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Geriatric CO-mAnagement for Cardiology patients in the Hospital: a quasi-experimental study

Cardio-geriatric co-management

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Key points

- The nurse-led cardio-geriatric co-management program prevented delirium, infections and obstipation.
- There was no clinically relevant effect on functional status.

Why does this paper matter?

This first nurse-led geriatric co-management program for frail patients on cardiac care units was not effective in improving functional status, but significantly improved secondary outcomes including delirium, infections and obstipation.

Abstract

Background/Objectives: Older patients admitted to cardiac care units often suffer functional decline. We evaluated whether a nurse-led geriatric co-management program leads to better functional status at hospital discharge.

Design: A quasi-experimental before-and-after study was performed between September 2016 and December 2018, with the main endpoint at hospital discharge and follow-up at six months.

Setting: Two cardiac care units of the University Hospitals Leuven.

Participants: 151 intervention and 158 control patients aged 75 years or older admitted for acute cardiovascular disease or transcatheter aortic valve implantation

Intervention: A nurse from the geriatrics department performed a comprehensive geriatric assessment within 24 hours of admission. The cardiac care team and geriatrics nurse drafted an interdisciplinary care plan, focusing on early rehabilitation, discharge planning, promoting physical activity, and preventing geriatric syndromes. The geriatrics nurse provided daily follow-up and coached the cardiac team. A geriatrician co-managed patients with complications.

Measurements: The primary outcome was functional status measured using the Katz Index for independence in Activities of Daily Living (ADL; one-point difference was considered clinically relevant). Secondary outcomes included the incidence of ADL decline and complications, length of stay, unplanned readmissions, survival, and quality of life.

Results: The mean age of patients was 85 years. Intervention patients had better functional status at hospital discharge (8.9, 95% CI = 8.7-9.3 versus 9.5, 95% CI = 9.2-9.9; p=0.019), and

experienced 18% less functional decline during hospitalization (25% versus 43%, p=0.006). The intervention group experienced significantly fewer cases of delirium and obstipation during hospitalization, and significantly fewer nosocomial infections. At 6-months follow-up, patients had significantly better functional status and quality of life. There were no differences regarding length of stay, readmissions, or survival.

Conclusions: This first nurse-led geriatric co-management program for frail patients on cardiac care units was not effective in improving functional status, but significantly improved secondary outcomes.

Keywords: disability, functional status, activities of daily living, cardiogeriatrics, co-management

Introduction

Older patients on cardiac care units are particularly vulnerable for adverse events. Up to 60% of patients with cardiovascular disease suffer from one or more geriatric syndromes. (1) Patients who have a cardiovascular disease and a geriatric syndrome are four times more likely to suffer functional decline, two times more likely to be readmitted to hospital and two times more likely to die. (2, 3)

Despite the geriatric needs in these patients, cardiovascular care remains predominantly diagnosis-driven, focusing on the cardiovascular problem. (4) The majority of cardiovascular care guidelines often fail to consider the complex functional, psychosocial, and environmental needs of older patients. As a result, researchers and clinicians have advocated for the integration of geriatric care in the management of older patients with a cardiovascular disease. (4) While the importance of frailty, physical functioning and quality of life in cardiovascular disease management have been recognized by cardiovascular societies, (5) the majority of healthcare professionals are not adequately trained to manage the complex needs of older patients on cardiac care units. (6) There have been efforts to promote geriatric training for cardiologists, (7) but no structural programs have been implemented.

Our team proposed a different approach by implementing a geriatric co-management program on cardiac care units. These programs are characterised by a shared decision-making and collaboration between non-geriatric and geriatric teams focusing on the prevention and management of geriatric syndromes in older patients. (8) We postulated that daily interaction between a geriatrics and cardiac care team would improve knowledge, attitude and skills with the purpose of creating intrinsically motivated and sustainable change. This is in contrast with top-down strategies, e.g. educational interventions, where internalization may be less likely.

Systematic reviews have concluded that geriatric co-management reduces functional decline, complications, length of stay, and mortality rates. (8, 9) However, the evidence was limited to patients with a hip fracture. Geriatric co-management has not yet been evaluated for patients on cardiac care units.

We therefore implemented the first nurse-led geriatrics co-management program and evaluated whether it led to better functional status at hospital discharge for frail patients hospitalized on cardiac care units. Secondarily, we performed a process evaluation to determine the program's reach and fidelity. Lastly, we clarified how and for whom the program worked best.

Methods

As part of the Geriatric CO-management for ACute Hospitalisation (G-COACH) project, we used a mixed-methods multi-phase design to develop the intervention and test its feasibility. (10) The program was developed based on a systematic review with meta-analysis, (8) a contextual analysis, (11) an international Delphi study to develop quality indicators, (12) and a cohort study to develop a prediction model for hospitalization-associated functional decline. (13) The feasibility was tested in a pilot study. (14) The protocol was registered on clinicaltrials.gov (NCT02890927) and the study approved by the Medical Ethics Committee UZ KU Leuven (s59543).

Design

A quasi-experimental before-and-after study was conducted on two cardiac care units of the University Hospitals Leuven. Patients in the control group were recruited between September 2016 and June 2017. The program was implemented and patients in the intervention group were recruited between January 2018 and December 2018. (10) A consecutive sampling

strategy was used for both groups. Patients aged 75 years or older were recruited within 72 hours of admission to the participating units. They were eligible if admitted for an acute cardiovascular disease or transcatheter aortic valve implantation with a length of stay of three days or longer, and if they were testable. Patients were excluded if they were admitted from another unit or hospital or were receiving palliative care. The study was designed to measure the intervention's effectiveness in patients at high risk for functional decline or experiencing acute complications. After obtaining informed consent, trained researchers performed the baseline assessment and collected daily data until hospital discharge. This information was used to stratify patients into three groups: 1) low risk for functional decline; 2) high risk for functional decline; or 3) experiencing acute complication (see Supplemental Text S1, Supplemental Table S1, and Supplemental Table S2). Patients at low risk for functional decline were excluded from the final sample. At six months, patients were contacted for follow-up via a postal survey and telephone interview. Researchers were not involved in delivering the intervention, and all research data was collected independent of the participating clinicians.

Usual care

The control group received acute care on their cardiac care units from a multidisciplinary team consisting of a medical supervisor, two medical residents, a head nurse, several registered nurses and healthcare assistants, a physical therapist, a dietician, and a social worker. Medical rounds took place daily, and patients were discussed weekly during a multidisciplinary team meeting. Geriatric consultations could be requested on a case-by-case basis, at the discretion of the cardiac care team. A comprehensive geriatric assessment (CGA, i.e. performing a multidimensional assessment and determining a care plan) was performed. The results were documented and oral recommendations were given.

Intervention

The geriatric co-management program was implemented by a mobile geriatrics team. This included a geriatrician (0.1 FTE), a geriatrics nurse (0.5 FTE), and an occupational therapist (0.3 FTE). The participating healthcare professionals had experience working on a geriatric unit and providing geriatric consultations. Patients were visited by the geriatrics nurse within 24 hours of admission to the cardiac care unit. A geriatric assessment was performed to identify if patients were at high risk for functional decline or if they experienced acute complications. (13)

Patients at high risk for functional decline or with acute complications were included for follow-up in the co-management program until hospital discharge. This included drafting interdisciplinary care plan in collaboration with the cardiac care team. The care plan had three key components: initiation of discharge planning and physical rehabilitation within 48 hours of admission (including a patient exercise program performed independently three times a day to promote physical activity); promotion and training of self-care (in activities of daily living) by an occupational therapist; and evidence-based protocols for the prevention of geriatric syndromes and complications (see Supplemental Text S2).

The geriatrics nurse coordinating the program visited the units daily to provide follow-up, reassess patients and coach the cardiac care team in implementing the interdisciplinary care plan. The program did not focus on specific cardiovascular problems and did not alter existing cardiovascular care pathways. However, the focus was on discussing the relevant medical, functional, cognitive, psychosocial, spiritual and other geriatric needs from an interdisciplinary perspective and defining a personalized and multidimensional care plan. This was achieved

during daily bedside contacts with the cardiac care team and during a weekly interdisciplinary meeting.

The geriatrician was responsible for the management of new-onset geriatric syndromes and complications. The geriatrics nurse discussed observations with the geriatrician, who discussed the patient's care with the cardiology medical resident. A more extensive role for the geriatrician, e.g. performing daily ward rounds, was not considered feasible because of the staffing levels.

Outcomes

Our primary outcome was functional status at hospital discharge, measured using the 6-item Katz Index of independence in Activities of Daily Living (Katz ADL) with a 3-scale response scale (1 = independence; 2 = partial dependence; 3 = complete dependence). (15) The range of the scale was 6 to 18 points.

Four secondary outcomes were assessed during hospitalization: the occurrence of delirium (3D Confusion Assessment Method); (16) symptomatic nosocomial infections (clinical diagnoses); obstipation (nurse-recorded observations); and the occurrence of at least one fall incident (patient-reported or nurse-observed). At hospital discharge, seven more were assessed: decline of one or more points on the Katz ADL between hospital admission and hospital discharge (i.e. functional decline); physical performance (via the Short Physical Performance Battery); (17) grip strength (with hand dynamometer); cognitive status (via the Mini-Cog© instrument); (18) length of stay; quality of life (via the EQ-5D-3L); (19) and self-perceived health (via a Visual Analogue Scale). (19) And at the six-month follow-up, the final eight secondary outcomes were assessed: functional status (via the Katz ADL scale); survival;

unplanned hospital readmissions; institutionalization; level of community mobility (via the Life Space Assessment); (20) occurrence of falls; quality of life; and self-perceived health.

A process evaluation was performed to observe the program's reach and fidelity, i.e. the start and timing of geriatric co-management and physical therapy, completion of the exercise program, ADL training by an occupational therapist, and the absence of physical restraints.

Sample size

The sample size was calculated for patients who were at high risk for functional decline or had acute complications. We assumed a minimal important difference (MID) of one point on the Katz ADL between the intervention groups at hospital discharge, with a standard deviation of three points (based on observations in a pilot study). (11) Accounting for 10% missing data, 159 patients were needed per group (alpha = 0.05, power = 0.8, two-sided test). We aimed to recruit 227 patients per group because we expected that 30% of recruited patients would be at low risk for functional decline and not be eligible for follow-up.

Statistical methods

Baseline characteristics were described and compared between the intervention and control group to evaluate the baseline equivalence (Table 1, Supplemental Table S3). A missing data analysis was performed for baseline characteristics and outcomes (Supplemental Tables S4-7). A multiple imputation model (k = 5) was build using the fully conditional specification method for five baseline characteristics with missing data (< 6%; Supplemental Table 6). The primary outcome, functional status at hospital discharge, was evaluated using an ANCOVA model. Baseline characteristics were included in the model to account for potential confounding (Supplemental Table S8).

Logistic regression was used for dichotomous outcomes, survival analyses for time to event variables (with mortality defined as a competing risk for the outcome readmission), and ANCOVA for mean inter-group differences. Effect estimates were adjusted for baseline characteristics.

We performed two exploratory analyses. First, we hypothesized *a priori* that the intervention's effect on functional status would be higher in patients with heart failure and in those at high risk for functional decline (i.e. effect moderation, see Supplemental Text S3 for methodological details). We also hypothesized *a priori* that the effect would be higher in patients who received the main components of the program as defined in the protocols (i.e. effect mediation, see Supplemental Text S4). These hypotheses were tested by extending the ANCOVA model with subgroups for the moderator and mediator variables and testing their statistical interaction with the intervention groups. The indirect 'mediation' effect was quantified using a linear regression-based causal mediation analysis.

SPPS version 26 (SPSS Inc., Chicago, Ill., USA) and STATA version 15 IC (StataCorp. 2019, College Station, TX: StataCorp LLC) were used for the analyses. Statistical inference was based on 95% confidence intervals (CI).

Results

A total of 1976 patients were screened, of which 544 fulfilled the preliminary requirements for participation. Following risk stratification (to determine eligibility for geriatric co-management), respectively 151 and 158 remained (see Figure 1). Minor baseline differences were observed between these groups regarding cognitive status (0.4 points on a 5-point scale), anxiety symptoms (0.8 points on a 21-point scale), and multimorbidity (1.7 points on a 56-point scale) (see Table 1). At six months, 115 intervention and 121 control group patients

were available for follow-up. Characteristics of the patients lost to follow-up are described in Supplemental Table S9.

Fidelity to the intervention

The program was offered to 88.1% (133/151) of the patients assigned to the intervention group (Supplemental Table S10). A total of 80.0% received a CGA and had an interdisciplinary care plan documented in their records (122/151). This was completed within 24 hours for 51.6% (63/122) of the patients. Of the patients eligible for the co-management program, 78% (118/151) received physical therapy; 36.4% (55/151) started within 48 hours of admission. Of the 58 who experienced acute functional decline during hospitalization, 35 (60%) received ADL training by an occupational therapist. Forty percent (61/151) of co-managed patients completed the individual exercise program; 19.2% (29/151) started within 48 hours of admission; and 21.2% (32/151) performed their exercises daily; 64.9% (98/151) remained free from physical restraints (including urinary catheters).

In-hospital outcomes

At hospital discharge, patients in the geriatric co-management group were less dependent than their control group counterparts regarding ADL, indicating better functional status (Katz ADL score = 8.9, 95% CI (8.7 to 9.3) versus 9.5, 95% CI (9.2 to 9.9); p = 0.019; mean difference = -0.6 points (95% CI, -1.0 to -0.1)).

The geriatric co-management group had 18% less functional decline (95% CI, -28% to -7%; number needed to treat (NNT) = 6); a 13% lower incidence of delirium (95% CI, -6% to -20%; NNT = 8); and 10% lower incidences both of nosocomial infections (95% CI, -3% to -17%; NNT = 11) and of obstipation (95% CI, -3% to -16%; NNT = 11). There was no effect on the number of fallers, length of stay, cognitive status, short physical performance battery scores, grip

strength, quality of life or perceived health. The outcome data and adjusted effect sizes are reported in Table 2.

Post-discharge outcomes

Patients in the geriatric co-management group continued to show better functional status at six months follow-up (Katz ADL = 8.69, 95% CI (8.34 to 9.03) versus 9.42, 95% CI (9.08 to 9.75); $p < 0.001$). They also indicated a higher quality of life (EQ-5D index = 0.50, 95% CI (0.46 to 0.55) versus 0.44, 95% CI (0.40 to 0.48); $p = 0.001$), and reported 18% fewer fallers (95% CI (-29% to -7%; NNT = 6). No effect was apparent on community mobility, perceived health, survival, hospital readmissions, or institutionalization. The outcome data and adjusted effect sizes are reported in Table 3.

Moderator analyses

The effect on the Katz ADL was significantly moderated by the baseline risk for developing functional decline: patients at highest risk for functional decline showed the largest mean control-minus-intervention difference regarding Katz ADL scores: -1.4 points (95% CI, -2.3 to -0.6), in comparison with -0.2 (95% CI, -1.0 to 0.5) for those at medium and 0.1 (95% CI, 0.8 to 1.1) for those at low risk. There was also a small non-significant moderation effect for heart failure (see Figure 2)

Mediation analyses

Patients who performed their individual exercise programs daily also had a greater mean control-minus-intervention difference regarding their Katz ADL scores (-1.4 points (95% CI, -2.4 to -0.3)), compared to those who did not (-0.3 points (95% CI, -0.8 to 0.2)); however, the mediation effect was not significant (see Supplement Figure S1, Table S11). Patients who

received ADL training also had a greater mean control-minus-intervention difference regarding their Katz ADL scores (-1.0 points (95% CI, -2.0 to 0)), and demonstrated an indirect 'mediation' effect (beta = -0.21 (95% CI, -0.41 to -0.06); see Supplement Figure S1, Table S11).

Discussion

This is the first study to evaluate the effectiveness of a nurse-led geriatrics co-management program for frail older patients on cardiac care units. Patients who received geriatric co-management had better functional status at hospital discharge. A large clinical and significant effect was observed in the patient subgroup with the highest baseline risk for developing functional decline. The effect was also large and clinically significant—but not statistically significant—in patients who performed their exercise programs daily. Receiving ADL training by an occupational therapist mediated the intervention effect. Secondary effects included clinically and statistically significant reductions in functional decline, delirium, obstipation and nosocomial infections, and a higher quality of life. There was a reduction in length of stay and unplanned hospital readmissions; however, the effect was not statistically significant. There was no effect on survival.

Our results demonstrate that older patients on cardiac care units often experience geriatric syndromes and adverse events while hospitalized, (21) and that our program was effective in managing these patients' complex care needs. The value of a geriatric or frailty assessment has already been recognized for identifying high-risk patients undergoing cardiac surgery. (22) Our results add to this evidence and demonstrate that risk stratification should also be considered for non-surgical patients. And that there is a benefit of going beyond an assessment to also managing the geriatric needs. Integrating geriatric care in the management of older patients on a cardiac care unit should be common practice. (7)

The importance of geriatric care in the field of cardiology will become more important as the patients with cardiovascular disease become increasingly older. Geriatric programs are usually coordinated by geriatricians, but these are not readily available in most health systems. We therefore invested in a nurse-led co-management program as a low-cost strategy for dealing with the increasing shortage of geriatricians. This is congruent with at least two systematic reviews' conclusion that nurse-led programs improve patient outcomes. (23, 24) Furthermore, we also used a risk stratification tool, and this strategy was effective in managing the most appropriate patients while conserving limited resources. However, careful selection of prediction models and decision criteria will be key to this intervention's successful implementation. Also, while most similar programs focus on medical management and demonstrate limited effects, our interdisciplinary focus likely resulted in larger effect sizes and impacts on multiple patient-centered outcomes including functional status and quality of life.

This study will require replication in a multicenter randomized controlled trial. A formal program theory with TIDiER description developed for this purpose has been reported elsewhere. (14) Trends observed in our mediation analyses suggest that physical exercise and activity and ADL training may be important components to further optimize acute care on cardiac care units. Levels of physical activity are typically very low in hospitalized patients; and other programs promoting physical activity have demonstrated improved functional outcomes in older patients. (25) However, as we observed low fidelity to the physical exercise intervention component, additional strategies are needed to support the necessary behavioral change that promote physical activity in frail hospitalized patients.

Also, our program focused solely on hospital care. While its impact on functional status and quality of life remained at the six-month follow-up, it lacked strong beneficial effects on

readmission and mortality rates. As nurse-led transitional care programs with home visits have been effective in reducing both of these, (26, 27) merging co-management and transitional care programs could very well increase the benefits of both.

Our results are in line with a larger body of evidence regarding ortho-geriatric co-management. After decades of research, implementation programs, e.g. AGS CoCare, are now emerging. (28) Our results confirm that there is value to co-management outside of orthogeriatrics, and that implementation to other frail hospital populations should be considered. Although there are still questions about the most effective way to organize co-management, we believe that the main concepts of the care program are effective. Hybrid studies who focus both on implementation and effectiveness measures can therefore be considered to facilitate the scaling up of effective geriatric care.

This study should also be considered within the larger body of evidence of CGA for older patients in the hospital. Results between programs have been inconsistent, and in particular consultation programs have failed to demonstrate consistent improvements in outcomes. (29) The amount of control over the implementation of geriatric protocols has been cited as an important factor for the effectiveness of CGA. (29) Our program provided CGA to a group of high-risk patients from admission to discharge with daily follow-up and coordination of a care plan by a geriatric nurse, that, likely created a new standard of geriatric care, which ad hoc consultation programs fail to do. However, the effectiveness should also be considered within the specific context of the evaluation. The program was extensively developed to ensure acceptability and feasibility. Furthermore, the program was delivered using a multifaceted implementation strategy, described elsewhere, (10, 14) and was performed by an experienced

geriatric team. All these elements are likely important determinants when considering the generalizability.

Study limitations

A priori, we defined that a 1.0 point difference on the Katz ADL would indicate a clinically significant effect. However, we observed a difference of 0.6 points in the full sample and only observed a clinically relevant difference in patients at high risk for functional decline. However, recent research has demonstrated that a difference of 0.5 points is clinically relevant. (30) There were small imbalances in baseline characteristics between the intervention and control group for patients included in the primary analysis, and for those lost to follow-up. Baseline characteristics were included in the analysis to control for potential confounding; propensity scores were used to create balanced subgroups for moderation and mediation analyses. These subgroup analyses suggest a dose-response causal relationship of our intervention; but the sample size was insufficient to generate precise estimates. The generalizability may be limited because we recruited our patient sample in a single academic center with an experienced geriatrics team. However, this sample is certainly representative of frail older patients on cardiac care units.

Conclusion

A nurse-led geriatric co-management program for frail patients on cardiac care units was not effective in improving functional status, but significant improvements on secondary outcomes were observed. The program prevented functional decline and complications, and resulted in a lasting increase in quality of life. Patients with the highest risk for functional decline demonstrated the largest benefits. Replication in a randomized controlled multicenter trial is recommended.

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Figures

Figure 1. Flowchart

Legend: Patients aged 75 years or older and admitted for acute cardiovascular disease or transcatheter aortic valve implantation (TAVI) were recruited for the study. * Risk stratification determined whether patients were eligible for geriatric co-management, i.e. at risk for functional decline or with acute complications.

Figure 2. Moderator analyses

The plot depicts two subgroup analyses for the outcome Katz ADL score (scale = 6 – 18 points) on hospital discharge based on A) the baseline risk for developing functional decline, and B) the presence of heart failure. Data are adjusted for baseline characteristics. Statistical interaction terms were added to test the significance of the effect moderation. The plot indicates that the co-management program was more effective in patients with a high risk for functional decline, in comparison with patients with a low or moderate risk. The program was not more effective in patients with heart failure.

Tables

Table 1. Baseline characteristics of patients included in the study

Baseline characteristics	**Control (n = 158)**	**Intervention (n = 151)**	**p-value**
Age, mean (SD)	84.9 (4.8)	84.5 (5.2)	p = 0.482
Male gender, n (%)	82 (52)	82 (54)	p = 0.672
Living situation, n (%)			p = 0.895
Home	140 (89)	131 (87)	
Retirement home	5 (3)	4 (3)	
Nursing home	13 (8)	13 (9)	
Reason for hospital admission, n (%)			
Heart failure	60 (38)	65 (43)	p = 0.055
Valvular heart disease	5 (3)	3 (2)	
Ischemic heart problem	16 (10)	4 (3)	
Heart rhythm disorders	22 (14)	15 (10)	
Transcatheter Aortic Valve Implantation	38 (24)	39 (25)	
Other	17 (11)	25 (17)	
Katz ADL (6 – 18), mean (SD)			

Two weeks before admission	8.6 (2.3)	8.6 (2.6)	p = 0.981
On hospital admission	9.0 (2.7)	9.6 (3.1)	p = 0.072
Mini Cog (0 – 5), mean (SD)	2.8 (1.5)	2.4 (1.5)	p = 0.032
Geriatric Depression Scale (0 – 10), mean (SD)	2.6 (2.3)	2.2 (2.3)	p = 0.163
Anxiety * (0 – 21), mean (SD)	4.2 (3.6)	3.4 (3.3)	p = 0.043
Mini Nutritional Assessment (0 – 14), mean (SD)	8.9 (2.4)	8.8 (2.4)	p = 0.790
Life Space Assessment (0 – 120), mean (SD)	39.9 (26.0)	39 (22.6)	p = 0.779
Short Physical Performance Battery (0 – 12), mean (SD)	3.8 (3.5)	4.1 (3.3)	p = 0.444
Grip strength (mmHg), mean (SD)	20.3 (9.5)	19.8 (7.6)	p = 0.624
Cumulative Illness Rating Scale (0 – 56), mean (SD)	20.9 (5.9)	19.2 (5.2)	p = 0.007
Number of medications, mean (SD)	8.8 (3.7)	9.2 (3.6)	p = 0.280

Legend: Underlined values indicate the best scores on the respective scales. * The Anxiety subscale of the Hospital Anxiety and Depression Scale was used; Abbreviations: SD = Standard Deviation; ADL = Activities of Daily Living

486 ***Table 2. Outcomes and effect of co-management during hospitalization***

Outcome	**Control group**	**Intervention group**	**Effect size (95% CI)**	**P value**
Functional status (Katz ADL), mean (95% CI)	9.55 (9.2 to 9.9)	8.99 (8.7 to 9.3)	MD = -0.56 (-1.0 to -0.1)	0.019
Functional decline (Katz ADL), n (%)	68/158 (43.0)	38/151 (25.2)	OR = 0.5 (0.3 to 0.8)	0.006
Grip Strength (mmHg), mean (95% CI)	20.2 (19.6 to 20.8)	20.3 (19.6 to 20.9)	MD = 0.1 (-0.4 to 0.6)	0.887
Physical Performance (SPPB), mean (95% CI)	4.6 (4.2 to 4.9)	4.7 (4.3 to 5.1)	MD = 0.1 (-0.2 to 0.4)	0.700
Delirium (3D CAM), n (%)	30/158 (19.0)	9/151 (6.0)	OR = 0.3 (0.1 to 0.7)	0.003
Nosocomial infections, n (%)	26/158 (16.5)	10/151 (6.6)	OR = 0.3 (0.1 to 0.6)	0.003
Obstipation, n (%)	23/158 (14.6)	7/151 (4.6)	OR = 0.3 (0.1 to 0.9)	0.026
Number of fallers, n (%)	13/158 (8.2)	12/151 (8.0)	OR = 0.6 (0.2 to 1.8)	0.397
Cognitive status (Mini-Cog), mean (95% CI)	2.9 (2.7 to 3.1)	2.8 (2.6 to 3.0)	MD = -0.1 (-0.3 to 0.0)	0.376

Quality of life index (EQ-5D), mean (95% CI)	0.52 (0.5 to 0.6)	0.55 (0.5 to 0.6)	MD = 0.03 (-0.01 to 0.08)	0.146
Perceived health (VAS), mean (95% CI)	65.8 (63.2 to 68.4)	65.1 (62.3 to 67.9)	MD = -0.7 (-2.6 to 1.2)	0.729
Length of stay (days), mean (95% CI)	9.4 (8.5 to 10.3)	8.9 (8.0 to 9.8)	MD = -0.5 (-1.8 to 0.8)	0.426

Legend: Effect sizes are based on ANCOVA and logistic regression models with adjustment for baseline characteristics: age, gender, functional status two weeks before hospital admission and on hospital admission (Katz ADL), level of community mobility (Life Space Assessment), physical performance (Short Physical Performance Battery, grip strength), cognitive status (Mini-Cog), multimorbidity and severity (Cumulative Illness Rating Scale), number of medications, depressive symptoms (Geriatric Depression Scale), anxiety symptoms (anxiety subscale of the Hospital Anxiety and Depression Scale), and nutritional status (Mini Nutritional Assessment). Abbreviations: MD = Mean Difference; OR = Odds Ratio's; CI = Confidence Intervals; ADL = Activities of Daily Living; SPPB = Short Physical Performance Battery; IQR = Interquartile range;

495 ***Table 3. Outcomes and effect of co-management at 6-month follow-up***

Outcome	**Control group**	**Intervention group**	**Effect size (95% CI)**	**P value**
Functional status (Katz ADL), mean (95% CI)	9.42 (9.1 to 9.8)	8.69 (8.3 to 9.0)	MD = -0.73 (-1.0 to -0.4)	0.004
Community mobility (Life Space Assessment), mean (95% CI)	41.6 (38.5 to 44.8)	41.2 (37.9 to 44.5)	MD = -0.4 (-3.3 to 2.5)	0.857
Quality of life index (EQ-5D), mean (95% CI)	0.44 (0.4 to 0.5)	0.50 (0.5 to 0.6)	MD = 0.06 (0.02 to 0.10)	0.029
Perceived health (VAS), mean (95% CI)	62.9 (59.7 to 66.1)	63.5 (60.4 to 66.7)	MD = 0.6 (-2.3 to 3.5)	0.798
Number of fallers, n (%)	47/119 (39.5)	24/113 (21.2)	OR = 0.5 (0.3 to 0.9)	0.016
Time to death, median (IQR)	187 (8)	186 (10)	HR = 1.1 (0.6 to 2.0)	0.883
30-day readmission rate, n (%)	25/142 (17.6)	17/135 (12.6)	OR = 0.7 (0.3 to 1.5)	0.299
Time to readmission (days), median (IQR)	153.5 (144)	180 (151)	SHR = 0.9 (0.7 to 1.3)	0.519

Institutionalization, n (%)	9/121 (7.4)	8/112 (7.1)	OR = 1.2 (0.4 to 4.0)	0.752

Legend: Effect sizes are based on ANCOVA, survival analysis and logistic regression models with adjustment for baseline characteristics: age, gender, functional status two weeks before hospital admission and on hospital admission (Katz ADL), level of community mobility (Life Space Assessment), physical performance (Short Physical Performance Battery, grip strength), cognitive status (Mini-Cog), multimorbidity and severity (Cumulative Illness Rating Scale), number of medications, depressive symptoms (Geriatric Depression Scale), anxiety symptoms (anxiety subscale of the Hospital Anxiety and Depression Scale), and nutritional status (Mini Nutritional Assessment). The reported means are the marginal estimated means from the ANCOVA model. Abbreviations: MD = Mean Difference; OR = Odds Ratio's; CI = Confidence Intervals; ADL = Activities of Daily Living; SPPB = Short Physical Performance Battery; IQR = Interquartille range; SHR =subdistribution hazard ratio.

Supplemental materials