**Appendix 1**:Details of physical therapy and psychotherapy

**Personalized Physical Therapy**:Physical interventions included cardiorespiratory capacity, dynamic standing balancing and strength of muscle endurance. The participants’ abilities in each category were evaluated and a tailored exercise program was designed. Exercise programs contained 3-6 repetitions of 50 minutes machine training and a home exercise introduction. Machine training included cardiorespiratory capacity, dynamic standing balancing, and resistance training. The training frequency was adjusted according to the individual’s physical fitness, with the usual interval once every 1-2 weeks. Training for cardiorespiratory capacity was 15 minutes aerobic exercise, such as a stationary bike or treadmill. Dynamic standing improvement was achieved by three sets of standing and stepping exercises for 10 seconds each. Resistance training was via POWER rehabilitation, which employs machine training with light resistance and was developed for the elderly.1 Participants received supervised PT for 30 minutes resistance training, including lower limb extension and flexion, truncal extension and flexion, chest press machine and hip abduction and adduction. Each machine was used for three sets of resistance training with ten repetitions per set and 30 seconds rest intervals between each set. The home exercise program was also designed and encouraged. Muscles of the upper limbs, lower limbs and trunk were all trained as part of the program. Home exercise instruction was carried out 1 to 3 times by the PT. Subjects were encouraged to perform their home exercises through monthly telephone follow ups by nursing case managers for 4 months.

**Personalized Psychotherapy Intervention**: All participants were screened using the GDS-5 and the exhaustion category in Fried’s frailty phenotype. People who scored >2 points in the GDS-5 then completed GDS-15 and were referred to a psychiatrist for a proper diagnosis. Treatments via either medication or psychotherapy were then initiated. For participants who reported exhaustion, the referring staff evaluated whether the exhaustion was caused by an uncontrolled illness. If the exhaustion was not related to a physical illness, psychotherapy intervention was then introduced. The participants’ cognitive function were screened using the SPMSQ. Those with abnormal results (wrong answers ≥3) would then visit a neurologist and receive neuropsychological testing. Personalized psychotherapy was conducted by a psychologist who analyzed the patient’s personality and character, their interpersonal relationships, and their pressure status, and then provided mental health promotion suggestions. The treatment course lasted 30 minutes each time and was arranged 1 to 3 times.

1. Ota A, Yasuda N, Horikawa S, et al. Differential effects of power rehabilitation on physical performance and higher-level functional capacity among community-dwelling older adults with a slight degree of frailty. *J Epidemiol.* 2007;17(2):61-67.

**Appendix 2**: Intervention summary for the study population

A total of 182 individuals received intervention. 174 (95.6%), 25 (17.6%), 63 (34.6%), and 65 (35.7%) individuals fit the criteria for physical therapy, psychotherapy, nutrition intervention and precise medication, respectively. 137 (75.3%), 14 (7.7%), 54 (29.7%), and 65 (35.7%) participants received the physical therapy, psychotherapy, nutrition intervention and precise medication, respectively.

11 individuals refused the psychologist’s intervention. 9 participants were unable to cooperate with the nutritionist’s education time. Nutrition education and psychoeducation were provided by the physician at the outpatient clinic.

The mean intervention times of physical therapy and psychotherapy was 4.3 and 1.2 times, respectively.

|  |  |  |
| --- | --- | --- |
| **Number of individuals enrolled in interventions**  Personalized physical therapy, n (%)¶  Personalized psychotherapy intervention, n (%)#  Personalized nutrition intervention, n (%)  Precision medicine, n (%)  Dementia center, n (%) | Number of individuals meeting the condition  174 (95.6%)  25 (13.7%)  63 (34.6%)  65 (35.7%)  83 (45.6%) | Number of individuals receiving the intervention¥  137 (75.3%)  14 (7.7%)  54 (29.7%)  65 (35.7%)  83 (45.6%) |
| **Mean number of intervention times**  Physical therapy, mean  Psychotherapy intervention, mean | 4.3 times  1.2 times | |
| **Precision medicine (N=65)**  Individuals meeting Beer’s criteria, n (%)  **Improper medications meeting Beer’s criteria (N=22)**  Anti-psychotics (Quetiapine, olanzapine), n (%)  Benzodiazepine(BZD) hypnotics (Alprazolam, triazolam, lorazepam, clonazepam), n (%)  Non-BZD hypnotics (Zolpidem), n (%)  Alpha-blocker (Terazosin), n (%)  Oral antidiabetic agents (Glimepiride), n (%)  Others (Lithium, dipyridamole, trihexyphenidyl, escitalopram), n (%) | 12 (18.5%)    2 (9%)  9 (40.9%)  2 (9%)  2 (9%)  3 (13.6%)  4 (18.2%) | |
| **Number of individuals utilizing LTC resources (N=44)**  Community development associations/ Community elderly stations, n (%)  Community dementia care centers, n (%)  District public health center / resource integration junction centers, n (%)  Community college courses, n (%)  Daycare centers, n (%) | 22 (50%)  16 (36.4%)  2 (4.5%)  3 (6.8%)  1 (2.3%) | |

**Supplementary Table 1**: Comparisons of basic characteristics of the included and excluded subjects

| **Characteristic** | **Value of included subjects** | **Value of excluded subjects** | **p-value** |
| --- | --- | --- | --- |
| Number, n | 182 | 24 |  |
| Age [years], mean (standard deviation) | 76.15 (6.95) | 76.42 (7.22) | 0.860 |
| Male sex, n(%) | 78 (42.9%) | 10 (41.7%) | 1.000 |
| Medical problems:  Dementia, n(%)  Cerebrovascular disease, n(%)  Parkinson’s disease, n(%)  Hypertension, n(%)  Diabetes mellitus, n(%)  Hyperlipidemia, n(%)  Cardiovascular disease, n(%)  Chronic kidney disease | 83 (45.6%)  34 (18.7%)  17 (9.3%)  83 (45.6%)  50 (27.5%)  71 (39.0%)  26 (14.3%)  14 (7.7%) | 24 (100.0%)  4 (16.7%)  1 (4.2%)  10 (41.7%)  5 (20.8%)  5 (20.8%)  5 (20.8%)  1 (4.2%) | <0.001  1.000  0.646  0.884  0.656  0.131  0.589  0.836 |
| Frailty status, n(%)  Frail, n (%)  Prefrail, n (%)  Robust, n (%) | 81 (44.5%)  98 (53.8%)  3 (1.7%) | 9 (37.5%)  13 (54.2%)  1 (4.2%) | 0.790 |
| Fried frail phenotypes  Weight loss, n(%)  Weakness, n(%)  Exhaustion, n(%)  Slowness, n(%)  Low physical activity, n(%) | 41 (22.5%)  123 (67.6%)  45 (24.7%)  149 (81.9%)  79 (43.4%) | 5 (20.8%)  15 (65.2%)  6 (25.0%)  19 (82.6%)  11 (45.8%) | 1.000  1.000  1.000  1.000  0.995 |

**Supplementary Table 2**: Outcomes of subgroup analysis for individuals eligible for physical therapy based on rehabilitation times (total 174 subjects)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Groups divided by rehabilitation times | | | p-value |
|  | 0 | 1-3 | 4-6 |
| Number of subjects, n | 38 | 42 | 94 |  |
| Number of subjects with improved frail status, n (%) | 9 (23.7%) | 17 (40.5%) | 45 (47.9%) | 0.03 |
| Change of ADL scores (Barthel index, points), mean (SD) | 0.00 (0.00) | -0.71 (4.63) | -0.37 (3.61) | 0.66 |
| Change of IADL (Lawton IADL Scales, points), mean (SD) | -0.42 (1.46) | -0.62 (2.36) | -0.05 (2.36) | 0.34 |
| Change of grip strength (kg), mean (SD) | 0.08 (1.82) | 0.33 (3.26) | 2.39 (3.68) | <0.001 |
| Change of gait speed (6-meters walking time, seconds), mean (SD) | -0.32 (1.10) | -0.64 (2.88) | -2.73 (3.71) | <0.001 |
| Change of exercise calories burned per week (kcal), mean (SD) | 81.96 (369.72) | 95.99 (431.81) | 103.96 (407.89) | 0.96 |
| Change of SPMSQ score (points), mean (SD) | 0.08 (1.26) | -0.07 (0.84) | 0.04 (1.15) | 0.80 |
| Change of GDS-5 score (points), mean (SD) | -0.21 (1.07) | -0.17 (0.96) | -0.45 (0.78) | 0.16 |
| Change of GDS-15 score (points), mean (SD) | -1.89 (3.66) | 0.00 (5.24) | -2.65 (3.14) | 0.37 |
| Change of MNA-SF score (points), mean (SD) | 0.26 (1.62) | 0.40 (1.21) | 0.57 (1.57) | 0.53 |

SD: standard deviation; ADL: Activity of daily living; IADL: instrumental ADL; SPMSQ: short portable mental state questionnaire; GDS-5: 5-item Geriatric Depression Scale; GDS-15: 15-item Geriatric Depression Scale; MNA-SF: Short Form Mini Nutritional Assessment

**Supplementary Table 3:** Characteristics of participants with or without improvements in frail status¶ after interventions

|  |  |  |  |
| --- | --- | --- | --- |
| Frail severity after intervention | Non-improvement individuals | Improvement individuals | p-value |
| Total number, N | 132 | 74 |  |
| Age |  |  | 0.380 |
| 60-70, n (%) | 29 (22.0) | 23 (31.1) |  |
| 70-80, n (%) | 60 (45.5) | 31 (41.9) |  |
| 80-90, n (%) | 41 (31.1) | 20 (27.0) |  |
| 90-100, n (%) | 2 (1.5) | 0 (0.0) |  |
| Male, n (%) | 56 (42.4) | 32 (43.2) | 1.000 |
| Diagnosis |  |  |  |
| Dementia, n (%) | 52 (48.1) | 31 (41.9) | 0.496 |
| Hypertension, n (%) | 45 (41.7) | 38 (51.4) | 0.256 |
| Hyperlipidemia, n (%) | 36 (33.3) | 35 (47.3) | 0.081 |
| DM, n (%) | 32 (29.6) | 18 (24.3) | 0.536 |
| CAD, n (%) | 15 (13.9) | 11 (14.9) | 1.000 |
| CKD, n (%) | 8 (7.4) | 6 (8.1) | 1.000 |
| CVD, n (%) | 25 (23.1) | 9 (12.2) | 0.094 |
| Malignancy, n (%) | 7 (6.5) | 10 (13.5) | 0.180 |
| Presence of frailty phenotype |  |  |  |
| Weight loss, n (%) | 27 (20.5) | 19 (25.7) | 0.491 |
| Exhaustion, n (%) | 26 (19.7) | 25 (33.8) | 0.038 |
| Reduced grip strength, n (%) | 92 (70.2) | 46 (62.2) | 0.304 |
| Reduced walking speed, n (%) | 105 (80.2) | 63 (85.1) | 0.483 |
| Low physical activity, n (%) | 58 (43.9) | 32 (43.2) | 1.000 |
| Intervention |  |  |  |
| Physical therapy, n (%) | 74 (56.1) | 63 (85.1) | <0.001 |
| Psychotherapy, n (%) | 10 (7.6) | 5 (6.8) | 1.000 |
| Nutrition intervention, n (%) | 35 (26.5) | 20 (27.0) | 1.000 |
| Precision medication, n (%) | 44 (33.3) | 22 (29.7) | 0.707 |

CAD: coronary artery disease; CKD: chronic kidney disease; CVD: cerebrovascular disease; DM: diabetes mellitus.

¶Improvement in frail status included subjects from frail to prefrail, prefrail to robust, or frail to robust after interventions