Non-Compliance in Surgical Patients With Herniated Lumbar Discs: an Application of a Latent Class Model As Selection Model(*)

I malati di ernia del disco che disattendono l'indicazione chirurgica: un’applicazione di un modello a classi latenti come “selection model”

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1. Background

Lumbar disc herniation (LDH) is a pathology of the intervertebral discs which causes lower-back pain and/or leg pain (sciatica). The best therapy for treating LDH is still controversial (Awad and Moskovich, 2006): in recent years the pendulum has swung from surgery toward non-operative treatment, with the subsequent increased use of physiotherapy options.

A prospective observational study has been carried out on a sample of 135 LDH patients, selected from among those who in the year 2004 were treated at a medical Centre in Bologna (Italy) which specializes in physiotherapy (Cavrini, Giovagnoli, Marzialetti and Miglio, manuscript). Only some of the patients had been advised to resort to an operative intervention (but had not complied), whereas another group had been recommended for non-operative rehabilitation; a third group had not been examined by any surgeon at all and had been referred to the Centre directly by their general practitioners. The three groups of patients were compared at the end of the treatment and their states of health did not appear to differ significantly across the three groups, after adjusting for covariates. The data thus seem to show that non-compliance with the recommendation of surgery did not in the end make the first group of patients worse-off than the others, although their clinical picture might have appeared more serious at the start.

However, the observed lack of effect may be induced by neglecting variables that measure unobserved features of the patients, such for instance as their degree of motivation in attending physiotherapy sessions. In order to investigate the effect of a selection mechanism on the distribution of interest, we fitted a latent class model, modified to allow for conditional associations between some of the observed variables.

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as described for instance in Stanghellini and Van Der Heijden (2004) and Bartolucci and Forcina (2006). It is reasonable to assume that the truncation mechanism acts with a different degree in the three groups under study - those not examined by a surgeon, those examined by a surgeon and assigned to physiotherapy, those examined by a surgeon and assigned to discectomy who did physiotherapy instead - being more severe in the group of non-compliers. The decision of not complying with the assignment is potentially related to the different degree of motivation in physiotherapy. In this case, the truncation mechanism is not independent of the outcome variable.

2. A modified latent class analysis of the data

We have defined a non-observable dichotomous variable U, which divides the patients according to whether they are highly versus moderately motivated towards the therapy, and have formulated a model in which, conditional on the covariates, the latent variable affects both the probability of belonging to one of the three groups of patients described above - labelled by the levels of a categorical variable Z - and the final outcome Y. We have assumed that the latent variable U may also affect an intermediate variable S, which expresses the patients’ keenness towards the therapy, measured by either full attendance of the physiotherapy sessions or not.

In the modelling procedure we have taken into account a vector of covariates x. The joint distribution of (U,Z,S,Y| x) is modelled as a series of univariate distributions with:

(i) a logit model for the distribution of U| x;
(ii) a continuation logit model for the distribution of Z | U,x;
(iii) an additive logit model for the distribution of S | Z,U,x;
(iv) an additive global logit model for the distribution of Y | S,Z,U,x.

The results of this latent class model seem to suggest that, taking into account all the other observed characteristics, there is a significant difference in the probability of improvement between the two latent classes. Patients who are highly motivated in doing the physiotherapy have a higher probability of recovering, keeping constant all the other variables that indicate the severity of illness. However, given the latent variable, the probability of improvement is the same whether or not the patient has been recommended for surgery and whether or not he/she has completed the therapy.

References