the decline in psychiatric hospital populations in the second half of the last century. At the same time prison populations may have risen because of a reduced tolerance of criminal behaviour and community pressure for stricter law enforcement, often in response to sensational media coverage and the law and order agendas of political parties, as much as real increases in crime rates.

The situation in LAMI countries appears to be somewhat different. GDP ppp is associated with both prison and psychiatric hospital populations, which suggests that per capita income is an important factor in determining how many institutional beds a country can support. However, as per capita hospital beds, but not GDP ppp was independently associated with prisoner numbers, a factor such as a general intolerance of abnormal behaviour, or even national differences in the ability to build and administer institutions such as hospitals and prisons may also be important. A further consideration in some low-income countries may be that the high mortality of patients with psychotic illness (Kurihara, Kato, Kashima, Takebayashi, Reverger, & Gusti Rai Tirta, 2006; Ran, Chen, Conwell, Chan, Yip, Xiang *et al.*, 2007) means that fewer psychiatric hospital beds are required.

A limitation of a comparison of prison and psychiatric hospital beds and GDP ppp between countries is that it may not identify particular social and political trends within countries. Our findings do not exclude the possibility that many patients have moved from hospitals to prisons in some countries and we did not try to investigate factors such as the availability of supported housing or the level of community psychiatric care, which are both essential parts of the management of the seriously mentally ill outside hospital. Hence careful analysis of the social, political, and economic factors that determine rates of institutional care within individual countries is still required.

In HI countries, Penroses' hypothesis has been repeatedly used as an argument against the closure of psychiatric hospitals. Despite the need for further research within countries, the findings of this study suggest that an increase in prisoner numbers is not an inevitable result of psychiatric hospital closures, and the construction of psychiatric hospitals should not be regarded as a way of preventing crime. Most psychiatric patients do not commit crimes and although the number of mentally ill prisoners in some countries is disturbingly high, most prisoners would not benefit from treatment in a psychiatric hospital.

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