

PREDICTING PERMANENT PHYSICAL DISABILITY
FOLLOWING ROAD-TRAFFIC-ACCIDENT TRAUMA

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INTRODUCTION

Severity measurements may serve as weights in converting frequency counts into more meaningful quantities to be used in evaluating the effect of various accident prevention programs.

Severity may connote a number of possible outcomes, such as death, disability and impairment. Quite often the last two are divided into "temporary" and "permanent".

Researchers have tried to develop a number of operational predictors of such outcome. The most widely accepted is the AIS for predicting death. Attempts have been made to examine possible relationship between AIS scores and mathematical computations based on such scores (e.g. the ISS) and permanent impairment (3) and AIS as a predictor of incapacitation time (2).

Even limiting the application to group prediction, AIS and ISS have proved of limited use beyond predicting death. The objective of the present study is to examine the relationship between AIS-scores, estimated incapacitation and observed permanent physical disability among victims of road-traffic accidents. Whenever possible, the study will also investigate the effect of age.

MATERIALS AND METHODS

During the period 1st September 1972 to 30th August 1974 a total of 5145 patients were registered at the emergency room of the Odense University Hospital as victims of road-traffic accidents.

At that time a maximum of 5 lesions per patient could be coded, and the treating physician would also give an estimate of the subsequent incapacitation relative to sustained lesions. The physician was asked to take the patient's age, sex and social-economic situation into account, when making his individual estimates.

The system used the following categories:

- 1) suspected cases, incapacitation not applicable;
- 2) slight injury, no incapacitation expected;
- 3) light injury, expected incapacitation less than 14 days;
- 4) moderate injury, expected incapacitation between 2 weeks and 3 months;
- 5) severe injury, expected incapacitation between 3 months and 6 months;
- 6) very severe injury, expected incapacitation beyond 6 months.

In the present study severity grades 1 and 2 were grouped and likewise 5 and 6 - hence 4 categories emerge.

A follow-up investigation was carried out between October 1975 and May 1976.

A 10-percent random sample of all patients graded with severity 1 to 4 received a mailed questionnaire, whereas all patients in severity grades 5 and 6 were interviewed by one of the authors (H.V.N.).

For analytical purposes a 10-percent random sample of severity grades 5 and 6 was drawn, as to match the 10 percent drawn among severity grades 1 to 4. In this way two samples are available;

sample A): 10 percent of milder cases (severity grades 1 to 4)
+ 100 percent of severe cases (severity grades 5 and 6)
with a total of 831 patients.

sample B): A constructed 10-percent overall sample of all severity grades comprising 586 patients;
(please observe that sample B is a sub-set of sample A).

Sample A is best suited for internal analysis across severity grades, - whereas sample B with some limitations may allow for more general conclusions.

All lesions among the 831 patients were AIS-scored using the 1976 edition. Since the registration form did not allow for ISS computation the maximum AIS value (defined as the highest obtained single AIS-score) has been computed for every patient and used throughout this study.

Based on a system published by Thorson (3) aimed at classifying

permanent physical disability all patients were asked a number of questions (via mailed questionnaire or personal interview) which enabled us to classify them according to Thorson's scale:

Grade 0: no disability found;

Grade 1: persons suffering from any longterm sign or symptom, irrespective of whether it is trivial or not, but who does not sustain restrictions in occupational or leisure activities;

Grade 2: persons who sometimes, but not always, require assistance with occupational or household work or similar activities of daily life, for a total of more than two days a month;

Grade 3: persons who need permanent assistance with household work or similar activities in daily life.

In the light of obtained numbers groups 0 and 1 were merged and also groups 2 and 3, thus two "categories" are used in this study only.

In order to further limit the number of subdivisions, the following age groups have been used in the present study: 0 - 18 years, 19 - 59 years and 60 years and above.

Finally, the type of primary (immediately following the emergency room visit) care - in some studies called "patient disposition" - is included in this study, partly to enable some control for non-respondents, and partly to allow for a comparison with previous findings by Gissane, Bull and Roberts (1).

The age and sex composition of the two samples are shown in Tables 1 and 2.

RESULTS

The relationship between severity (expected incapacitation) and physical disability is shown in Table 3.

The number of non-respondents is annoying, but a deeper investigation shows an accumulation of very light cases, both with regard to AIS and primary care. The likelihood of finding cases with physical sequelae among the 62 patients with no expected incapacitation is very small. With proper reservation one might conclude that although more permanent physical disability is found among patients with longer expected incapacitation disability is not commonly found.

The "effect of age" is shown in Table 4 using only the 273 patients with the largest expected incapacitation (grades 5 + 6) since 43 of the 49 cases with permanent physical disability are found here. Although there seems to be an increase over age only

the youngest group differs significantly. Another way to illustrate age differences is shown in Figure 1 based on sample A, using single categories of expected incapacitation (above grade 2) against percentage of patients within age group having Thorson grade 2 or 4.

AIS AND DISABILITY

Since the AIS coding was done subsequent to sampling for the present study sample B is used to examine the relation between maximum AIS and permanent disability.

The cross tabulation is shown in Table 5; in order to illustrate the pattern towards heaping in the low maximum AIS groups single categories of Thorson's scale have been used. Again, the number of non-respondents is troublesome in the interpretation, - but it seems justified to say, that maximum AIS tends to show less separation in material. In fact only when Thorson's scale is reduced to either "nil" or "some +" and maximum AIS is reduced to 1, 2 and 3+, some statistical analysis may be carried out. With such groupings it may be shown that there are significantly more permanent physical disability among patients rated with maximum AIS 3 and above.

The age effect is found again, but the numbers are too small for statistical testing. However, for completion Figure 2 is supplied.

PRIMARY CARE AND DISABILITY

The distribution of patients according to type of care immediately subsequent to their initial visit to the emergency room is shown in Table 6, where such groups are cross tabulated against observed physical disability. A distinct pattern towards disability being found primarily among inpatients is demonstrated. With regard to the non-respondents should be noted, that 6 of the 24 inpatients showing non-respondent status, died after admission.

DISCUSSION

There is an increasing demand for operational trauma-severity and accident-outcome measurements. For analytical purposes and moreover for setting priorities in research and preventive programs accident frequencies and injury rates are not sufficient. Different considerations are recognized such as threat to life, resulting disability and societal-cost measures.

The only generally accepted severity scale is the Abbreviated Injury Scale (AIS). The scale has proven reasonably operational and several studies have shown its ability to reveal group prediction of the probability of death, especially when some mathematical modifications of the scores are used.

In a sample of road-traffic-accident victims however, only a small

proportion of the victims will be graded in the higher severity strata. This leads to a very skewed distribution of cases over the strata, which for many reasons is inconvenient if one were to use AIS as an indirect measure of resulting disability and/or incapacitation time. This shortcoming is clearly shown in our findings.

The severity scale formerly used at the Odense University Hospital based on the physician's best judgement of the duration of incapacitation gives a more "even" distribution of the patients over the severity strata than does the AIS. However, neither of these scales have been created with the primary purpose of predicting permanent disability, so perhaps one should not be too discouraged to realize the rather poor "predictive value" in relation to permanent resulting disability.

Our investigation confirms the findings of Gissane, Bull and Roberts that sequelae are almost non-existent among outpatients after road-traffic-accident trauma. The occurrence is so rare that outpatients might be left out of samples aimed at elucidating resulting permanent disability - at least in countries with no fee-for-service contact bias. Among hospital admitted cases however, the occurrence of significant physical disability interfering with normal daily activities is found in about 12 percent of all cases, increasing with increasing age.

As an alternative to either AIS-derived statistics and estimated incapacitation time a more direct approach may be developed. At present the Accident Analysis Group in Odense is involved in developing operational measurements for accident related disability. The basic approach is rather similar to the development of the AIS, and it is hoped that a manual for coding accident related disability may be developed. It will be a cumbersome task involving several refinements of the instrument based on expert judgements and repeated population surveys.

REFERENCES

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Table 1. Age and sex distribution in Sample A.

Age group	Males	Females	Total	Percent
0 - 18 years	237	118	355	43 %
19 - 59 years	225	116	341	41 %
60 years +	81	54	135	16 %
Total	543	288	<u>831</u>	
Percent	65 %	35 %		

Table 2. Age and sex distribution in Sample B.

Age group	Males	Females	Total	Percent
0 - 18 years	175	99	274	47 %
19 - 59 years	152	90	242	41 %
60 years +	42	28	70	12 %
Total	369	217	<u>586</u>	
Percent	63 %	37 %		

Table 3. Observed permanent physical disability in relation to expected incapacitation time among RTA victims in Sample A.

Expected incapacitation time (at initial emergency-room visit)	Observed permanent physical disability. (Grades according to Thorson, see text)			Total	Percentage of Patients with Thorson grades 2 & 3.
	0 ⁰ + 1 ⁰	2 ⁰ + 3 ⁰	Non-resp. (unclass.)		
Nil	253	1	62	316	0.3 %
Less than 2 weeks	106	0	17	123	-
2 weeks to 3 months	106	5	8	119	4.2 %
More than 3 months	217	43	13	273	15.8 %
Total	682	49	100	<u>831</u>	5.9 %

Table 4. Observed permanent physical disability in relation to age among RTA victims expected to have more than 3 months of incapacitation. (From Sample A)

Age group	Observed permanent physical disability. (Grades according to Thorson, see text)			Total	Percentage of patients with Thorson grades 2 & 3.
	0 ⁰ + 1 ⁰	2 ⁰ + 3 ⁰	Non-resp. (unclass.)		
0 - 18 years	82	5	0	87	5.7 %
19 - 59 years	85	21	7	113	18.6 %
60 years +	50	17	6	73	23.3 %
Total	217	43	13	<u>273</u>	15.8 %

Table 5. Observed permanent physical disability in relation to maximum AIS score obtained. Distribution based on sample B.

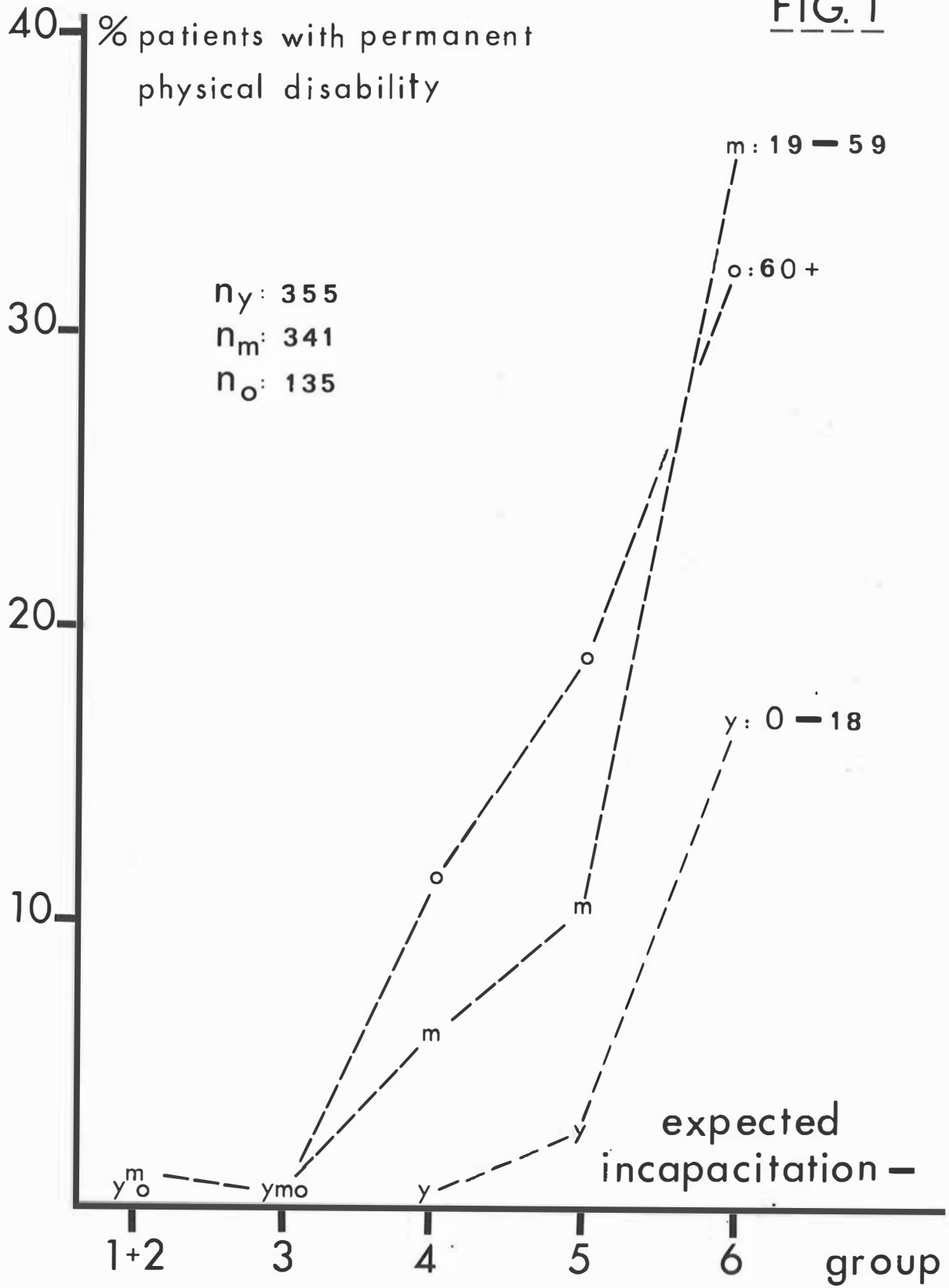
Maximum AIS score obtained.	Observed permanent physical disability. (Grades according to Thorson, see text)					Total
	0 ⁰	1 ⁰	2 ⁰	3 ⁰	Non-resp. (unclass.)	
1	295	24	1	0	70	390
2	116	27	3	1	16	163
3	13	9	4	0	1	27
4	2	0	0	0	0	2
5	1	0	1	2	0	4
Total	427	60	9	3	87	586 ===

Table 6. Observed permanent physical disability in relation to type of medical care given to RTA victims subsequent to initial emergency-room visit. (Based on Sample A)

Type of care subsequent to E-R visit	Observed permanent physical disability. (Grades according to Thorson, see text)			Total	Percentage of patients with Thorson grades 2 & 3.
	0 ⁰ + 1 ⁰	2 ⁰ + 3 ⁰	Non-resp. (unclass.)		
No further hospital treatment	212	1	53	266	0.3 %
Referred to outpatient clinic	131	1	23	155	0.6 %
Admitted to hospital	339	47	24 ^(*)	410	11.6 %
Total	682	49	100	831 ===	

(*): Six of these patients died after admission.

FIG. 1



100 % PATIENTS WITH PERMANENT
PHYSICAL DISABILITY

FIG.2

$n_y: 274$

$n_m: 242$

$n_o: 70$

50

m

y

o

m

o

y

m

y

MAX. AIS

1

2

3+