LETTERS TO THE EDITOR

Dear Editor,

Evaluation of Geriatric Day Hospitals

I thank Dr. Or for his interest in my article on evaluation of Geriatric Day Hospitals (GDH)[1] and would like to comment on his proposal of a GDH Activity Index (AI) as a better way to reflect the amount of activity of GDH[2]. To avoid confusion in discussion, I think it is better to separate the two meanings of the word "activity" used in his letter:

1. measurement of "input" - the amount of staffs' effort put on each individual patient; and
2. measurement of efficiency of process, i.e.output/input ratio encompassing such concepts as mean turnover time and average length of stay

Traditionally, the evaluation of geriatric day hospital is based on measuring input (eg. total attendance, treatment units) and such input measures have limitations as discussed in my article. Thus Martin and Millard have proposed the New Patient Index (NPI) and later the Corrected New Patient Index (CNPI) based on the concept of an optimal duration of stay in GDH, a concept also shared by other authors eg. Pathy[3], Evans[4].

Since both the CNPI and AI are based on an optimal duration of stay, I try to find out what is the difference between them and work out the relationship, if any, between the two measurements.

To simplify the calculation, I assume that the GDH patient population is homogeneous and the patients are admitted and discharged from GDH at a steady rate. A graphical representation of the dynamics of a GDH of 30 places is shown in Figure 1.

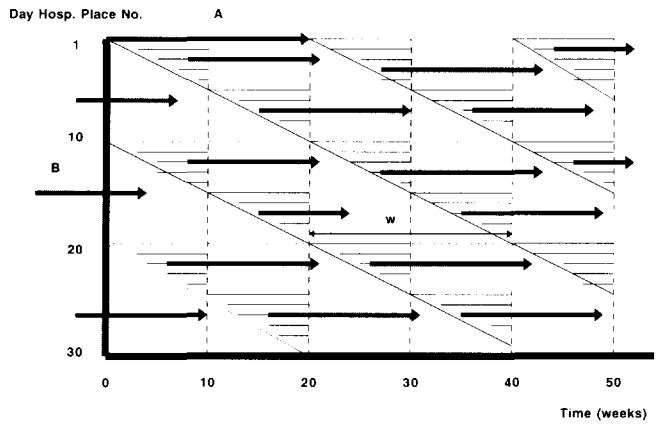

Figure 1. Dynamics of a 30-place GDH used in calculating AI. An arrow denotes a patient occupying a day hospital place, stays for the duration represented by the length of the arrow (average is w weeks). The attendance of patient "B" is not counted in $^1AN_{10}$(attendance by new patients in first 10 weeks) because "B" is regarded as "old" whereas that of patient "A" is counted in $^1AN_{10}$ because it is regarded as "new," i.e. admitted within the first 10-week sampling period.

Let AN_{10} = total number of attendance by new patients over a 10 week period
A_{52} = annual total attendance (i.e. over 52 weeks)

By definition,

$$AI = \frac{AN_{10}}{A_{52}} \times 10$$

Consider 5 consecutive 10-week sampling periods in the whole year with corresponding 5 values of $^1AN_{10}$, $^2AN_{10}$, $^3AN_{10}$, $^4AN_{10}$, $^5AN_{10}$. By taking the mean of the 5 values, variation due to different sampling period is minimized:

$$AN_{10} = \frac{1}{5} \times (^1AN_{10} + ^2AN_{10} + ^3AN_{10} + ^4AN_{10} + ^5AN_{10})$$

Let the average duration of stay = w weeks
total attendance for the 50 weeks = A_{50}

then $^1AN_{10} + ^2AN_{10} + ^3AN_{10} + ^4AN_{10} + ^5AN_{10}$
= attendance within the total shaded area of Figure1

$$= \frac{A_{50}}{2} \quad \frac{10}{w}$$

Thus,

$$AI = \frac{AN_{10}}{A_{52}} \times 10$$

$$= \frac{1}{5} \times \frac{A_{50}}{2} \times \frac{10}{w} \times \frac{10}{A_{52}}$$

$$= \frac{A_{50}}{A_{52}} \times \frac{10}{w}$$

$$= \frac{10}{w} \text{ since } \frac{A_{50}}{A_{52}} \approx 1$$

Therefore,

$$AI = \frac{10}{w} \quad \text{.....(1)}$$

i.e. $$\mathbf{AI = \frac{10}{\text{Length of stay in weeks}}}$$

eg. for average stay w = 10 weeks, AI = 1
for average stay w = 20 weeks, AI = 0.5

Let us next calculate the CNPI for one year.
Let n_{52} = number of new patients in 52 weeks

A_{52} = total attendance in 52 weeks

By definition,

$$CNPI = \frac{n_{52}}{A_{52}} \times 10$$

Let the average duration of stay of each new patient
= a days of attendance
then $A_{52} = n_{52} \times a$

Therefore,

$$CNPI = \frac{10}{a} \quad \text{.....(2)}$$

eg. for average stay a = 10 days of attendance, CNPI = 1
for average stay a = 20 days of attendance, CNPI= 0.5

Hence, from (1) and (2),

$$AI = CNPI \times \frac{a}{w}$$

i.e. **AI = CNPI x (average weekly attendance)**

If on average, each patient attends once per week, AI = CNPI.
If on average, each patient attends twice per week, AI = CNPI x 2

While both AI and CNPI are based on the concepts of optimal duration of stay, they differ in how that duration is being measured: for AI, the duration is assessed by the number of weeks stayed; while for CNPI, the duration is assessed by the actual number of **days** attended to complete the treatment. This distinction is important, because unlike a hospital patient receiving daily treatment, a day hospital patient is treated usually from one to three days per week. As shown in Table 1 of my article[1], the frequency of attendance for the six series reviewed actually varied from 1.2 days per week to 2.5 days per week.

As an illustration, consider 2 GDHs with the characteristics shown in Table 1.

Table 1. Two hypothetical day hospitals for an average patient

	Days Attended	Weeks Stayed	Weekly Attendance	CNPI	AI
A	30	10	3	0.33	1
B	20	10	2	0.50	1

Although the patients of both GDHs "A" and "B" have the same duration of stay of 10 weeks and thus the AI for both are 1, the staff input is more for GDH "A" since each patient from GDH "A" attends one more day per week and 10 more days in total to complete the course of treatment. The lower efficiency (more input for the same output) of GDH "A" is reflected in a lower CNPI. The AI in this situation reflects neither the difference in activity in the first sense (staff input as emphasized by Dr. Or) nor in the second sense (efficiency).

The limitation of these activity measures (CNPI, AI) is the assumption that GDH is homogeneous with one optimal duration of stay. This is not actually the case, bearing in mind the diverse functions of a GDH. Martinez[5] et al. have thus classified day hospital attenders as once-only (for assessment), short-term (2-6 visits, for investigation), medium-term (7 or more visits, for rehabilitation), and chronic (long-term till death, for medical or social supportive care). Perhaps, the multi-compartment model as proposed by Professor Millard[6] will be a more accurate model in evaluating GDH activity.

Finally, I would like to emphasize that such discussions on efficiency measures of GDH should not distract one from what I think an even more important aspect of GDH evaluation - the measurement of final outcome or effectiveness, which I have briefly touched on in my article.

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References

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6. Millard PH. Modelling Hospital Services. J HK Geriatr Soc 1993; 4(1): 22.

Editor's note: The original article on evaluation of GDH by Dr. Kong, Dr. Or's letter to the editor on Activity Index and Dr. Kong's derivation of the relationship between AI and CNPI were shown to Professor Millard, the originator of CNPI, for comments. Professor Millard et al. reply in their letter to the editor.

Dear Editor,

Measuring Activity in Day Hospitals

We read with interest your review of measurements of activity in departments of geriatric medicine[1]. We have studied the proposed Activity Index of Dr. Or[2] and we agree that the formula can be simplified to AI=10 / Length of Stay (in weeks).

Assuming that a fixed number of new patients attend the day hospital in each ten week period, $AN^{10/52}$ is equal to the product of the number of new patients and the frequency of their attendance. If that frequency is halved for any period then the $AN^{10/52}$ is halved and thus the Activity Index is also approximately halved.

If, however, the frequency of attendance of all new patients over the whole year is halved, but the length of stay remains constant, then the annual total attendance is also halved (as total attendance = frequency of attendance/week x number of weeks attended). Therefore the Activity Index would be the same whether all patients attended once, twice or thrice weekly.

Thus although it does discriminate against long, indolent programmes (which increase the denominator), the AI can be made apparently good by restricting the length of stay (eg to 10 weeks) without increasing activity. The AI is therefore inversely proportional to the length of stay.

Assuming that 10 weeks is the desirable length of stay, AI = 10/Length of Stay (in weeks), giving a value of 1 when the average length of stay is 10 weeks. If, for example, the average length of stay is 20 weeks, AI = 10 / 20 = 0.5.

Thus, whilst the AI can be used to compare one period with another, it does not give a true reflection of the intensity of the actual work done.

We have analyzed the routine data collected during 1992 at a a Hospital in the South West Thames Region. Weekly records are kept of the number of patients on the register, new patients, reattendances, total attendance and failures to attend during that week. Table 1 is taken from the recorded data, grouped in five 10-week blocks and for the calendar year of 1992.

Table 1 • Day Hospital Data 1992

10 Week Periods	Number of New Patients	Total Attendance	Average Number of Patients on Register
6 Jan-15 Mar	42	516	30.8
16 Mar-24 May	29	403	27.9
25 May-2 Aug	33	549	31.5
3 Aug-11 Oct	31	516	31.7
12 Oct-14 Dec	34	561	32.1
50 Week Total	169	2545	30.8
All of 1992	175	2624	30.9

Using the data in Table 1 and assuming that the type of patients being treated are the same and that the length of stay is normally distributed, Table 2 shows, (i) the average number of visits to the day hospital per patient, (ii) the average number of visits per patient per week, (iii) the average length of stay per patient in weeks, (iv) the corrected new patient index (CNPI), an improved version of the new patient index (NPI)[3], (v) the Activity Index (AI).

Table 2 • Day Hospital Activity Indicators

10 Week Period	Average no of Visits (i)	Average no of visits per week (ii)	Average length of Stay in Weeks (iii)	CNPI (iv)	AI (v)
6 Jan-15 Mar	12.29	1.68	7.32	0.81	1.37
16 Mar-24 May	13.9	1.44	9.65	0.72	1.04
25 May-2 Aug	16.64	1.74	9.56	0.6	1.05
3 Aug-11 Oct	16.65	1.63	10.21	0.6	0.98
12 Oct-14 Dec	16.5	1.75	9.43	0.61	1.06
50 Week Total	15.06	1.65	9.13	0.66	1.10
All of 1992	14.99	1.63	9.2	0.67	1.09

In 1992, the average attendance per patient was 1.63 times/week for 9.2 weeks. This is reflected in the high AI score of 1.09. The relatively large number of visits per patient (14.99) is reflected in a lower CNPI of 0.67. These figures demonstrate that whilst AI has been achieved, CNPI has not. To improve the CNPI would require decreasing the attendance per week or reducing the duration of stay.

In measuring the activity of a day hospital, the AI introduces a time element and the CNPI identifies the proportion of new to old patients. The frequency of attendance is obtained from our routine data. Thus all three measures are valid indicators of day hospital activity.

The dilemma of day hospital activity measurement is to identify the therapeutic and social aspects of care. All attenders at the day hospital on any day have in common that they attend for a measurable period of time. Using a computerised modelling package (BOMPS)*, based on the method of Harrison and Millard[4], which applies a census approach to measuring activity in hospitals, Figure 1 was obtained from a one day census. This illustrates that the majority of patients in the day hospital are short stay, but one patient attends long term for social reasons. We intend to expand this approach using BOMPS to refine this analysis.

* An overview of the ideas behind this package is published in this volume in the article "Modelling Hospital Services" by Professor Peter H. Millard.

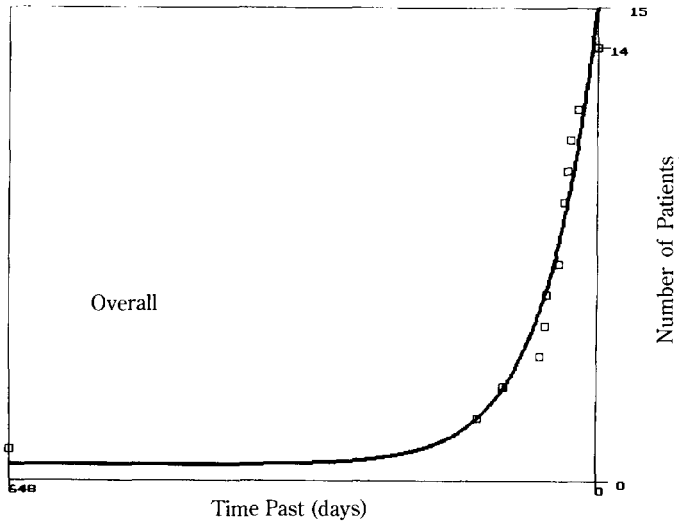

Figure 1. Occupancy Plot: The acumulation of geriatric day hospital patients up to the census date.

Fit of Y= A*e (-BX)+G

A = 14.79	Standard Error = 1.091339
B = 0.0175	Standard Error = 0.002707
G = 0.5119	Standard Error = 0.852655
ChiSq = 10.903432	Rsquared = 0.943797

We are grateful for the opportunity to enter into correspondence on this matter which we think is an ideal subject for international co-operation to compare the activities of day hospitals in our respective countries.

Yours sincerely,

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