Aus dem Zentrum für Innere Medizin der Universität zu Köln
Klinik und Poliklinik für Innere Medizin II der Universität zu Köln
Direktor: Universitätsprofessor Dr. med. Th. Benzing

"'Vun nix kütt nix' – Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management"

Role of self-esteem and depression on the prognosis of older hospitalized patients

Inaugural-Dissertation zur Erlangung der Doktorwürde
der Medizinischen Fakultät
der Universität zu Köln

vorgelegt von
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aus Düren

promoviert am 28. Februar 2024

Gedruckt mit Genehmigung der Medizinischen Fakultät der Universität zu Köln
2024

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Die auf der Krankenstation 17.1 der Klinik II für Innere Medizin durchgeführten Untersuchungen im Rahmen der „*Vun nix kütt nix“*-Studie habe ich unter Aufsicht der Oberärztin Frau Universitätsprofessorin Dr. med. Dr. M. Cristina Polidori Nelles und der Stationsärztin Dr. med. Anna Maria Meyer gemeinsam mit den Promotionsstudentinnen Anne Ferring, Jill Stegemann und Laura Wiebe vorgenommen. Die im Rahmen der Studie durchgeführten telefonischen Nachbeobachtungen wurden durch Anne Ferring, Jill Stegemann, Laura Wiebe und mich vorgenommen.

Die Anleitung zur von mir selbst durchgeführten statistischen Auswertung der Daten erfolgte durch Frau Ingrid Becker. Das dieser Arbeit zugrundliegende Paper „S*elf-esteem is associated with health status and PROMs in advanced age independent of multidimensional frailty: secondary analysis from a RCT with 6 months follow-up”* befindet sich derzeit im Einreichungsprozess. Die in Kapitel 5.1 und 6.1 dargestellten Hauptergebnisse der dieser Arbeit zugrundeliegenden Studie wurden in der Publikation „A Tailored Discharge Program Improves Frailty and Mood in Patients Undergoing Usual Rehabilitative Care: A Randomized

Controlled Trial“ in der Zeitschrift Journal of the American Medical Director Association durch Dr. med. Anna Maria Meyer etl al. verfasst.

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Danksagung

Zuallererst möchte ich mich bei allen Patienten bedanken, die sich bereit erklärt haben an dieser klinischen Studie teilzunehmen. Ihre Bereitschaft, sich Zeit für unsere Studie zu nehmen während einer Phase der akuten Erkrankung, hat mich tiefgehend beeindruckt. Zu Beginn meiner Doktorarbeit hätte ich nicht gedacht, dass mich diese Gespräche in meinem beruflichen Werdegang als Ärztin nachhaltig prägen werden.

Ausdrücklich möchte ich meiner Doktormutter Frau Prof. Dr. Dr. Polidori danken. Die Leidenschaft, mit der Sie Ihre Arbeit bewältigen, ist mir ein Vorbild und hat mich auf dem Weg meiner Dissertation immer wieder motiviert. Sie haben mich gefordert, aber auch gefördert und mir einen intensiven Einblick in die wissenschaftliche Forschung ermöglicht. Wenn ich auch nicht den Weg in die Geriatrie eingeschlagen habe, prägen Ihre Ideen und Forschungsansätze meinen beruflichen Werdegang. Dafür bin ich Ihnen sehr dankbar.

Ein weiterer Dank gilt Dr. Anna Maria Meyer. Ohne dich wäre ich wahrscheinlich nicht auf die Studie und Forschungsgruppe aufmerksam geworden. Dein unermüdlicher Einsatz, Forschung und den Berufseinstieg unter einen Hut zu bringen, hat mich zutiefst fasziniert. Ich bin sehr dankbar für die Erfahrung, dich bei dem Aufbau der Station der Universitären Altersmedizin begleitet zu haben. Zudem gilt mein Dank allen Coautoren des Papers, besonders Frau Becker, für Ihre Geduld und Unterstützung bei der statistischen Beratung und Laura, für die gemeinsame Arbeit auf der Station. Anne und Jill, ihr habt mir gezeigt, was Freundschaft und gegenseitige Unterstützung bedeutet. Mit niemandem hätte ich lieber diesen Weg gehen wollen.

Mama und Papa, eure bedingungslose Liebe und Unterstützung haben es mir ermöglicht, erfolgreich zwei Studiengänge abzuschließen. Dafür danke ich euch aus tiefstem Herzen.
Felix, Sabine, Laura, Channi, Nicole, Dshamilja und all diejenigen, die ich namentlich nicht erwähnen kann, vielen Dank für euren unerschütterlichen Optimismus und eure emotionale Unterstützung.

Zu guter Letzt danke ich meinem Mann Conny, für deine endlose Geduld und Liebe und dass du mir zeigst, was wirklich wichtig ist im Leben - mit dir werde ich gerne alt.

Für Opa Josef und Felix,
meine beiden ewigen Enzyklopädien.

CONTENTS

Abbreviations

ADL	Activity of Daily Living
ANOVA	Analysis of Variance
CGA	Comprehensive Geriatric Assessment
CIRS	Cumulative Illnes Rating Scale
DRG	Disease Related Groups
e.g.	exempli gratia
ESS	Exton Smith Scale
EQ-5D-5L	European Quality of Life 5 Dimensions 5 Level
GDS	Geriatric Depression Scale
GP	General Practitioner
HRQoL	Health-related quality of life
IADL	Instrumental Activities of Daily Living
i.e.	id est
ICD	International Statistical Classification of Diseases and Related Health Problems
ICF	International Classification of Functioning, Disability and Health
MNA-SF	Mini Nutritional Assessment Short Form
MPI	Multidimensional Prognostic Index
PCS	Post-COVID syndrome
PROMs	Patient-Reported Outcome Measures
RSES	Rosenberg Self-Esteem Scale
SARS-CoV-2	Severe acute respiratory syndrome coronavirus type 2
SPMSQ	Short Portable Mental Status Questionnaire
TIDP	Tailored Intersectoral Discharge Program
VAS	Visual Analogue Scale
WHO	World Health Organization

1. Deutsche Zusammenfassung

Während die Bevölkerung immer älter wird, ist es das Ziel die Zahl der behinderungsfreien Lebensjahre älterer Menschen möglichst hochzuhalten, um einerseits die Morbidität und Mortalität in der Bevölkerung zu verringern, andererseits die Lebensqualität zu steigern. Im Rahmen der Verlagerung des Schwerpunkts von der krankheitsspezifischen Versorgung auf die individuelle Gesundheitsversorgung zur Verbesserung der Behandlung älterer multimorbider Patienten liegt ein besonderer Fokus auf dem biopsychosozialen Krankheitsmodell, das von einem Wechselspiel von biologischen, sozialen und psychologischen Faktoren bei der Entstehung von Krankheiten ausgeht. Psychische Probleme und auch ein mangelndes Selbstwertgefühl können Einflüsse auf den Verlauf und Krankheitsprognose nehmen, die mit Hilfe von patientenbezogenen Ergebnissen (Patient-Reported Outcome Measures PROMs) gemessen und damit die klinische Entscheidungsfindung unterstützt werden. Umfassende geriatrische Assessments (Comprehensive Geriatric Assessment CGA) dienen als Goldstandard in der Altersmedizin und Geriatrie zur Erfassung der interdisziplinär und multidimensional gemessenen Frailty, um den diagnostischen Prozess, der Behandlungsplanung und der Langzeitprognose älterer multimorbider Patienten zu unterstützen. Auf der Grundlage des CGA wurde der Multidimensionale Prognostische Index (MPI) als Instrument entwickelt, um physische, psychische, funktionelle und soziale Aspekte älterer, multimorbider Patienten zu erheben und damit einen Risikoindex der Mortalität, Rehospitalisierung und Institutionalisierung zu prognostizieren. Die Komplexität älterer, multimorbider Patienten und der Einfluss solcher psychologischen Faktoren wie der Selbstwert und die Depression auf die Prognose älterer Patienten, die mit dem hochgradig prädiktiven Wert des MPI auf der Grundlage des CGA gemessen wird, ist jedoch noch nicht ausreichend erforscht worden.

Ziel der vorliegenden Dissertation war es herauszufinden, welchen Einfluss psychologische Aspekte wie der Selbstwert, gemessen anhand der Rosenberg Selbstwertskala (Rosenberg's Self-Esteem Scale RSES) auf die Prognose älterer multimorbider Patienten haben und welche psychologischen Auswirkungen bei älteren Patienten zu Beginn der Pandemie messbar waren.

Die Datenbasis der vorliegenden Dissertation bildet die Interventionsstudie *"'Vun nix kütt nix' - Patient, Geriater und Hausarzt als multiprofessionelles Team für ein intersektorielles Entlassmanagement".* Dieses maßgeschneiderte sektorübergreifende Entlassungsprogramm (tailored intersectoral discharge program TIDP) als Intervention umfasste den Kontakt mit dem

behandelnden Hausarzt, um den weiteren Behandlungsplan zu besprechen, eine strukturierte medizinische und lebensstilbezogene Beratung für Patienten und Betreuer bei der Aufnahme sowie ein Entlassungsprogramm mit Internisten, Geriatern und Hausärzten, die gemeinsam mit den Patienten Entscheidungen treffen, um die intersektorielle Zusammenarbeit zu optimieren und deren Einfluss auf die Rehospitalisierung älterer, multimorbider Patienten zu messen. In einer Sekundäranalyse dieser randomisierten Kontrollstudie sollte der Einfluss von psychologischen Faktoren, insbesondere des Selbstwerts, respektive die positive oder negative Einstellung einer Person zu sich selbst und die Gesamtbeurteilung ihres Wertes und ihrer Bedeutung[1] und Depression auf den Gesundheitszustand und die Prognose älterer Patienten ermittelt werden.

Durch die „*Vun nix kütt nix“*-Studie konnte gezeigt werden, dass zwar keine signifikante Reduzierung der Rehospitalisierung durch die Intervention erreicht werden konnte, jedoch Verbesserung der Prognose anhand des MPIs, des Selbstwerts und Depressionssymptomen als sekundäre Endpunkte gemessen wurden. Darüber hinaus konnte in einer Sekundäranalyse gezeigt werden, dass das Selbstwertgefühl in engem Zusammenhang mit Gebrechlichkeit (engl. frailty) steht und ein potenzieller Prädiktor für gesundheitsbezogene Ergebnisse im fortgeschrittenen Alter ist. In Anbetracht seiner Bedeutung für PROMs könnte die Bewertung des Selbstwertgefühls in der klinischen Praxis für die gemeinsame Entscheidungsfindung hilfreich sein. Einhergehend mit der Rekrutierung vor und während der COVID-19 Pandemie konnten auffälligere depressive Symptome gemessen mit der Geriatrischen Depressionsskala (GDS) nach Beginn der Pandemie gezeigt werden.

Perspektivisch sollten diese Ergebnisse dafür genutzt werden, weitergehende Studien über sowohl die Verbesserung der intersektoriellen Zusammenarbeit zwischen stationärem und ambulantem Setting als auch den Einfluss psychologischer Aspekte wie der Selbstwert und Depressionen auf die Krankheitsprognose zu initiieren. Durch ein allumfassendes Bild der Ressourcen und Syndrome der geriatrischen Patienten sollte eine bestmögliche, individuelle Behandlungsplanung ermöglicht werden, um somit der Herausforderung der älter werdenden Gesellschaft entgegenzutreten und gesundes Altern zu fördern.

Im folgenden Text wird bei der Bezeichnung von Personen oder Personengruppen nur die männliche Form verwendet. Dies geschieht lediglich im Dienste einer besseren und flüssigeren Lesbarkeit und schließt selbstverständlich sowohl männliche als auch weibliche Personen kontextuell mit ein.

2. Introduction

"It's not how old you are. It's how you are old." – Jules Renard (1864-1910)[2]

The size of the population aged 60 years and older is steadily growing, and thus it the increasing number of older patients at risk of functional decline is a major challenge for health care systems in the twenty-first century.[3] While people are getting older, the main challenge is to keep the number of disability-free years as high as possible to reduce morbidity and mortality and increase quality of life in the older population.[4] Functional integrity in everyday life tasks can minimize the need for nursing care dependence and plays an important role in patients' prognosis.[5,6] Unfortunately, important determinants of functional independence such as psychosocial factors are often neglected in high-performance medicine of older patients, who often undergo rehospitalizations and suffer from disability.[7] In this context, frailty is one of the key concepts of Geriatric Medicine, describing an increased vulnerability resulting from external stress factors and functional decline over the course of one's life.[8] Due to the reduced physiological reserve, several physiological systems are affected, which is associated with an increased risk of disability, hospitalization and death.[9] This process is not part of the normal aging process, but rather an extreme form.[10] An established way of diagnosing and treating the older patients in their biopsychosocial dimensions and assessing frailty is the use of a Comprehensive Geriatric Assessment (CGA).[11,12] The CGA-based measurement of the Multidimensional Prognostic Index (MPI) - currently the most reliable and highly validated tool for calculating mortality risk - enables quantifying patients' multidimensional frailty and prognosis.[5,13-16]

The complexity of multimorbid patients in treatment planning[17,18] as well as the continuation of treatment after discharge from hospital[19] pose particular challenges. According to the biopsychosocial model of disease,[20] in addition to biological and social factors, psychological features such as coping skills, self-esteem and mental health profoundly influence health trajectories, especially with increasing age. Most recently, the observed replicable association between mitochondrial DNA copy number (mtDNAcn) and personality is being considered in support of the hypothesis that mtDNAcn is a biomarker of the biological process that explains the association between personality and mortality to some extent.[21] Within this frame, the patient's perspective and the effectiveness of treatments are measured using patient-reported outcome measures (PROMs), which may well support clinical decision-making.[22,23] While literature indicates the prognostic signature of PROMs concerning health-related quality of life (HRQoL), measured by the European Quality of Life 5 Dimensions 5 Levels (EQ-5D-5L),[24,25] a

tailored intersectoral discharge program (TIDP) has been recently shown to improve self-confidence as part of self-esteem together with frailty and prognosis in older inpatients undergoing high-performance medicine and usual rehabilitative treatment.[26] Among psychological factors, self-confidence, self-efficacy and self-esteem - peaking at the age of 60 and subsequently declining[27] - play an important role in the health course. Low self-esteem is a risk factor for depression[28] and results in a lower quality of life,[29] while higher self-efficacy and self-esteem are associated with lower health risks and better health in general.[30,31] However, a substantial lack of information on the prognostic role of personality traits and psychological factors such as self-esteem in patients with or at risk of frailty is visible and the relationship between self-esteem, frailty and prognosis in older patients has not yet been sufficiently researched.

Therefore, this thesis first briefly presents the main results of the underlying study *"'Vun nix kütt nix' - Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management"* which investigated whether a TIDP on the intervention can optimize the patient's inpatient-outpatient transition with the support of intersectoral teamwork between the patient, geriatrician and treating general practitioner (GP) to ascertain whether the treatment of older, multimorbid patients is improved by joint clinical decision-making. In a secondary analysis of this randomized control trial, the aim was to explore the relationship between self-esteem, frailty and depression in older patients' health status and prognosis.

The introduction of this thesis aims to provide an overview of current geriatric medicine and the shift towards a patient-centered approach taking into account the biopsychosocial model of diseases, as well as presenting the interface gap in treatment planning from inpatient to outpatient care. In addition, geriatric measurement tools like the CGA and MPI are introduced. Furthermore, based on a definition overview of the self-concept, psychological influencing factors of geriatric patients is presented. A special focus is placed on the current COVID-19 pandemic.

After presenting the research gap, the method of the study *"'Vun nix kütt nix' - Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management"* - on which the work is based - is described and the results of the study and the secondary analyses is presented.

Subsequently, the results are critically discussed against the background of current research literature, the study limitations are presented and an outlook for further research is offered.

2.1. Geriatric Medicine

2.1.1. The biopsychosocial model of disease

"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." [32]

This WHO definition of health emphasizes the strong influence of biopsychosocial factors on the interaction of health and diseases. Starting with the Scientific Revolution in the 16th and 17th centuries, the biomedical model previously served as an explanatory approach for the development of diseases.[33] The reductionist approach followed at the time perceived the mind and body as separate phenomena, attributing diseases to physical causes and considering disorders of the psyche as separate and unrelated problems.[34] On the other hand, according to the social model, diseases are caused by social circumstances that also promote health.[35]

The psychosocial model is a concept that emphasizes the interactions between psychological and social factors in the emergence and progression of human behavior and well-being. This was predominantly determined in the 1950s and 1960s by the developmental psychologist and psychoanalyst Erik Erikson, who viewed human development as coping with tasks and conflicts of different stages.[36,37] It comprises eight stages, from infancy to adulthood, whose developmental and coping tasks contribute to the formation of personality and identity. The model illustrates how individual psychological processes and social conditions are interrelated and influence each other.

With the biopsychosocial model of disease in 1977, Engel attempted to combine the previous models. It explains the individual, interacting influences on the development of disease: in addition to biological factors (physical health, genetic predispositions), psychological categories (coping skills, self-esteem, mental health) and social categories (peers, family relationships) were discussed as determinants of health beyond disease.[20] Health and disease are not viewed as dichotomous entities but rather end points defined by the time of occurrence, chronicity and impact on functioning in everyday life.[38] In this model, individuals are considered to play an active role in maintaining and promoting their health, and medical decisions also

depend on the extent of subjective complaints of the patients, which can be explained multifactorially by the biopsychosocial model.[38]

Ten years later, the development of the CGA by Rubenstein tried to implement a tool in response to the high complexity and multimorbidity of geriatric patients by focusing not only on the disease itself but also on the psychological and functional capability.[12] Moreover, the World Health Organization (WHO) reacted to the complex model of disease by implementing the International Classification of Functioning, Disability and Health (ICF) in 2001, describing the functional state of health, disability, social impairment, and the relevant environmental factors of people.[39] The usual rehabilitative care was introduced in the German health care system in 2001, based on the ICF and used in geriatric settings,[40,41] with reimbursement within Disease Related Groups (DRGs). This usual rehabilitative care includes the implementation of a CGA and a standardized number of goal-oriented physical, occupational, speech, cognitive and nutritional therapy sessions in addition to acute medical treatment over 7 to 21 hospital days.[40,41] Further geriatric complex interventions focus on the multidimensionality of diseases and an interdisciplinary teamwork to improve prognosis and meet individuals' needs and preferences.[42]

However, there is currently a clear separation from the ICF and the International Statistical Classification of Diseases and Related Health Problems (ICD), and a merging of the two models to account for the interaction of different factors of multimorbidity has not yet taken place.[43] It remains to be seen to what extent the clinical introduction of the ICD-11 will succeed in this fusion and a multidimensional approach. It is necessary to consider social factors such as poverty - which can prevent affordable medical access - in the development of the disease as well as molecular processes as part of the biological explanation.[35] Further, in the current S1 guideline on multidimensional geriatric assessments, psychological aspects are still given little consideration apart from depression.[44] Studies are needed to generate evidence and to meet this complex challenge in future S3 guideline developments, integrating biomolecular structures and psychosocial aspects into geriatric assessment to improve the treatment of older multimorbid patients.

The object of the present thesis routes in the above-described concepts such as the biopsychosocial model, CGA and ICF and aims to consider the biopsychosocial model of disease and how it can be used in geriatric treatment.

2.1.2. Patient-centered approach: A paradigm shift

The shift from disease-focused medicine to patient-centered care allows patients to actively participate in the decision-making process and treatment planning and focuses on individual health care needs considering the interplay of biological and non-biological factors of an aging population.[45] It is therefore necessary to recognize the needs of patients, and this also requires communication skills from all involved. In addition, nurses and physicians face different requirements due to focusing on the needs and demands of patients, which are presented - inter alia - below.

The paradigm shift started in the last century and is evidenced by the fact that "analysis of contemporary nursing knowledge revealed that theorists of the 20th century developed their conceptual models, grand theories, and middle-range theories with the person as the central focus".[46] In the 1980s, the Picker Institute, along with researchers at Harvard Medical School, developed eight principles of patient-centered care, which popularized patient-centered care. These principles were published in the book *Through the Patient's Eyes*.[47] The first principle is *respect for patients' values, preferences and expressed needs*, which involves the patient in the decision-making process while respecting people's choices and preferences considering their sociocultural background. The second principle concerns *coordination and integration of care*. To reduce vulnerability, coordination of clinical care, support service and frontline patient care is imperative. *Information, communication and education* are the focus of the third principle. Patients need free and accessible information to help them to manage their clinical status, prognosis, care process, and promote their autonomy. The fourth principle involves *physical comfort,* which includes both the hospital environment and pain management. The fifth principle of *emotional support and alleviation of fear and anxiety* combines a multidimensional approach and focuses on the patient's emotional needs, including anxiety about the diagnosis, prognosis, the financial impact of the disease and the impact on their social lives. The sixth principle is the *involvement of family and friends*. The importance of family and friends to the healing and wellbeing process must be recognized by identifying the family's and friends' needs, offering support and involving them in the decision-making processes. *Continuity and transition* focus on the discharge management, providing patients with information, coordinating subsequent treatment and medication and ensuring smooth transitions. The final principle is *access to care,* which includes the ambulatory care system, ease of scheduling appointments and availability of appropriate specialists. [48,49]

Mead and Bower propose five key conceptual dimensions of patient-centeredness: the *biopsychosocial perspective*, to understand the patient's illness experience within a broader biopsychosocial framework; the *patient-as-person*, to understand the individual illness experience; *sharing power and responsibility*, to share medical power and support patient autonomy; the *therapeutic alliance*, where a positive emotional relationship between patient and physician can lead to improved treatment adherence; and the *doctor-as-a-person,* focusing on the physician's subjective influence on treatment and the growing affective relationship between the patient and physician.[50]

Other studies have focused on effective communication, partnership (between patients and clinicians) and health promotion as the key components of patient-centered care processes.[51] In this context, health promotion can be defined as the development of health care plans based on prior health care experiences and the patient's health history with the goal of reducing risk and improving health.[52] In this context, basic structures of the course of treatment, the duration of treatment and the treatment services have been defined for early rehabilitative complex services, although there is a lack of defined quality assurance.[41] There is also a lack of criteria for the need for acute inpatient hospital treatment for geriatric patients, taking into account the foreseeable acute medical stability of patients in the context of geriatric hospital treatment and economic aspects.[41]

Geriatric medicine is at the forefront of patient-centered medicine, shifting the focus away from disease-focused medicine. The dimensions mentioned above - such as the involvement of family members who frequently accompany their relatives to medical appointments, as well as good communication and special needs at this stage of life - need to be urgently addressed in geriatric medicine and health care planning. Working in an interdisciplinary setting to coordinate clinical care and ensure smooth discharge management can be a challenging task. However, the benefits of patient-centered care include better health outcomes, greater patient satisfaction and lower health care costs.[53]

2.1.3. The intersectoral gap in the care of geriatric patients

Demographic change is one of the greatest challenges of this century among climate change, migration, urbanization, mobility, informality, financial resources, mental health and pandemics.[54] People are getting older, but this also means an increase in the number of advanced-aged people who require treatment from the healthcare system. There are currently five million people in Germany over the age of 80, with 82% of those over 85 being multimorbid.[55] The high burden of disease associated with aging can lead to complications, secondary diseases[56] and severe functional limitations, which in turn leads to increased use of the healthcare system[17] and prolonged hospital stays[18]. As a result, immense costs are incurred,[55] especially when medical care is not provided according to the needs of patients, but focuses on disease-centered interventions and the shortest possible length of hospital stay, which in turn leads to a higher risk of readmissions.[7]

The healthcare system has a high risk potential for inefficiencies and both over- and undertreatment. This applies in particular to the interface between acute inpatient and outpatient care. The complex medical care situation of multimorbid patients poses a particular challenge. For example, follow-up treatment of older patients is particularly challenging, requiring a narrow time window for physicians and both intra- and intersectoral cooperation. A lack of cooperation between inpatient and outpatient settings to follow up on medication and other treatment goals due to lack of time and accessibility are problems of this intersectoral gap. Inadequate communication between inpatient and outpatient settings has already been observed.[57] Physicians from acute care hospitals complain that referral letters from GP are inadequate in content, lack support or do not exist at all,[58-61] while GP physicians criticize the lack of content in discharge letters, a lack of support and the fact that decisions are made without their knowledge.[59,62-64] Geriatric patients often present multiple geriatric syndromes and health problems, not all of which can be treated in the acute setting. Therefore, a structural transition from the hospital to the GP and a smooth follow-up hold strong importance.

Active transitional care for acutely hospitalized patients is imperative to facilitate patient stabilization.[19] An *Entlassmanagement* framework agreement between the GKV-Spitzenverband and the German Hospital Association was published in October 2017.[65] It contains the notion that the discharging hospital must organize further medical treatment, nursing care, assistance in everyday life, as well as outpatient rehabilitation, medication and contact with other service providers. Frequent communication among the interdisciplinary team, including the patient and family along with post-acute care and primary care providers

seems necessary to reduce readmissions and increase adherence with discharge recommendations.[66] The patient should be involved in this process through structured instructions and the provision of information and exercise material, as he often does not receive any information about a healthy lifestyle or a self-help explanation for recovery.[67,68] However, this is more of a theoretical ideal than a practical reality, given that there is usually insufficient time for detailed assessments, physicians claim that discharge management is not adequately reimbursed[69] and there is little evidence on the impact of TIDPs.[70,71]

One approach to address and improve this situation is the usual rehabilitative care introduced in the German health care system in 2001, based on the WHO framework of the ICF[39] and used in geriatric settings[40,41] with reimbursement within DRGs. This usual rehabilitative care includes the implementation of a CGA and a standardized number of goal-oriented physical, occupational, speech, cognitive and nutritional therapy sessions in addition to acute medical treatment over 7 to 21 hospital days.[40,41] However, this generalized approach treats all patients the same instead of focusing on individual patient needs, and therefore leads to economically driven aberrations in the care of geriatric patients.[41]

A new concept of early rehabilitation tries to combine acute medical treatment with rehabilitative treatment of multimorbid patients. Central departments have been introduced to ensure the medical-therapeutic structures for the treatment of the acute illness coupled with specialists for rehabilitative medicine with the aim of shortening lengths of hospital stay.[40]

To ensure a smooth transfer, active patient engagement in discharge management and treatment planning in an early rehabilitation concept seems essential as part of a patient-centered approach. Active change is needed to ensure a seamless transfer of communication, minimize additional negative impacts on patient health, reduce already high healthcare costs and be prepared for the demographical challenges as a silver tsunami.[41] It may also have a positive effect on medical staff satisfactions on both inpatient and outpatient care.[72,73]

2.1.4. Geriatric assessments and the Multidimensional Prognostic Index (MPI)

In order to implement the patient-centered approach, it is necessary to assess the individual health status specifically of advanced-aged patients, including existing resources, but also comorbidities as well as functional, mental, and social capacities. In recent decades, the CGA has become the gold standard of geriatric medicine.

In the 1930s, the beginnings of geriatric medicine were shaped by Marjory Warren (1897-1960), who noted a lack of medical, social and psychological assessments of patients in advanced age.[74] CGA was popularized by the work of Laurence Rubenstein,[12,75] who defined it as a "multidimensional interdisciplinary diagnostic process focused on determining a frail elderly person's medical, psychological and functional capability in order to develop a coordinated and integrated plan for treatment and long term follow up".[76] For three decades, the CGA has been used as a diagnostic tool in various clinical settings.[77]

This diagnostic tool considers the high complexity of advanced-aged patients and supports the diagnostic process, treatment planning and long-term prognosis. It not only identifies the patient's deficits - as is the case with standard geriatric screenings - but also assess the patient's level of functioning, resources and needs.[78] Thus, it draws a multidimensional picture that helps to develop a treatment approach.[79]

The dimensions of CGA include nonmedical aspects and comprise of medical/physical psychological/psychiatric, socioeconomic, functional and nutritional assessments.[80] Key features of CGA include specialty expertise, multidimensional assessment and the identification of medical, functional, mental, social and environmental problems, coordinated multidisciplinary meetings, the formulation of a plan of care around patient-centered goals, the implementation of the care plan, including rehabilitation and an iterative review of progress and care planning.[79] The main outcomes of the CGA are death, disability and institutionalization.[80] The benefits of using CGA in a clinical setting have been demonstrated in the sense that patients are more likely to remain alive and living in their own homes than being admitted to a nursing home at follow-up.[79]

There are several CGA-based assessments that vary in terms of recording of physiological function, nutrition and social situation[79] and are used in outpatient and inpatient settings[78]. Common to all is the determination of frailty, defined as a state of increased vulnerability to

poor resolution of homeostasis following a stress, increasing the risk of adverse outcomes such as falls, delirium and disability.[8]

In order to provide predictive value for treatment planning and clinical decision-making, prognostic instrument measures are an important addition to the CGA. Among these prognostic instrument measures, the MPI[5,15] has the highest predictive ability of adverse outcomes in hospitalized patients[14] and has been shown to be an accurate predictor of short- and long-term mortality[81,82].

The MPI is based upon six assessments, namely the Cumulative Illness Rating Scale (CIRS)[83], Exton Smith Scale (ESS)[84], Mini Nutritional Assessment Short Form (MNA-SF)[85], Katz' Activities of Daily Living (ADL)[86], Lawton's Instrumental Activities of Daily Living (IADL)[87], Short Portable Mental Status Questionnaire (SPMSQ)[88], as well as the number of drugs taken and living conditions. The scores of each subscale are summed and divided by the number of indices. The MPI is a continuous variable indicating risk of mortality, ranging from 0 = lowest risk to 1 = highest risk and allowing the classification into one of three mortality risk levels: MPI-1 with a score of (0-0.33) for low risk, MPI-2 with a score (0.34-0.66) for medium risk and MPI-3 with a score of (0.67- 1) for high risk.[5]

The MPI has been validated in various inpatient settings in several European countries: Cardiac Surgery[89], Centre for Cognitive Impairment[90], Oncology[91], Nephrology[15,92], Neurology[93], Orthopedics[94,95] and Dentistry[96]. It also appears to be reliable in outpatient setting of general practice[97]. The work with the MPI on the Universitäre Altersmedizin ward of the University Geriatric Medicine at the University Hospital of Cologne in a comanaged area of internists and geriatricians is the subject of this dissertation. For patients with complex needs and severe illnesses,[98,99] this comanaged ward combines high-performance internal medicine and geriatric medicine and represents an exceptional pilot project of university geriatric medicine.

2.2. Geriatric medicine and psychological factors

2.2.1. Definition of the self-concepts

Inevitably, it is necessary to condeputalize and precisely define the commonly used terms of self - which may have different common-sense definitions - to clarify differences and provide a basis for the further work of this dissertation.

The current Oxford Dictionary defines self-esteem as a "good opinion of oneself; high self-regard; confidence in one's own worth or abilities. Also: one's own estimation or evaluation of oneself".[100] One of the earliest approaches and definitions of self-esteem was by William James (1842-1910), who equates self-esteem to one's success divided by pretensions which are one's expectations of success.[101] Abraham Maslow (1908-1970) sees self-esteem in his well-known hierarchy of needs as one aspect of the needs, without which individuals are unable to grow and achieve self-actualization, which in turn is on top of the hierarchy.[102] Sociologist and social psychologist Morris Rosenberg (1922-1992) defines self-esteem in his remarkable work *Society and the Adolescent Self-Image* "as one's positive or negative attitude toward the self and an overall evaluation of one's worth and value".[1] According to Rosenberg, self-esteem is part of the social construct and is shaped by social interactions. The sociometer theory of Marl Leary and his colleagues in 1995 supports this assumption by stating that self-esteem is a sociometer of interpersonal relationships and thus depends on social acceptance or rejection.[103] The behaviorist approach assumes that self-esteem influences human behavior.[104,105] In AlHarbi's concept analysis, worth, acceptance and efficacy are mentioned as defining attributes of self-esteem and AlHarbi sees confidence and integrity as antecedents for the emergence of these attributes and identifies assertiveness and resilience as consequences of self-esteem.[106] Development over the life course is also considered in the more current definition by Christina Doré from 2017, perceiving self-esteem as "an inner attitude at the base of the personality's construction that is responsible about that individual's psychic balance and the adaptive processes over the course of life".[107]

In contrast to the unidimensional concept of self-esteem presented above, other theorists advocate a dualistic concept of self-esteem. They consider self-competence and self-liking as the main components of self-esteem.[108] These components are defined as self-competence being an "evaluation of one's ability to successfully bring about desired outcomes, and self-liking is a judgment of self-worth based on an internalized sense of positive regard from others".[109] Self-worth is what one must be and do to have value and worth as a person and is also described as contingency of self-worth.[110] Positive and negative events in domains of

contingency of self-worth - such as academic competence, superiority over others, or morality - can increase or reduce momentary feelings of self-esteem.[111]

Briefly summarizing all the different theories of self-esteem, they can be divided into three different theories: the sociocultural theory of self-esteem, the self-determination theory and the terror management theory. According to sociocultural theory, self-esteem is shaped by societal and cultural factors, which in light of aging can either positively or negatively affect self-esteem.[112] For instance, older adults who maintain active engagement in social activities and retain a sense of belonging often experience higher self-esteem, which in turn can contribute to better health outcomes.[113] The self-determination theory emphasizes the importance of fulfilling three psychological needs: autonomy, competence, and relatedness.[114] Autonomy and control can influence self-esteem, especially in older adults patients when they are able to make choices, set personal goals, and engage in meaningful activities, whereby their self-esteem tends to be higher, which contributes to better health outcomes.[31,115] The terror management theory posits that individuals grapple with existential concerns - including their mortality - especially in later life and self-esteem can help in coping with these existential anxieties.[116]

Self-efficacy has previously been described as a one of the defining attributes of self-esteem according to AlHarbi's concept analysis.[106] Self-efficacy is the belief that one has the power to effect changes through one's actions[117] and it is therefore understandable that the belief in the power to change something has an impact on a person's internal attitude towards himself. Furthermore, Albert Bandura (1925-2021) defines self-efficacy as the confidence to perform the necessary actions to achieve desired goals.[118] Self-efficacy depends on different contexts, and associations between self-efficacy and changes in it with changes in health behavior and health status have already been observed.[118]

An early psychological definition of empowerment posits the latter as "the connection between a sense of personal competence, a desire for, and a willingness to take action in the public domain".[119] In the health literature, self-empowerment is considered as a process in which individuals have more power to determine their choices and self-care activities for their health and thus plays an important role in the decision-making process.[120]

In addition, self-management has implications for the decision-making process, particularly in health care. According to Creer, the concept of self-management sees patients as active participants in medical treatment.[121] Self-management is often applied to chronic conditions

and can be considered as a “lifetime task”[122] that helps patients to maintain wellness in their foreground perspective.[123] Self-management can be divided into three tasks: medical management of a condition, i.e., taking medication; role management, i.e., maintaining, changing and creating new behaviors or life roles; and emotional management, i.e., dealing with the emotional consequences of a chronic disease.[124] In addition, self-management requires five self-management skills: problem-solving, i.e., defining problems, developing solutions, implementing solutions and evaluation outcomes; decision making, i.e., having sufficient information to make a decision; resource utilization, i.e., using a variety of resources; building a partnership between the patient and health care provider as a supervisor; and taking action, i.e., creating a plan and implementing it, whereby self-efficacy can make self-management effective.[125,126] Self-tailoring can also be considered part of this concept by matching self-management skills to one’s needs.[122]

Self-consciousness is often equated with self-awareness. A person is not only conscious or aware of one’s own environment but also oneself and sees himself as the object of awareness.[127] Self-consciousness is the consistent tendency to direct attention inward to oneself and - compared to self-awareness - has a social evaluation component [128].

2.2.2. Philosophical concept of *self*

After defining the various terms of the concept of *self*, a brief digression into the philosophical concept of *self* is useful. The concept of the *self* is the subject of research and is an inconsistently used term from diverse disciplines with different sociological, psychological, philosophical, pedagogic, and theological approaches.

With the beginning of the early Modern Age, the concepts of the *self* and persons as individuals became more present in literary works. One of the earliest approaches came from the philosopher and natural scientist René Descartes (1596-1650). In his Cartesian ontology, Descartes distinguishes between two substances: “res cogitans” (mental substance), which includes the mind, spirit, soul and human reason; and the “rest extensa”, the extended substance as a corporeal substance underlying the principles of logic and definiteness and representing the whole material world.[129] The first appearance and coining of the term “self” was by Ralph Cudworth (1617-1688), who also uses two substances: the extended substance and the “life and mind, or the self-active cogitative nature, an inside being, whose action is not local motion, but an internal energy, within the substance or essence of the thinker himself, or the inside of him”.[130]

By contrast, John Locke (1632-1704) rejects Cartesian ontology, which holds the soul responsible for personal identity. Locke distinguishes between body and spirit on the one hand, and postulates the *self* or person as "a thinking intelligent being, that has reason and reflection, and can consider itself as itself, the same thinking thing in different times and places; which it does only by that consciousness which is inseparable from thinking, and as it seems to me essential to it: it being impossible for any one to perceive, without perceiving that he does perceive" [131]. Attributes, therefore, are considered part of the self when they are conscious. Locke defines personal identity not as the numerous substances, but as the continuous same consciousness [131].

David Hume (1711-1776) represented a more unstable and changing conception of the *self*, stating "that the true idea of the human mind, is to consider it as a system of different perceptions or different existences, which are link'd together by the relation of cause and effect, and mutually produce, destroy, influence, and modify each other".[132]

Immanuel Kant (1724-1804) also connects the *self* with consciousness: "For we cannot judge even from our own consciousness whether as soul we are persisting or not, because we ascribe to our identical Self only that of which we are conscious; and so we must necessarily judge that we are the very same in the whole of the time of which we are conscious".[133] Kant further distinguishes between a formal aspect of the *self* as a process or function and an empirical *self* that is filled with content and related to our souls. According to Kant, man is a unity of body and spirit, while personality is the practical sense that takes knowledge from the *self* and moral laws.[134]

The separation of psychology from philosophy led to more scientific psychological research. The psychological definition of William James (1842-1910) divides the *self* into "I" and "me". The "I" refers to the subject that has consciousness, while the "me" is the object that can come to consciousness, and is further subdivided into a material me, which refers to possessions, a social me combining the images others have of one, and a spiritual me reflecting the sum total of the state of consciousness.[101]

Today's leading definition sees the *self* as a self-determining, conscious and thinking spirit and summarizes self-esteem as "self is the way a person experiences himself as himself".[135]

The preceding definitions of the *self* were necessary to provide a foundation for the definitions and better understand the discussion of the impact of the *self* on the patient's health status and prognosis.

2.2.3. Psychological aspects of geriatric patients

The Big Five personality traits model by McCrae and Costa (conscientiousness, neuroticism, extraversion, openness to experiences, and agreeableness)[136] and psychological factors such as resilience have an impact on successful aging and are currently the subject to research. In particular, a recent review by Pocnet et al. has shown that the self-discipline facet of conscientiousness promotes an individual and continuous development, openness and emotional reflections can lead to a higher quality of life, extraversion allowing adaption in social challenges. However, personality risk factors can be defined as conscientiousness as inflexibility or compulsive behavior and high expectations as part of an unhealthy extraversion and neuroticism as a risk factor for increasing stress.[137]

Resilience refers to the individual's recovery potential after trauma or stress to restore to its current state.[138] Functional loss not only affects independence but may also affect the individual's psychological well-being and affective state, as their personal autonomy is severely limited.[139] Other studies suggest that the lifelong contributions of behavioral styles (e.g. health behaviors, social interaction styles), emotions (e.g. emotional stability, optimism, motivations), and cognitive tendencies (e.g. perception and interpretation, selection of environments and comparison frames) may influence an individual's development over their lifespan and contribute to successful ageing.[137] A sense of coherence, depression, life satisfaction, attitude towards one's own aging, subjective age, subjective health, optimism, potential of shared responsibility, barriers to shared responsibility, developmental gains are considered as factors that contribute to mental stability.[140]

Mental health and self-esteem issues may influence PROMs, such as depression.[141] In particular, low self-esteem may be a risk factor for depression.[28] Research findings suggest that demographic characteristics of older people in residential care do not significantly affect their feeling of self-esteem or depression.[142] However, self-efficacy has previously been associated with depression in the female population.[139] In addition, social support has been significantly correlated with depression, and there is some evidence that the type of institutional setting and frequency of religious participation are also related to levels of depression.[142] Furthermore, the presence of depressive symptoms predicts a deterioration of health conditions,[143]taking the form of malnutrition, falls, delirium, functional decline, worsening of other chronic conditions, increased risk of subsequent dementia and frailty, institutionalization and early death.[144-147]

Low self-esteem has been associated with prefrail and frailty status, as it is thought that a frail person is unlikely to be able to engage in regular physical activity, and that the individual's self-esteem may deteriorate, which could adversely affect various aspects of mental health, such as personality, adaptability, and sense of belonging.[148] Another study showed that frequency of physical activity and changes in physical fitness, body fat, and self-efficacy are related to improvements in self-esteem perceptions.[149] This may be due to a biological connection between resilience, robustness and frailty.[150]

Low self-esteem further results in a low quality of life.[29] An association between quality of life and the patient's prognosis as measured by the MPI has already been demonstrated, whereby patients with poor health status as indicated by the MPI group classification tended to report lower general and specific health-related quality of life (HRQoL) as indicated by the new five-level version of the EQ-5D-5L and a visual analogue scale (VAS) compared with patients with a better MPI score.[24] Further, geriatric resources are associated with improved HRQoL, geriatric syndromes with worsened HRQoL, especially those that indicate physical functionality (instability and chronic pain) and mental situation (isolation, depression and emotional resources).[25] Other studies have highlighted the association between HRQoL on admission and increased mortality and functional impairment.[151] Another study showed that self-efficacy for falls is an important predictor of both physical performance and health-related quality of life, supporting the role of psychological factors in moderating physical performance and HRQoL.[152]

Other psychological factors such as self-efficacy can increase an individual's engagement in performing an activity and consequently lead to greater personal independence.[139] Further studies suggest that self-efficacy predicts improvement in health status, as analyses have examined the notion that self-efficacy predicts changes in self-reported health status.[153] Higher self-efficacy and self-esteem have also been shown to be associated with lower health risks and better health,[30,31] whereas lower self-esteem has been associated with a higher risk of mortality.[154]

In terms of the effects on resilience in older age, it has been shown that people with a positive attitude towards life in old age have less functional physical impairment and recover faster from illness.[155] Humor, optimism and physical activity can therefore be seen as crucial for successful aging.[155]

The challenges that the growing and aging population poses for our health care system have already been presented in chapter 2.1. In order to reduce costs and use resources efficiently,

it makes sense to identify risk factors in addition to the disease to be treated. Furthermore, preventive psychological factors such as resilience or self-esteem should also be used to adequately utilize the potential and resources of patients to ensure the efficient treatment of geriatric patients. However, the influence especially of self-esteem on the prognosis of advanced-aged patients measured by the MPI has not yet been sufficiently researched and is therefore the research object of this dissertation.

2.2.4. Mental health problems in the COVID-19 pandemic

The current global health crisis is one of the greatest challenges of this century, not only for governments around the world but also every individual. Strict public health measures have been necessary to contain spreading, including wearing face masks, increased hand hygiene and vaccinations from the end of 2020, but also social life measures such as social distancing, stay-at-home advice and lockdown measures.

Increased social distancing behavior appeared to have negative consequences for social life, as an increase in emotional loneliness was documented during the second wave of the pandemic in October-December 2020.[156] The study by Wang et al. during the initial phase of the pandemic provides evidence of potential mental health consequences such as increased depressive symptoms, anxiety and stress: in their study, 16.5% of respondents reported moderate to severe depressive symptoms, 28.8% of respondents reported moderate to severe anxiety symptoms, and 8.1% reported moderate to severe stress levels.[157] A review paper in the *Quarterly Journal of Medicine* summarizes that the COVID-19 pandemic is associated with distress, anxiety, fear of contagion, depression and insomnia in the general population, and that health care professionals are particularly hard hit.[158] Other studies even suggest that there was higher suicide ideation during the pandemic lockdown.[159] Especially older people are at higher risk of depression and increasing anxiety due to social distancing measures.[160,161]

After an infection with the severe acute respiratory syndrome coronavirus type 2 (SARS-CoV2-virus) multiple symptoms were noted and referred to as post-COVID syndrome (PCS), defined by the presence of persistent symptoms for more than four weeks after infection.[162-164] There are epidemiological differences regarding the incidence rates of PCS, which vary from 13.3% after 28 days,[162] 87% at 60 days,[165] 32.6% at 60 days[166] and 93.2% at 90 days[167]. These differences could be due to the population assessed, the follow-up period and the accuracy of self-report and symptoms examined. However, they show that a crucial proportion of people develop PCS after SARS-CoV-2 infection. In addition to somatic symptoms such as

musculoskeletal, pulmonary and digestive (i.e., diarrhea) symptoms, neurological symptoms such as fatigue and depression are the most commonly observed symptoms.[168] In a peer review by Hossain et al., a broader spectrum of mental health problems was noted, including depression, anxiety disorders, emotional disturbance, posttraumatic stress disorders and suicidal ideation.[169] The possible causes of PCS remain under study, but the main hypotheses are that the underlying mechanism could be a persistent chronic inflammatory process, an autoimmune process or a hormonal imbalance.[61,168,170,171]

Risk factors such as advanced age, pre-existing physical frailty, psychological symptoms (e.g., anxiety and depression) and cognitive impairment (e.g., dementia) are identified for post-intensive care syndromes in COVID-19 patients.[172] Other factors associated with mental health problems during the COVID-19 pandemic have been identified, including younger and older age, female gender, marital status, education, occupation, income, residence and living near the outbreak area, close contact with people infected with the SARS-CoV2-virus, comorbid physical and mental health problems, exposure to COVID-19-related news and social media, coping styles, stigma, psychosocial support, health communication, confidence in health services, personal protective measures, risk of contracting COVID-19 and the perceived likelihood of survival. [169]

The pressure to adhere to the rules of social distancing increased particularly among older people, who are considered vulnerable and at risk. Older people were separated in care homes with limited access and visitation from family members. It is shown that emotional loneliness of older people increased with the pandemic.[173] Another impact on the older population is presented in a systematic review of people with dementia/mild cognitive impairments, noting an increase in the exacerbation of neuropsychiatric symptoms such as depression, anxiety, agitation, irritability and apathy.[174] Older people were generally at higher risk of deterioration in mental health status, leading to depression and anxiety, underscoring the synergism between the biological process of aging and the psychosocial environment that triggers the hypothalamic-pituitary-adrenal axis and the inflammatory immune system,[175] which were previously hypothesized to be causes of PCS. Further long-term functional decline - as evidenced by impaired mobility and the ability to carry out ADL - as well as a negative change in quality of life and higher mortality risks due to SARS-CoV2-virus infection in older people have been observed.[176]

Therefore, it is imperative to identify vulnerable individuals such as older geriatric patients and introduce them to the necessary care to prevent further deterioration of the high utilization of the health care system.

2.3. Research question and aim of the work

As mentioned earlier, demographic change and the associated care of multimorbid older patients is an enormous challenge for the health care system to identify the individual patient risks and needs and improve their health status, while also reduce health care costs.[3,4,17,55,56] Geriatric Medicine has made immense progress in addressing these challenges and the CGA has proven to be the best tool to understand the needs, goals and treatment options of geriatric patients.[79,177] The MPI has been an important complement to the CGA as a prognostic calculation tool that provides predictive value for treatment planning and adverse outcomes.[5,14,15] However, Geriatric Medicine faces the challenge of understanding the complexity of its geriatric patients and influencing variables, taking into account psychological factors in addition to physical symptoms and frailty. Furthermore, intersectoral treatment is particularly challenging to guarantee a smooth transition from inpatient to outpatient treatment without a loss of information.

This thesis first briefly presents the main results of the intervention study *"'Vun nix kütt nix' - Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management".* The aim of the study was to investigate whether joint clinical decision-making by intersectoral teamwork between the patient, geriatrician and treating GP can optimize the treatment of older, multimorbid patients and the inpatient-outpatient transition of the patient. The main question was to assess whether the intervention in the study (implementation of the collaboration between patient, geriatric multiprofessional team and GP based on a problem identifying CGA with MPI and joint setting and follow-up of outpatient action goals) influenced the patient's rehospitalization days in the next six months. Furthermore, as secondary outcomes, it should be shown which other health indicators such as the use of care services, depression symptoms or quality of life were influenced within the scope of the study.

The main aim of the analysis presented in this thesis was to investigate - for the first time - the role of self-esteem in relation to hospitalization and patient prognosis as measured by the MPI and PROMs. Therefore, a secondary analysis of a randomized control trial was performed to identify differences in demographic characteristics between subgroups of self-esteem to

identify factors that have a significant association with self-esteem, how self-esteem is associated with MPI, and how self-esteem influences both inpatient and post-inpatient outcomes.

During the current COVID-19 pandemic, we had the unexpected yet tragic opportunity to provide evidence on the mental health status of older hospitalized patients as part of a longitudinal study. In light of the fact that we focused on psychological aspects of aging and disease recovery, we decided to look at differences of pre-pandemic and pandemic depression symptoms. In addition, the impact of the pandemic on the self-esteem of hospital patients should also be examined.

3. Material and Methods

The following chapter describes the methods of the study "*'Vun nix kütt nix' - Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management*", which forms the basis of the data analyzed in this thesis. First, the study with its scientific objectives is described, followed by the study design, including the recruitment of patients and presentation of the evaluated assessments, and finally the presentation of the statistical analysis.

3.1. Description of the study *"Vun nix kütt nix"*

The study "*'Vun nix kütt nix' - Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management"* is a clinical-interventional randomized controlled trial with the aim to improve discharge management of older multimorbid patients in an acute care unit. The study was awarded the *Förderpreis 2019* by the *Wilhelm Woort Stiftung für Alternsforschung im Stifterverband,* which is funding the study with 20,000€. It is registered at the German Clinical Trials Register (DRKS00015996) and complies with the ethical rules for human experimentation set out in the Declaration of Helsinki (1983). The study was approved by the Ethical Committee (EK number 18-394) of the University Hospital of Cologne, Germany, and signed informed consent was obtained from each patient or proxy.

At the beginning of the hospitalization, older patients (≥60 years) in the university geriatric ward of the Department II of Internal Medicine of the University Hospital of Cologne in Germany, were visited by a multiprofessional team, comprising individuals or all professionals: a physician, geriatrician, occupational therapist, physiotherapist, social service, case management, pharmacist and nutritionist, depending on the patient's needs as determined by the geriatrician. This is to identify the age-related risk factors, geriatric syndromes and resources. Therefore, a CGA was assessed, followed by a prognosis calculation using the MPI.

All identified resources, risks and problem areas were compiled, discussed in the multiprofessional team and systematically documented. On this basis, initial treatment proposals for further outpatient treatment were developed. The geriatrician or geriatric specialist then revisited the patient again to inform him of the identified resources, risks, and

problems and ascertain out his preferences regarding therapy and treatment. Treatment proposals were again adjusted with the patient. The patient also received the patient guide *"Vun nix kütt nix"* which serves as a guideline for life after hospital as part of psychoeducation. This book covered medical topics, preventive care, correct medication, fall prophylaxis but also lifestyle topics such as balanced nutrition and drinking, instructions for physical exercises (including a TheraBand for performing these exercises and a pedometer with diary, which are given free of charge for this purpose) and social and psychological topics. The book also included information and templates on nursing care and nursing initiation, as well as templates for advanced care planning and local social services. The book was adapted to older patients to make it easier for them to read and was designed with a large font size, minimal text, and thicker picture book pages for easier grasping and reading.

Finally, the multiprofessional team consulted the GP physician by telephone before the patient's planned discharge. He was also informed about all identified resources, risks and problems. At the same time, the GP physician added information about previous problems that had come to his attention. Together, the treatment plan for the acute care unit and especially the outpatient setting was discussed, defined and documented. The GP received the discharge letter along with the documented geriatric syndromes and resources and the final common treatment plan in a written form. In addition, the GP physician was offered continued telephone contact with the geriatrician and asked to evaluate this common treatment plan and respond to a questionnaire sent after the telephone call.

Patient progress was tracked through follow-up calls at one, three and six months after discharge. Health indicators such as rehospitalization, quality of life, self-esteem, amount of medication, level of care, use of care services, presence of advance care planning, use of pedometer and TheraBand and mortality were recorded. In addition, patients were sent a written questionnaire about their nutrition.

3.2. Scientific objectives

The aim of the "*Vun nix kütt nix*" study is to optimize the transition from the inpatient to the outpatient setting by supporting intersectoral teamwork between the patient, geriatrician and GP physician. It also aims to improve the treatment of older, multimorbid patients by shared clinical decision-making. The primary outcome of this study is the rate of rehospitalization days in the subsequent six months. Other secondary outcomes include higher quality of life and self-esteem, shorter length of hospital stay, better advanced care planning, lower increase in level

of care, reduced use of nursing home accommodation, lower incidence of depression symptoms, a higher activity level through the use of a TheraBand and pedometer, satisfaction with discharge management and contact between the GP physician and geriatrician after the patient's discharge.

The aim of the secondary analysis is to explore the relationship between self-esteem, frailty and prognosis in older patients. While focusing on psychological aspects during the pandemic, also differences between pre-pandemic and pandemic depression symptoms will also be examined.

3.3. Study design and assessment

Between October 2019 and August 2020, 112 patients admitted to the university geriatric ward of the Department II of Internal Medicine of the University Hospital of Cologne in Germany, were consecutively screened with 110 patients being included in the study. Inclusion criteria beyond an age over 60 years were multimorbidity (defined as the co-occurrence of two or more chronic medical conditions requiring treatment[178]), admission for treatment of acute disease, suffering from at least two geriatric syndromes requiring usual rehabilitative care and the ability to provide informed consent. Exclusion criteria were the presence of life-threatening conditions, severe disability and neuropsychiatric disorders interfering with communication abilities.[26]

All recruited patients received a CGA with MPI prognosis calculation. Components of the CGA included the following assessments: MPI as previously described[5,15,179], SARC-F Score for sarcopenia[180], Yesavage's Geriatric depression scale (GDS)[181], Rosenberg Self-Esteem Scale (RSES)[182], the HRQoL[183] measured with the EQ-5D-5L[184] and a VAS, Goodglass and Kaplan communication scale[185] and a structured assessment of geriatric syndromes and resources[179]. In addition, the level of care (according to the German nursing care insurance level 0 to 5, with 0 indicating no need for care[186]), advanced care planning, hospitalizations and falls in the last three months were assessed.

The MPI is based on six assessments, namely Cumulative Illness Rating Scale (CIRS)[83], Exton Smith Scale (ESS)[84], Mini Nutritional Assessment Short Form (MNA-SF)[187], Katz's Activities of Daily Living (ADL)[188], Lawton's Instrumental Activities of Daily Living (IADL)[87], Short Portable Mental Status Questionnaire (SPMSQ)[88], as well as the number of drugs taken and living condition[5]. The MPI is a continuous variable indicating the mortality risk and degree of

multidimensional frailty, ranging from 0 = lowest risk and robustness to 1 = highest risk and severe frailty.[5] The system enables the allocation to one of three mortality risk/ frailty grades: MPI-1 with a score of 0 to 0.33 displaying low risk and robustness, MPI-2 with a score of 0.34 to 0.66 displaying intermediate risk and prefrailty as well as MPI-3 with a score of 0.67 to 1 displaying severe risk and frailty.[5,10,189]

The RSES has been previously described as a valid and reliable quantitative instrument to assess self-esteem,[190] consisting of ten items, five items on self-confidence and five items on self-depreciation. The items have four Likert-scale response options (3 = strongly agree; 2 = tend to agree; 1 = tend to disagree; 0 = disagree at all for positive statements and vice versa for negative statements), resulting in a total score from zero to 30 points. The higher the score on the scale, the higher the person's self-esteem. Based on statistical analysis, the median RSES score was used to classify patients as high and low self-esteem, in a method that has been previously used.[191] Patients with a score higher than or equal to 26 were included in the "high self-esteem" group (HSEG), and those with a score less than 26 were included in the "low self-esteem" group (LSEG).

The GDS comprises fifteen statements to which the patient can agree ("yes") or disagree ("no"). A score of more than 5 indicates depression.[181]

HRQoL is assessed using the EQ-5D-5L and the VAS-Score. The EQ-5D-5L uses five items on mobility, self-care, usual activities, pain/discomfort and anxiety/depression with five Likert-scale response levels (1 = no problems; 2 = mild problems; 3 = moderate problems; 4 = severe problems; 5 = 'unable to'/extreme problems). The index value reflects how good or bad a health condition is according to the preferences of the general population in Germany. This study uses the German value set of Ludwig et al.[192] The higher the value, the better the health status. The EQ-5D-5L instrument is completed by a VAS in which the patient can self-rate his health status on a scale from 0 = the worst health imaginable to 100 = the best health imaginable.

During hospitalization, the Barthel Index (BI) was determined daily as part of the nursing procedure. This index measures dependence in activities of daily living on a three-point scale with a maximum score of 100 points. The higher the score, the less dependent that the patient is.[193]

Envelopes for randomization were opened after obtaining informed consent and after performing CGA. Patients were randomly assigned in a 1:1 ratio to receive either the TIDP or

usual rehabilitative care upon stratification by age (<75 years, 75-85 years, >85 years). Given the nature of the interventions provided and the context of the trial, it was not possible to blind the clinicians involved. The control group arm received usual acute medical care with no further intervention. The TIDP received another intervention to support the active-patient approach. A shared treatment planning was discussed with the patient, the GP physician and the multiprofessional geriatric team as part of a shared decision-making process. The GP physician was able to provide more necessary information about the patient. In addition, the geriatric team was available for GP, caregivers and patients via telephone hotline throughout the intervention period if needed. The telephone contact with the GP focused on patients' preferences as well as the needs of medication reconciliation and geriatric therapy during follow-up, of aids, or of home care services. In order to strengthen patient autonomy and psychoeducation, patients of the TIDP received the patient guide *"Vun nix kütt nix"*, a TheraBand and either a bracelet or belt clip pedometer. In addition, a modified Medication Appropriateness Index (MAI score) - which includes potentially inadequate medication according to the PRISCUS[194] and Fit fOR The Aged-list (FORTA)[195] - and adherence according to Medication Adherence Report Scale (MARS-D)[196] were assessed. Details of drug-related problems were collected in interviews with the patients.

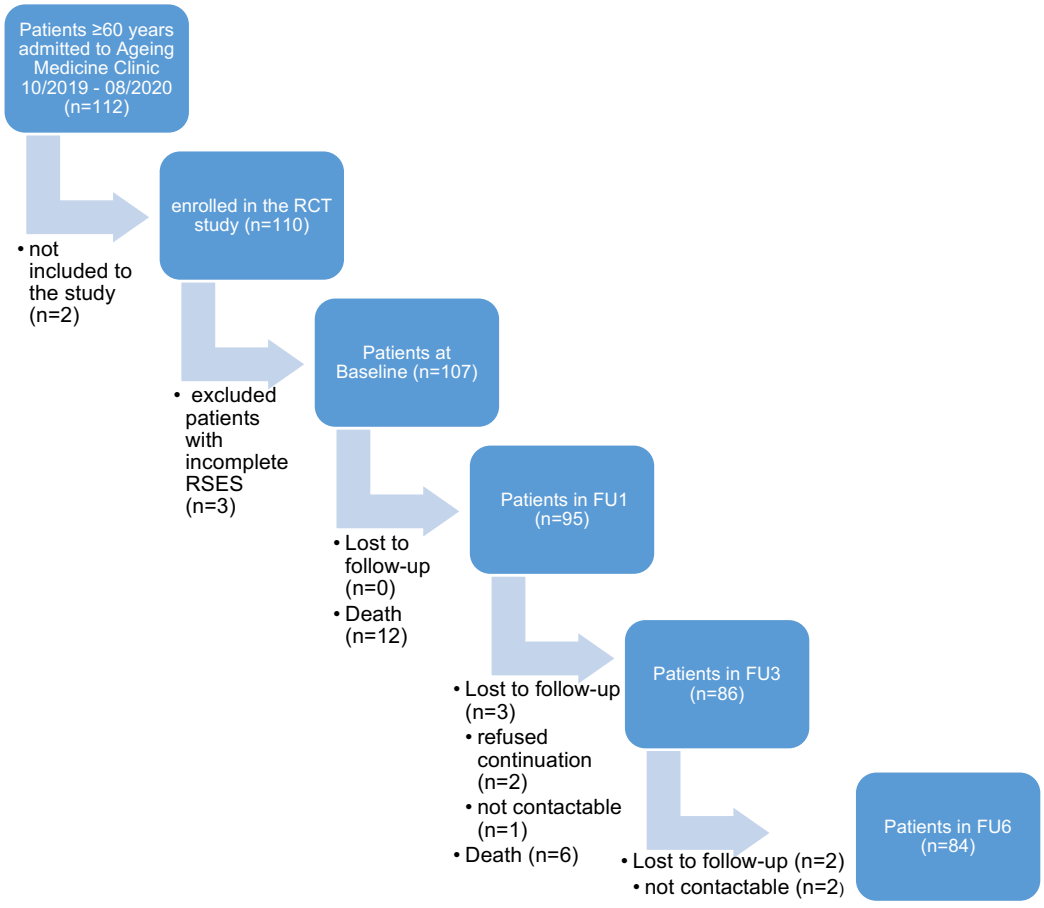
All patients were followed up at one, three and six months by telephone interview to assess rehospitalization, mortality, use of home care services, falls, GDS, EQ-5D-5L, VAS and RSES.

3.4. Statistical analysis

Patients missing the RSES survey (n=3) were excluded from the secondary statistical analysis which focuses on the relationship among self-esteem, frailty and prognosis in older patients. The final sample size included 107 patients, as shown in **Figure 1**.

Figure 1 Study flow chart.

Notes: Of the n=110 patients enrolled in the RCT study (17), a subsample of n=107 patients with complete RSES assessment at baseline was used for analyses. The flow chart illustrates the number of patients included in the follow-up analyses and provides information about the number and reason for exclusion. RCT= Randomized controlled trial; FU= Follow-up; RSES= Rosenberg Self-Esteem Scale.



All analyses were performed with SPSS (Statistical Package for Social Sciences, SPSS Inc., Chicago, IL, version 28.0) software. Two-tailed probabilities were reported and a significance level alpha of 0.05 was used. Figures were created using SPSS.

Descriptive statistics are expressed using absolute numbers and relative frequencies for description of categorical variables and means (standard deviation, SD) or medians (interquartile range, IQR) for continuous and ordinal variables. Testing of normal distribution was performed with the Kolmogorov-Smirnov test. Depending on distribution, continuous variables were compared by t-tests or non-parametric Mann–Whitney-U tests between the two self-esteem groups. Rates were compared by Chi-square test.

The average MPI change was calculated as delta MPI by subtracting the MPI value at discharge from the one on admission, while the delta GDS and delta BI were calculated in the same way. The relationship between the prevalence of geriatric resources and geriatric syndromes was calculated using the percentage of geriatric resources (individual's number of geriatric resources divided by 10 in total) and performing a subtraction from the percentage of the geriatric syndromes (individual's number of geriatric syndromes divided by 18 in total).

Linear regression analyses of the primary outcomes were adjusted by the assessment at admission as well as possible influencing factors such as sex, age, MPI, and the ratio of geriatric resources/syndromes. Subgroup analyses were performed for sex, age group, MPI group, and groups according to the ratio of geriatric resources/syndromes and grade of care.

Linear and logistic regression analyses were used to test associations between self-esteem groups on admission and clinical scales and were adjusted for age, sex and MPI on admission, unless otherwise specified. Clinical outcomes were further adjusted for TIDP intervention and the respective scales on admission whenever assessed. Spearman's correlation was used to test the linear association between RSES and MPI on admission.

In order to analyze the association between the self-esteem groups and several scales as dependent outcomes, mixed models with repeated measurements were calculated with fixed effects for self-esteem group, time, age, sex, MPI on admission, intervention, and the baseline value of the respective outcome scale. An unstructured covariance was assumed in all models. Timepoints included the one-, three- and six-month follow-up for GDS, VAS and EQ-5D-5L as well as daily measurements during hospitalization up to day 21 for the BI. After day 21, the sample size of the BI data was too low for reasonable evaluation and was therefore not

analyzed. The same method was applied to analyze the association between the repeated measurements of the RSES at one-, three- and six-month follow-up and the MPI on admission and discharge.

4. Results

The results section is subdivided into general results of the "*Vun nix kütt nix"*-study to answer the main research question concerning whether the TIDP influences patients' rehospitalization days in the next six months and if the intervention affects health indicators such as the length of hospitalization, number of existing preventive measures (health care proxy and patient decree), development of level of care, use of nursing home, number of medication, existing depression symptoms, level of activity (TheraBand, bracelet or belt clip pedometer), quality of Life (EQ-5D-5L), level of self-esteem (RSES), satisfaction with discharge management, satisfaction of the GP with discharge management and team work, contact of GP with the geriatrician after hospitalization as presented in a recently published paper.[26]

This is then followed by the analysis of the relationship between self-esteem, frailty and prognosis in older patients, analyzing whether patients incorporated in different self-esteem groups differ in demographical characteristics, which factors are associated with self-esteem, if self-esteem is associated with the MPI and how the self-esteem affects the inpatient and post stationary outpatient course.

The section concludes by answering the research question of whether the pandemic has measurable psychosocial effects on hospitalized, multimorbid patients.

4.1. General results of the *"Vun nix kütt nix"*-study

Six patients (6% total, 5% intervention group, 6% control group) died during hospitalization and were therefore excluded from further analysis. Fifty-seven percent of the 104 study participants were female, and the median age was 78 years (IQR=10). Most patients arrived at ward as new admissions (56%) or as internal transfers (36%), with few arriving as external transfers (9%). While 55% of patients lived with relatives, 38% lived alone, and 8% lived with a private caregiver or in a long-term care. 83% of patients had been hospitalized in the previous year (**Table 1**). Forty-three percent of patients did not have a level of care on admission, and 60% of patients had completed health care proxies or living wills. The mean length of hospital stay was 19.8 days (±12.2, **Table 2**).

On admission, 14% of patients were in the MPI-1 group, 61% MPI-2 and 25% MPI-3. On average, 7.32 (±2.17) different geriatric resources were present and 7 (IQR=4) geriatric syndromes. More resources than syndromes were present in 81% of patients. The median MPI showed a medium risk of 0.56 (IQR 0.3, p=0.766 for the intervention group comparison)

and was not significantly associated with mortality (p=0.45) or rehospitalization days (p=0.145) but was associated with length of hospital stay (p=0.022), level of care (p<0.001), and long-term care (p=0.049) at six months. There were no significant differences in demographic characteristics at the baseline between the two groups (**Table 1**).

During the follow-up period of six months, 48 patients (53%) of patients were hospitalized for a median of 4 (IQR 15.5) days. There was no significant difference in the rehospitalization rate in the control group versus intervention group after one, three or six months (p>0.05), including after adjusting for age, sex MPI and GR/GS (p>0.05).

There were some statistically significant differences in secondary outcomes between the two groups (**Table 2**). After six months, 87 patients (84%) were alive with no statistical difference between the two study arms.

The intervention group showed a significantly better MPI at discharge compared to admission, independent of age, sex, MPI on admission an GR/GS. The intervention improved the MPI at discharge particularly in men (0.31 vs. 0.44, p<0.0001), MPI-2 group patients (0.038 vs. 0.046, p=0.016) and patients living with relatives (0.49 vs 0.44, p=0.021).

Use of home care service was significantly higher in the intervention group after six months (50 % vs. 29%, p=0.042). This effect was also shown in the intervention group in the MPI-3 subgroup (58% vs 11%, p=0.037), patients with geriatric resources>geriatric syndromes (50% vs 27%, p=0.037), patients living alone (67% vs 19%, p=0.009) and females (52% vs 23%, p=0.032).

Patients aged >85 years were significantly less frequentlyadmitted to long-term care (0% vs. 57%, p=0.035). Significantly more patients in the control group had advanced care planning after three months (p=0.043, Tab. 2), whereas this effect was no longer evident after six months (p=0.468).

Regarding the GDS of the intervention group, the score after six months had significantly improved (4.0 vs 5.0, p=0.027) adjusted for GDS on admission. This effect remained significant after adjustment for age, sex, MPI on admission and geriatric resources/geriatric syndromes (p=0.049). The intervention group hospitalized in the previous year had a significantly better GDS after three months (3.0 vs 5.0, p=0.014), adjusted for the GDS on admission. In the intervention group, men (4.0 vs 6.0, p=0.024), patients with MPI-2 (4.0 vs 5.5, p=0.031),

patients with geriatric resources>geriatric syndromes (4.0 vs 4.0, p=0.034) and patients living with relatives (3.0 vs 6.0, p=0.006) showed a significantly better GDS after six months.

There was no significant difference in the EQ-5D-5L between the two groups (p>0.05), although a general trend towards an increase of quality of life in the intervention group and a decrease of quality of life in the control group could be observed during six-month follow-up. There was no significant difference in total RSES after one, three and six months, although the intervention group showed higher values than the control group (p>0.124). The subgroup of patients aged <75 years (28.8 vs 23.3, p=0.050) as well as patients living with relatives (28.0 vs 26.0, p=0.014) showed a significantly better RSES in the intervention group after six months - independent of RSES on admission - than patients of the control group.

Table 1 Characteristics of study population

		Intervention group (n=54)	**Control group** (n=50)	**Total** (n=104)	***P* value**[a]
Demographic history					
Age, *median (IQR)*		76.0 (10)	78.5 (10)	78 (10)	0.682
Female, *n (%)*		30 (56)	29 (58)	59 (57)	0.802
Length of education (years), *median (IQR)*		12 (4)	12 (3)	12 (4)	0.451
Living circumstances, *n (%)*	**Relatives**	35 (65)	22 (44)	57 (55)	0.102
	Private caregiver/ long-term care	3 (6)	5 (10)	8 (8)	
	Living alone	16 (30)	23 (46)	39 (38)	
Medical history					
Source of referral, *n (%)*	**New admission**	25 (46)	33 (66)	58 (56)	0.114
	Internal transferal	24 (44)	13 (26)	37 (36)	
	External transferal	5 (9)	4 (8)	9 (9)	
Hospitalized last 12 months, *n (%)*		42 (78)	44 (88)	86 (83)	0.215
Morbidity, *n (%)*	**Hypertension**	36 (72)	41 (76)	77 (74)	0.648
	Heart disease	38 (76)	31 (57)	69 (66.3)	0.045
	Arrhythmia	28 (56)	26 (48)	54 (52)	0.423

	Chronic kidney disease	33 (66)	33 (61)	66 (64)	0.605
	Diabetes	20 (40)	15 (28)	35 (38)	0.188
	Thyroidal dysfunction	20 (40)	19 (35)	39 (38)	0.612
	History of cancer	14 (28)	23 (43)	37 (36)	0.12
	Neurological disease	19 (38)	18 (33)	37 (36)	0.619
	Arthrosis	13 (26)	10 (19)	23 (22)	0.358
	Gastrointestinal disease	32 (64)	36 (67)	68 (65)	0.775
	Depression	12 (24)	15 (28)	27 (26)	0.661
Number of medication, *median (IQR)*		11.0 (6)	9.5 (6)	10.0 (7)	0.187
Geriatric history					
Grade of care, *n (%)*	**None**	26 (48)	19 (38)	45 (43)	0.819
	1	1 (2)	1 (2)	2 (2)	
	2	14 (26)	15 (30)	29 (28)	
	3	9 (17)	12 (24)	21 (20)	
	4	4 (7)	3 (6)	7 (7)	
Home care services, *n (%)*		12 (22)	15 (30)	27 (26)	0.366
Advanced care planning, *n (%)*		29 (54)	33 (66)	62 (60)	0.202
Geriatric Syndromes, *median (IQR)*		7 (3)	7 (4)	7 (4)	0.694
Polypharmacy, *n (%)*		48 (89)	42 (84)	90 (87)	0.329
Incontinence, *n (%)*		23 (43)	25 (50)	48 (46)	0.449
Instability, *n (%)*		49 (91)	46 (92)	95 (91)	0.549
Immobility, *n (%)*		23 (43)	20 (40)	43 (41)	0.789
Cognitive impairment, *n (%)*		14 (26)	14 (28)	28 (27)	0.812
Inanition, *n (%)*		25 (46)	16 (32)	41 (39)	0.136
Irritability, *n (%)*		20 (37)	21 (43)	41 (40)	0.547
Insomnia, *n (%)*		24 (44)	27 (54)	51 (49)	0.330
Dysphagia, *n (%)*		13 (24)	12 (24)	25 (24)	0.993
Chronic pain, *n (%)*		20 (37)	24 (48)	44 (42)	0.258
Sensory Impairment, *n (%)*		44 (82)	46 (92)	90 (87)	0.116
Irritable Colon, *n (%)*		26 (48)	27 (54)	53 (51)	0.551

Fluid/electrolyte disbalances, *n (%)*		29 (54)	23 (46)	52 (50)	0.432
Incoherence/ delirium, *n (%)*		10 (19)	9 (18)	19 (18)	0.574
Geriatric Resources (GR), *mean (SD)*		7.22 (2.23)	7.42 (2.13)	7.32 (2.17)	0.645
Physical resources, *n (%)*		23 (43)	22 (44)	45 (43)	0.885
Good living conditions, *n (%)*		35 (65)	33 (66)	68 (65)	0.899
Social resources, *n (%)*		47 (87)	42 (84)	89 (86)	0.660
Financial resources, *n (%)*		41 (77)	39 (78)	80 (78)	0.938
Competence-related resources, *n (%)*		42 (78)	36 (72)	78 (75)	0.497
Intellectual resources, *n (%)*		38 (70)	36 (72)	74 (71)	0.855
Spiritual resources, *n (%)*		33 (62)	34 (68)	67 (65)	0.542
Motivational resources, *n (%)*		44 (83)	45 (92)	89 (87)	0.182
Emotional resources, *n (%)*		40 (76)	39 (80)	79 (78)	0.619
Mnestic resources, *n (%)*		48 (91)	44 (90)	92 (90)	0.896
More GR than GS, *n (%)*		42 (78)	42 (84)	84 (81)	0.290
EQ-5D-5L value, *mean (SD)*		0.56 (0.3)	0.58 (0.3)	0.57 (0.3)	0.892
EQ-5D-5L VAS, *mean (SD)*		51.2 (21.4)	51.3 (27.1)	51.2 (24.1)	0.989
RSES total, *mean (SD)*		25.1 (4.0)	25.3 (3.5)	25.2 (3.7)	0.749
RSES self-confidence, *mean (SD)*		12.8 (1.8)	12.9 (1.8)	12.9 (1.8)	0.688
RSES self-depreciation, *mean (SD)*		12.3 (3.5)	12.4 (2.8)	12.3 (3.2)	0.880
GDS, *mean (SD)*		4.5 (3.2)	4.5 (3.2)	4.5 (3.2)	0.953
Sarc-F Score, *mean (SD)*		5.9 (2.7)	6.0 (2.5)	5.9 (2.6)	0.887
MPI, *median (IQR)*		0.50 (0.3)	0.56 (0.2)	0.56 (0.3)	0.766
MPI group, *n (%)*	**MPI-1**	7 (13)	8 (16)	15 (14)	0.762
	MPI-2	32 (59)	31 (62)	63 (61)	
	MPI-3	15 (28)	11 (22)	26 (25)	
ADL, *mean (SD)*		3.9 (1.8)	3.9 (1.7)	3.9 (1.8)	0.936
IADL, *mean (SD)*		4.3 (2.5)	4.1 (2.7)	4.2 (2.6)	0.560

SPMSQ, *mean (SD)*	1.8 (2.2)	1.5 (2.2))	1.7 (2.2)	0.521
MNA-SF, *median (IQR)*	7 (5)	8 (5)	7 (5)	0.950
ESS, *mean (SD)*	15.1 (2.8)	15.3 (2.6)	15.2 (2.7)	0.649
CIRS, *mean (SD)*	6.1 (1.4)	6.2 (2.2)	6.2 (1.8)	0.532

Notes:
IQR = Interquartile Range ; SD = standard deviation; GS = Geriatric Syndromes; GR = Geriatric Resources
EQ-5D-5L = European Quality of Life Five Dimensions Five Levels; RSES = Rosenberg Self-Esteem Scale; GDS = Geriatric Depression Scale;
MPI= Multidimensional Prognostic Index; ADL= Katz's Activities of Daily Living; IADL= Lawton's Instrumental Activities of Daily Living; SPMSQ= Short Portable Mental Status Questionnaire; MNA-SF= Mini Nutritional Assessment Short Form; ESS=, Exton Smith Scale; CIRS = Cumulative Illness Rating Scale
[a] *After testing for normal distribution (Kolmogorov-Smirnov) and interpretation of the histogram, either Mann-Whitney-U for median or unpaired t-test (with Levene-Test) were performed; Chi-squared or Fisher's Exact for frequencies. No results are adjusted unless otherwise specified*

Table 2 Follow-Up outcomes after one, three and six months

		Intervention group (n=54)	**Control group** (n=50)	**Total** (n=104)	***P* value**[a]
Mortality					
Alive after one month, *n (%)*		49 (91)	48 (96)	97 (93)	0.285
Alive after three months, *n (%)*		46 (85)	43 (86)	89 (86)	0.884
Alive after six months, *n (%)*		45 (83)	42 (84)	87 (84)	0.886
Hospital stay					
Length of hospital stay (days), *mean (SD)*		20.2 (13.6)	19.4 (10.5)	19.8 (12.2)	0.751
MPI at discharge, *mean (SD)*		0.43 (0.13)	0.49 (0.15)	0.45 (0.14)	**0.011**[b]
MPI group at discharge, *n (%)*	**MPI-1**	18 (37)	7 (15)	25 (26)	**0.040**
	MPI-2	29 (59)	34 (74)	63 (66)	
	MPI-3	2 (4)	5 (11)	7 (7)	
Delta MPI, *mean (SD)*		-0.12 (0.15)	-0.07 (0.14)	-0.09 (0.14)	0.096
Destination at discharge	**Home**, *n (%)*	42 (78)	38 (76)	80 (77)	0.966
	Rehabilitation, *n (%)*	5 (9)	4 (8)	9 (9)	
	External transferal, *n (%)*	3 (6)	3 (6)	6 (6)	

	Internal transferal, *n (%)*	4 (7)	5 (10)	9 (9)	
Advanced care planning					
Advanced care planning one month, *n (%)*		28 (57)	33 (69)	61 (63)	0.237
Advanced care planning three months, *n (%)*		23 (51)	31 (72)	54 (61)	**0.043**
Advanced care planning six months, *n (%)*		26 (59)	28 (67)	54 (63)	0.468
Grade of care					
Grade of care one months, *n (%)*		35 (71)	39 (81)	74 (76)	0.255
Grade of cafe three months, *n (%)*		37 (82)	36 (84)	73 (83)	0.852
Grade of care six months, *n (%)*		38 (86)	36 (86)	74 (86)	0.931
Home care services one month, *n (%)*		17 (35)	19 (40)	36 (37)	0.618
Home care services three months, *n (%)*		18 (40)	13 (30)	31 (35)	0.338
Home care services six months, *n (%)*		22 (50)	12 (29)	34 (40)	**0.042**
Long-term care one month, *n (%)*		4 (8)	8 (17)	12 (12)	0.233
Long-term care three months, *n (%)*		3 (7)	7 (16)	10 (11)	0.156
Long-term care six months, *n (%)*		2 (5)	6 (14)	8 (9)	0.120
Number of medication					
Medications per day at discharge	**3-5***, n (%)*	3 (6)	4 (8)	7 (7)	0.407
	>5, *n (%)*	9 (17)	13 (26)	22 (21)	
	>**9**, *n (%)*	42 (78)	33 (66)	75 (72)	
>9 medications per day one month, *n (%)*		33 (69)	29 (60)	62 (65)	0.514
>9 Medication per day three months, *n (%)*		26 (58)	21 (49)	47 (53)	0.769
>9 medications per day six months, *n (%)*		23 (52)	23 (56)	46 (54)	0.784
Depressive symptoms according to GDS					

GDS one month, *mean (SD)*	3.7 (2.6)	4.6 (3.6)	4.1 (3.1)	0.327[b]
GDS three months, *median (IQR)*	3 (2)	4 (6)	3 (3)	0.103[b]
GDS six months, *median (IQR)*	4 (2)	5 (2)	4 (3)	**0.027[b]**
Quality of life (EQ-5D-5L)				
EQ-5D-5L index one month, *median (IQR)*	0.80 (0.48)	0.58 (0.56)	0.72 (0.50)	0.376[b]
EQ-5D-5L VAS one month, *median (IQR)*	60 (20)	50 (30)	50 (23)	0.293[b]
EQ-5D-5L index three months, *mean (SD)*	0.65 (0.30)	0.57 (0.38)	0.61 (0.34)	0.421[b]
EQ-5D-5L VAS three months, *median (IQR)*	56.0 (20.8)	62.2 (21.8)	58.9 (21.3)	0.245[b]
EQ-5D-5L index six months, *median (IQR)*	0.67 (0.44)	0.53 (0.66)	0.65 (0.50)	0.284[b]
EQ-5D-5L VAS six months, *mean (SD)*	60.0 (20.3)	49.3 (24.2)	54.8 (22.8)	0.077[b]
Self-esteem (RSES)				
RSES one month, *median (IQR)*	27 (6)	26 (5)	26 (5)	0.166[b]
RSES self-confidence one month, *mean (SD)*	13.1 (1.9)	12.5 (2.6)	12.8 (2.3)	0.192[b]
RSES self-depreciation one month, *mean (SD)*	13.0 (2.3)	12.2 (3.1)	12.6 (2.7))	0.274[b]
RSES total three months, *mean (SD)*	27.2 (2.8)	25.9 (4.9)	26.6 (3.9)	0.124[b]
RSES self-confidence three months, *mean (SD)*	13.7 (1.3)	13.0 (2.4)	13.4 (1.9)	0.099[b]
RSES self-depreciation three months, *mean (SD)*	13.5 (2.1)	12.9 (3.1)	13.2 (2.6)	0.289[b]
RSES six months, *mean (SD)*	26.9 (3.8)	25.2 (5.1)	26.1 (4.8)	0.159[b]
RSES self-confidence six months, *mean (SD)*	13.9 (1.2)	12.4 (2.9)	13.2 (2.3)	**0.009[b]**
RSES self-depreciation six months, *mean (SD)*	14.3 (3.3)	12.8 (3.0)	13.6 (3.2)	0.055[b]

Notes:
SD = standard deviation; IQR = Interquartile Range
MPI= Multidimensional Prognostic Index;; GDS = Geriatric Depression Scale; RSES= Rosenberg Self-Esteem Scale; EQ-5D-5L = European Quality of Life Five Dimension 5 Levels;
[a] Unless labelled different, after testing for normal distribution (Kolmogorov-Smirnov) together with interpretation of the

histogram either Mann-Whitney-U for median or unpaired t-test (with Levene-Test) for mean were performed; Chi-squared or Fisher's Exact for frequencies. No results are adjusted unless otherwise specified.
[b] After linear regression analysis adjusted for the test-value on admission for group (intervention or control group).

4.2. Self-esteem of geriatric patients

4.2.1. Characteristics of the study population according to self-esteem groups on admission

For the analysis regarding associations with self-esteem, 107 patients were included in the study, since three of the 110 assessed patients did not perform a RSES on admission. The majority of the 107 patients were female (56%). The mean age was 77.2 (SD 7.1) years. According to self-esteem groups, 59 patients (55%) were classified into the HSEG (RSES ≥26 points), 48 patients (45%) were classified into the LSEG (RSES <26 points). The mean RSES in HSEG was 27.8 (SD 1.36) and for LSEG 21.92 (SD 2.97).

Age (p=0.842), sex (p=0.453) and length of education (p=0.460) were not significantly associated with the self-esteem group, as well as comorbidities (CIRS p=0.537), grade of care (p=0.818) and number of medication (p=0.072). Clinical characteristics categorized by self-esteem groups are shown in **Table 3**.

Table 3 Demographic and clinical characteristics of patients according to their self-esteem groups on admission

		Total *(n=107)*	**High self-esteem** *(n= 59; 55%)*	**Low self-esteem** *(n= 48; 45%)*	**p-value**°
Demographical and clinical characteristics					
Age (years), *mean (SD)*		77.2 (7.1)	77.3 (7.7)	77 (6.4)	0.842
Female, *n (%)*		60 (56)	35 (59)	25 (52)	0.453
Family status, *n (%)*	**married or in a permanent relationship**	59 (55.1)	35 (59.3)	24 (50)	0.132
	widowed	28 (26.2)	17 (28.8)	11 (22.9)	

	single/ divorced	20 (18.7)	7 (11.9)	13 (27.1)	
Education (years), *median (IQR), n=105*		12.0 (5.0)	12.0 (4.0)	12.0 (4.0)	0.460
Level of educational requirement, *n (%), n=104*	**1**	19 (18)	11 (19)	8 (17)	0.221
	2	65 (63)	10.6 (55)	33 (72)	
	3	14 (14)	11 (19)	3 (7)	
	4	6 (6)	4 (7)	2 (4)	
Ambulant care*,* n (%)		27 (25.2)	18 (30.5)	9 (19)	0.164
Existing level of care, *n (%)*		59 (56)	31 (53)	28 (60)	0.469
Grade of care, *n (%), n=106*	**None**	47 (44)	28 (48)	19 (40)	0.818
	1	2 (2)	1 (2)	1 (2)	
	2	29 (27)	15 (25)	14 (29)	
	3	21 (20)	12 (20)	9 (19)	
	4	7 (7)	3 (5)	4 (8)	
Advanced care planning, *n (%)*		65 (61)	36 (61)	29 (60)	0.950
Body mass index, *median (IQR)*		24.2 (5.9)	24.4 (5.9)	24 (7.4)	0.483
Number of main diagnoses, *median (IQR),* n=106		8 (5)	8 (6)	7.5 (4)	0.823
Hospitalized in the last year*, n (%),* n=105		84 (80)	46 (81)	38 (79)	0.845
Number of medication*, mean (SD)*		10.6 (4.5)	11.3 (5.0)	9.8 (3.7)	0.072
Length of stay, *median (IQR)*		17 (8)	17 (8)	17 (9)	0.604
Scores on admission					
MPI, *median (IQR),* n=106		0.5 (0.27)	0.5 (0.25)	0.6 (0.25)	**0.021****
MPI group, n (%)	**MPI-1**	14 (13)	9 (16)	5 (10)	0.057**
	MPI-2	64 (60)	38 (66)	26 (54)	
	MPI-3	28 (26)	11 (19)	17 (35)	
SPMSQ, *median (IQR),* n=105		1 (2)	1 (2)	1 (2)	0.569*
MNA-SF*, mean (SD)*		7.3 (2.9)	8.2 (2.7)	6.2 (2.9)	**0.003***
ADL, *median (IQR)*		4 (3)	5 (3)	4 (3)	0.445*

IADL, *median (IQR)*	4 (4)	4 (5)	3.5 (5)	0.458*
ESS, *median (IQR)*	15 (3)	16 (3)	15 (4)	**0.013***
CIRS, *median (IQR)*	6 (2)	6 (2)	6 (2)	0.537*
Geriatric resources, *median (IQR)*	8 (3)	9 (3)	7 (4)	**<0.001***
Geriatric syndromes, *median (IQR)*	7 (4)	7 (3)	8 (4)	**0.048***
GR (%) > GS (%), *n (%)*	85 (79)	54 (92)	31 (65)	**<0.006***
EQ-5D-5L, *median (IQR)*	0.59 (0.5)	0.72 (0.42)	0.54 (0.53)	**0.025***
VAS, *median (IQR), n=103*	50 (30)	55 (20)	50 (45)	0.082*
GDS, *median (IQR), n=105*	4 (4)	2.5 (3)	6 (6)	**<0.001***
Barthel Index admission, *median (IQR), n=105*	50 (25)	50 (30)	40 (28.8)	**0.021***

Notes: Patients were subdivided into high self-esteem group with a Rosenberg Self-Esteem Score greater or equal 26, all other patients were classified into the low self-esteem group.

MPI = Multidimensional Prognostic Index; SPMSQ = Short Portable Mental Status Questionnaire; MNA-SF = Mini Nutritional Assessment-Short Form; GR = geriatric resources; GS = geriatric syndromes; ADL = Activities of Daily living; IADL = Instrumental Activities of Daily Living;

ESS = Exton Smith Scale; CIRS = Cumulative Illness Rating Scale; EQ-5D-5L = European Quality of Life 5 Dimensions 5 Level Version; VAS = Visual Analogue Scale; GDS = Geriatric Depression Scale

°Chi-square for frequencies, t-test for mean, Mann-Whitney-U for median.

* After linear/logistic regression analysis, results were adjusted for age, sex and MPI.

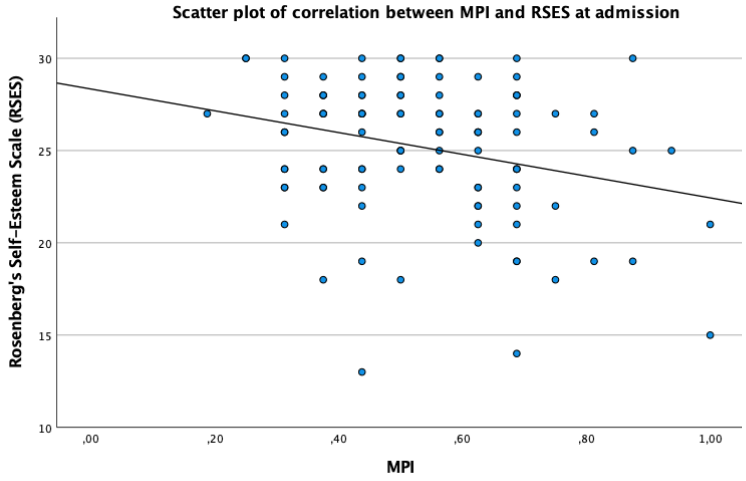
** After linear/logistic regression analysis, results were adjusted for age and sex.

4.2.2. Association between self-esteem and geriatric outcomes

The median MPI on admission was 0.5 (IQR=0.27), showing a significantly lower MPI in the HSEG (median HSEG: 0.5 (0.25) vs. LSEG 0.6 (0.25), p=0.021 adjusted for age and sex, **Table 3**). In line with this, the scatter plot of RSES and MPI on admission showed a significant negative correlation (Spearman's ρ=-0.229, p=0.018, **Figure 2**). Regarding MPI subdomains, patients from the HSEG had better nutritional status (MNA-SF, p=0.003 adjusted for age, sex and MPI) and a significantly lower pressure ulcer risk (ESS, p=0.013 adjusted for age, sex and MPI) compared to LSEG. Additionally, after adjustment for age, sex and MPI, patients with HSEG showed a higher BI on admission (p=0.021) and had significantly more geriatric resources (p<0.001) as well as fewe syndromes compared to LSEG (p=0.048). All of these correlations could not only been shown with the self-esteem groups but also with the continuous RSES adjusted for age, sex and MPI (MNA-SF: p=0.025; ESS: p=0.003; BI on admission: p=0.024; GR: p<0.001; GS: p=0.002).

Concerning PROMs, patients from the HSEG had a significantly higher quality of life (EQ-5D-5L, p=0.025) and lower GDS score (p<0.001, both adjusted for age, sex and MPI). This also applies for the continuous variable of RSES when adjusted for age, sex and MPI (EQ-5D-5L: p=0.015; GDS: p<0.001). Geriatric scores on admission, categorized by self-esteem groups are shown in **Table 3**.

Figure 2 Scatter plot of the correlation between MPI and RSES on admission.



Notes: Spearman's ρ = -0.229, p = 0.018. MPI= Multidimensional Prognostic Index; RSES = Rosenberg Self-Esteem Scale

4.2.3. Association between self-esteem and follow-up at discharge

The MPI at discharge was not associated with the self-esteem groups (p=0.646) when adjusted for age, sex, intervention and MPI on admission. Both self-esteem groups mostly showed an improvement in the MPI at discharge compared to the MPI on admission without significant difference between the groups (p=0.534 adjusted for age, sex, intervention and MPI on admission). GDS at discharge (p=0.076 adjusted for age, sex, intervention, MPI on admission and GDS on admission) and falls during hospitalization (p=0.667 adjusted for age, sex, intervention and MPI on admission) were not significantly associated with self-esteem (**Table 4A**).

Table 4 Clinical characteristics at follow-up according to self-esteem groups

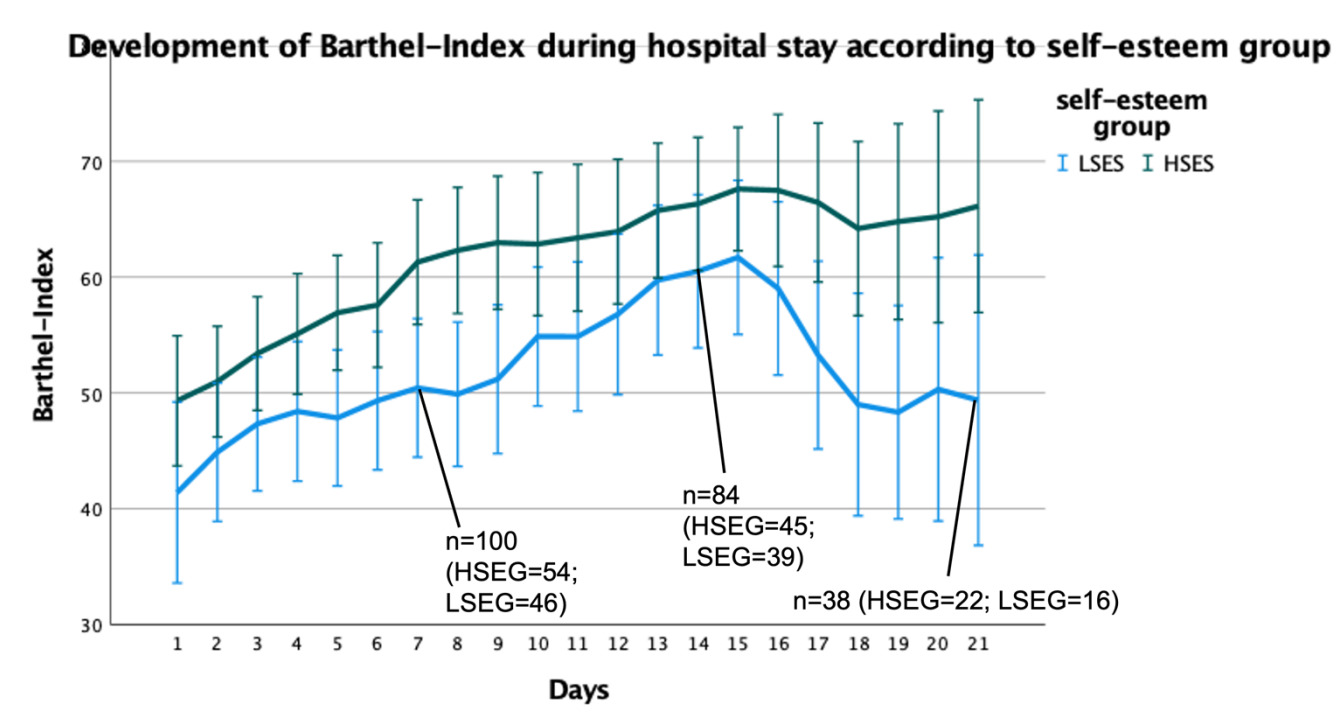
A) At discharge

		Total *(n=107)*	**High self-esteem** *(n= 59; 55%)*	**Low self-esteem** *(n= 48; 45%)*	**p-value°**
MPI, *median (IQR),* n=94		0.44 (0.14)	0.44 (0.12)	0.44 (0.25)	0.646*
MPI group, n (%), n=93	**MPI-1**	25 (27)	14 (28)	11 (26)	0.587*
	MPI-2	63 (68)	34 (67)	29 (69)	
	MPI-3	5 (5)	3 (6)	2 (5)	
MPI change, *n (%),* n=94	**no change**	3 (3)	2 (4)	1 (2)	0.534*
	improvement	68 (72)	38 (73)	30 (71)	
	worsening	23 (25)	12 (23)	11 (26)	
Delta MPI, *median (IQR),* n=94		-0.063 (0.19)	-0.061 (0.13)	-0.123 (0.21)	0.822*
GDS*, median (IQR),* n=81		2 (3)	2 (2)	3.5 (4)	0.076*
Delta GDS*, n (%),* n=80	**no change**	24 (40)	15 (35)	9 (24)	0.124*
	improved	49 (61)	25 (58)	24 (65)	
	worsening	7 (9)	3 (7)	4 (11)	
Falls during hospitalization*, n (%)*		9 (8)	4 (7)	5 (10)	0.667*
Barthel Index, *median (IQR),* n=105		70 (25)	75 (20)	67.5 (25)	0.748**
Delta Barthel, *n (%),* n=105	**no change**	7 (7)	5 (9)	2 (4)	0.792**
	improved	89 (85)	47 (83)	42 (88)	
	worsening	9 (9)	5 (9)	4 (8)	

Figure 3 illustrates the course of BI in the two self-esteem groups during the hospital stay. In the analysis, the course of the Barthel Index during the 21 days of complex treatment was considered. It indicates that the BI increased almost equally for both groups during hospitalization, with the value for the HSEG being higher on admission, as these patients consistently performed better in daily living activities (HSEG: 50 (30) vs. LSEG: 40 (28.8), p=0.021 adjusted for age, sex and MPI). In a mixed model analysis adjusted for age, sex, intervention and BI on admission, the development of the daily repeated measured BI during hospitalization was significantly associated with the MPI on admission (p=0.05), but not

significantly associated with the self-esteem groups (p=0.770). The BI at discharge (p=0.748) and the delta BI admission/ discharge (p=0.792) were not significantly associated with the self-esteem groups when adjusted for age, sex, MPI on admission, intervention and BI on admission.

Figure 3 BI course during hospitalization



Notes: BI= Barthel Index; LSES = Low self-esteem group; HSES = High self-esteem group. Error Bar: 95% Confidence Interval, +/- 2 Standard Error. Illustrated until the end of the complex treatment program of 21 days.

4.2.4. Association between self-esteem and one-month follow-up

One month after discharge, after adjusting for age, sex, intervention and admission MPI, significantly fewer patients of the HSEG were rehospitalized compared to the LSEG (HSEG: 9 (18) vs. LSEG: 17 (39), p=0.040) and rehospitalization days were significantly less in LSEG compared to HSEG (p=0.019, **Table 4B**).

Notably, patients of the HSEG had an increase in their grade of care significantly more often compared to patients in the LSEG (HSEG: 13 (26) vs. LSEG: 5(11), p=0.044 adjusted for age, sex, intervention and MPI on admission). The existence of a grade of care in general was not significantly different (p=0.753, adjusted for age, sex, intervention and MPI on admission).

Table 4 Clinical characteristics at follow-up according to self-esteem groups

B) At one month after discharge

	Total *(n=95)*	**High self-esteem** *(n= 51; 54%)*	**Low self-esteem** *(n= 44; 46%)*	**p-value**
Alive, *n (%),* n=107	95 (89)	51 (86)	44 (92)	0.174*
Rehospitalization, *n (%)*	26 (27)	9 (18)	17 (39)	**0.040***
Rehospitalization days, *median (IQR),* n=94	0 (2)	0 (0)	0 (10)	**0.019***
Falls, *n (%), n=94*	11 (12)	6 (12)	5 (12)	0.856*
Ambulatory home care, *n (%)*	35 (37)	20 (39)	15 (34)	0.595*
Existing grade of care, *n (%), n=95*	72 (75.8)	39 (76.5)	33 (75)	0.753*
Higher grade of care, *n (%)*	18 (19)	13 (26)	5 (11)	**0.044***
GDS, *median (IQR),* n=67	3 (3)	3 (2)	4 (4)	0.430*
EQ-5D-5L, *median (IQR),* n=75	0.65 (0.54)	0.69 (0.45)	0.6 (0.54)	0.866*
VAS, *median (IQR),* n=65	50 (28)	60 (20)	50 (30)	0.708*

4.2.5. Association between self-esteem and three-months follow-up

Three months after discharge significantly fewer patients of the HSEG were alive (77% vs 90%, p=0.026 adjusted for age, sex, intervention and MPI on admission). While there was no longer a significant difference in rehospitalization rate between the groups, the number of hospitalization days was still significantly higher in LSEG compared to HSEG (p=0.019 adjusted for age, sex, intervention and MPI on admission). All follow-up results are shown in **Table 4C.**

Table 4 Clinical characteristics at follow-up according to self-esteem groups

C) At three months after discharge

	Total *(n=87)*	**High self-esteem** *(n= 44; 50.5%)*	**Low self-esteem** *(n= 43; 49.5%)*	**p-value**
Alive, *n (%),* n=105	87 (83)	44 (77)	43 (90)	**0.026**[*]
Rehospitalization*, n (%),* n=89	36 (40)	17 (36)	19 (45)	0.555[*]
Rehospitalization days, *median (IQR),* n=84	0 (3)	0 (0)	0 (6)	**0.019**[*]
Falls*, n (%),* n=83	10 (12)	7 (17)	3 (7)	0.155[*]
Ambulatory home care, *n (%)*	30 (35)	15 (35)	15 (35)	0.902[*]
Existing grade of care, *n (%), n=86*	71 (82.6)	34 (79.1)	37 (86)	0.800[*]
Higher grade of care*, n (%)*	20 (23)	7 (16)	13 (30)	0.183[*]
GDS, *median (IQR),* n=60	3 (3)	3 (3)	4 (6)	0.655[*]
EQ-5D-5L, *median (IQR),* n=61	0.74 (0.48)	0.78 (0.46)	0.66 (0.45)	0.830[*]
VAS, *median (IQR),* n=61	60 (25)	65 (25)	50 (28)	0.830[*]

4.2.6. Association between self-esteem and six-month follow-up

Six months after discharge, once again significantly less patients of the HSEG were alive compared to LSEG patients (76% vs 90%, p=0.021 adjusted for age, sex, intervention and MPI on admission, **Table 4D)**). No other significant differences could be observed.

Mixed model analysis showed that the self-esteem allocation was significantly associated with the repeated measurements of the GDS during the follow-up timepoints (p=0.042 adjusted for age, sex, intervention, MPI on admission and GDS on admission), with patients from HSEG having lower depression scores at follow-up than patients from LSEG (**Table 4A-D**). This association could also been shown for the RSES scale and the repeated measurements of the GDS during the follow-up timepoints (p=0.013 adjusted for age, sex, intervention, MPI on admission and GDS on admission). However, this association could not be shown for the repeated measurements of the quality of life scores (VAS: p=0.815; EQ-5D-5L: p= 0.587

adjusted for age, sex, intervention, MPI on admission and VAS/EQ-5D-5L on admission).

Table 4 Clinical characteristics at follow-up according to self-esteem groups

D) At six months after discharge

	Total *(n=85)*	**High self-esteem** *(n= 42; 49.5%)*	**Low self-esteem** *(n= 43; 50.5%)*	**p-value**
Alive, *n (%),* n=103	85 (83)	42 (76)	43 (90)	**0.021**[*]
Rehospitalization, *n (%),* n=88	45 (51)	20 (44)	25 (60)	0.313[*]
Rehospitalization days, *median (IQR),* n=83	0 (0)	0 (0)	0 (5)	0.190[*]
Falls, *n (%)*	9 (11)	5 (12)	4 (10)	0.625[*]
Ambulatory home care, *n (%)*	33 (39)	17 (41)	16 (38)	0.767[*]
Existing grade of care, *n (%), n=84*	72 (85.71)	35 (83.3)	37 (88.1)	0.725[*]
Higher grade of care, *n (%)*	14 (17)	8 (19)	6 (14)	0.686[*]
GDS, *median (IQR),* n=61	4 (3)	3 (2)	5 (5)	0.343[*]
EQ-5D-5L, *median (IQR),* n=71	0.61 (0.49)	0.60 (0.67)	0.67 (0.49)	0.055[*]
VAS, *median (IQR),* n=59	60 (30)	60 (20)	55 (40)	0.322[*]

Notes: MPI = Multidimensional Prognostic Index; GDS = Geriatric Depression Scale; EQ-5D-5L = European Quality of Life Five Dimensions Five Level Version; VAS = Visual Analogue Scale.

[°]Chi-square for frequencies, t-test for mean, Mann-Whitney-U for median.

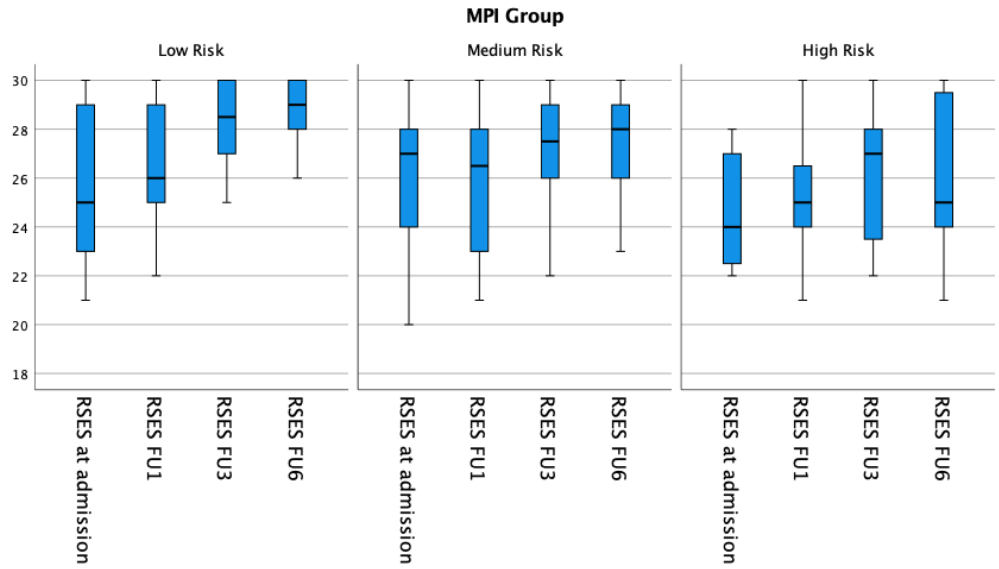
[*] After linear/logistic regression analysis, results were adjusted for age, sex, MPI, intervention and if assessed the responding score on admission.

[**] After linear regression analysis, results were adjusted for age, sex, MPI, intervention, length of hospital stay and the Barthel Index on admission.

In a mixed model analysis, the post-discharge course of the RSES in the six months after discharge was significantly associated with the MPI score at discharge (p=0.050 adjusted for age, sex, intervention and RSES on admission), and with a trend towards a significant association with the MPI score on admission (p=0.061 adjusted for age, sex, intervention and

RSES on admission). Accordingly, patients with a lower MPI at discharge had a higher self-esteem scale over the follow-up period (**Figure 4**).

Figure 4 Development of RSES according to MPI groups



Notes: RSES = Rosenberg Self-Esteem Scale; MPI = Multidimensional Prognostic Index; FU1 = One-month follow-up; FU3 = Three-month follow-up; FU6 = Six-month follow-up

4.3. Psychological effects during the pandemic

The „*Verlauf der Depressionssymptome und Selbstwirksamkeit älterer Patienten*“scientific poster *(*Supplementary 1) was presented online during the 33rd annual congress of the *Deutsche Gesellschaft für Geriatrie* (DGG) from September 2 until December 1, 2021 and at the *Fifth Cologne Symposium on Ageing Medicine 2022* of the Department of Internal Medicine II of the University Hospital of Cologne on June 11, 2022. The topic of the poster addresses psychosocial parameters (GDS, RSES) that showed a significant difference in the period before and after the pandemic.

All 110 patients recruited were included in the analaysis of psychosocial effects during the pandemic on hospitalized, multimorbid advanced-aged patients. The median age was 78 years (IQR 9), and 57% of the patients were female. 62 patients were included before the start of the pandemic, and 48 patients were included afterwards.

The mean GDS score on admission before pandemic onset was 4 (±2.8) and after the pandemic 5.2 (±3.8) (p=0.048, **Figure 5**). Adjustments for dementia, MPI on admission, intervention and gender showed a significantly worse GDS on admission (p=0.048) after pandemic onset compared to the pre-pandemic period. The three-month follow-up results showed a significantly improved GDS score (p=0.006) in admitted patients during the pandemic vs. those admitted before the pandemic's onset (**Figure 6**) Regarding the RSES, the three-month follow-up results showed a significantly higher self-esteem scale (p=0.036) in patients admitted during pandemic vs. those admitted prior to the pandemic onset.

Figure 5 GDS score on admission

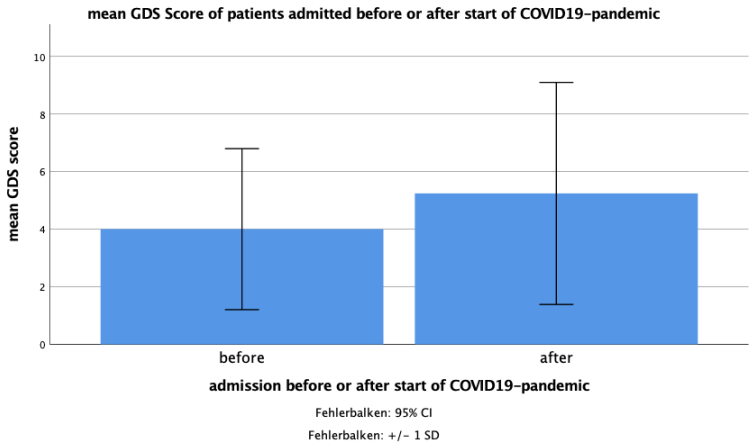
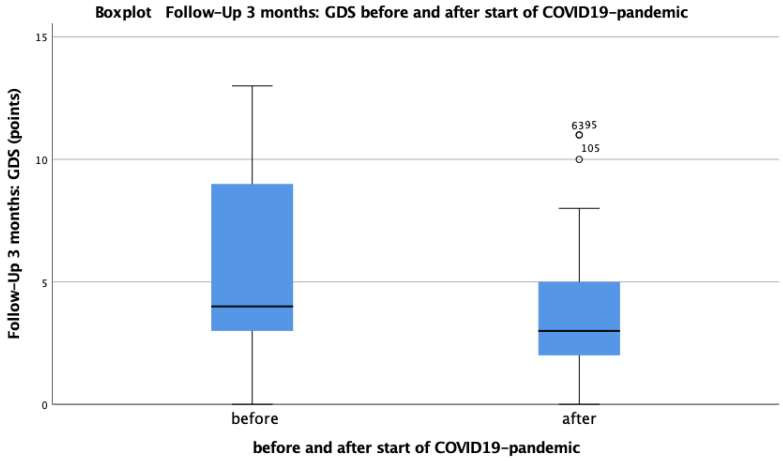


Figure 6 Three-month follow-up: Geriatric Depression Scale



5. Discussion

5.1. Key findings of the *"Vun nix kütt nix"* study

To our knowledge, the study *"'Vun nix kütt nix' - Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management"* is one of the first studies to show that the intersectoral triad of GP, patient and geriatrician can reduce frailty in acutely hospitalized patients and improve PROMs such as mood and self-esteem. The main results and the discussion below were recently published in a paper of Meyer et al. [26]

Although the intervention had no effect on the rehospitalization rate of older patients and the rehospitalization rate was higher compared with four randomized control trials of discharge planning for geriatric patients (intervention 8.6-35.3%, control 13.9-47%),[197-200] this may be due to the high complexity of patients in a university hospital.[98,99] As the focus in the treatment of geriatric patients is placed more on social and rehabilitative aspects, PROMs seem to be more suitable as a marker of patient-centered treatments.[26]

MPI at discharge - as marker of frailty and prognostic value for hospitalization and mortality after six months - was significantly better in the intervention group, especially in patients with prefrail status and among men. This suggests that geriatric treatment may have an impact on patients' prognosis. Patient empowerment may be a key factor in reducing rehospitalization[201] and MPI has already been shown to be an accurate monitoring tool for the overall health course of older patients during hospitalization.[92]

The increasing use of home care services in the intervention group after six months suggests that the intervention group was probably better educated through counseling program of the multiprofessional team and the patient guidebook, which includes a chapter on home care services, thus facilitating access to help for people in need of care.

A surprising result was that after three months, the control group had a significantly higher number of patients with advanced care planning than the intervention group. However, when looking at the raw numbers, it is clear that this effect is not necessarily evident, as more patients had advanced care planning and more patients in the intervention group with advanced care planning died.

As an important addition, the intervention group had a lower GDS score and higher self-esteem and a better MPI compared to other studies.[197] This could also be due to the patient guidebook and complex treatment planning in the hospital. This is consistent with another study showing that frequency of physical activity and changes in physical fitness, body fat, and self-efficacy are associated with improvements in self-esteem perceptions[149], highlighting the positive effect of improving self-esteem and reducing depression symptoms, which may contribute to reducing hospital readmissions[155] and preventing functional decline[42,201].

We did not find a difference in HRQoL between the two groups. However, previous studies have highlighted the association between HRQoL and health status and clinical prognosis, e.g. patients with poor health status according to MPI group classification tended to report lower general and specific HRQoL, as indicated by the EQ-Index and VAS, than patients with better MPI scores.[24] Therefore, further studies should focus on how to support HRQoL.

Compared to other studies, no difference in mortality was found,[202] which could be due to the small size of the study. A larger study population seems necessary to be able to make statements about the influence of the intervention on mortality.

A comparison of the results of the "*Vun nix kütt* nix"-study with a historical group of geriatric patients who received neither usual rehabilitative care nor TIDP was able to show significantly lower mortality and less rehospitalization and underlines the importance of a multidimensional geriatric intervention tailored to frailty and functions on admission to counteract the potentially disabling effects of $_{\text{aggressive}}$ medical treatments in older patients.[26]

This study provides new evidence as the treatment was initiated in hospital and focused on three risk factors for potential rehospitalization (uninformed patient, uninformed GP, frailty in hospital during acute medical treatment) and can serve as a model of transition in this interface. A systematic review supports this finding that rehospitalization rates can be reduced by an intervention that starts in hospital and continues after discharge, rather than starting after discharge.[201] Although we did not find this effect on rehospitalization rates, this study showed the major benefits of a TIPD in reducing frailty and producing better PROMS such as higher self-esteem and lower depressive symptoms.

5.2. Self-esteem, frailty and prognosis in older patients

The secondary analysis shows a strong interaction between self-esteem and PROMS such as depressive symptoms measured by the GDS and patients' prognosis. Patients with lower self-esteem had significantly higher depression scores (GDS) at admission and during the follow-up. We were able to demonstrate this association for self-esteem regardless of sex and the timepoint of the study.

These findings are consistent with previous studies that have found low self-esteem to be a risk factor for depression.[28] Self-efficacy has also been associated with depression in the female population, as measured by Beck's depression inventory.[203] This could be explained by the learned helplessness theory, reflecting the belief developed as a result of negative experience that one has lost the ability to change one's life situation and is personally responsible for this state. Accordingly, this theory explains low self-esteem and an increased susceptibility to depression.[204]

Again, within the PROMs frame and in line with previous findings, a significant association between self-esteem and quality of life (EQ-5D-5L) on admission was shown in the present analysis. The association of self-esteem with self-reported health status[153] as well as quality of life[205] has previously been shown in different study populations. Other studies have shown the association between quality of life on admission and increased mortality and functional decline.[29,151] Although we could not find this association over the follow-up period, further studies with a larger sample size might focus on the impact of self-esteem on quality of life.

Further, this present analysis shows the possible influence of self-esteem on health outcomes such as rehospitalization, grade of care and mortality up to six months after hospital discharge. As a most relevant observation, patients with lower self-esteem had significantly more frequent rehospitalizations at one-month follow-up and significantly more rehospitalization days during the one- and three-month follow-up period compared to patients with higher self-esteem. This result is particularly interesting considering the conservative adjustment model, which implies the independence of this association from tailored discharge counseling (TIDP), sex, chronological age and MPI frailty, which is largely accepted as a surrogate marker of biological age.[206] It is possible that patients who perceive themselves as ineffective contributors of their own health recovery need to visit and stay in the hospital more often and longer because they are increasingly dependent on medical and nursing care.

Interestingly, HSEG patients more often had a significantly higher grade of care after one month after discharge than LSEG, with more patients from HSEG having an existing grade of care at that point than patients from LSEG. A possible explanation could be that patients with a higher level of self-esteem were more active in organizing their health care preparations and therefore more frequently - after information had been given in the hospital - asked for an increase in the level of care.

A surprising result was the association of self-esteem and mortality, with people from the HSEG having a higher mortality rate in the three- and six-month follow-up compared to patients from the LSEG. This lies in contrast to previous findings, where lower self-esteem has been associated with a higher mortality risk.[154,207] This may probably be due to the small sample size and the short observation period of six months. Therefore, further studies in a longitudinal study design with more patients and a longer follow-up period are needed to clarify this issue. However, some studies have already shown that high self-esteem is also associated with an increased risk of making excessive assessments and predictions about oneself, which can lead to failure and performance declines as a result of threatened egoism.[208-210] This could also be important for a more precise interpretation of the observed higher mortality risks in the patient group with high self-esteem in further studies trying to shed light on the importance of quality over quantity.

Finally, in line with previous findings,[142] the present results suggest that demographic characteristics such as age, sex and education are not associated with self-esteem. However further studies are needed to further explore the role of gender and diversity for the effects of self-efficacy and self-esteem during recovery from diseases.

This secondary analysis shows for the first time the close interaction between self-esteem - measured by the RSES - and multidimensional prognosis and frailty, measured by the MPI. Self-esteem on admission was significantly associated with the MPI on admission independent of sex and chronological age, and the MPI at hospital discharge was significantly associated with the course of self-esteem during the follow-up period. Patients with a lower MPI on hospital discharge indeed had a higher self-esteem up to six months thereafter and vice versa, independent of age, sex, intervention and self-esteem on admission. This suggests that self-esteem may have prognostic significance for older hospitalized patients and its consideration might be useful for shared decision-making.

To our knowledge, this is the first study to show a potential prognostic fingerprint of self-esteem. Other studies have previously shown that high self-efficacy and higher self-esteem are linked to lower health risks as well as better health.[30,31] Another study found a significant association between frailty and life satisfaction, but could not show the same effect for self-esteem.[211] A significant association between physical frailty and core dimensions of psychological well-being was found in a previous study, although it could not show this for self-esteem in older frail women.[212] In line with this, we are able to show that patients in the HSEG had significantly more geriatric resources than syndromes. Since the prognostic significance of these resources and syndromes is already known,[179] this once again underscores the close interweaving of PROMS such as self-esteem and multidimensional prognosis and frailty. As a recently published article of the same cohort showed that TIDP improves frailty, self-esteem and mood,[26] the opportunity in strengthening these factors through individual programs should be used to improve the prognosis of older multimorbid patients, restore robustness and enable successful aging.[10,14,189]

Interestingly, especially the MPI subdomains of the nutritional score MNA-SF and the pressure ulcer risk score ESS showed significant associations with self-esteem. Other subscores of the MPI as the SPSMQ as cognition indicator were not significantly associated with self-esteem groups, possibly indicating a stronger impact of motor performance and physical functioning on self-esteem independent of the intellectual level. Literature already suggests an association of health risk behavior with self-esteem, with overall self-efficacy being repeatedly shown as a good predictor of health behavior[213] and nutrition being a major component of good health behavior. A significant positive association between self-esteem and weight[214], as well as the improvement of self-efficacy through web-based nutrition education have previously been observed.[215] Despite evidence in older adults being scarce, these findings suggest that interventions developed to promote self-esteem as well as awareness on balanced lifestyle behavior could improve nutritional status and overall health, including in older adults.

Finally, this present analysis shows that self-esteem is associated with the BI on admission. Despite not being able to conclude cause-effects, psychological factors like self-esteem may influence the level of independence in daily functioning.[139] An influence of self-esteem in physical function has been previously shown,[152] although the BI course displayed in **Figure 3** demonstrates the overtime higher BI scores in the HSEG, whereby the sharp drop in the BI on day 17 may be due to the decrease in the number of cases after seventeen days (n=57). However, no association of the BI repeated measures nor of discharge BI with self-esteem was found, possibly due to the dominating effect of the medical treatment. While previous

studies have shown that the MPI can serve as a monitoring tool during hospitalization,[92,216] linking the MPI to changes in the BI during hospitalization and considering the impact of self-esteem on these changes could create a more accurate and specific monitoring tool. High self-esteem may influence patients' potential, which is a determinant of success of geriatric interventions. Further studies are needed to compare the predictive power of these instruments.

5.3. Impact of psychological factor on geriatric patients during the COVID-19 pandemic

The main advantage of our findings regarding psychological impact during the pandemic is the unintended longitudinal data, as we studied patients from October 2019 - before the pandemic began and was officially declared a pandemic by the WHO on March 11, 2020[217] - until early August 2020, when the first wave of the pandemic had ended. Thus, we had data concerning older hospitalized people before and during the pandemic and could analyze the differences.

We found that patients hospitalized during the pandemic had higher depression scores than those hospitalized before the pandemic started. This is consistent with previous findings that depressive symptoms were more frequently observed during the pandemic.[157-159]

Surprisingly, patients hospitalized during the pandemic had a significantly better GDS and self-esteem at follow-up. However, other studies have also shown a decrease in depression, anxiety and stress four weeks after the begin of the pandemic in the general Chinese population.[218] Stable mental health status was previously shown by comparing data from May 2020 with those before the pandemic in November 2019 among Dutch older adults and attempts were made to explain these results by mental preparation for the pandemic by looking at the situation in China in the months before, low mortality rates and sufficient intensive care capacity.[173]

However, most data - including our results at the time of admission - show that mental health problems - especially depressive symptoms - are increasing in the population, which may have an additional impact on the health status and overall prognosis of older patients and should therefore be considered not only in treatment planning but also in public health decisions, such as social distancing measures.

5.4. Limitations and problems conducting of the study

As is common in empirical research, the conduct of the present study also involved some limitations. First, our sample size was relatively small with a study population of 110 patients, although the lost-to-follow-up rate of five patients was low. However, the highly significant observations that we made for the first time allow a reliable interpretation as a basis for further studies with a larger sample size in a multicenter setting with a possible longer follow-up period to confirm our results. Second, the "*Vun nix kütt nix"*-study was a non-blinded randomized control trial, and thus observational bias cannot be ruled out. However, the focus of the study was placed on the TIDP at discharge, meaning that the influence of the control group should be sufficiently reduced. Furthermore, giving that it was a single-center study, it may not be transferable to patients who do not meet the inclusion criteria, or the study may not be applicable in other settings. A further multicenter study with a larger study population - as already mentioned - therefore seems necessary.

A general weakness of our questionnaires and the assessment of self-esteem and other PROMs is that they have to rely on patients' statements. However, for health and quality of life outcomes in advanced age patients, these questionnaires remain the most suitable survey instrument and are widely used.[219]

Even though the RSES showed significant results in association with the MPI, GDS and Barthel Index, the concept of the self is more complex, as presented in chapter 2.2.1. The literature has also shown that self-efficacy is related to several health-related outcomes.[139,152,153] We only tested self-esteem with the RSES, but further studies should also consider the role of self-efficacy and include appropriate instruments in the assessment. Aspects as self-efficacy and resilience to show one's competence to cope with a broad range of stressful or challenging demands[220], seem to hold particular interest for hospitalized patients in acute hospital settings, including the impact of these aspects have on the course of the disease and its prognosis. This impact should be deeper investigated in greater depth in further studies, whereby the General Self-Efficacy Scale[221] has proven to be a reliable and valid tool to assess self-efficacy.[222,223]

Looking at the data regarding the psychological aspects during the pandemic, we only had a short comparison period before the pandemic from October 2019 to March 11 ,2020, whereby the first cases in China already occurred in December 2019 and therefore the virus had been reported intensively in German media since the beginning of 2020 and possible effects on - for example - depression symptoms of our patients cannot be ruled out as a result.

Comparisons with previous studies on depression or self-esteem as a historical control group or a comparison after the end or regulation of the pandemic seem necessary here to confirm our findings.

5.5. Research outlook

The "*Vun nix kütt nix"* study showed that geriatric co-treatment, patient education and GP involvement can improve prognosis assessed with the MPI and PROMs such as self-esteem and depressive symptoms. We have also been able to show the impact of self-esteem on the prognosis and hospital course of geriatric patients and how psychological variables affect patients' health status and prognosis in times of a pandemic. Therefore, a TIDP such as the one implemented in our study should be replicated in other clinical settings, as it is seen as an opportunity to improve the treatment of geriatric patients. However, other approaches seem necessary to strengthen the sustainability of the intervention, especially in the follow-up period.

Further research could therefore investigate whether additional in-hospital exercise interventions or rehabilitation programs could have a preventive effect on rehospitalization rates. These interventions could focus on how HRQoL can be supported, as well as psychological aspects such as self-esteem and mood in order to enhance health status and clinical prognosis. Programs that improve self-esteem have already been researched[224] and it has been shown how psychotherapeutic interventions can reduce depressive symptoms and enhance self-esteem.[225] The aim of future research should be to establish a link between programs improving psychological aspects such as self-esteem and health prognosis.

The multidimensional model of frailty already includes QoL,[226] but other psychological factors such as depression and self-esteem could also complement this model. The biopsychosocial model of frailty and resilience and the associated integration of bio-basic and clinical intergration consider the need to build resilience to counteract frailty.[227] As mentioned earlier, the concept of self and psychological influences are complex and should be in focus of future research. Here, the question should be answered whether monitoring these aspects and improving them through specific programs can lead to a better prognosis. Scales other than the GDS or RSES should therefore be investigated. The General Self-Efficacy Scale may be in a special focus as it seeks responses to statements such as "Thanks to my resourcefulness, I can handle unforeseen situations" or "It is easy for me to stick to my aims and accomplish my goals",[221] which can be seen as a useful characteristic for coping with health problems and the implementation of interventions. The focus on these aspects can be seen as an important

complement to patient-centered care to examine and strengthen the resources of patients with regarding the implementation of health-promoting behaviors. Comprehensive geriatric assessments such as the CGA provide a basis for this shared clinical decision-making to improve the hospitalization rates of geriatric patients.[228] Adding psychological aspects to these assessments - such as the RSES or the General Self-Efficacy Scale - would require only three minutes in the practical implementation of the survey, which can be considered a helpful resource in the management of geriatric syndromes. Moreover, further studies are needed to investigate whether factors such as depression or self-esteem should be added to geriatric resources. This should be the case if these factors have an additional effect on current prognostic relevance.[179]

The recently emerging COVID-19 pandemic in which depressive symptoms occur more frequently,[229,230] thus enhancing self-esteem - which is related to depressive symptoms, as this study found - could be an approach to help patients to better cope with these challenges and should therefore be the focus of further studies. The aspect of the long-term consequences of the pandemic - such as when an end of the pandemic can be foreseeable - should also hold particular importance for future research.

In summary, medical research should not only focus on the physical aspects but also on the influence of psychological aspects of older patients, which could open up new avenues in medical research in the future. In this way, the upcoming challenge of an increasing number of multimorbid patients and the associated costs and use of resources in multiprofessional teams could be better understood and implemented.

6. Conclusion

In summary, medicine is facing the major challenge of the 21st century regarding an increasingly aging society and therefore more complex, multimorbid patients. The aim should be to recognize the individual resources and syndromes of a patient through a patient-centered approach to provide them with the best possible treatment.

The study "*'Vun nix kütt nix' - Patient, geriatrician and general practitioner as a multiprofessional team for intersectoral discharge management"* showed that an intersectoral triad of geriatrician, patient and GP improves the prognosis of patients measured by the CGA-based MPI and has positive effects on factors such as self-esteem and mood. This should be used as an opportunity to strengthen cooperation between the disciplines to ensure targeted treatment planning for patients beyond inpatient treatment to close the intersectoral gap and reduce rehospitalization.

In addition, our results suggest that self-esteem is highly associated with health-related outcomes and individual MPI prognosis and frailty in older patients undergoing acute treatments in hospital. Considering the rapidly increasing number of older persons and their treatment outside of geriatric settings as well as the importance of self-esteem for PROMs, its systematic though feasible evaluation might be helpful in clinical practice. The multidimensional model of frailty already includes quality of life,[226] but other psychological factors such as self-esteem could also complement this model. Further studies are needed to investigate whether factors such as depression or self-esteem should be added to geriatric syndromes or resources. In a pandemic similar to COVID19 - in which depressive symptoms occur more frequently[229,230]- enhancing self-esteem could be an approach to help patients to better cope with these challenges and should therefore be the focus of further studies. Future studies may also examine whether measuring and managing self-esteem through education and rehabilitation programs could improve patient outcomes.

In times of the COVID-19 pandemic, it could be shown that depression symptoms increase, thus emphasizing the topicality and necessity of considering psychological aspects in the treatment of elderly patients. For this very reason, a focus should be placed on the psychological aspects of older, multimorbid patients to recognize their influence on the prognosis of the disease, and programs should be used to strengthen the psychological resources of the patients and thus promote healthy aging. Indeed, as Jules Renard says: "It's not how old you are. It's how you're old." [2]

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8. Attachments

8.1. List of figures

8.2. List of tables

8.3. List of publications

8.3.1. Publications (Data collection)

11/2021 Meyer AM, Polidori MC. Ratgeber Altern: Leitfaden für Gesundheit und Wohlbefinden im Alter: Elsevier Health Sciences; 2021.

12/2022 Meyer AM, Bartram MP, Antczak P, Becker I, Benzing T, Polidori MC. A Tailored Discharge Program Improves Frailty and Mood in Patients Undergoing Usual Rehabilitative Care: A Randomized Controlled Trial. J Am Med Dir Assoc 2022.

8.3.2. Poster presentations (as first author)

09/2021 Verlauf von Depressionssymptomen und Selbstwirksamkeit älterer Patienten während der COVID-Pandemie. L. Mück, A. Ferring, J. Stegemann, L. Wiebe, M. C. Polidori Nelles, A. M. Meyer.

i.R. des 33. Jahreskongress der deutschen Gesellschaft für Geriatrie, Onlinekongress

06/2022 Verlauf von Depressionssymptomen und Selbstwirksamkeit älterer Patienten während der COVID-Pandemie. L. Mück, A. Ferring, J. Stegemann, L. Wiebe, M. C. Polidori Nelles, A. M. Meyer.
i.R. des 5th Cologne Symposium on Ageing Medicine 2022, Köln, Deutschland

Supplementary 1

Verlauf der Depressionssymptome und Selbstwirksamkeit älterer Patienten während der COVID-Pandemie

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1. EINLEITUNG

- Eine der größten Herausforderungen der Patientenversorgung aktuell besteht aus Maßnahmen zur Bekämpfung der Pandemie durch den Sars-CoV-2-Virus (Severe Acute Respiratory Syndrome Coronavirus Type 2)
- Studien belegen, dass psychosoziale Herausforderungen der Pandemie wie die Zunahme von Ängsten, Zwängen, Depressionen und Burnout einen großen Einfluss auf den Krankheitsverlauf haben
- Soziale Isolation von älteren Patienten können neuropsychiatrische Symptome wie Apathie, Angst und Agitation auslösen und beeinflussen
- Ziel der vorliegenden Analyse: Hat die Pandemie einen messbaren psychosoziale auf hospitalisierte, multimorbide Patient*innen?

2. PATIENTEN UND METHODIK

- 110 multimorbide Patient*innen der „Vun nix kütt nix"-Studie (Wilhelm-Woort-Förderpreis 2019): A tailored, co-managed Discharge Program improves Multidimensional Prognosis in older Inpatients: Randomized Controlled Trial with 6 months Follow-Up
- Bei Aufnahme: multidimensionales Assessment mit Erhebung des Multidimensionalen Prognostischen Index (Multidimensional Prognostic Index, MPI), Geriatrische Depressionsskala (Geriatric Depression Scale, GDS) und Rosenbergs Selbstwirksamkeitsskala (Rosenbergs Self Esteem Scale, RSES).
- Follow-Up nach 1, 3 und 6 Monaten: Überleben, Rehospitalisierungsrate, GDS, RSES
- Datenanalyse vor und nach Pandemiebeginn (WGO: 11.03.2020)

3. ERGEBNISSE

- Das mediane Alter betrug **78 Jahre** (IQR 9), 57% der Patient*innen waren weiblich (Tabelle 1)
- Vor Beginn der Pandemie wurden 62 Patient*innen eingeschlossen, 48 Patient*innen danach (Tabelle 1)
- **Mittlerer GDS-Score** bei Aufnahme **vor Beginn der Pandemie bei 4 (±2,8) Punkten und nach der Pandemie bei 5,2 (± 3,8) Punkten (p=0,056)** (Abbildung 1)
- Adjustierung nach Demenz, MPI bei Aufnahme, Intervention und Geschlecht zeigte **nach Beginn der Pandemie einen signifikant schlechteren GDS-Score** bei Aufnahme (p=0,048) im Vergleich zum Zeitraum vor der Pandemie (Tabelle 2)
- **3-Monate-Follow-up: signifikant verbesserter GDS-Score (p=0,006)** bei aufgenommenen Patienten während Pandemie vs. aufgenommene Patienten vor Pandemiebeginn (Abbildung 2, Tabelle 2)
- **3-Monate-Follow-up: signifikant bessere Selbstwirksamkeit (p=0,036)** bei Patienten während Pandemie vs. Aufgenommene Patienten vor der Pandemiebeginn befanden (Tabelle 2)

Tabelle 1 Deskriptive Ergebnisse

	Vor Corona	Nach Corona
Geschlecht	♂ 26 (42%) ♀ 36 (58%)	♂ 21 (44%) ♀ 27 (56%)
Alter, Mittelwert (SD)	76,6 (7,3)	78 (6,7)
MPI, Mittelwert (SD)	0,54 (0,19)	0,57 (0,18)
Geriatrische Depressionsskala nach Yesevage, Mittelwert (SD)	4 (2,8)	5,2 (3,9)
Rosenberrgs Selbstwirksamkeits skala, Mittelwert (SD)	25,3 (3,5)	25 (3,9)

Abbildung 1 GDS Score bei Aufnahme

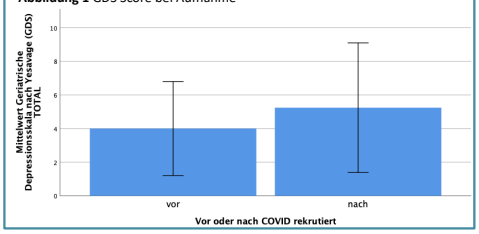
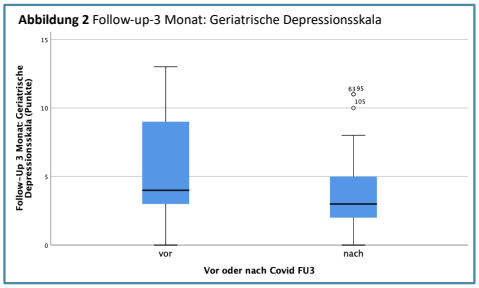


Tabelle 2 Ergebnisse lineare Regressionsanalyse*

Skalen	Regressions-koeffizient B	Signifikanz p
Aufnahme GDS vor oder nach COVID	1,249	0,048
3FU GDS vor oder nach COVID	-2,905	0,006
3FU Selbstwirk-samkeit	2,9	0,036

*adjustiert nach Demenz, MPI bei Aufnahme, Intervention und Geschlecht

Abbildung 2 Follow-up-3 Monat: Geriatrische Depressionsskala



4. SCHLUSSFOLGERUNG

- In dieser Sekundäranalyse beobachten wir basierend auf den GDS-Werten, dass hospitalisierte Patienten während der Pandemie depressiver scheinen
- Interessanterweise zeigt die vorliegende Analyse, dass während der Pandemie hospitalisierte Patienten im Verlauf eine Verbesserung der Depressionssymptome zeigen im Vergleich zu vor Beginn der Pandemie hospitalisierten Patienten. Diese Verbesserung wird begleitet mit stärkerer Selbstwirksamkeit. Weitere Studien sind erforderlich, um verbesserte Selbstkompetenz zu evaluieren.
- Weitere Studien bei vulnerablen Patienten mit großer Studienpopulation und weiteren Assessments des psychosozialen Status scheinen notwendig.

5. LITERATURQUELLEN

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