

# SIMPLE ASSESSMENT OF OUTCOME AFTER ACUTE BRAIN INJURY USING THE GLASGOW OUTCOME SCALE

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To evaluate alternative methods of determining Glasgow Outcome Scale scores, a postal survey was made of 288 general practitioners and 128 relatives of patients who had sustained acute brain injuries 5–7 years previously. The Glasgow Outcome Scale score from the general practitioner and relative were compared with that calculated from questionnaire information by an experienced rater. There was poor agreement between general practitioner and rater ( $K = 0.17$ ) and relative and rater ( $K = 0.35$ ) scores. Both general practitioners and relatives indicated more favourable outcomes than the rater, with a higher level of agreement ( $K = 0.61$ ) between them. When Glasgow Outcome Scale scores are used, the methods employed should be valid and reliable; failure to ensure this may be responsible for a considerable proportion of variability in reported studies of brain injury outcome.

**Key words:** outcome, Glasgow Outcome Scale, acute brain injury, postal survey.

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## INTRODUCTION

The Glasgow Outcome Scale (GOS) (1) is the most widely used outcome scale in head injury research (2), and has been increasingly used to describe outcome following subarachnoid haemorrhage (SAH) (3, 4). Its main advantages lie in its simplicity and reported reliability, making it suitable for use in multicentre trials. Its use has been accepted worldwide, and it has the advantage of enabling comparisons in outcome between different centres.

The reliability of the GOS was originally tested on the basis of an interview with patients (5), which remains the most reliable way to determine the score. As attendance rates for hospital review by head-injured patients are notoriously low (6), alternative methods of using the scale have been reported, including telephone interview and postal surveys (7, 8). Others have questioned the reliability of such methods (9, 10).

Anderson et al. (11) compared the GOS scores obtained by

direct patient interview with those of an experienced rater based on information from a Relative's Questionnaire (RQ) (12), and with GOS scores obtained from the patient's general practitioner (GP). The scores based on the RQ showed better agreement (81%) than the GP score (61%) with the "gold standard" interview-based GOS. The major disadvantage of using the RQ to obtain a GOS score is that the questionnaire contains 60 items, making it rather long and unwieldy and so risking a low response rate.

The present study describes an attempt to develop a simpler method of obtaining a GOS score from the principal caregiver of the brain-injured patient.

## METHODS

Hospital records were used to identify 288 patients who had been discharged consecutively from a regional neurosurgical unit with a diagnosis of traumatic brain injury ( $n = 188$ ) or SAH ( $n = 100$ ), during the 3-year period 1989–91. The study comprised a postal survey of the subjects' GPs, followed by a questionnaire mailed to survivors. These were carried out 5–7 years after initial injury. The letter to GPs sought to confirm the subjects' current address and permission to mail to surviving patients. In addition, the GP was asked to estimate the patients' current GOS (GP-GOS) based on their knowledge of the patient without specific examination. A list of definitions of the GOS categories was supplied.

The surviving subjects were written to with the request that a relative or close friend (hereafter referred to as informants) complete a questionnaire to be returned in a pre-paid envelope. This questionnaire consisted of the simple question:

How would you describe the patient now?

- Dependent—needing help for at least some activities of everyday life.
- Independent, but has difficulties with some aspects of everyday life.
- Independent with no (or only minor) difficulties with some aspects of everyday life.

The three possible responses were felt to correspond to GOS scores of 3 (severe disability), 4 (moderate disability) and 5 (good recovery), respectively, and were used for translation into an informant's GOS assessment (Inf-GOS).

In addition the informant was asked to complete the RQ. An independent assessor (DH), with many years of experience in assessment of outcome following brain injury, including the use of the GOS, was asked to determine a GOS score from the completed RQ results (Rater-GOS). She was blind to the GP-GOS and Inf-GOS scores.

## RESULTS

Replies were received from all 288 GPs. Twenty-five patients (16 with traumatic brain injury and 9 with SAH) had died since discharge from hospital and a further 52 patients (44 with traumatic brain injury and 8 with SAH) had moved away and

Table I. Number of patients in each Glasgow Outcome Scale category according to different rating methods (from general practitioner (GP), informant and rater)

	GP	Informant	Rater
Severe disability	12	21	32
Moderate disability	25	28	62
Good recovery	90	78	34

could not be traced. Two further cases of traumatic brain injury were excluded: one was more accurately diagnosed as a case of spinal cord injury, and the other showed progressive neurological deterioration.

Thus, 209 patients (126 with traumatic brain injury and 83 with SAH) were mailed the questionnaire. Completed questionnaires were returned by 128, giving an overall response rate of 61%. The return rate was higher for the SAH group (70%) than for the traumatic brain injury group (56%). GP-GOS scores between responders and non-responders revealed no significant differences between groups for the patients with traumatic brain injury ( $\chi^2 = 3.455$ ;  $p = 0.178$ ), or the patients with SAH ( $\chi^2 = 1.744$ ;  $p = 0.418$ ), suggesting that the sample of patients who returned questionnaires was not biased. We report results for patients with traumatic brain injury and SAH combined; the separate analyses were very similar.

As the questionnaires were sent to survivors, none of whom were reported as in a persistent vegetative state, the only components of the GOS recorded were 3 (severe disability), 4 (moderate disability) and 5 (good recovery). The distribution of GOS scores from GPs, informants and rater is given in Table I. One score was missing for different patients in the GP-GOS and INF-GOS data: the GP refused to release the information, and one informant did not answer the question.

The results show that the GPs give the most optimistic assessment of outcome, with the most pessimistic assessment of

outcome given by the rater. Table II summarizes the agreement among the three methods of rating the GOS. The level of agreement was greatest between informants and GPs, with a raw agreement of 80.2% and a Kappa coefficient (13) of 0.61 (95% CI = 0.48, 0.74). The raw agreement between informants and the rater was 55.1%, with a Kappa of 0.35 (95% CI = 0.24, 0.46), and the level of agreement between GPs and the rater was the lowest at 42.5%, with a Kappa of 0.17 (95% CI = 0.08, 0.27).

When considering possible explanations for the disparity in assessment of outcome, comparisons were made based on the specific relationship between informant and patient. The informants were categorized into three groups comprising spouse/partner; parent or child; or friend/other relative. Separate analyses revealed no difference in the levels of agreement between rater, GP and type of informant, and so results were reported from the informants as a combined group, irrespective of relationship to the patient.

## DISCUSSION

The primary aim of this study was to determine whether a simple method of obtaining GOS scores by postal survey of the principal caregiver of brain-injured patients provided valid and reliable results. It also allowed further evaluation of GPs' rating of the GOS.

The response rate from GPs was excellent, whilst rates of 56% for traumatic brain injury and 70% for SAH informants, respectively, compare favourably with similar postal surveys of the general population (14, 15). They are also in keeping with reports of higher response rates in women and older people (16) and in those from affluent areas (17).

It is possible that the simple question that formed the basis for the informants' assessment (Inf-GOS) was insufficiently explained, making it open to misinterpretation. The question was based on the work of Lindley et al. (18) and worded to avoid using "disability" because of the negative connotations associated with such a term. However, the informants may have interpreted "dependent" as pure physical dependency, or as dependency in self-care. Alternatively, it is reasonable to surmise that the informant will have a much better personal knowledge of the patient than either the GP or the rater, and so perhaps their rating of the GOS should be considered the most valid, reflecting the real-life situation. In support of this, it could be suggested that, as the RQ is directed at detecting problems rather than highlighting intact functions, the GOS based on this information (Rater-GOS) could result in inappropriately low GOS scores, calling into question Anderson et al.'s conclusions (11). It may fail to detect the individual's capacity to adapt to persisting problems lessening their overall dependency.

In the case of the ratings by GPs (GP-GOS) it has been argued that the GOS is biased toward physical and neurological deficits, and that patients classified as having made a "good recovery" may have other long-term deficits (19).

Another factor that may contribute to inaccurate estimation of outcome is variability in interpretation of the GOS categories.

Table II. Agreement among assessments

		Informant's assessment			
		GOS 3	GOS 4	GOS 5	Total
GP's assessment	GOS 3	11	0	1	12
	GOS 4	7	16	2	25
	GOS 5	3	12	74	89
	Total	21	28	77	126
		Rater's assessment			
Informant's assessment		GOS 3	GOS 4	GOS 5	Total
GP's assessment	GOS 3	19	2	0	21
	GOS 4	11	17	0	28
	GOS 5	2	42	34	78
	Total	32	61	34	127
		Rater's assessment			
GP's assessment		GOS 3	GOS 4	GOS 5	Total
GP's assessment	GOS 3	10	2	0	12
	GOS 4	14	11	0	25
	GOS 5	8	49	33	90
	Total	32	62	33	127

The scale has been criticized for its use of subjective terms such as "good" or "moderate", which may obscure quite considerable degrees of disability (20). Some workers have defined the category "severe disability" as meaning that the individual is totally dependent on others (21, 22). However, the original authors' definition of severe disability includes patients ranging from those who are totally dependent to those who are able to maintain their self-care in terms of activities of daily living within their room or house, and only require help over and above this (1). Such misinterpretations have serious implications for the use of the GOS as an outcome variable for multicentre randomized controlled trials. If the blinded measurement of outcome differs between centres, then although the estimate of treatment effect will not be biased, there may be a substantial increase in the variance, thus reducing the power of the study. Care should thus be taken that in this situation the definitions of the various outcome categories are explicitly stated and rigorously applied.

The results of this study have shown a great degree of variability between GOS scores for the same patient according to the method used. The most likely explanation is that there is a discrepancy between the GPs', the informants' and the rater's understanding of what corresponds to the definitions provided. This would suggest that even a simple scale such as the GOS is open to interpretation in different ways, which affect the assessment of outcome in an unsystematic and unpredictable way. Appropriate methods must be used to ensure that the GOS score is obtained in a reliable and valid manner by staff trained and experienced in its use. When GOS scores are reported, the methods by which they were obtained should be described in detail, as this in itself may be responsible for a considerable proportion of the variability amongst reported studies.

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