# The «Will Rogers Effect» on Stage Grading

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**Abstract**

*Will Rogers Phenomenon affects survival statistics applied to clinical research and could determine a misreading of results. Stage migration due to new methods of diagnostic imaging and staging invasive procedures could improve actuarial survival in each stage. TNM System is impaired when survival rates come from different inhomogeneous countries, regions and eras. Randomized trials suffer this fallacious phenomenon when staging depends on the different treatments which are to be evaluated.*

Key words: Survival statistics, Will Rogers Phenomenon, stage migration, lung cancer.

**Riassunto**

*Il fenomeno di Will Rogers affligge gli studi statistici di sopravvivenza risultanti dalla ricerca clinica e può determinare una errata interpretazione dei risultati ottenuti. La migrazione di stadio dovuta a nuovi sistemi di acquisizione di diagnostica per immagini così come le procedure invasive di stadiazione possono determinare un fallace aumento della sopravvivenza attuariale nei singoli stadi di malattia. Il sistema di stadiazione TNM viene a perdere la sua validità quando i tassi di sopravvivenza ad esso correlato provengano da differenti e non omogenee nazioni, regioni e periodi storici. Anche i trials randomizzati possono essere inficiati dal medesimo fenomeno quando al loro interno la stadiazione venga a dipendere dalle differenti modalità di trattamento che dovrebbero, al contrario, essere valutate nello studio.*

Parole chiave: Statistica sopravvivenza, Will Rogers Phenomenon, migrazione di stadio, carcinoma del polmone.

The eponym "Will Rogers Phenomenon" was proposed by Fenstein in 1985[1] translating into clinical field what the humorist-philosopher Rogers had said about the geographic migration occurred in Oklahoma during the American depression of the 1930s: *"when the Okies left Oklahoma and moved to California, they raised the average intelligence in both states"*. Surprisingly, this phenomenon has a strict parallel in statistics applied to clinical research. The survival rates in literature are therefore calculated on the basis of survival from date of diagnosis. Every time a new test or any other diagnostic procedure is able to anticipate the detection of a disease in a presymptomatic phase, the period of survival will be increased but without prolonging the real duration of life (*zero-time shift*).

Moreover, if new methods of diagnostic imaging or invasive procedures find metastases in silent phase, these patients migrate from lower TNM Stages (I and II) into higher ones. Although the total survival rates in this cohort would be unaffected, the migration will improve the survival rates in each stage: in the lower stages because fewer patients with metastases would be assigned to them; in the higher stages because new patients with presymptomatic metastases and an expected longer survival and free interval time are included.

Therefore staging can often be a *shell game*, according to Glatstein[2]. As illustrated by Bush's diagram, survival could improve in each stage through a better accuracy of staging procedures. The boxes contain subgroups of patients equal in number. As shown, the survival becomes progressively less from left to right and the way by which the subgroups are classified in different stages affects the survival by stage, but the overall survival is not modified (Fig. 1).

The introduction of new supersensitive tests allows staging migration (*reshuffling of the deck*)[3], but in the absence of

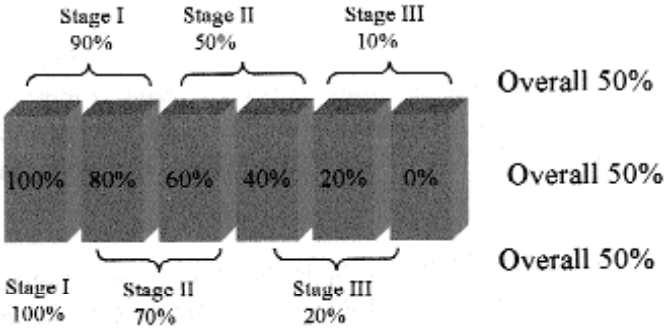


Fig. 1

any effective therapy no survival benefit is achieved in the same cohort of patients[4]. Restaging with more sensitive tests and adoption of effective treatments of radio/chemotherapy (colonic carcinoma, germ cell tumors) transformed actuarial survival benefit into a true survival advantage.

It was emphasised that different levels of technology and the subsequent statistical error caused by the *zero-time shift* as well as stage migration, could determine the observed differences in survival rates between nations, regions or hospitals.

In the same way, the prognostic value of the TNM system is impaired when survival results are compared for patients from different eras due to the heterogenecity of diagnostic data used to assign the disease stage. New and more articulated systems for staging will increase the problem of stage migration, since more detailed stages offer more opportunities to migrate as just shown in lung cancer by Fenstein and Pfister[5]. Comparing the 3-stage with the expanded 5-stage system, the stages in both systems were assigned using old technological data and reassigned with all available new data. Restaging determined better survival results in each stage showing the Will Rogers effect due to stage migration. Six-month survival was the end point of follow-up. Within the traditional 3-stage system, migration from stage I and II into stage III was 15% and the 6-month survival rate increased from 83 to 89% in stage I, from 61 to 62% in stage II and from 39 to 44% in stage III. In the 5-stage TNM, migration amounted to 25%. The survival rate increased from 83 to 89% in stage I, from 62 to 67% in stage II, from 52 to 57% in stage IIIA and from 37 to 45% in stage IIIB. For a more refined analysis of results in different stages, median survival times (MST) were also calculated in the 5-stage system. MST appeared quantitatively more improved in stage I and II: from 31.6 to 46.9 months in stage I and from 11.3 to 18.9 in stage II.

The accuracy of a prognostic system depends, therefore, on technological impermeability: survival results are acceptable only if the diagnostic system and staging procedures are stable.

Will R ogers phenomenon could occur again in randomised prospective trials where the staging depends on treatment. Staging could be less accurate in the control group and the likelihood of a patient who had been correctly staged would be higher in the treatment group. In the control group, therefore, there would be a systematic tendency to substaging and survival should fallaciously appear better in the treatment group. This phenomenon appears clearly evident when clinical and surgical staging are compared. In Mountain's report[6], 5 yr survival was 61% in cTNM stage I, while in pTNM stage I amounted to 67%; 38% in cTNM stage IB and 57% in pTNM stage IB; 34% in cTNM stage IIA and 55% in pTNM stage IIA; 24% in cTNM stage IIB and 39% in pTNM stage IIB; 13% in cTNM stage IIIA and 23% in pTNM stage IIIA.

Therefore, even surgery, as a step of staging, could determine stage migration. Lymphoadenectomy and histological examination of dissected nodes are to be standardised. Otherwise, results could be biased because of other more subtle factors of migration, i.e. non compliance (performance of less nodal dissection than specified) or the contamination (performance of more extensive dissection than specified).

## Conclusions

According to Bunt et Al. (1995)[7], the expanded view of cancer's natural history should be distinguished from an ability to improve the course of disease. So, survival statistics seems spurious criteria for evaluating either the prognosis of individual patients or the efficacy of experimental therapies.

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