AIS AS A MEASURE OF INJURY RELATED INCAPACITATION TIME AMONG SELECTED AGE AND SEX GROUPS

by

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The introduction of the AIS scale provided crash investigators, injury researchers & biomechanic engineers with a tool which in numerical terms could rate lesions acquired in automotive crashes. The rating and rating procedure is focused on summarizing the amount of threat to life exerted to any given victim of a crash (4). Further studies have shown that the AIS scale may be used for expressing probability of death (1).

Some investigators have pointed to the possibility that AIS scaling might become an instrument for outcome validation relative to resources available for treatment, and the reliability of the instrument was tested among various professional groups for this purpose (3).

In the field of accident research numerous studies have attempted to quantify financial and functional consequences of trauma. Such studies, albeit conducted with great skill and bravery, have hitherto not localized a practical way of summarizing the injury related burdens to the individual and/or society. March et al. (2) state in their conclusions from a study of 59 victims of road traffic accidents that "The relationship between accident trauma and functional consequences such as time loss and threat to life should continue to be explored as a viable alternative to societal cost measures".

It is somewhat problematic to limit the outcome measures to these two aspects and simultaneously try to establish an AIS derived statistic as an indirect measurement of time lost. It might be much more relevant to conduct a straightforward survey. Nevertheless, if surveys can be carried out only at a few locations whereas AIS scaling can be done on a routine basis, it could be

of more than academic interest to investigate the relationship.

Formulating the problem

In normative terms the problem may be stated as follows:

To what extent does AIS scaling technique lend itself as a measurement of injury related incapacitation time at a given point in time for a given population group?

Assuming such relations exist, - to what extent does the relationship hold true for selected age and sex groups across selected AIS groups?

The term incapacitation time shall denote the number of days from the accident up to the point in time when the patient has resumed his or her normal daily activities. We shall use the term AISMAX to denote the highest AIS score given to a victim, regardless of the number of single lesions he or she acquired and regardless of what region of the body was affected. An AISMAX group accordingly consists of patients having the same AISMAX value.

In the present study "injury related" means resulting from injuries aquired in road traffic accidents.

To anticipate AIS or AISMAX having individual prognostic value in relation to incapacitation time seems unlikely, but when dealing with groups of patients one might hypothesize that increased AISMAX values are related to increased incapacitation time in some systematic way.

Method and materials

For the present study, data from a random sample of all traffic accidents registered at the emergency room of the Odense University Hospital during the period September 1, 1972 to August 31, 1974 was extracted. This sample consists altogether of 831 cases, 543 males and 288 females. The registration system at the university hospital in Odense for several years used to categorize patients by the expected incapacitation time for any given lesion. In accordance with this grading the total material originally was divided into two partitions: 1) severe cases, that is patients with more than three months estimated incapacitation time and 2) milder cases, - patients with up to three months of estimated incapacitation time.

The follow-up examinations were conducted in the period October 1975 to May 1976. Group 1 was interviewed personally and Group 2

recieved a mail questionnaire. In both groups the response rate was well above 90 percent leading to an average of 94.7 percent. Two questions incorporated in both interview and questionnaire could be used for calculating the incapacitation time following the accident: 1) When did you go back to work following the accident, and 2) When did you resume normal daily activities?

Attending school or regular studies was considered as work when applicable.

No attempt has been made to confirm the patient's reportings on these questions from outside sources; accordingly the measurement should be called "reported incapacitation time." Of the total sample, 271 persons were not grinfully employed (or regular students) prior to the accident and accordingly their reported incapacitation time would have to be calculated based on their answers to question number 2. However, since the interview and the questionnaire were administered at quite some distance in time from the accident one would imagine that replies to question number 2 would have only little precision. Accordingly only data from the 560 gainfully employed patients or regular students have been used in this study. The age and sex distribution of these two groupings of the material are shown in the two superimposed population pyramids in Figure 1. The preponderence of elderly patients in the discarded group is obvious.

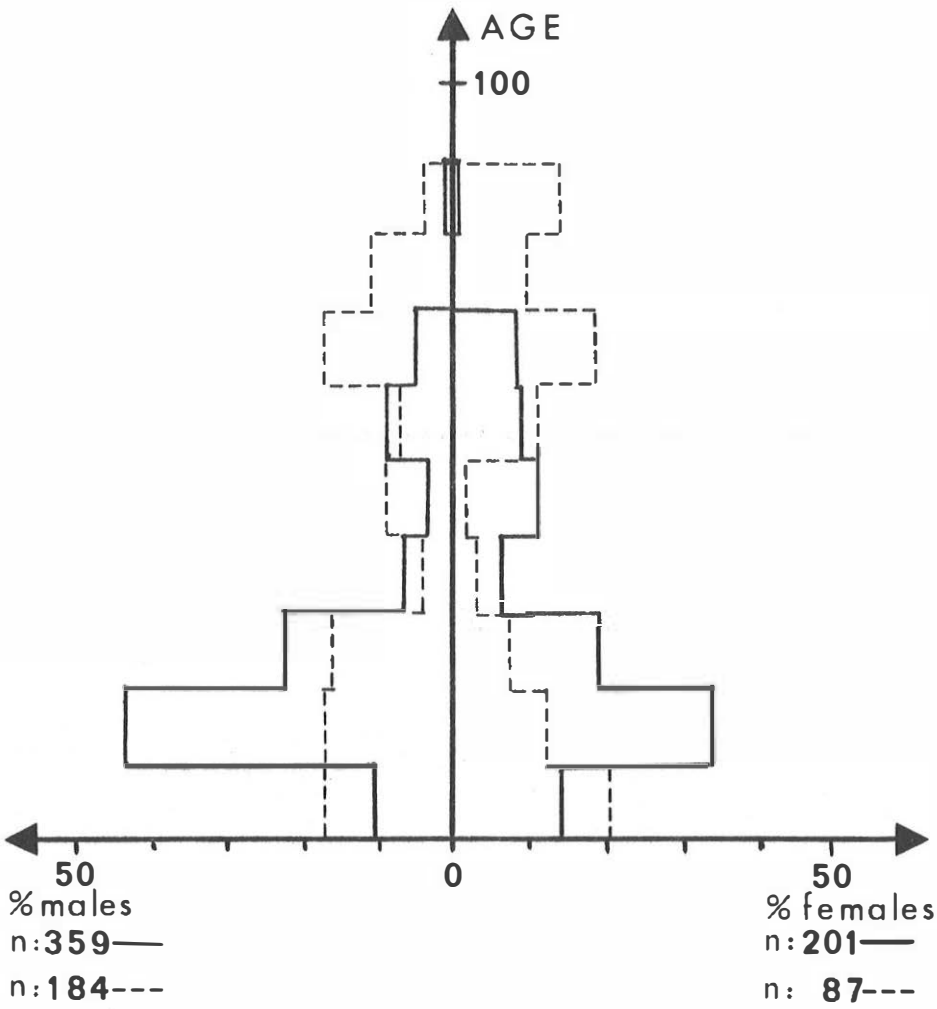
The record of each victim allows for up to 5 defined lesions, each of which had been given an appropriate AIS score in accordance with the 1976 AIS manual (4). However, the Odense system does not allow for computation of an ISS score, partly because a more detailed subdivision of the body regions are used and partly because no coding for "general external" has been performed.

Rather than trying to construct an Odense variant of the ISS scoring technique we have categorized the patients by their AISMAX values as mentioned above. This imposes a problem: we are deliberately disregarding any multiplicity of lesions for a given victim and the reported incapacitation time may well be reflecting some lesion other than the one with AISMAX. Per definition certain lesions will lead to high AIS scores, e.g. a ruptured spleen; but if one survives, no larger incapacitation time follows.

In order to control for differences in the age composition among patients in the various AISMAX groups, we computed the distributions shown in Figure 2. One will notice that no distributions are shown for AISMAX values 0, 4, 5 and 6. Among the 560 selected patients no cases with AISMAX = 0 were found. Only 8 patients had AISMAX = 4, and 10 patients had AISMAX = 5. The results of this study are accordingly limited to patients with AIXMAX = 1, 2 or 3, hence totalling 542 patients.

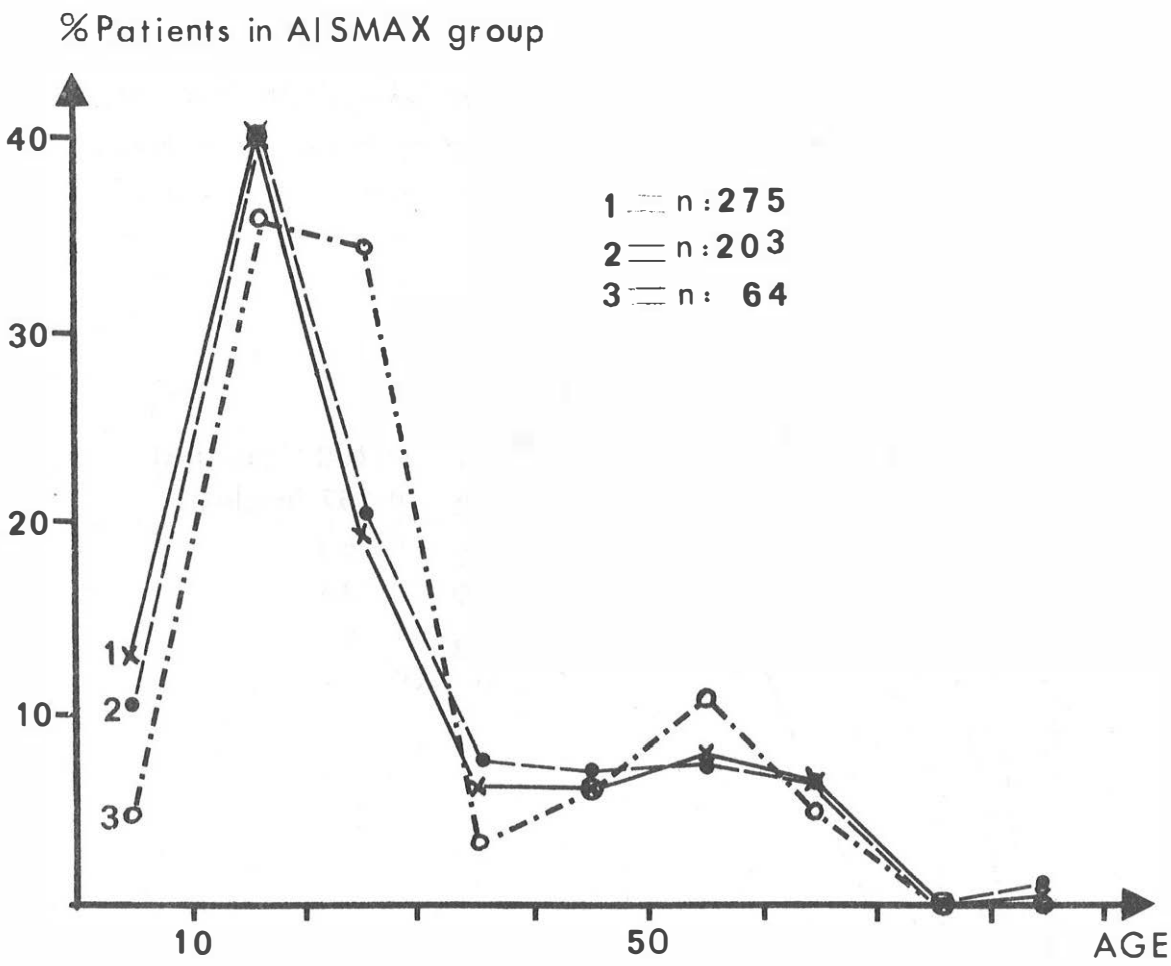
Fig. 1

Age and Sex distribution for selected and discarded patient groups.



Solid line pyramid represents respondents for whom reported incapacitation could be computed.
Broken line pyramid represents respondents not gainfully employed prior to RTA.

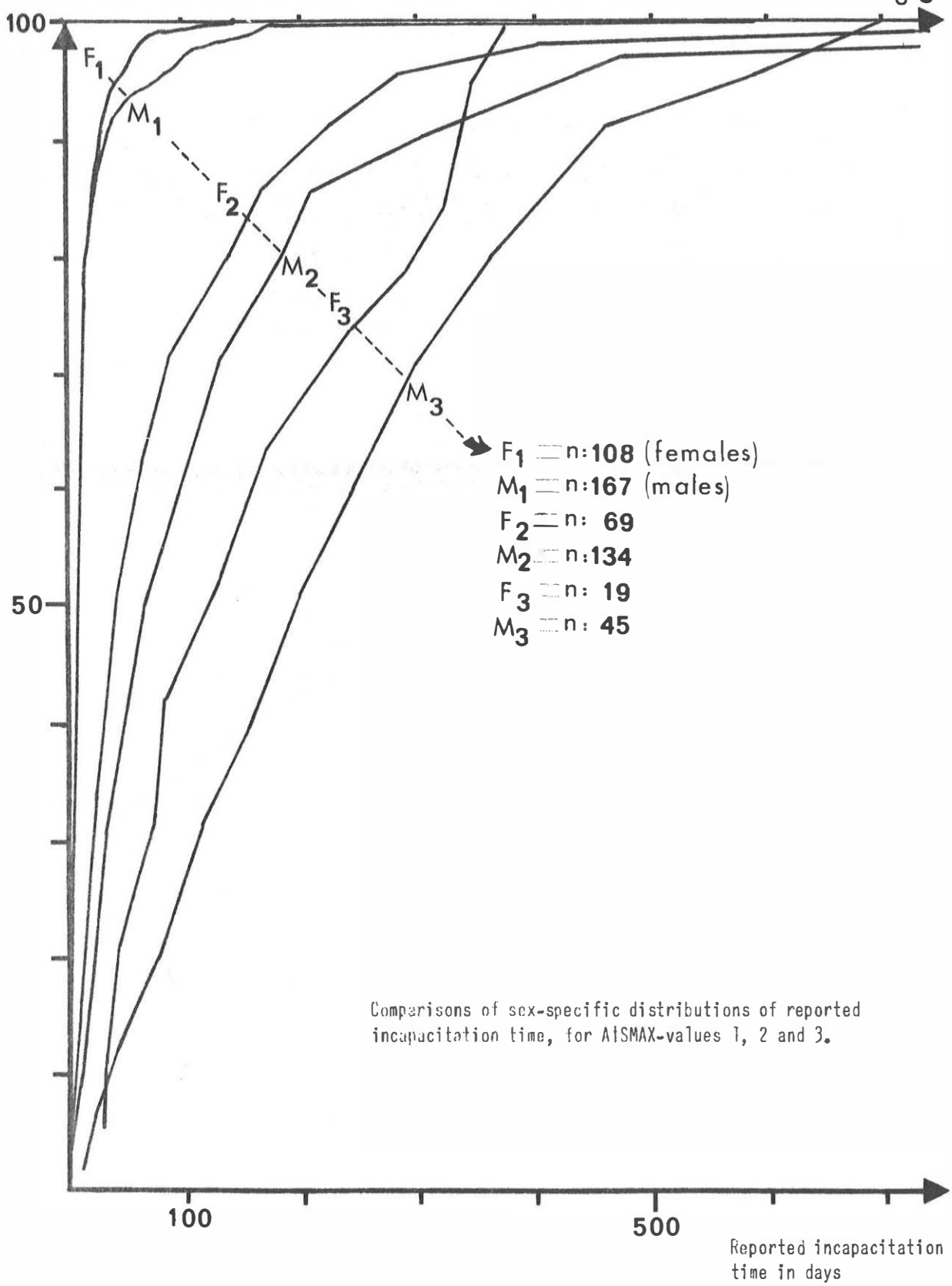
Fig. 2



Comparison of age distributions for patients with AISMAX values 1, 2 and 3.

Cumulative percentage of patients in specified AISMAX and sex groups.

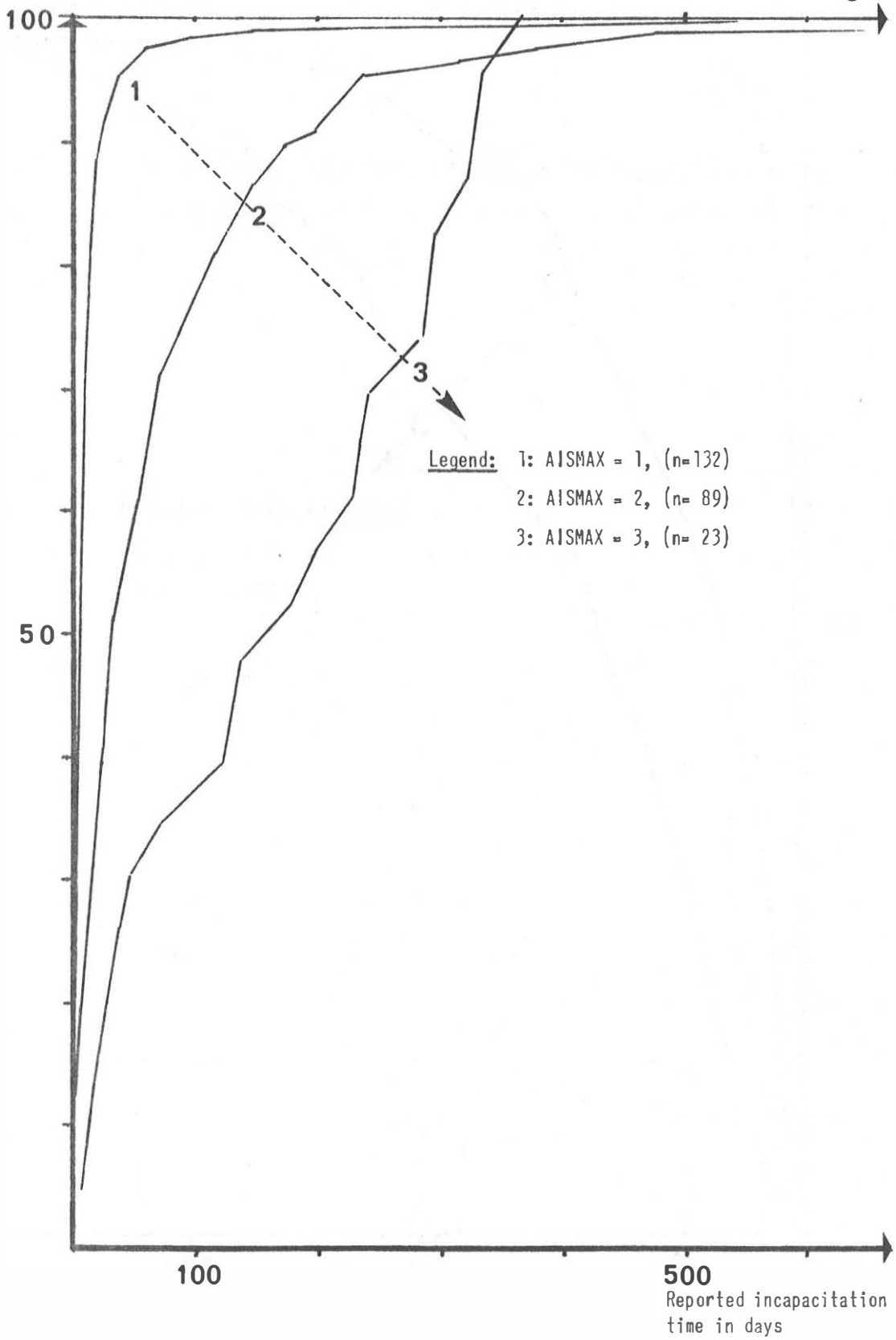
Fig. 3



Comparisons of sex-specific distributions of reported incapacitation time, for AISMAX-values 1, 2 and 3.

Cumulative percentage of patients aged 0 to 18 years.

Fig. 4



Cumulative percentage of patients aged 19 - 59 years.

Fig. 5

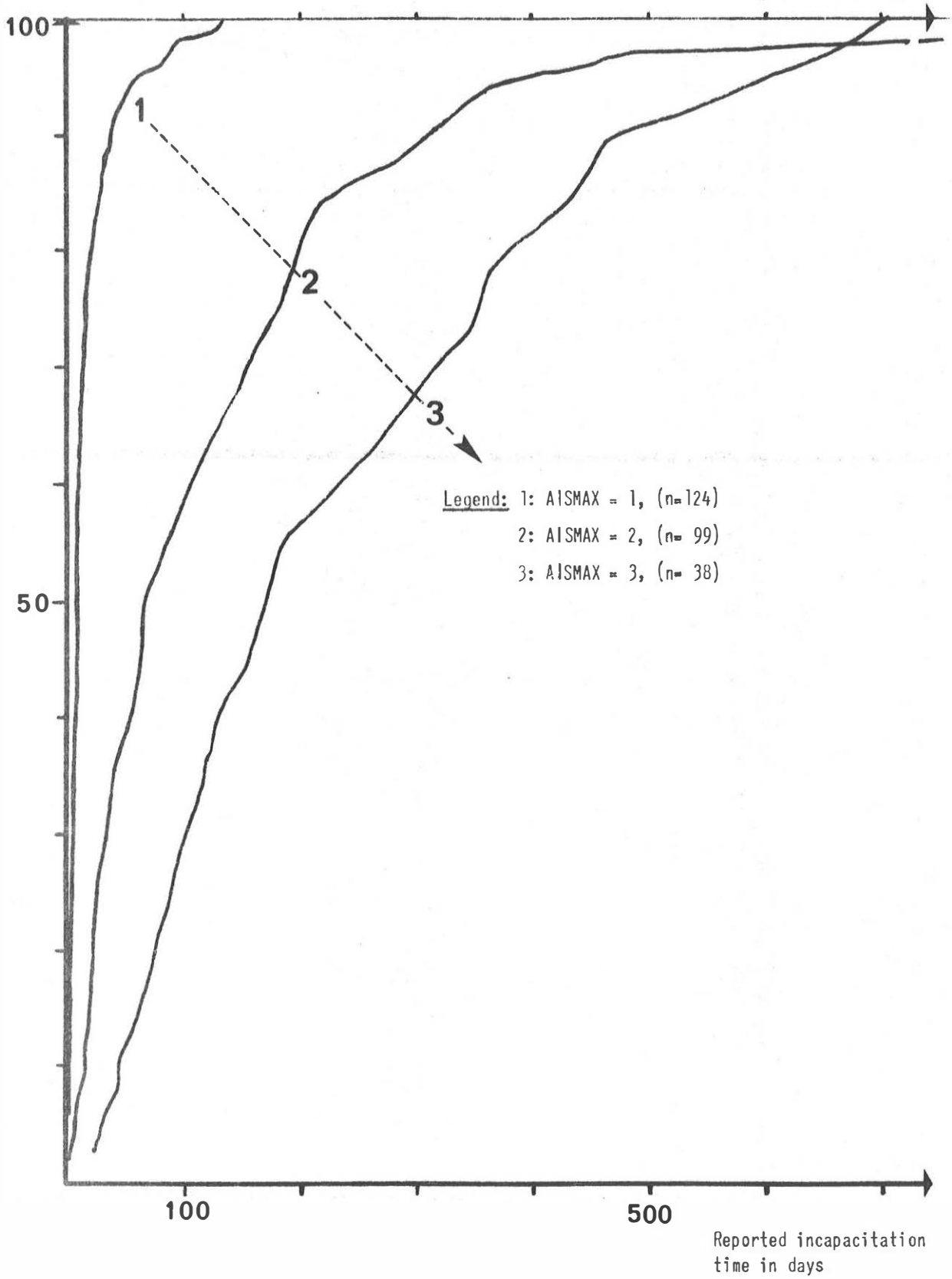
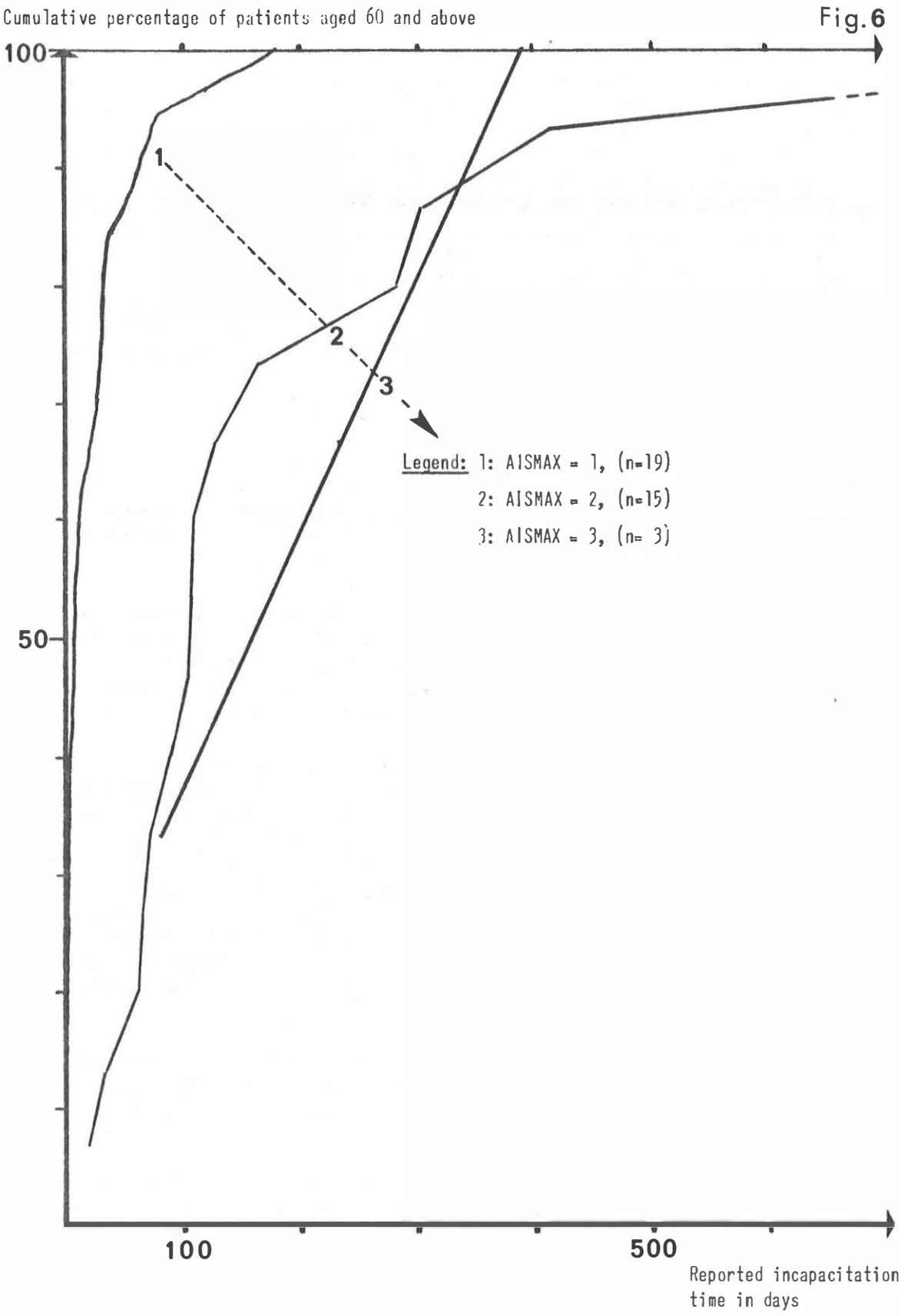


Fig.6


Cumulative percentage of patients aged 60 and above
100
50
1
2
3
Legend: 1: AISMAX = 1, (n=19)
2: AISMAX = 2, (n=15)
3: AISMAX = 3, (n= 3)
100
500
Reported incapacitation time in days

Results

Sex-specific differences within and between AISMAX groups are shown in Figure 3. The cumulative distributions show a distinct pattern towards higher incapacitation time for higher AISMAX values. Likewise it is seen that females constantly have lower incapacitation time in all AISMAX groups. Three patients with extreme values have been excluded from the Figure.

Age-specific distributions are shown in Figures 4, 5 and 6. Figure 6 should be interpreted with some caution, since the numbers are small. A comparison across these three figures reveals the picture that with increasing age reported incapacitation time also increases, consistent for each AISMAX group.

Discussion

Before interpreting the findings a few more comments on methodology seem appropriate. First, the data used in the present study were not collected for this purpose. No attempts have been made at the time of data collection to ensure an even distribution of follow-up time. This may have some bearing on the validity of the respondents' answers to question number 1. However, restricting ourselves to respondants either gainfully employed or active students will hopefully have focused on a situation precise enough to be recalled with reasonable precision.

Further, one might question to what extent our findings can be generalized. Hospital based data should more often be interpreted very cautiously. We do not know the true population at risk, and since data are not collected for non-injured parties in road traffic accidents we do not know the population exposed to biomechanical forces of impact either. From special studies however, we know that less than 10 percent of injured road-traffic-accident victims are not seen by the emergency room at the Odense University Hospital, when referring to our catchment area.

So, for the purpose of establishing a relationship between AIS and injury related incapacitation time it would seem justified to say, that at least we can relate our findings to all serious cases. Further studies should preferably be conducted as prospective studies with repeat and frequent interviewing over a substantial period of time. Furthermore, sampling procedures should be refined as to ensure sufficient numbers of patients in all categories. Taking such precautions one might be able to dig deeper into the problems of making lesion-specific analyses. Differences in respect to type of lesions might explain, at least in part, some of the wide ranges for reported incapacitation time even given the same AISMAX score. Given

sufficient numbers one might also be able to explore to what extent social determinants are playing a role in this respect. In other words, what are the characteristic differences between a patient in the upper and lower end of the cumulative distributions.

As a special exercise we re-ran our data on the computer deliberately manipulating AIS scores from lesions acquired in the thoracic region, abdominal region and uro-genital systems from whatever value they were originally given to a fixed value of 1. The purpose of this exercise was to examine to what extent lesions in these areas, which normally get high AIS scores, might have skewed our distributions, since their related incapacitation time usually is rather low, - granted you survive them. However, no such effect could be demonstrated and this may be due to the very small number of such lesions in our material. Alternatively it could be that physicians are biased, believing that short recovery period and early discharge from hospital equals short incapacitation time, although the patient may well be incapacitated at home for quite some time before he or she can go back to work.

One striking feature about the results of the present study is the surprisingly good separation between AISMAX groups apparent in the figures. Seemingly there is no need to apply squaring techniques to obtain separation, as with the ISS system.

Conclusions

From the findings of the present study it seems justified to conclude that in fact there is some relationship between AIS scores and injury related incapacitation time.

However, the wide differencies in reported incapacitation time within specific age, sex and AISMAX groups indicates that further research should be aimed at explaining differences between patients of the same sub-groups by means of a more refined sampling technique and inclusion of lesion-specific analyses as well as distinct sociodemographic variables.

References

(1) Huang, Lily C. & Marsh, Joseph C.: AIS and Threat to Life. In 1978 AAAM Proceedings, Ann Arbor, pp 242-254.

(2) Marsh, J. C., Flora, J.D., Kornfield, S.M. & Bailey, J.: Results of Financial and Functional Consequences of Injury:

A Pilot Study. In AAAM Proceedings 1978, Ann Arbor, pp: 300 - 318.

(3) MacKenzie, Ellen J., Garthe, Elizabeth A. & Gibson, G.: Evaluating the Abbreviated Injury Scale. In 1978 AAAM Proceedings, Ann Arbor, pp: 55 - 66.

(4) Joint Committee of AMA, SAE & AAAM: The Abbreviated Injury Scale (AIS), 1976 Revision, AAAM, Morton Grove, Illinois.