Longitudinal Study of MRI Features of the Human Lumbar Disc
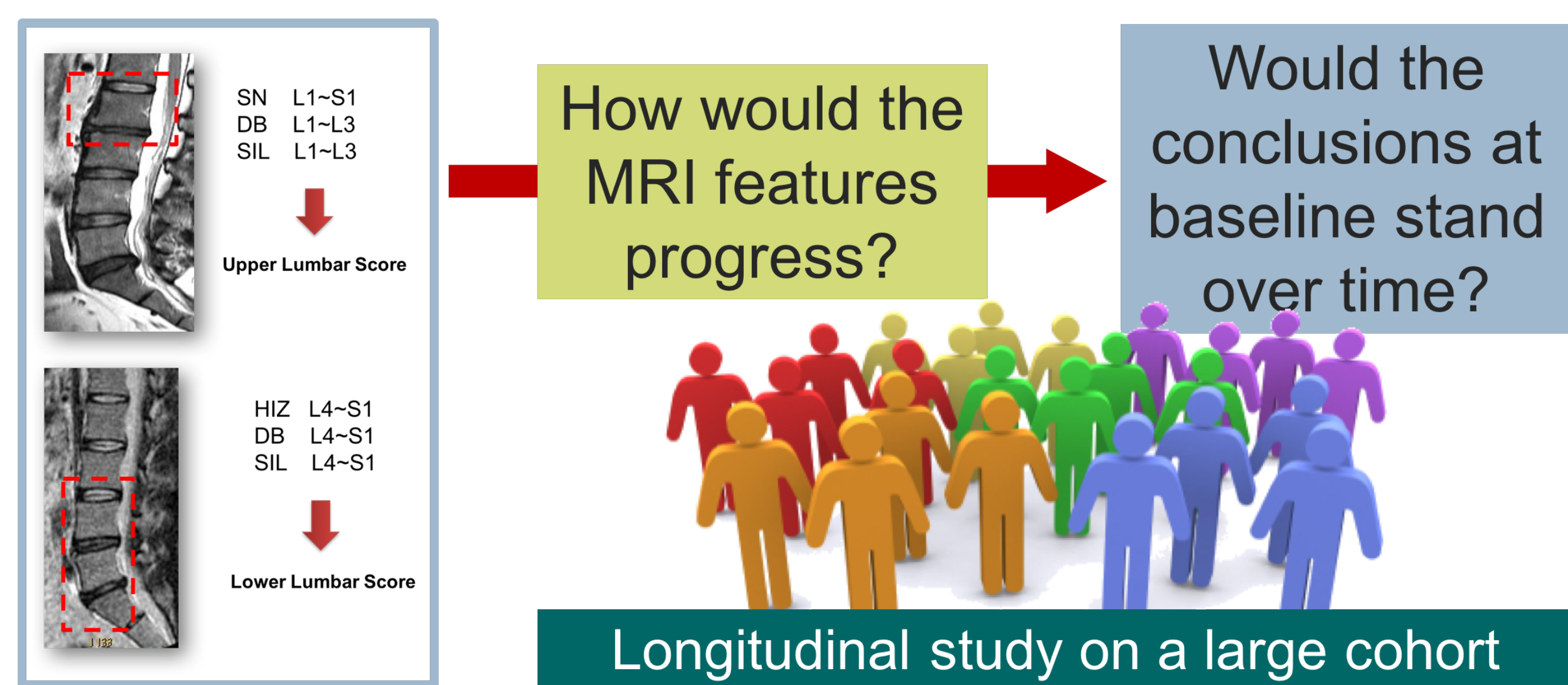
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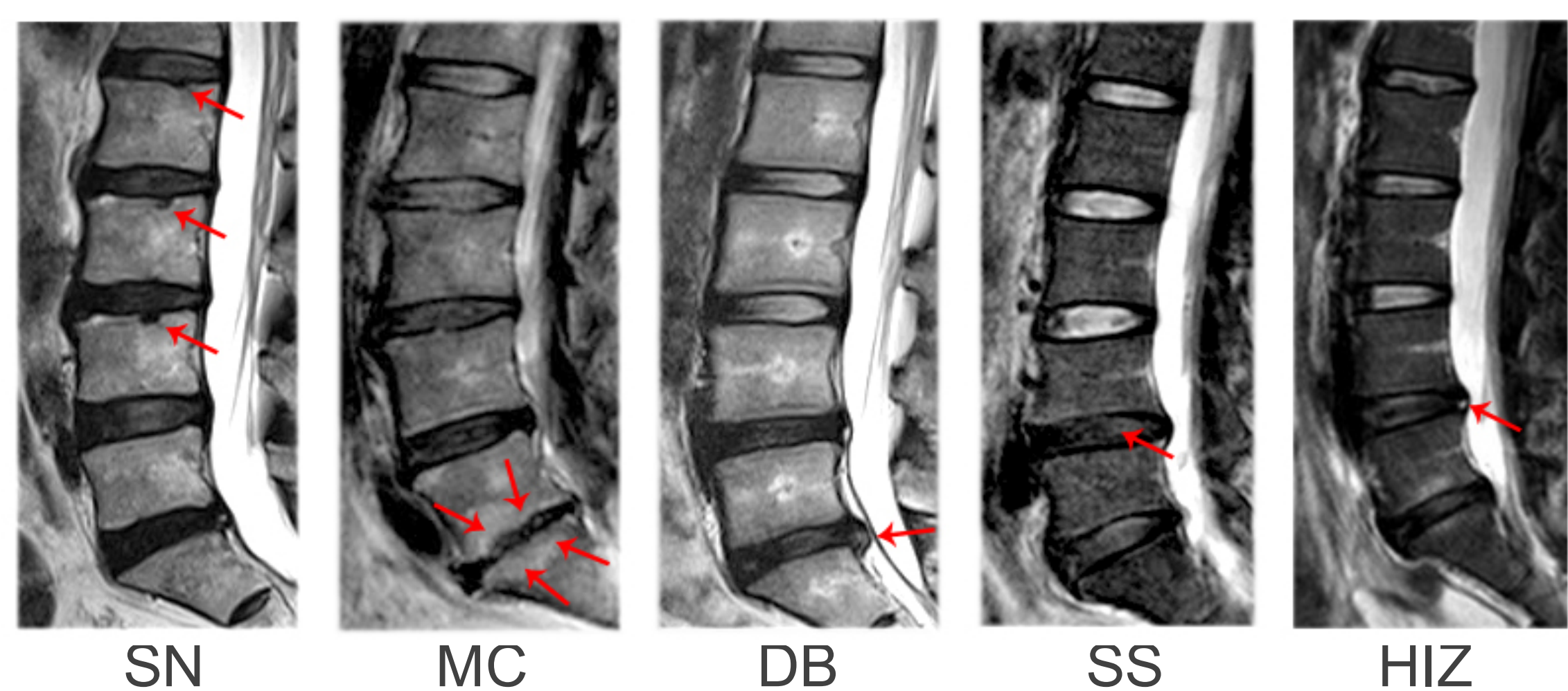
1. Introduction

A cohort of 1288 southern Chinese probands was followed longitudinally with magnetic resonance imaging (MRI) scans.

SN   L1~S1
DB   L1~L3
SIL L1~L3

Upper Lumbar Score

HIZ L4~S1
DB   L4~S1
SIL L4~S1

Lower Lumbar Score

How would the MRI features progress?

Would the conclusions at baseline stand over time?

Longitudinal study on a large cohort

2. Methods

Five MRI features associated with LDD are analysed in this study – **disc bulging (DB)**, **Schneiderman's score (SS)**, **high intensity zone (HIZ)**, **modic change (MC)**, **Schmorl's node (SN)**

SN   MC   DB   SS   HIZ

2.1. Development of MRI features is associated with disc levels

Method: **contingency table analysis** (log-linear model).

Disc Bulging

Schneiderman's Score

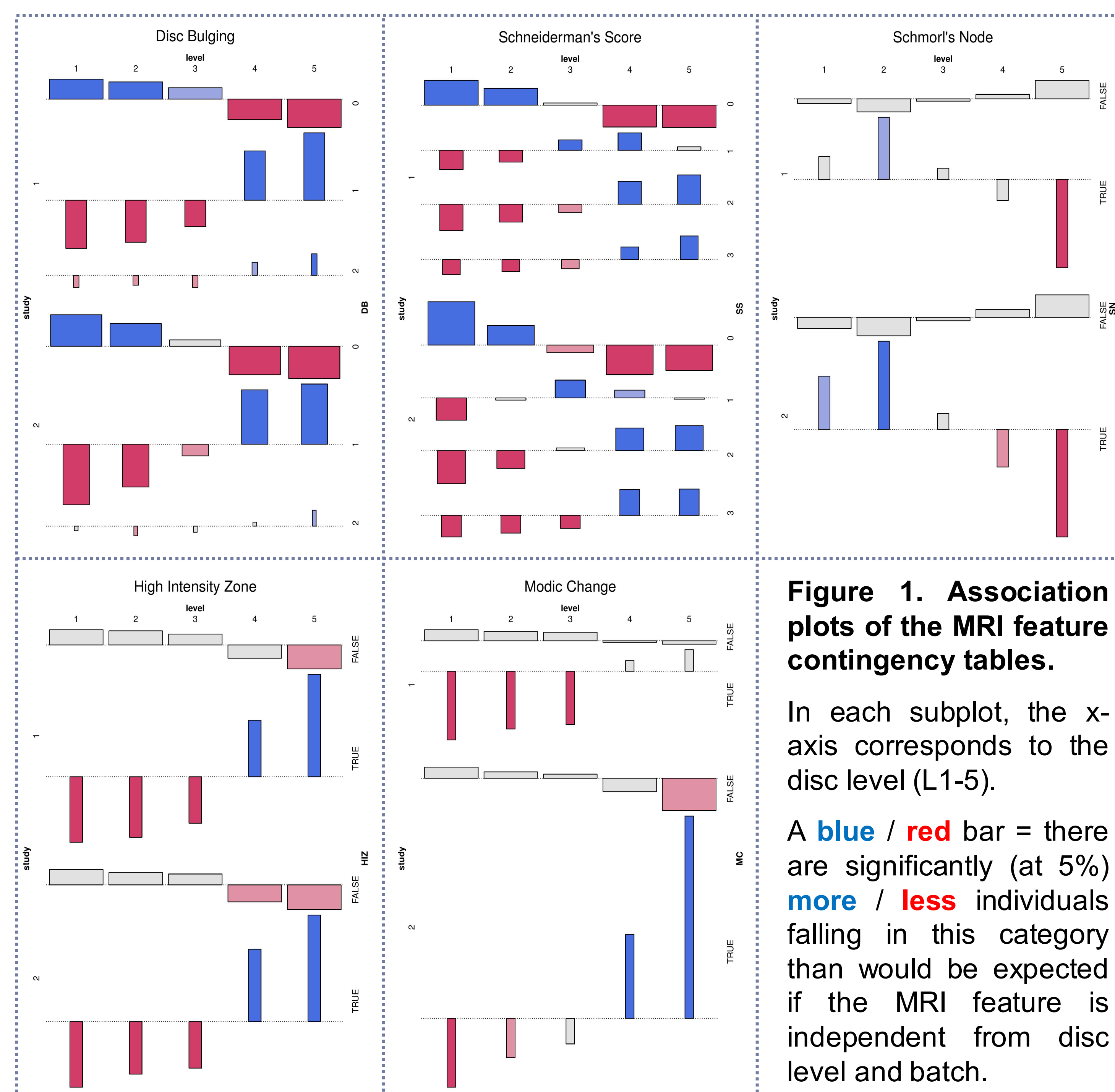Schmorl's Node

High Intensity Zone

Modic Change

Figure 1. Association plots of the MRI feature contingency tables.

In each subplot, the x-axis corresponds to the disc level (L1-5).

A **blue** / **red** bar = there are significantly (at 5%) **more** / **less** individuals falling in this category than would be expected if the MRI feature is independent from disc level and batch.

There are significantly **more discs** with **DB, SIL, HIZ or MC** and significantly **less discs** with **SN** at **lower disc levels**. The five disc levels form two clusters – {L1, L2, L3} and {L4, L5}.

2.2. MRI features progress and "spread" over time
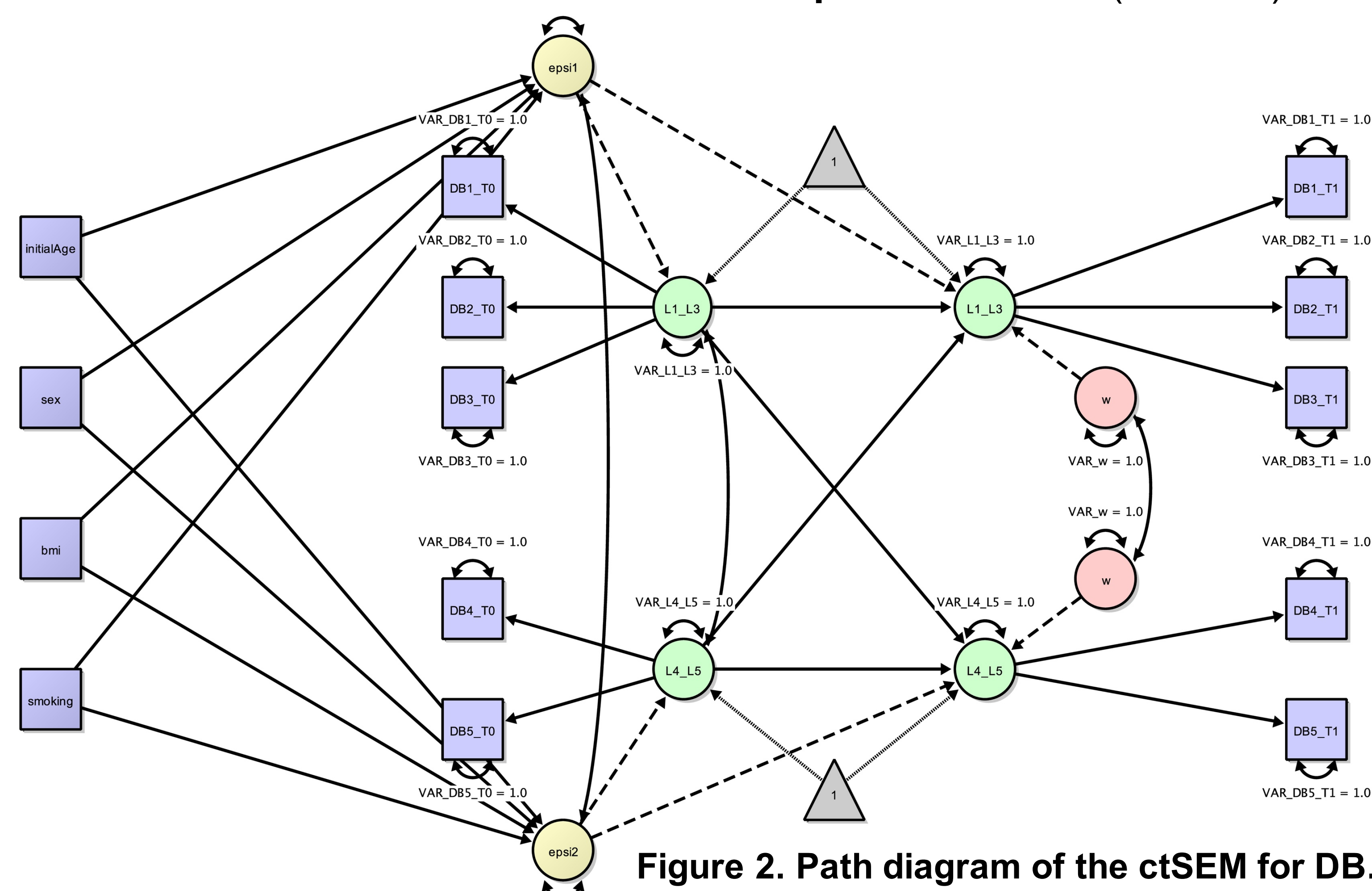
Method: **continuous time structural equation models** (ctSEM's).

Figure 2. Path diagram of the ctSEM for DB.

Process Mean
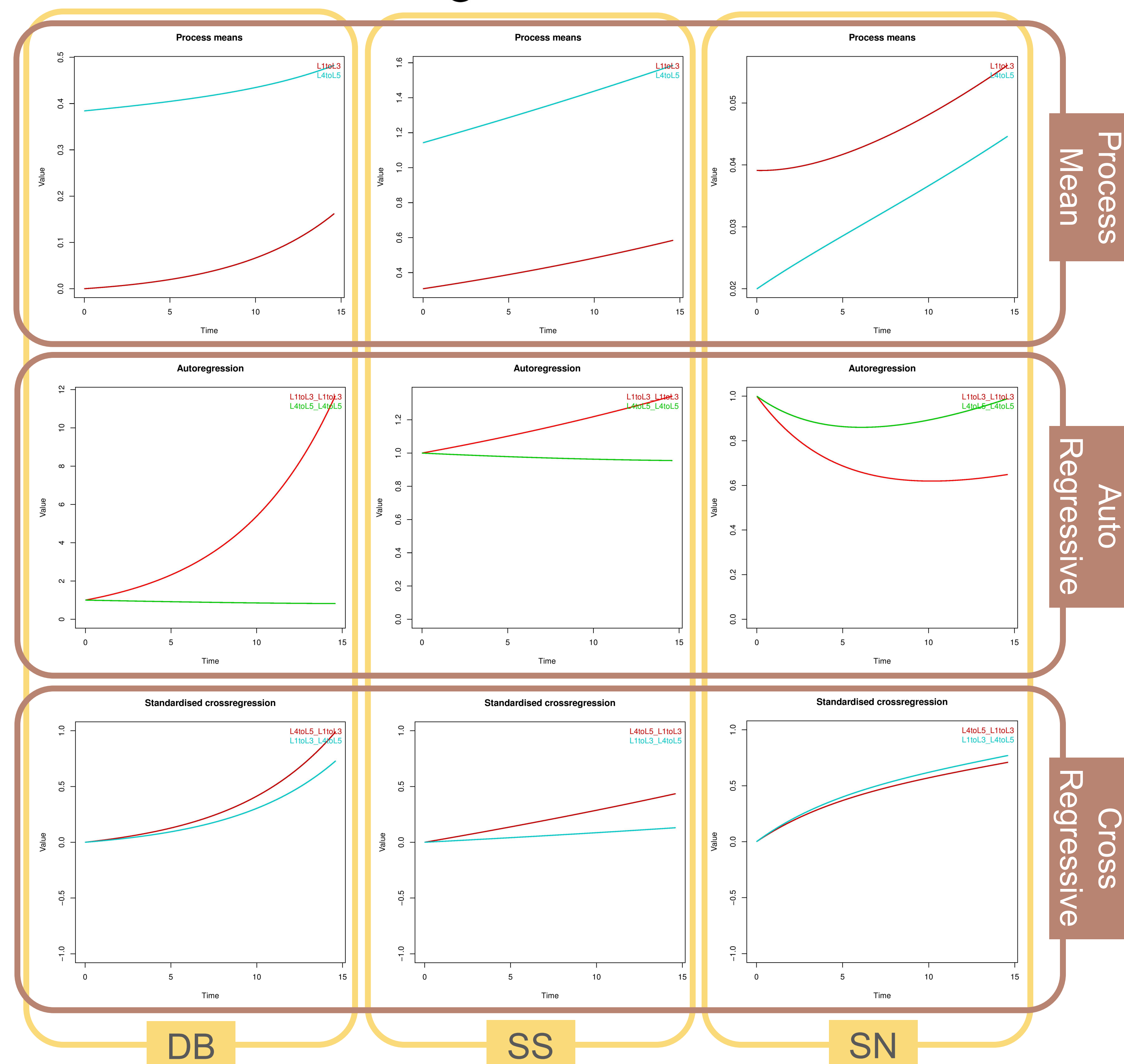
Auto Regressive

Cross Regressive

DB   SS   SN

Figure 3. Process mean trajectories, auto-regression, and cross-regression plots of the fitted ctSEM's for DB, SS and SN.

- As **time elapses**, discs are **more** prone to developing DB, SIL and SN.
- For **DB and SIL**, the **autoregressive effect** is very **positive** at **upper** levels. They also **spread (mostly upwards)** to neighboring discs.
- **SN** also **spreads** to neighboring discs over time. The autoregressive effect at upper levels seems negative on average, which may support that SN is a **developmental** condition.

3. Conclusions

- **DB, SIL, HIZ and MC** are more prone to developing at **lower** disc levels, whereas **SN** is more prone to developing at **upper** disc levels.
- The MRI features associated with LDD generally **worsen** and **spread** to neighbouring discs over time.