

Les trajectoires de développement : une revue appliquée de l'approche non paramétrique

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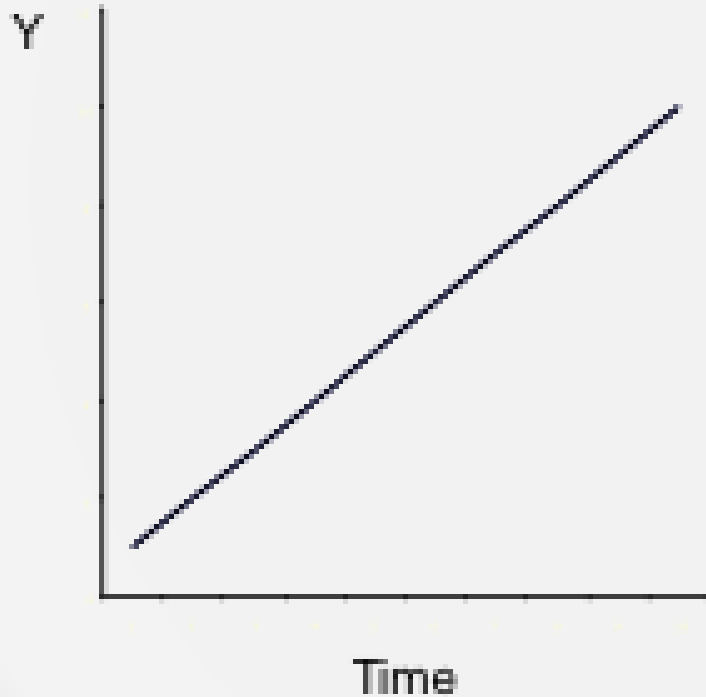


Plan

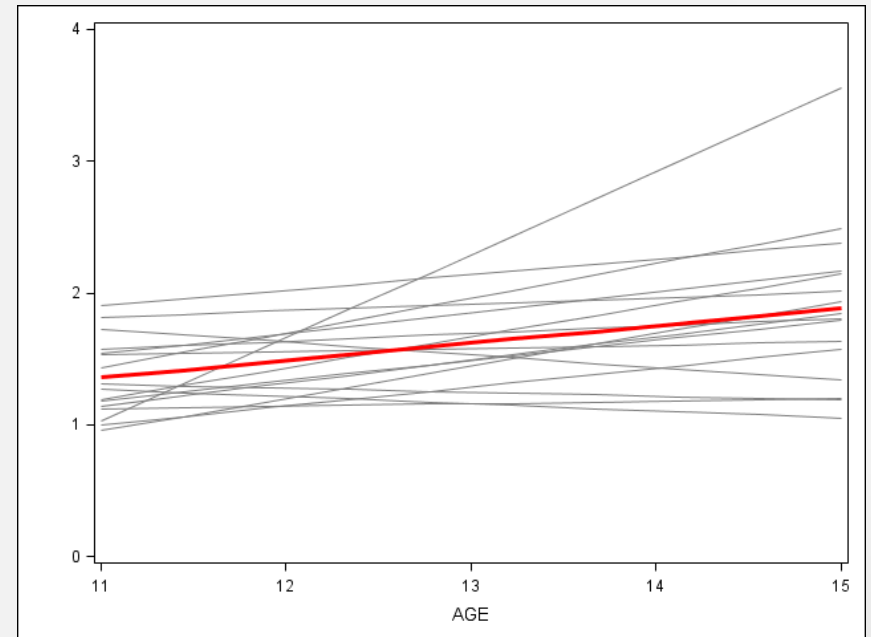
- Analyse du changement
- Modéliser les différences interindividuelles
 - Approche paramétrique
 - Approche non paramétrique
- Exemple d'application à l'ELDEQ: Le développement de l'agressivité physique
- Applications futures

Analyse du changement

Variation intra-individuelle



Variation interindividuelle



Modélisation des différences interindividuelles

Paramétrique

- La variabilité des trajectoires est captée par deux termes aléatoires de niveau 2 associés aux:
 - Statuts initiaux (constante),
 - Taux de changement (pente).

Non paramétrique

- La variabilité des trajectoires est captée par des groupes de trajectoires.

L'approche non paramétrique par variable latente catégorielle

L'approche non paramétrique n'impose aucune forme à la distribution des termes aléatoires de niveau 2. Elle utilise des groupes pour estimer une distribution inconnue.

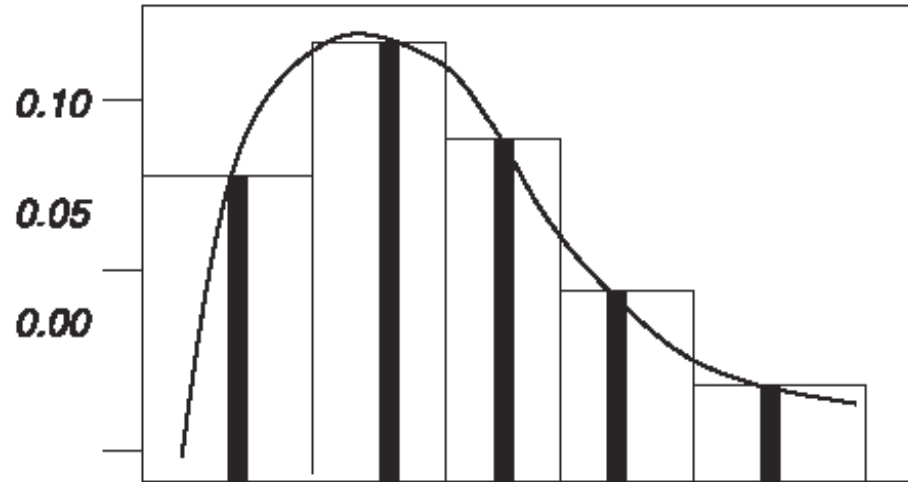


Fig. 1. Using groups to approximate an unknown distribution.

Comparaison de résultats

Paramétrique
Dupéré, V. & coll. (2007)

Non paramétrique
Lacourse, E. & coll. (2002)

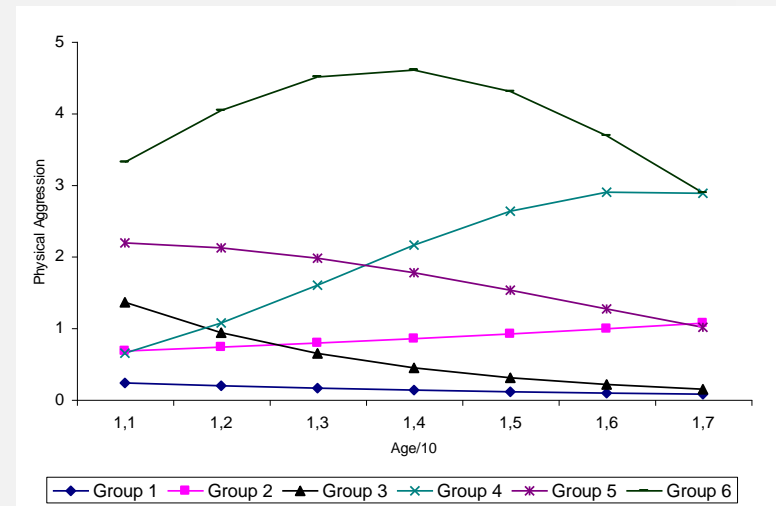
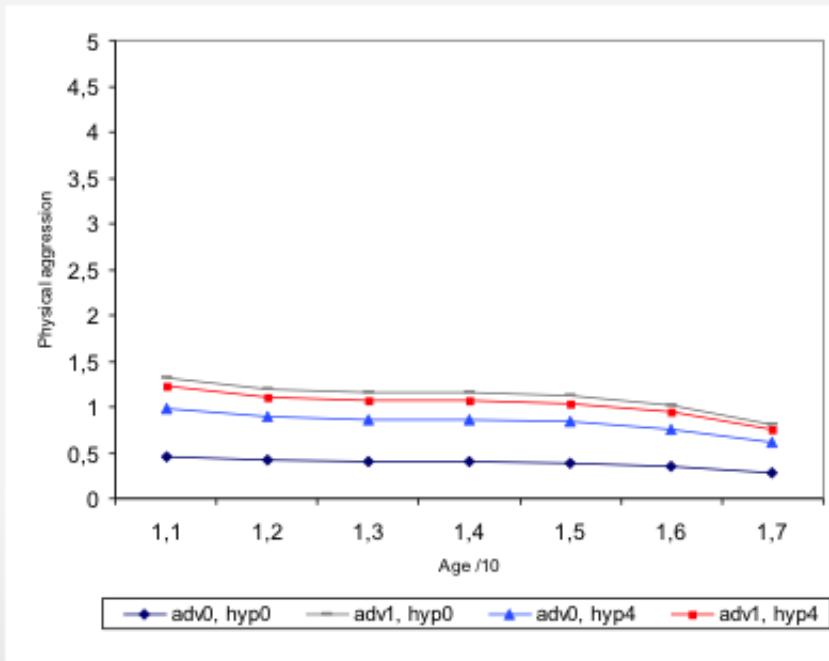


Figure 2. Trajectories of physical aggression as estimated with PROC TRAJ.

Avec les facteurs de risque

Paramétrique

	Paramètre	Erreur standard	
Effets fixes			
Statut initial, π_{0i}			
Origine	β_{00}	18.468**	5.718
ADV	β_{01}	1.048***	0.196
HYP	β_{02}	0.190***	0.041
INAT	β_{03}	0.055~	0.029
ADV*HYP	β_{04}	-0.208*	0.088
Changement, π_1, π_2, π_3			
Temps	β_{10}	-42.990***	12.558
Temps ²	β_{20}	31.826***	9.097
Temps ³	β_{30}	-7.860***	2.174
Composantes aléatoires			
Niveau- Statut initial, μ_{0i}	τ_{00}	0.784***	

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Non paramétrique

		Groupe					
		1	2	3	4	5	6
Pourcentage		22.3	23.0	26.6	3.4	19.5	5.3
Paramètres							
Statut initial, π_{0i}							
Origine	β_{00}	0.570 (1.251)	-1.217* (0.495)	4.412*** (-3.732)	-12.666** (4.841)	-1.435 (1.520)	-6.795*** (1.490)
Changement π_1, π_2							
Temps	β_{10}	-1.852* (0.884)	0.754* (0.328)	-3.732*** (0.466)	16.704* (6.638)	4.154~ (2.273)	12.117** (2.174)
Temps ²	β_{20}				-5.077* (2.261)	-1.943* (0.833)	-4.410*** (0.781)
Facteurs de risque							
ADV	Ref	1.308~ (0.755)	1.816* (0.865)	0.123 (1.593)	2.873*** (0.802)	4.851*** (1.122)	
HYP	Ref	0.108 (0.165)	0.214 (0.185)	-0.198 (0.363)	0.539** (0.167)	0.889*** (0.227)	
INAT	Ref	0.267* (0.120)	0.036 (0.153)	0.601** (0.201)	0.124 (0.119)	0.064 (0.148)	
ADV*HYP	Ref	-0.050 (0.396)	-0.281 (0.447)	0.440 (0.700)	-0.545 (0.379)	-0.927* (0.469)	

Note. ADV = adversité familiale. HYP = hyperactivité. INAT = inattention.

Qualités de l'approche non paramétrique

- C'est une application spécifique d'une méthode plus générale: la modélisation par mélange fini (finite mixture modeling).
- Elle est utile lorsque le changement intra-individuel est composé de plusieurs patrons qualitativement distincts.
 - La méthode est bien adaptée à des phénomènes qui ne sont pas distribués normalement au sein d'une population, comme l'agressivité physique.
- L'approche peut aussi s'appliquer aussi à des données transversales

Limites

- Le choix du nombre de trajectoires peut être difficile à faire.
- La convergence est parfois instable, notamment avec l'ajout de variables indépendantes qui varient dans le temps.
- L'approche est sensible aux valeurs extrêmes.

Exemple d'application à l'ELDEQ: le développement de l'agressivité physique

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Le développement de l'agression physique

- Au sein d'un échantillon de jeunes garçons défavorisé, Nagin, D.S. & R.E. Tremblay (1999) identifient 4 trajectoires de développement de 6 à 15 ans.
- Les résultats sont ensuite répliqués par Broidy, L.M. & coll. (2003) à partir de l'ELDEQ.
- À l'aide de l'ELDEQ, identification des trajectoires d'agressivité physique dès la petite enfance.

Tremblay, R.E. & coll. (2004)

Physical Aggression During Early Childhood: Trajectories and Predictors

Richard E. Tremblay, PhD*; Daniel S. Nagin, PhD‡; Jean R. Séguin, PhD*; Mark Zoccolillo, MD§; Philip D. Zelazo, PhD||; Michel Boivin, PhD¶; Daniel Pérusse, PhD*; and Christa Japel, PhD*

ABSTRACT. *Objectives.* Physical aggression in children is a major public health problem. Not only is childhood physical aggression a precursor of the physical and mental health problems that will be visited on victims, but also aggressive children themselves are at higher risk of alcohol and drug abuse, accidents, violent crimes, depression, suicide attempts, spouse abuse, and neglectful and abusive parenting. Furthermore, violence commonly results in serious injuries to the perpetrators themselves. Although it is unusual for young children to harm seriously the targets of their physical aggression, studies of physical aggression during infancy indicate that by 17 months of age, the large majority of children are physically aggressive toward siblings, peers, and adults. This study aimed, first, to identify the trajectories of physical aggression during early childhood and, second, to identify antecedents of high levels of physical aggression early in life. Such antecedents could help to understand better the developmental origins of violence later in life and to identify targets for preventive interventions.

Methods. A random population sample of 572 families with a 5-month-old newborn was recruited. Assessments of physical aggression frequency were obtained from mothers at 17, 30, and 42 months after birth. Using a semiparametric, mixture model, distinct clusters of physical aggression trajectories were identified. Multivariate logit regression analysis was then used to identify

who started having children early (OR: 3.1; CI: 1.4–6.8), families with low income (OR: 2.6; CI: 1.3–5.2), and mothers who smoked during pregnancy (OR: 2.2; CI: 1.1–4.1). Best predictors at 5 months of age were mothers' coercive parenting behavior (OR: 2.3; CI: 1.1–4.7) and family dysfunction (OR: 2.2; CI: 1.2–4.1). The OR for a high-aggression trajectory was 10.9 for children whose mother reported both high levels of antisocial behavior and early childbearing.

Conclusions. Most children have initiated the use of physical aggression during infancy, and most will learn to use alternatives in the following years before they enter primary school. Humans seem to learn to regulate the use of physical aggression during the preschool years. Those who do not, seem to be at highest risk of serious violent behavior during adolescence and adulthood. Results from the present study indicate that children who are at highest risk of not learning to regulate physical aggression in early childhood have mothers with a history of antisocial behavior during their school years, mothers who start childbearing early and who smoke during pregnancy, and parents who have low income and have serious problems living together. All of these variables are relatively easy to measure during pregnancy. Preventive interventions should target families with high-risk profiles on these variables. Experiments with such programs have shown long-term im-

Tremblay, R.E. & coll. (2004)

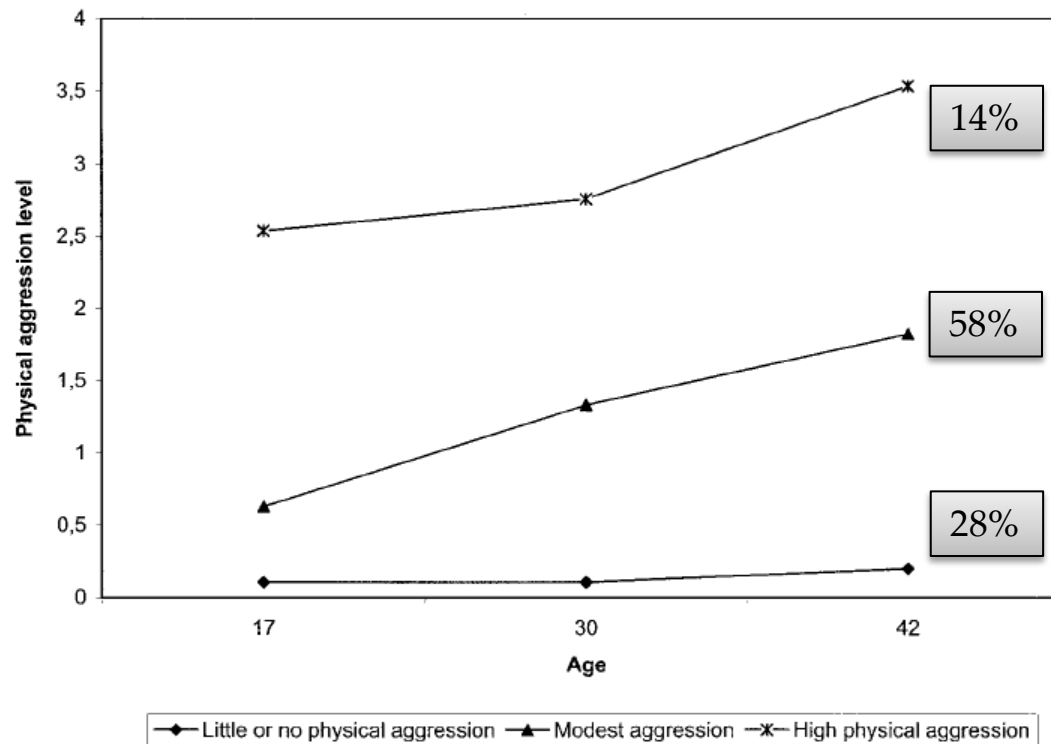


Fig 1. Trajectories of physical aggression from 17 to 42 months of age.

Tremblay, R.E. & coll. (2004)

TABLE 1. Parental and Child Characteristics by Trajectory Group

Variable	Trajectory Group		
	Low	Medium	High
<i>N</i>	140	294	70
At birth, %			
Male	38.6	50.3	58.6
Young siblings	16.4	40.8	57.1
Low income	20.5	20.2	43.9
Parents separated	3.7	3.2	11.8
Early motherhood	22.8	22.2	42.4
Young mother now	26.2	20.0	31.3
Mother no high school diploma	5.3	9.7	15.4
Mother antisocial (before end of high school)	.1	4.9	14.0
Mother smoked (during pregnancy)	20.1	22.1	38.2
Mother drank alcohol (during pregnancy)	3.0	5.0	4.4
Maternal postpartum depression	17.9	16.6	29.4
Father antisocial (before end of high school)	13.6	11.2	12.9
At 5 mo of age, %			
High family dysfunction	32.8	29.2	53.8
Mother coercive parenting	8.1	12.1	31.3
Mother feels ineffective	18.3	17.5	20.9
Difficult temperament	25.4	21.2	40.0

Applications futures

- Traitement des données manquantes au sein d'un modèle de trajectoires non paramétriques à partir des données de l'ELDEQ
- Application de l'approche non paramétrique en génétique quantitative
 - À partir de l'Étude des jumeaux nouveaux-nés du Québec (EJNQ) qui comprend tous les jumeaux nés entre 1995 et 1998 dans la grande région de Montréal (Boivin, M. & R.E. Tremblay)
- Article en préparation pour tester l'hypothèse d'héritabilité différentielle selon les trajectoires d'agression physique
 - Paquin, S. & coll. (en préparation). Testing the Differential Heritability Hypothesis from the Developmental Taxonomy of Physical Aggression during Childhood

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