SUPPLEMENTS

Does care managers' initial professional background affect the outcomes of pulmonary rehabilitation? A retrospective cohort study of 2,450 individuals with chronic respiratory diseases.

METHODS

Home-based PR programme

All participants performed an 8-week personalised, home-based PR programme, including a weekly face-to-face supervised 90-minute home session, during which education, self-management strategies and physical training were implemented as previously described.[1] At the start of the programme, a learning needs and goal-setting assessment—essential for developing a personalised plan in collaboration with the participant—was conducted in the participant's home The results of this assessment guided the design of a personalised intervention, created collaboratively by the care manager, the participant and their caregiver (if present). In addition to the weekly face-to-face supervised home visit, participants were encouraged to engage in personalised daily life physical training and follow a self-management plan. During each weekly supervised visit, both the successes—regardless of their magnitude—and the challenges were systematically evaluated as part of the ongoing co-construction of solutions. This tailored routine was to be maintained without face-to-face supervision for the remainder of the week and sustained throughout the one-year follow-up period, during which no visits or supervised maintenance strategies were provided by the PR team.

Education and self-management interventions were tailored to address the specific needs, barriers and personal goals of each individual. These sessions were delivered either one-on-one or in the presence of a caregiver or other family members. Core educational topics included the pathophysiology of lung disease and comorbidities, medication and its use (including bronchodilators, oxygen therapy, non-invasive ventilation, continuous positive airway pressure), prevention and recognition of exacerbations and allergic triggers, indoor air pollution, physical activity, breathing techniques, stress management and emotional responses related to the disease. Additional topics were addressed based on individual needs and could include nutritional counselling, smoking cessation strategies, airways

clearance techniques, relaxation practices (such as yoga, cardiac coherence, mindfulness meditation), and end-of-life planning.

Equipment for endurance training and strengthening exercises was loaned to participants for the duration of the 8-week program. No equipment remained in the participants' homes between the end of the program and the 12-month follow-up, except for elastic bands, which were given to participants. Each participant received a cycle ergometer (Domyos 120, Decathlon, Villeneuve-d'Ascq, France), and/or a stepper (Go Sport, Grenoble, France), and/or a mini bike (Domyos 100, Decathlon, Villeneuve-d'Ascq, France). The selection of equipment was negotiated between the care manager and the patient, based on the patient's abilities, needs, preferences, and home environment constraints.

The training programme followed the guidelines for exercise prescription in CRDs.[2] Participants were encouraged to exercise for 30-45 minutes, (performed in 10-min intervals or shorter, depending on individual capacity), 5 times per week. Exercise intensity was progressively adjusted to reach a dyspnea score between 3 and 4 (moderate to somewhat severe) on the Borg 0-10 scale or 11-13 on the Borg 6-20 scale.[3] Physical training was completed with upper and lower limb strengthening exercises using dumbbells, elastic bands, Swiss ball and/or body weight, performed daily alongside endurance training. Intensity was progressively adjusted—by increasing repetitions and/or resistance—based on participants' perceived dyspnœa or fatigue. For participants with severe deconditioning who were unable to tolerate endurance training, the programme began with two daily 30-minute sessions of self-administered quadriceps electrostimulation, five times a week.[4] All participants were encouraged to increase time spent in daily life physical activities such as gardening, housekeeping, and grocery shopping, to promote the long-term integration of physical activity.[5] Strategies for maintaining physical activity and/or exercise training were discussed and negotiated between the patient (the caregiver if present) and the care manager throughout the 8-week programme.

A diary was offered to participants who wished to track their training sessions in the absence of the care manager. The diary was reviewed during the weekly face-to-face visits, and objectives were re-evaluated accordingly. However, maintaining the diary was optional, as clinical experience suggested that few participants completed it consistently. For those who did not update the diary, objectives were reassessed based on verbal reports.

Care manager training and role

From 2010 to 2021 the PR team comprised a respiratory physician (medical coordinator), a physiotherapist, six nurses, two kinesiologists, a dietician and a sociomedical beautician. All team members held professional degrees or certifications relevant to patient care, including the sociomedical beautician, for whom the French qualification requires at least two degrees: a diploma in Aesthetics, Cosmetics and Perfumery and a specialised certification in Humanitarian and Social Aesthetic Care. In addition, the team included a psychologist and an administrative manager, neither of whom were directly involved in patient care.

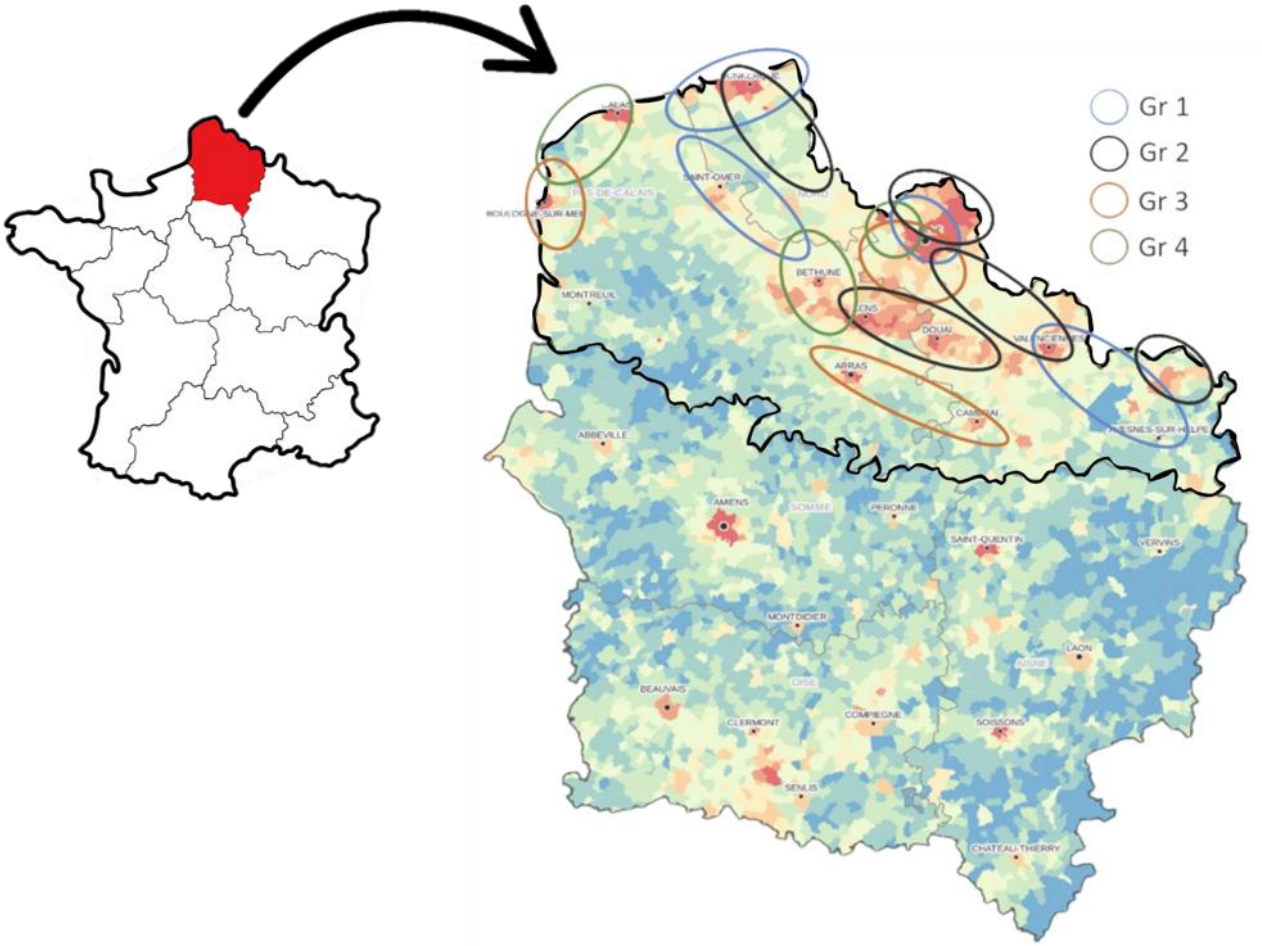
Despite their diverse professional backgrounds, all team members completed the same standardized therapeutic education training, consisting of a 40-hour course delivered by a licensed instructor. The instructor, who was also the medical coordinator of the PR team, possessed 30 years of expertise in developing PR programmes and held a specific regional license for therapeutic education training. All team members received the same training in behaviour change principles and motivational communication skills to promote health-enhancing behaviour.[6] They also received training on physical activity management and on how to perform physical assessments safely in participants' homes.

Additionally, at the start of their employment, each new care manager shadowed the other senior care managers during home visits for a period of two months. This mentorship period allowed the new care managers to acquire knowledge and skills beyond their initial training.

To function as a transdisciplinary team, weekly four-hour team meetings were organised with all care managers, including the coordinating physician, during which newly enrolled patients and corresponding action plans were presented. These plans were discussed collaboratively, with discipline-specific experts providing guidance as needed (e.g., the respiratory physician consulting the dietician on a dietary program for a malnourished participant). Each care manager was free to provide their opinion on a case based on their expertise. In our model, this half-day session (Monday, 1–5 pm) is essential for transdisciplinary coordination, as the team does not meet together during the rest of the week. On average, 10–15 patients are discussed per week, including any cases requiring additional problem-solving. Each care manager, employed at a minimum of 0.8 FTE, sees 3 to 4 patients per day depending on distance travelled, amounting to 14–18 patients per week

and approximately 60 new patients per year. Weekly meetings could also include training sessions led by team members or external specialists (e.g., a tobacco addiction expert or a palliative care physician). Through initial and ongoing training, each care manager was equipped to deliver all aspects of the PR programme within patients' homes. Care managers could also consult colleagues when a patient's needs exceeded their expertise. For example, the physiotherapist might request the respiratory physician's intervention in cases of persistent exacerbation unresponsive to the patient's standard treatment plan.

Care managers communicated with patients' family and respiratory physicians by sending reports at the beginning, end and at 12-month follow-up. In the event of an adverse event during the program (e.g., exacerbation, injury, or family issue), the care manager informed both the family and respiratory physicians. Respiratory physicians who prescribed the PR programme had secure, code-protected access to weekly reports entered by the care manager into the electronic health record system (Care Itou) following each face-to-face visit. Each patient's primary point of contact was their assigned care manager, who remained accessible by telephone outside of weekly supervised visits. Upon receiving a prescription from the physician, participants were assigned to a care manager based on the geographic proximity of the care manager's residence. This allocation system enables coverage of a large territory—including both urban and rural areas—while minimizing travel distances for the mobile team. The following figure illustrates the northern region of France (12,500 km2), where the PR mobile team operates (2 areas: Nord and Pas de Calais). Population density is also illustrated, with warm colors indicating more densely populated areas and cool colors representing less populated regions. The population of the Nord and Pas-de-Calais area is approximately 4,033,000. On average, each team member travels between 25,000 and 30,000 kilometers annually.


Gr 1
Gr 2
Gr 3
Gr 4
SAINT-OMER
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MONTREUIL
DOUAI
ARRAS
CAMBRAI
ABBEVILLE
AMIENS
SOMME
PERONNE
SAINT-QUENTIN
VERVINS
MONTDIDIER
LAON
AISNE
OISE
BEAUVAIS
CLERMONT
COMPIEGNE
SOISSONS
SENLIS
CHATEAU-THIERRY

RESULTS

Supplement T1. Evolution of assessments at baseline (M0), end (M2) and one year after the end of PR (M14) in individuals who completed all assessment time points.

Gr 1 (n= 653 completers at M14)	**n**	**M0**	**M2**	**M14**
CAT, score (0-40) *lower is better*	301	20.5 ± 8.0	16.6 ± 8.2	16.4 ± 8.0
VSRQ, score (0-80) *higher is better*	325	34.2 ± 16.1	42.3 ± 16.3	39.7 ± 17.6
HAD_Anxiety (0-21) *lower is better*	630	9.1 ± 4.6	7.8 ± 4.2	7.6 ± 4.6
HAD_Depressive (0-21) *lower is better*	630	7.3 ± 4.1	5.5 ± 3.7	5.5 ± 4.1
mMRC dyspnea scale (0-4) *lower is better*	406	3 [2-4]	3 [2-4]	3 [2-4]
6MST, strokes *higher is better*	355	365 ± 152	445 ± 161	422 ± 187

Gr 2 (n=302 completers at M14)	**n**	**M0**	**M2**	**M14**
CAT, score (0-40) *lower is better*	234	21.6 ± 8.2	17.8 ± 7.6	18.2 ± 8.5
VSRQ, score (0-80) *higher is better*	57	34.4 ± 16.1	39.8 ± 15.7	36.3 ± 16.6
HAD_Anxiety (0-21) *lower is better*	295	9.0 ± 4.6	7.5 ± 4.1	7.6 ± 4.5
HAD_Depressive (0-21) *lower is better*	295	7.2 ± 4.3	5.4 ± 4.1	5.8 ± 4.3
mMRC dyspnea scale (0-4) *lower is better*	235	3 [2-4]	3 [2-4]	3 [2-4]
6MST, strokes *higher is better*	145	366 ± 171	443 ± 185	394 ± 194

Gr 3 (n=476 completers at M14)	**n**	**M0**	**M2**	**M14**
CAT, score (0-40) *lower is better*	247	21.6 ± 7.6	16.7 ± 8.4	17.5 ± 8.8
VSRQ, score (0-80) *higher is better*	201	33.2 ± 13.6	41.4 ± 14.9	39.6 ± 15.4
HAD_Anxiety (0-21) *lower is better*	456	9.3 ± 4.5	8.0 ± 4.3	7.8 ± 4.6
HAD_Depressive (0-21) *lower is better*	456	7.3 ± 3.8	5.6 ± 3.9	5.6 ± 4.4
mMRC dyspnea scale (0-4) *lower is better*	331	3 [2-4]	3 [2-4]	3 [2-4]
6MST, strokes *higher is better*	249	421 ± 172	495 ± 172	477 ± 199

Gr 4 (n=114 completers at M14)	**n**	**M0**	**M2**	**M14**
CAT, score (0-40) *lower is better*	47	19.2 ± 7.5	16.0 ± 8.1	15.9 ± 7.6
VSRQ, score (0-80) *higher is better*	58	33.2 ± 15.3	38.6 ± 15.3	39.1 ± 15.8
HAD_Anxiety (0-21) *lower is better*	108	9.4 ± 4.1	8.3 ± 3.9	8.1 ± 4.6
HAD_Depressive (0-21) *lower is better*	108	7.5 ± 4.0	6.2 ± 3.8	5.7 ± 3.9
mMRC dyspnea scale (0-4) *lower is better*	64	3 [2-4]	3 [2-4]	3 [2-4]
6MST, strokes *higher is better*	67	424 ± 156	492 ± 164	475 ± 178

Note. Data are presented as mean ± standard deviation or median [interquartile range]

Due to the retrospective design over 11 years of real-life practice, missing data are significant, especially for the 6MST, which many deconditioned patients could not perform.

Abbreviations. CAT, COPD assessment test; VSRQ, visual simplified respiratory questionnaire; HAD, Hospital Anxiety and Depression scale; mMRC, modified Medical Research Council scale; 6MST, 6-minute stepper test.

Supplement T2. Delta at short (M2) and long-term (M14) after PR according to care manager group (**adjusted analyses**)

	Gr 1		Gr 2		Gr 3		Gr 4	
	ΔM2-M0	**ΔM14-M0**	**ΔM2-M0**	**ΔM14-M0**	**ΔM2-M0**	**ΔM14-M0**	**ΔM2-M0**	**ΔM14-M0**
CAT, score	-3.9 [-4.5 to -3.2]	-4.4 [-5.2 to -3.6]	-3.4 [-4.2 to -2.6]	-3.1 [-4.0 to -2.1]	-3.8 [-4.6 to -3.1]	-3.9 [-4.8 to -3.0]	-4.0 [-5.5 to -2.5]	-3.8 [-5.7 to -1.8]
VSRQ, score	7.8 [6.2 to 9.4]	5.7 [3.8 to 7.5]	3.5 [-0.3 to 7.3]	-0.5 [-5.0 to 4.1]	8.0 [6.1 to 10.0]	6.5 [4.1 to 8.8]	6.0 [2.8 to 9.3]	5.9 [2.0 to 9.9]
HAD_Anxiety	-1.4 [-1.7 to -1.2]	-1.6 [-1.9 to -1.3]	-1.5 [-1.9 to -1.1]	-1.4 [-2.0 to -0.8]	-1.2 [-1.5 to -0.9]	-1.5 [-2.0 to -1.1]	-1.3 [-1.9 to -0.8]	-1.3 [-2.0 to -0.6]
HAD_Depressive	-1.9 [-2.1 to -1.6]	-2.0 [-2.3 to -1.6]	-1.6 [-2.0 to -1.2]	-1.5 [-1.9 to -1.0]	-1.5 [-1.8 to -1.1]	-1.7 [-2.0 to -1.3]	-1.5 [-2.1 to -0.9]	-2.0 [-2.7 to -1.3]
6MST, strokes	68 [60 to 76]	56 [45 to 67]	66 [54 to 78]	22 [5 to 39]	76 [66 to 86]	60 [47 to 74]	61 [43 to 79]	49 [25 to 74]

Note. Data are presented as Mean [CI 95%]. Analysis were adjusted for sexe, geographical area, airflow obstruction, COPD prevalence, number of comorbidities and 6MST performance at baseline.

Changes over time between M0 and M2 were not different between groups (CAT, p=0.759; VSRQ, p=0.147; HAD_Anxiety, p=0.460; HAD_Depressive, p=0.188; 6MST, p=0.367). At M14, only the 6MST change was different between groups (smaller improvement in Gr 2 compared to the other groups, p=0.003). Gr 2 did not improved VSRQ at M2 or M14 compared to baseline but the changes were not different from the other groups (M2, p=0.147 and M14, p=0.063)

Abbreviations. CAT, COPD assessment test; VSRQ, visual simplified respiratory questionnaire; HAD, Hospital Anxiety and Depression scale; mMRC, modified Medical Research Council scale; 6MST, 6-minute stepper test.

Supplement T3. Delta at short (M2) and long-term (M14) after PR according to care manager group (**adjusted and imputed analyses**)

	Gr 1		Gr 2		Gr 3		Gr 4	
	ΔM2-M0	**ΔM14-M0**	**ΔM2-M0**	**ΔM14-M0**	**ΔM2-M0**	**ΔM14-M0**	**ΔM2-M0**	**ΔM14-M0**
CAT, score	-3.2 [-3.7 to -2.7]	-3.8 [-4.4 to -3.2]	-3.3 [-3.9 to -2.7]	-3.5 [-4.3 to -2.6]	-3.5 [-4.0 to -3.0]	-4.0 [-4.6 to -3.4]	-3.2 [-4.2 to -2.1]	-3.7 [-5.0 to -2.4]
VSRQ, score	7.8 [6.8 to 8.8]	6.4 [5.0 to 7.7]	7.5 [6.1 to 8.9]	5.9 [3.9 to 7.9]	8.2 [7.1 to 9.2]	7.0 [5.7 to 8.3]	6.7 [4.6 to 8.8]	7.1 [4.5 to 9.7]
HAD_Anxiety	-1.3 [-1.5 to -1.1]	-1.5 [-1.8 to -1.3]	-1.5 [-1.8 to -1.2]	-1.5 [-1.9 to -1.1]	-1.3 [-1.5 to -1.0]	-1.5 [-1.8 to -1.2]	-1.2 [-1.7 to -0.8]	-1.4 [-2.0 to -0.5]
HAD_Depressive	-1.7 [-1.9 to -1.5]	-1.8 [-2.1 to -1.6]	-1.7 [-1.9 to -1.4]	-1.6 [-2.0 to -1.3]	-1.7 [-1.9 to -1.4]	-1.8 [-2.1 to -1.5]	-1.5 [-1.9 to -1.0]	-1.9 [-2.6 to -1.3]
6MST, strokes	61 [54 to 69]	47 [36 to 58]	66 [55 to 76]	33 [17 to 48]	68 [59 to 77]	51 [38 to 63]	58 [42 to 73]	54 [31 to 77]

Note. Data are presented as Mean [CI 95%]. Analysis were adjusted for sexe, airflow obstruction, COPD prevalence, number of comorbidities and 6MST performance at baseline. Changes over time between M0 and M2 were not different between groups (CAT, p=0.689; VSRQ, p=0.523; HAD_Anxiety, p=0.546; HAD_Depressive, p=0.826; 6MST, p=0.668) neither between M0 and M14 (CAT, p=0.797; VSRQ, p=0.586; HAD_Anxiety, p=0.944; HAD_Depressive, p=0.792; 6MST, p=0.300).

Abbreviations. CAT, COPD assessment test; VSRQ, visual simplified respiratory questionnaire; HAD, Hospital Anxiety and Depression scale; mMRC, modified Medical Research Council scale; 6MST, 6-minute stepper test.

Supplement T4. Number of individuals reaching the MCID of the assessments according to the care manager group

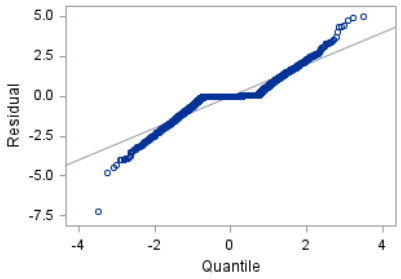
Outcomes	**Gr 1**		**Gr 2**		**Gr 3**		**Gr 4**	
	M2	M14	M2	M14	M2	M14	M2	M14
CAT, change ≥ -2 pts, n (%)	245/441 (55.5)	190/301 (63.1)	205/346 (59.2)	138/235 (58.7)	260/393 (66.1)	158/247 (64.0)	51/87 (58.6)	33/47 (70.2)
VSRQ, change ≥ 3.4 pts, n (%)	258/448 (57.6)	173/328 (52.7)	37/77 (48.0)	22/57 (38.6)	200/309 (64.7)	106/205 (51.7)	50/91 (54.9)	31/58 (53.4)
HAD_A, change ≥ -1.5 pts, n (%)	381/886 (43.0)	313/631 (49.6)	187/426 (43.9)	141/296 (47.6)	316/710 (44.5)	219/459 (47.7)	76/176 (43.2)	52/109 (47.7)
HAD_D, ≥ -1.5 pts, n (%)	424/886 (47.9)	318/631 (50.4)	197/426 (46.2)	137/296 (46.3)	353/710 (49.7)	229/459 (49.9)	83/176 (47.2)	53/109 (48.6)
6MST, change, ≥ 40 strokes, n (%)	420/656 (64.0)	204/370 (55.1)	196/321 (61.1)	63/154 (40.9)	302/513 (58.9)	138/259 (53.3)	80/133 (60.1)	37/71 (52.1)

Note. Data are presented as n (%). Overall, approximately half of the participants met the MCID of the variables assessed at M2 and M14. In accordance with the linear regression analyses, results for Group 2 indicated a numerically smaller number of responders for the VSRQ and 6MST at long-term. However, this must be interpreted with caution due to the significant number of missing data at M14, particularly for the 6MST. To illustrate, of the 1,545 participants evaluated at M14, only 854 (55.3%) had a valid 6MST evaluation with no missing data at M0 or M14 (Gr 1: 56.7%, Gr 2: 51.0%, Gr 3: 54.4%, Gr 4: 62.3%).

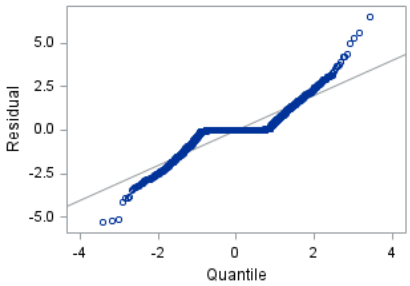
Abbreviations. MCID, minimal clinically important difference; CAT, COPD assessment test; VSRQ, visual simplified respiratory questionnaire; HAD, Hospital Anxiety and Depression scale; mMRC, modified Medical Research Council scale; 6MST, 6-minute stepper test.

Supplement F1. Q-Q plots of linear mixed models residuals for per protocol analyses.

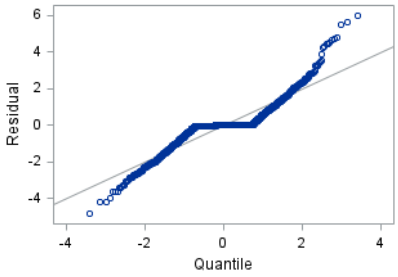
A. CAT M2 vs. M0



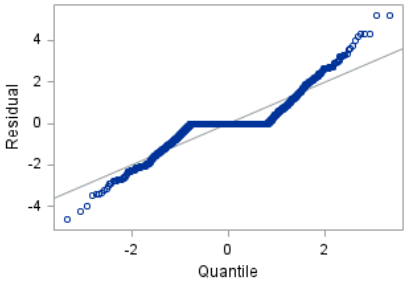
B. CAT M14 vs. M0



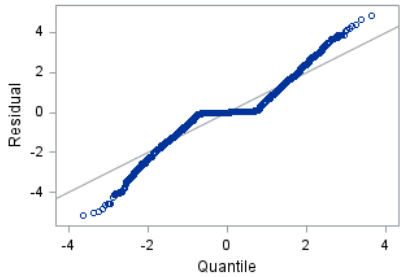
C. VSRQ M2 vs. M0



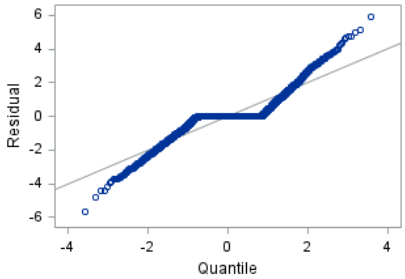
D. VSRQ M14 vs. M0



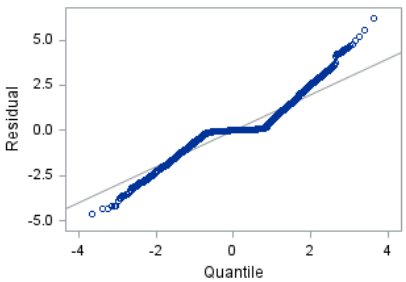
E. HAD Anxiety M2 vs. M0



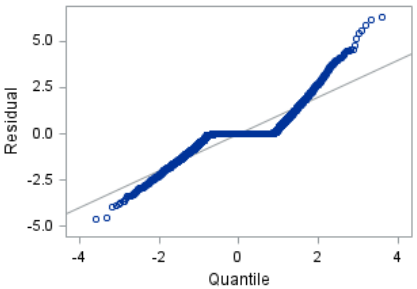
F. HAD Anxiety M14 vs. M0



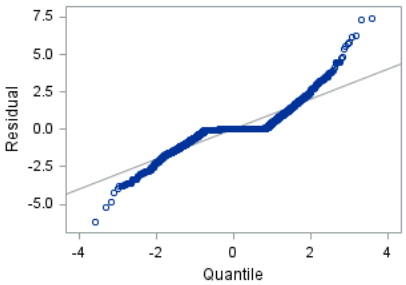
G. HAD Depression M2 vs. M0



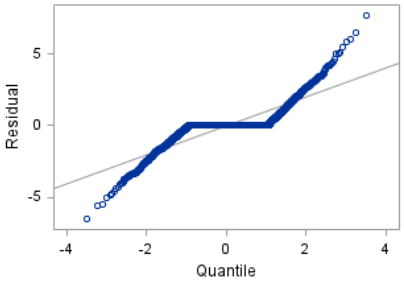
H. HAD Depression M14 vs. M0



I. 6MST M2 vs. M0



J. 6MST M14 vs. M0



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