

Consequences of the Covid-19 pandemic on complex multimorbid elderly: Follow-up of a community-based cohort. SAMAC3 Study

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Abstract

Background: The restrictions imposed during the management of the pandemic led to lack of care of other health problems.

Purpose: To assess changes in the health status of complex multimorbidity elderly, functional and cognitive capacities, perception of the social surroundings, care provided by the nurses, including nursing diagnosis and interventions, use of health services, adverse events, and use of devices and technical help during the first 6 months of the Covid-19 pandemic.

Design: A 1-year longitudinal cohort study was conducted.

Methods: Ninety-seven complex multimorbid elderly attended in primary care were evaluated every 3 months in a health area of the Spanish National Health System (SNHS). The research was called “SAMAC3 study”.

Results: Significant negative changes were observed in the functional and cognitive capacity of the elderly, and in several nursing diagnoses. A decrease was observed in the frequency of visit to the nurses, hospital admittance, length of hospital stays, and falls.

Conclusions: The functional and cognitive capacities of the cohort became worse. However, a significant decrease in the frequency of use of health services was observed. The nurses detected significant changes in activity-exercise, cognitive-perception, and roles-relationships, but their interventions were mostly centered on resolving clinical matters that required immediate attention.

Clinical Relevance: The present study allowed us to observe that a situation of social and health stress has worsened the health indicators of multimorbid elderly, and the

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clinical care of community nurses was insufficient to providing care for the deterioration of the physical and cognitive domains.

KEYWORDS

community-setting, Covid-19, health services for the aged, multimorbidity, nursing diagnosis, outcome assessment

BACKGROUND

Multimorbidity, defined as the presence of two or more co-existing chronic conditions, has a worldwide prevalence of 41.3% and is perhaps greater than 80% among individual aged ≥ 85 years old (Nguyen et al., 2019). The chronic multimorbid patient has more associated health problems (Lavan et al., 2016), which in the elderly translates into complex states of health, responsible for polypharmacy, fragility, loneliness, social isolation, depression, anxiety, cognitive deterioration, and gradual loss of autonomy (Papathanasiou et al., 2021). The high complexity and vulnerability of this population habitually leads to a greater consumption of health resources and services, and an increased visits to emergency services (Palladino et al., 2016), a greater meetings with primary care (PC) professionals (Barrio Cortes et al., 2019; Bleijenberg et al., 2013), an increase in hospitalizations (Morales-Asencio et al., 2019), a higher mortality (Holt-Lunstad et al., 2015), and an escalation in health care spending (Larkin et al., 2021). The informal caregivers who provide care to complex multimorbid patients can also experience high levels of stress and fatigue (Price et al., 2020).

Within this framework of nurses' action, multimorbidity presents us with numerous challenges for the community. The use of nursing care plans through the use of Standard Nursing Language (SNL), such as NANDA-I and the Nursing Intervention Classification (NIC) eases the monitoring and follow-up of these patients through the identification of precise nursing diagnoses, an essential aspect for planning adequate interventions. Research on this area has normally focused on the evaluation of patients with specific pathologies, although there is a scarce number of studies directed to multimorbid patients in the community. Recent studies have been found which studied patients who either required home care, or in nursing homes. These individuals, showed alterations mainly in mobility, lack of self-care, risk for falls, inefficient family processes, risk due to pressure ulcers, and impaired memory (Shin et al., 2021; Sousa et al., 2021).

During the COVID-19 pandemic, restriction of movement was mandated worldwide to reduce the impact of the disease (World Health Organization, 2020), with detrimental effects on the care provided by healthcare institutions. The elderly were forced to avoid physical contact and to remain at home, which led to the substantial increase in the effects of multimorbidity. These measures affected their physical health (Hugelius et al., 2021), increased their levels of pain (Sizoo et al., 2020), and reduced their

ability to self-care, including the maintenance of personal hygiene (O'Caioimh et al., 2020). An increase was observed in the levels of loneliness, symptoms of depression, agitation, and aggression among the elderly during the period of restricted visits, as compared to periods of normal visits (Hugelius et al., 2021). Also, cognitive functions, such as the loss of memory, were also affected (Wammes et al., 2020).

The health care model in primary care in many regions of Spain utilizes a care model named Family Care Unit, composed of family doctors and community nurses, in which the care is determined by uniform procedures derived from the needs associated to classifications of illnesses and degrees of dependence and by organizational constraints where care is given according to user demand (Ong et al., 2020). According the health professionals, the organization of health systems is not oriented towards an adequate follow-up of the complex multimorbid patients, but instead towards the treatment of acute processes, which results in maladjustments in the health care loads of health professionals, as well as the collapse in the different health care services that impede the adequate monitoring of these patients (Tambo-Lizalde et al., 2021). Similarly, the changes experienced due to the overflow in the health systems resulting from the management of the COVID-19 pandemic led to the lack of care of other health problems, or the way care was provided (Halcomb et al., 2020). It has been shown that nurses worked under situations of high stress, anxiety, and fear, which affected the quality of their care (Baysal et al., 2022).

The unprecedented events due to the pandemic had a great repercussion on the health care of the population, but it is unknown whether health systems have been able to soundly adapt to the new needs. Also, the repercussion on the quality of care of the most vulnerable multimorbid elderly who were care for by the community are unknown. Moreover, longitudinal studies do not exist that describe the main changes in the functional capacity and health of these users, or the consequences these aspects have had on the care provided by and health professionals. Thus, the objective of the present study was to assess the changes produced in the health of complex multimorbid elderly individuals, and the changes in the frequency of use of health services from September 2019 to September 2020, 6 months after the COVID-19 pandemic began. More specifically, we studied the changes in the health status, functional and cognitive capacities, perception of the social surroundings, care provided by the nurses, including nursing diagnosis and interventions, use of health services, adverse events, and use of devices and technical help.

METHODS

Design

A 1-year longitudinal cohort study was conducted in a group of complex multimorbid elderly individuals from September 2019 to September 2020, in a health area of the Spanish National Health System (SNHS). The research was called "SAMAC3 study".

Setting and participants

In Spain, each geographical area is divided into different "health areas" (i.e., Health Area 1 covers the main city, while other health areas cover the surrounding towns). The health area studied includes a 200-bed university hospital and 10 primary health centers, which in 2021 provided care to a total population of 182,338 inhabitants, of which 27,438 were older than 65 years old. The community health care is conducted through a primary care team composed of 113 general practitioners, 117 community nurses, 119 healthcare assistants, 7 physical therapists, and 4 social workers. At the level of Primary care, this area offers services for the prevention and detection of problems in the elderly. It also includes a service of at-home care for immobilized patients, to guarantee continuity of care, accessibility, and equity of comprehensive care of the patients who would otherwise not be able to visit the health center.

The study population was comprised by patients older than 65, who were registered in the home-based care of the health area of the SNHS. Of these, the complex patients were included, who were found in any of the following situations: (a) polymedicated with 10 or more drugs; (b) two or more simultaneous chronic pathologies; (c) living alone, or not being cared for by a family member or formal caregiver; (d) presence of some type of help device at home: oxygen therapy, aerosol therapy, sub-cutaneous or intravenous perfusion pump, vesical or nasogastric catheter.

The community nurses from the 10 primary care centers were invited for the selection the study subjects. The nurses selected the participants according to the selection criteria, through convenience sampling. A design with a sample size of 82 subjects, as that obtained in this study, can detect effect sizes of $\delta \geq 0.32$ with a power of 80%, assuming a two-tailed criterion for detection that allows for a maximum Type-I error rate of $\alpha = 0.05$.

Variables and instruments

The design of the study was guided by two conceptual frameworks. First, the CURVE model (Morales-Asencio et al., 2016), which describes the factors that affect complexity across a course of life with chronic illness, such as self-care behaviors, family support, effective coping, lifestyle adaptation, proactivity of the health care team, continuity of care, and socioeconomic determinants. This model guided the inclusion of nursing diagnoses and interventions related

to self-care, coping, and lifestyle adaptation, with educational level as a socioeconomic determinant. On the other hand, for the analysis of the use of health services, the Andersen's framework was utilized. This framework has been widely used to evaluate health care frequentation in multiple settings (Andersen, 1995). According to this model, there are three domains that determine health care use: predisposing factors (such as health beliefs, sociodemographic characteristics), facilitating factors (family support, perceived social support) and health status. As predisposing factors, age, gender, and nationality were evaluated. Moreover, as facilitating factors, the number of individuals living with the patient, the presence of a family caregiver, and the perceived social support and loneliness, were selected to identify facilitating factors. Finally, health status was evaluated by collecting the main medical diagnoses, Charlson comorbidity index, functional status (Barthel Index), and cognitive assessment evaluated with the short portable mental status questionnaire (SPMSQ). Adverse events were also evaluated, as they can exert an important influence on health status.

The following variables were measured using robust and validated instruments:

- Sociodemographic characteristics of the patient: age, sex, nationality, level of education.
- Social context of the patient: environment in which the patient lived, number of individuals living with the patient, presence of a family member caregiver, characteristics of the family caregiver (age, sex, relationship, level of education, housing), social support received, through the DUKE questionnaire, (Bellón Saameño et al., 1996) an instrument with an adequate reliability, as shown by its Cronbach's alpha of 0.90, and appropriate construct and criterion validity; loneliness through the UCLA scale (Velarde-Mayol et al., 2016), this scale has an adequate reliability, with a Cronbach's alpha value of 0.95, and with satisfactory results in its construct and discriminant validity; and lastly, the effort of the caregiver was measured with the Caregiver Strain Index (CSI) (López Alonso & Moral Serrano, 2005), which obtained a Cronbach's alpha of 0.80, and an adequate criterion validity for its use in the screening of strain experienced by the caregiver.
- Health and functional characteristics: medical diagnoses; Charlson Comorbidity Index (CCI) (Charlson et al., 1987), this is a weighted index that takes into account the number and the seriousness of comorbid disease, and it has shown to be readily applicable and valid method of estimating risk of death; assessment of functionality of the elderly with the Barthel index (González et al., 2018); this tool has shown to have a good reliability, with Cronbach's alpha coefficients between 0.88 and 0.91, aside from an adequate construct validity and convergent and discriminant validity, and lastly, a cognitive assessment was performed through the short portable mental status questionnaire (SPMSQ) (Pfeiffer's Test) (Martínez De La Iglesia et al., 2001), this instrument was shown to have a good reliability, with a test-retest of 0.92, and an adequate convergent and discriminant validity.

- Nursing care. In our Health Area, the nurses use the Gordon patient assessment system (Herdman & Kamitsuru, 2019), which assesses 11 Functional Patterns. After their assessment, the nurses identify the diagnoses corresponding to the patient from a total of 196 diagnoses from the NANDA-I nursing diagnosis taxonomy (Herdman & Kamitsuru, 2019), that were pre-selected for the study. Next, they plan and conduct interventions oriented towards the reduction or the prevention of the diagnoses detected, selecting them starting with 53 standardized nursing interventions (Butcher et al., 2019). For the analysis of data, the nursing diagnoses were grouped into 11 functional patterns, while the NIC interventions were grouped into 30 classes and 7 domains for ease of use: The 7 domains were: (1) Physiological: Basic, (2) Physiological: Complex, (3) Behavioral, (4) Safety, (5) Family, (6) Health System, and (7) Community.
- Adverse events: number of falls, number of pressure ulcers, problems associated with the medication, institutionalization.
- Use of services, devices, and technical help: number of visits to emergencies, number of hospital admittances, type of admittance (planned/urgent), number of days at the hospital, number of visits with health professionals, number of diagnostic tests, use of devices, and technical help, visits to day centers, use of home-based help.

Data collection process

For the collection of data, the online access platform RANGECOM was utilized, previously developed by Morales-Asencio (Morales-Asencio et al., 2015). This platform includes all the variables used in the study. The nurses who participated in the study were trained on the RANGECOM platform and the recording of the information from the patients included in the study. Each of the nurses was provided with personal access to the RANGECOM platform. Once a patient was included in the study, the nurses gave the patient an appointment, either at the health center, or at their home, to assess them and for the initial recording of the data. Next, another appointment was given every 12 weeks (3 months) until completing a year of follow-up, or until their death or abandonment of the study for other reasons. In total, each patient was assessed 5 times: T0 (basal assessment: September 2019), T1 (3 months, December, 2019), T2 (6 months: March, 2020), T3 (9 months: June, 2020), and final assessment T4 (12 months: September, 2020). Lastly, the main researcher downloaded the data recorded to an anonymized database for posterior analysis.

Ethical considerations

The study was approved by the Research Ethic Committee from the Health Area (209/2018) and follows the principles of the Declaration of Helsinki. The participants were informed about the objective of

the study. The participant's consent was solicited in writing to be included in the registry. The data were pseudo-anonymized before their analysis and processing, to avoid the identification of any user. The information was utilized in a strictly confidential manner.

Data analysis

An exploratory analysis was performed with the data, through the calculation of the central tendency and dispersion or percentages. The bivariate analysis was performed with Student's *t* test, Chi-square, Wilcoxon test, and Mann-Whitney U test. For the longitudinal analysis of the data, statistical tests were performed for related samples. A McNemar test and Cochran's Q were utilized to compare the dichotomous or qualitative variables with more than 2 categories. For the quantitative variables, Student's *t*-test was used for related samples, as well as a single factor repeated measures ANOVA. All the analyses were performed with the SPSS v.25 package. All the results were considered statistically significant at $p < 0.05$.

RESULTS

A total of 48 nurses from 8 primary care centers in the health areas of the SNHS participated in the study. On the first assessment, 97 patients were included in the registry. Each subject was re-assessed every 3 months on four occasions after the first (basal) assessment, for a total of 1 year in duration and a total of 434 records. During the study, the sample was reduced to 82 subjects, after the loss of 14 users due to death, and one due to a change of address.

Sociodemographic and clinical data

The patients studied had a mean age of 83.6 years (SD: 6.7), and were predominantly female (71.1%), and without an education or primary education (94.8%). Of these, 86.6% lived with one or more individuals, and 88.7% had a caregiver (Table 1). 28% of participants had at least two pathologies, 37% three pathologies, and 35% four or more pathologies. The most prevalent medical diagnoses were high blood pressure (71.1%), diabetes mellitus (45.5%), arthrosis (41.2%), heart failure (27.8%), and depression (24.7%). None were diagnosed with Covid-19 during the study period.

Changes in the functional state and state of health

Statistically significant worsening changes were observed in their everyday life functional ability, and in their cognitive state (Table 2). The mean score in the assessment of loneliness barely changed. No statistical differences were observed in social support, CCI and the CSI (Table 2).

TABLE 1 Sociodemographic data of the elderly and the caregivers

	Mean (SD)		Mean (SD)
Age of patient (years)	83.6 (6.7)	Age of family caregiver (years)	59.1(11.6)
Sex of the patient	n (%)	Sex of family caregiver familiar	n (%)
Female	69 (71.1)	Female	58 (82.9)
Male	28 (28.9)	Male	12 (17.1)
Level of education of the patient	n (%)	Level of education of family caregiver	n (%)
None	75 (77.3)	None	18 (25.7)
Primary	17 (17.5)	Primary	40 (57.1)
Secondary	3 (3.1)	Secondary	7 (10)
University	2 (2.1)	University	5 (7.1)
Advance directives	n (%)	Relationship family caregiver	n (%)
	12 (12.4)	Spouse	13 (18.6)
Tutorships	n (%)	Son/daughter	48 (68,6)
None Informal	61 (62.9)	Brother/sister	3 (4.3)
Formal or legal	30 (30.9)	Niece	3 (4.3)
	6 (6.2)	Son-in-law	3 (4.3)
Living conditions	n (%)	Hours dedicated family caregiver	n (%)
Alone	13 (13.4)	0-6h	9 (12.9)
One persons	40 (41.3)	7-12h	12 (27.1)
2 or more persons	44 (45.3)	13-18h	42 (60)
Presence of caregiver formal or family	n (%)	Area of residence of family caregiver	n (%)
	86 (88.7)	Urban	58 (82.9)
Presence of caregiver formal	n (%)	Rural	12 (17.1)
	38 (39.2)	Caregiver Strain Index (CSI)	Mean (SD)
Presence of caregiver family	n (%)		5.2 (3.5)
	70 (72.0)		

TABLE 2 Comparison of the mean base and final clinical assessment scores of the elderly

	Basal time (T0) Mean (SD)	Final time (T4) Mean (SD)	p-value
Social support (DUKE)	45.07 (9.13)	43.33 (9.84)	0.14
Loneliness (UCLA)	30.99 (6.96)	30.03 (7.05)	0.099
Comorbidity (CCI)	2.83 (1.85)	3.21 (2.39)	0.35
Functionality (Bhartel)	56.28 (32.41)	50.91 (33.46)	<0.001
Cognitive state (Pheiffer's Test)	3.38 (3.33)	3.82 (3.22)	0.006
Caregiver Strain Index (CSI)	4.80 (3.55)	4.90 (3.52)	0.641

Changes in nursing care

The nurses detected more alterations in the patterns of Health Perception-Health Management, Activity-exercise, Nutritional-metabolic and Cognitive-perception with some modifications during the year assessed (Table 3). Particularly, a statistically significant increase was produced in the diagnoses "Impaired physical

mobility", "Impaired ambulation", and "Dressing self-care deficit", and "Constipation". There was also an increase in the importance of the Roles-Relationships pattern, which showed a statistically significant increase in the frequency of the diagnoses "Impaired social interaction" and "Impaired verbal communication". Lastly, a considerable change was observed in the Self-perception-self-concept pattern due to the increase in the diagnoses "Risk of loneliness" and "hopelessness" (Table 3).

The interventions proposed and performed by the nurses are shown grouped into domains and classes (Table 4). The nursing interventions mainly took place in the domain Safety, associated with the measures taken to prevent falls; the domain Physiological complex, related with interventions for the management of pressure ulcers; and lastly, in the domain Family, associated with the care provided to the caregivers of the elderly. The order and size of the interventions from these domains was not modified at the end of the assessment period, although some statistically significant changes were observed in some interventions (Table 4). Additional material Table 7 shows the nursing diagnoses in the basal time (T0) and final time (T4) assessed, which are linked with the nursing interventions.

TABLE 3 Comparison of the most frequent nursing diagnoses in the 5 moments evaluated

Health pattern	Nursing diagnoses	T0 n(%)	T1 n(%)	T2 n(%)	T3 n(%)	T4 n(%)	p-value
Health perception-health management	Risk of falls	56 (68)	59 (71.9)	59 (71.4)	55 (67.1)	57 (69.5)	0.340
Activity-exercise	Impaired physical mobility	41 (49.5)	41 (49.4)	46 (56)	48 (58.5)	54 (65.9)	0.004
	Impaired ambulation	38 (46.4)	41 (49.4)	41 (50)	40 (48.8)	47 (57.3)	0.033
	Sedentary lifestyle	15 (18.6)	22 (27)	22 (27.4)	23 (28)	25 (30.5)	0.114
	Bathing self-care deficit	19 (23.7)	19 (23.6)	19 (22.6)	18 (22)	20 (24.4)	0.795
	Dressing self-care deficit	13 (15.5)	12 (13.5)	13 (15.5)	15 (18.3)	16 (19.5)	0.034
	Impaired transfer ability	15 (18.6)	14 (16.9)	15 (17.9)	16 (19.5)	16 (19.5)	0.891
	Decreased diversional activity engagement	14 (17.5)	17 (21.3)	17 (20.2)	16 (19.5)	15 (18.3)	0.764
	Toileting self-care deficit	13 (15.5)	13 (15.7)	14 (16.7)	15 (18.3)	15 (18.3)	0.255
	Impaired bed mobility	8 (10.3)	10 (12.4)	11 (13.1)	9 (11)	13 (15.9)	0.084
	Activity intolerance	11 (13.4)	11 (13.5)	11 (13.1)	11 (13.4)	12 (14.6)	0.856
	Feeding self-care deficit	8 (10.3)	11 (13.5)	11 (13.1)	10 (12.2)	10 (12.2)	0.115
Nutritional-metabolic	Risk for impaired skin integrity	27 (33)	25 (30.3)	27 (33.3)	26 (31.7)	27 (32.9)	0.821
	Impaired skin integrity	18 (21.6)	21 (25.8)	21 (26.2)	22 (26.8)	18 (22)	0.461
	Risk for unstable blood glucose level	7 (8.2)	6 (7.9)	9 (10.7)	7 (8.5)	8 (9.8)	0.760
Cognitive-perception	Impaired memory	16(19.6)	15 (18)	15 (17.9)	16 (19.5)	20 (24.4)	0.076
	Chronic pain	14 (16.5)	16 (19.1)	18 (21.4)	15 (18.3)	16 (19.5)	0.649
	Deficient knowledge	8 (10.3)	8 (10.1)	12 (14.3)	12 (14.6)	8 (9.8)	0.213
Elimination	Impaired urinary elimination	11 (13.4)	10 (12.4)	12 (14.3)	12 (14.6)	15 (18.3)	0.357
	Functional urinary incontinence	12 (14.4)	10 (12.4)	11 (13.1)	11 (13.4)	11 (13.4)	0.720
	Constipation	4 (5.2)	4 (4.5)	8 (9.5)	7 (8.5)	8 (9.8)	0.012
Roles-relationships	Impaired social interaction	4 (5.2)	11 (13.5)	12 (14.3)	11 (13.4)	15 (18.3)	0.001
	Impaired verbal communication	8 (10.3)	10 (12.4)	11 (13.1)	9 (11)	13 (15.9)	0.055
	Risk for caregiver role strain	9 (11.3)	9 (11.2)	11 (13.1)	11 (13.4)	13 (15.9)	0.066
Sleep-rest	Disturbed sleep pattern	9 (11.3)	11 (13.5)	12 (14.3)	11 (13.4)	11 (13.4)	0.472
Self-perception-self-concept	Risk of loneliness	4 (5.2)	5 (6.7)	8 (9.5)	6 (7.3)	8 (9.8)	0.406
	Hopelessness	2 (2.1)	2 (2.2)	2 (2.4)	2 (2.4)	4 (4.9)	0.757
Coping – stress tolerance	Generalized adult impairment	13 (15.5)	8 (10.1)	8 (10.7)	9 (11)	8 (9.8)	0.174

Use of services, adverse events, devices, and technical help

The complex multimorbid elders spent more time with the nurses, with a mean of 6 face-to-face meetings every 3 months at the start, which decreased in a statistically significant manner to 3.6 meetings ($p = 0.007$). In second place, we find the number of meetings with the general practitioner, with a mean of 2 contacts every 3 months without statistically significant changes ($p = 0.128$). The number of consultations with other professionals, and the number of diagnostic tests were less than one per trimester, and statistically significant changes were not observed throughout the study (Table 5).

The hospital admissions at the start of the study (15.7%) were reduced to almost half at the end of the study (7.3%). The mean number of days at the hospital also decreased, and the visits to emergencies were reduced by 11%. A change was observed in the main cause of hospital admittance, “exacerbation of the chronic condition”, with initial values of 14.3%, increasing to 66.7% at the end of the study (Table 6). The number of falls decreased by 12%, while the pressure ulcers and associated problems with the medications did not change. About 13% of the patients utilized some type of device, mainly oxygen therapy, which significantly increased by 4% during the study. Between 74–75% of the patients utilized some type of technical help, mainly a “walker”, “adjustable bed”, or “anti-bedsore mattress”,

TABLE 4 Comparison of the most frequent nursing interventions in the 5 moments assessed

Domain	Classes	Nursing interventions	T0 n(%)	T1 n(%)	T2 n(%)	T3 n(%)	T4 n(%)	p-value
Safety	Risk management	Fall prevention	61 (74.2)	60 (73)	57 (69)	56 (68.3)	59 (72)	0.762
		Risk identification	30 (36.1)	30 (37.1)	30 (36.9)	25 (30.5)	23 (28)	0.245
	Environmental management: safety	Environmental management	26 (32)	28 (33.7)	29 (35.7)	28 (34.1)	26 (31.7)	0.533
		Dementia management	13 (15.5)	8 (10.1)	8 (9.5)	7 (8.5)	10 (12.2)	0.240
	Immunization/Vaccination management	8 (10.3)	16 (19.1)	14 (16.7)	10 (12.2)	10 (12.2)	0.273	
Physiological:complex	Skin/Wound Management	Skin surveillance	41 (50.5)	45 (55.1)	48 (58.3)	43 (52.4)	50 (61)	0.020
		Pressure ulcer prevention	37 (45.4)	36 (43.8)	38 (46.4)	37 (45.1)	39 (47.6)	0.919
	Tissue perfusion management	Cardiac care	12 (14.4)	11 (13.5)	10 (11.9)	8 (9.8)	9 (11)	0.437
		Cardiac risk management	7 (8.2)	5 (6.7)	5 (6)	5 (6.1)	4 (4.9)	0.092
	Drug management	16 (19.6)	12 (14.6)	17 (20.2)	16 (19.5)	19 (23.2)	0.088	
Family	Lifespan care	20 (24.7)	26 (31.5)	26 (32.1)	28 (34.1)	28 (34.1)	0.078	
	Caregiver support	45 (54.6)	49 (59.6)	46 (56)	43 (52.4)	46 (56.1)	0.692	
Behavioral	Coping assistance	Emotional support	27 (33)	24 (29.2)	24 (29.8)	24 (29.3)	27 (32.9)	0.690
		Counseling	21 (25.8)	20 (24.7)	18.5 (22.6)	23 (28)	24 (29.3)	0.623
	Patient education	Decision-making support	10 (12.4)	7 (9)	11 (13.1)	11 (13.4)	14 (17.1)	0.223
		Health education	57 (69.1)	53 (65.2)	60 (72.6)	59 (72)	61 (74.4)	0.489
	Psychological comfort promotion	40 (48.5)	45 (55.1)	43 (52.4)	41 (50)	45 (54.9)	0.406	
Physiological: basic	Behavior therapy	Anxiety reduction	11 (13.5)	10 (12.4)	8 (9.5)	6 (7.3)	7 (8.5)	0.235
		Patient contracting	21 (25.8)	21 (25.8)	19 (22.6)	19 (23.2)	21 (25.6)	0.246
	Activity and exercise management	Mutual goal setting	14 (17.5)	7 (9)	9 (10.7)	10 (12.2)	8 (9.8)	0.339
		Exercise therapy: joint mobility	16 (19.6)	14 (16.9)	16 (19)	14 (17.1)	15 (18.3)	0.756
	Exercise promotion: strength training	10 (12.4)	14 (16.9)	12 (14.3)	11 (13.4)	10 (12.2)	0.492	
Physical comfort promotion	Exercise therapy: muscle control	Exercise therapy: ambulation	10 (12.4)	11 (13.5)	9 (10.7)	10 (12.2)	11 (13.4)	0.934
		Pain management	8 (10.3)	7 (9)	6 (7.1)	5 (6.1)	9 (11)	0.130
	Elimination management	Environmental management: comfort	8 (10.3)	8 (10.1)	8 (9.5)	9 (11)	9 (11)	0.959
		Constipation management	8 (9.3)	9 (11.2)	10 (11.9)	9 (11)	10 (12.2)	0.750
	Immobility management	8 (9.3)	14 (16.9)	15 (17.9)	14 (17.1)	10 (12.2)	0.002	
Health system	Information management	13 (15.5)	13 (15.7)	15 (17.9)	13 (15.9)	18 (22)	0.252	

TABLE 5 Comparison of the number of contacts with the health services in the 5 moments evaluated

	T1 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)	T4 Mean (SD)	p-value
General practitioner	1.99 (1.91)	2.27 (1.56)	2.66 (2.5)	2.18 (2.5)	0.128
Community-nurse	5.89 (8.01)	6.07 (5.83)	4.77 (5.99)	3.6 (4.3)	0.007
Social worker	0.12 (0.47)	0.01 (0.11)	0.06 (0.28)	0.01 (0.32)	0.119
Specialist	0.44 (0.89)	0.37 (0.65)	0.3 (0.71)	0.18 (0.11)	0.62
Physiotherapist	0.48 (4.45)	0.38 (3.38)	0.13 (1.21)	0.04 (0.33)	0.269
Imaging test	0.3 (0.71)	0.15 (0.44)	0.16 (0.65)	0.17 (0.62)	0.344
Analytical test	0.82 (1.32)	0.71 (1.10)	0.88 (1.80)	0.66 (1.3)	0.733

with similar percentages observed during the entire assessment period (Table 6).

DISCUSSION

This study shows how the application of movement restriction measures and changes in health care at the start of the Covid-19 pandemic affected the health and the use of health services of the most vulnerable elderly population in the community. According to the dimensions proposed in the model of health services' use by Andersen (Andersen, 1995), the predisposing factors, and the health status of the elderly who participated in the study, the participants had a profile of high dependency. They were mainly women older than 80 years old, without an education or primary education, with various chronic pathologies, with the most prevalent coinciding with multimorbidity patterns identified in previous studies (Garin et al., 2016). The elderly lived with one or more people and received care from a family member, mainly a daughter, so that they had an adequate family support network. Care provided by the family was found as a facilitating factor and having support from family and caregivers could explain that elders perceived an adequate social support during the entire period of assessment.

In the year-long period of assessment, the multimorbid elderly who lived in the community suffered a significant worsening in their functional ability for their day-to-day activities, and an increase in cognitive deterioration. Until now, data on this worsening was only available for the elderly who were institutionalized during the pandemic (Pérez-Rodríguez et al., 2021). On the other hand, significant changes were not observed in the main adverse events, and a paradoxical decrease in the incidence of falls was observed, which can be attributed to the reduction in the outdoor daily activity of the elderly due to the movement restrictions, or as suggested in other studies, due to a decrease in the mobility at the home due to the fear of falling (Nakamura et al., 2021).

In this context, and in a health system in which community care is universal and free for all citizens, the predisposing factors, and the worsening of the state of health of the multimorbid elderly led to a higher expectation of demand for health services. However, as other studies in Spain and other countries have shown (Lange et al., 2020; Torres-Cantero et al., 2022), only the confinement measures and the

restrictions to the access to the health system can justify the reduction in the number of face-to-face meetings with health services and care providers, mainly in the number of meetings with the nurses, and hospital admittances, together with reduced visits to emergency services and the mean length of hospital stays. These results could have negative long-term consequences for these patients, perhaps even resulting in an increase in morbi-mortality (Cuschieri & Mamo, 2021).

Our results highlight that community nurses play a central role in the care of multimorbid elderly in the management model utilized in the Health Area studied. Community nurses had the most personal contact with the multimorbid elderly, even higher than the general practitioners throughout the study. The most frequent NANDA-I nursing diagnoses were risk for falls, and impaired ambulation, similar to the study conducted with the elderly in nursing homes (Shin et al., 2021), followed by diagnoses of risk and impaired skin integrity. As a response, the nurses prioritized the interventions within the Safety and Physiological complex domains, which included activities directed towards preventing falls, and the management and prevention of skin lesions related with dependency. Also highlighted due to their high incidence, we found interventions in the domains Behavioral and Family, which promote interventions such as health education, caregiver support, and active listening. As previously pointed out, these aspects are key for the care of multimorbid patients, given that most of the time, patients and their families are alone, with no support from the health care system (Morales-Asencio et al., 2016).

An interesting yet controversial finding was that community nurses were able to detect the physical and cognitive worsening of those they provided care to. They observed an increase in the number of patients with the diagnoses of impaired physical mobility, ambulation, self-care, social interaction, constipation, and a worsening in verbal communication and risk of fatigue of the caregiver. However, these did not involve the implementation of interventions for solving them. It is difficult to know if this was due to the situation derived from the pandemic, the deficiencies suffered by the professionals, the increase in other demands (Halcomb et al., 2020), the novel and potential complexity of the interventions required, or as other previous studies have pointed out, because in traditional models of care, the community nurses prioritize acute clinical interventions, with less consideration given to prevention-type activities (Ramos-Morcillo et al., 2014).

TABLE 6 Comparison of use of services and adverse events in the 4 moments evaluated

Use of services / adverse events	T1 n (%)	T2 n (%)	T3 n (%)	T4 n (%)	p-value
Visits to emergency services	23(25.8)	20(23.8)	20(24.4)	12(14.6)	0.241
Admittance or re-admittance	14 (15.7)	5 (6)	5 (6.1)	6 (7.3)	0.095
Type of admittance					NPC
Urgent	12 (92.9)	3 (60)	4 (80)	5 (83.3)	
Planned	1 (7.1)	2 (40)	1 (20)	1 (16.7)	
Days of hospital stay (mean; SD)	6.21 (4.3)	3.00 (2.0)	4.60 (3.7)	4.00 (2.3)	NPC
Cause of admittance					NPC
Exacerbation of chronic condition	2 (14.3)	1(20)	2 (40)	4(66.7)	
Surgical intervention	1 (7.1)	1(20)	1(20)	0	
Diagnostic study	1 (7.1)	1(20)	0	0	
Accident or lesion	2 (14.3)	1(20)	0	1(16.7)	
Other	8 (57.1)	1(20)	2(40)	1(16.7)	
Discharge after admittance					NPC
Home	14 (100)	5 (100)	5 (100)	6 (100)	
Hospital transfer	0(0)	0(0)	0(0)	0(0)	
Exitus	0(0)	0(0)	0(0)	0(0)	
Discharging unit					NPC
Internal medicine	8(57.1)	4(80)	3(60)	3(50)	
Cardiology	1(7.1)	1(20)	1(20)	1(16.7)	
Pulmonology	0(0)	0(0)	1(20)	0(0)	
Trauma	1(7.1)	0(0)	0(0)	1(16.7)	
Surgery	1(7.1)	0(0)	0(0)	0(0)	
Other	3(21.4)	0(0)	0(0)	1(16.7)	
Pressure ulcer	11 (12.4)	10 (11.9)	8 (9.8)	8 (9.8)	0.786
Falls	14(15.7)	3(3.6)	6(7.3)	3(3.7)	0.006
Problems related with medication	3 (3.4)	0 (0)	2 (2.4)	3 (3.7)	0.351
Presence of devices	13(14.6)	11(13.1)	9(11)	11(13.4)	0.629
Oxygen therapy	4(4.5)	4(4.8)	4(4.9)	7(8.5)	0.029
Aerosol therapy	2(2.2)	2(2.4)	3(3.7)	3(3.7)	0.392
CPAP	4(4.5)	2(2.4)	2(2.4)	2(2.4)	0.392
Vesical catheter	5(5.6)	4(4.8)	3(3.7)	4(4.9)	0.494
Nasogastric catheter	1(1.1)	1(1.2)	0(0)	0(0)	NPC
Presence of technical help	66(74.2)	63(75)	61(74.4)	62(75.6)	0.096
Adjustable bed	22(24.7)	20(23.8)	21(25.6)	23(28)	0.137
Rails	11(23.6)	19(22.6)	18(22)	19(23.2)	0.261
Anti-bedsore mattress	22(24.7)	22(26.2)	21(25.6)	22(26.8)	0.112
Crane	8(9)	8(9.5)	8(9.8)	8(9.8)	1.000
Walker	31 (34.8)	28 (33.3)	28 (34.1)	29 (35.4)	0.392
Crutches	13 (14.6)	13 (15.5)	13 (15.9)	13 (15.9)	1.000
Self-propelled wheelchair	20 (22.5)	18 (21.4)	18 (22)	20 (24.4)	0.112
Motorized wheelchair	3 (3.4)	3 (3.6)	3 (3.7)	3 (3.7)	1.000
Day center	1 (1.1)	1 (1.2)	1 (1.2)	1 (1.2)	1.000
Home help	14 (15.7)	14 (16.7)	15 (18.3)	15 (18.3)	0.392

Abbreviation: NPC, Not possible calculate.

TABLE 7 NANDA-I nursing diagnosis linked with the nursing interventions (NICs)

Nursing diagnoses (NANDA-I)	T0 n (%)	T4 n (%)	Nursing interventions (NIC)	T0 n (%)	T4 n (%)
Risk for falls	56 (68)	57 (69.5)	Fall Prevention	61 (74.2)	59 (72)
			Risk identification	30 (36.1)	23 (28)
			Environmental Management: Safety	26 (32)	26 (37.1)
Impaired physical mobility	41 (49.5)	54 (65.9)	Exercise Therapy: Joint Mobility	16 (19.6)	15 (18.3)
			Exercise Promotion: Strength Training	10 (12.4)	10 (12.2)
Impaired ambulation	38 (46.4)	47 (57.3)	Exercise Therapy: Ambulation	10 (12.4)	11 (13.4)
Risk for impaired skin integrity	27 (33)	27 (32.9)	Skin surveillance	41 (50.5)	50 (61)
			Pressure ulcer prevention	37 (45.4)	39 (47.6)
Bathing self-care deficit	19 (23.7)	20 (24.4)	Mutual Goal Setting	14 (17.5)	8 (9.8)
Impaired skin integrity	18 (21.6)	18 (22)	Skin surveillance	41 (50.5)	50 (61)
			Positioning	8 (9.3)	10 (12.2)
Impaired memory	16 (19.6)	20 (24.4)	Emotional support	27 (33)	27 (33)
			Family support	20 (24.7)	28 (34.1)
			Dementia Management	13 (15.5)	10 (12.2)
Sedentary lifestyle	15 (18.6)	25 (30.5)	Cardiac care	12 (14.4)	9 (11)
			Exercise Therapy: Joint Mobility	16 (19.6)	15 (18.3)
			Exercise Therapy: Ambulation	10 (12.4)	11 (13.4)
			Exercise Promotion: Strength Training	10 (12.4)	10 (12.2)
			Exercise Therapy: Muscle Control	8 (10.3)	9 (11)
Impaired transfer ability	15 (18.6)	16 (19.5)	Environmental Management: Safety	26 (32)	26 (37.1)
			Positioning	8 (9.3)	10 (12.2)
Decreased diversional activity engagement	14 (17.5)	15 (18.3)	Patient Contracting	21 (25.8)	21 (25.6)
			Mutual Goal Setting	14 (17.5)	8 (9.8)
Chronic pain	14 (16.5)	16 (19.5)	Active listening	40 (48.5)	45 (54.9)
			Drug management	16 (19.6)	19 (23.2)
			Pain Management	8 (10.3)	17 (20.7)
			Environmental Management: Comfort	8 (10.3)	9 (11)
Toileting self-care deficit	13 (15.5)	15 (18.3)	Drug management	16 (19.6)	19 (23.3)
			Constipation Management	8 (9.3)	10 (12.2)
Dressing self-care deficit	13 (15.5)	16 (19.5)	Patient Contracting	21 (25.8)	21 (25.6)
			Mutual Goal Setting	14 (17.5)	8 (9.8)
Generalized adult impairment	13 (15.5)	8 (9.8)	Health Care Information Exchange	13 (15.5)	18 (22)
			Immunization/Vaccination Management	8 (10.3)	10 (12.2)
			Cardiac Risk Management	7 (8.2)	4 (4.9)
Functional urinary incontinence	12 (14.4)	11 (13.4)	Environmental Management: Safety	26 (32)	26 (31.7)
Impaired urinary elimination	11 (13.4)	15 (18.3)	Skin surveillance	41 (50.5)	50 (61)
			Drug management	16 (19.6)	19 (23.2)
Activity intolerance	11 (13.4)	12 (14.6)	Exercise Promotion: Strength Training	10 (12.4)	10 (12.2)
			Exercise Therapy: Muscle Control	8 (10.3)	9 (11)
Risk for caregiver role strain	9 (11.3)	13 (15.9)	Caregiver support	45 (54.6)	46 (56.1)
			Family support	20 (24.7)	28 (34.1)
Disturbed sleep pattern	9 (11.3)	11 (13.4)	Exercise Therapy: Ambulation	10 (12.4)	11 (13.4)
			Environmental Management: Comfort	8 (10.3)	9 (11)
Feeding self-care deficit	8 (10.3)	10 (12.2)	Patient Contracting	21 (25.8)	21 (25.6)
			Anxiety Reduction	11 (13.5)	7 (8.5)

TABLE 7 (Continued)

Nursing diagnoses (NANDA-I)	T0 n (%)	T4 n (%)	Nursing interventions (NIC)	T0 n (%)	T4 n (%)
Impaired bed mobility	8 (10.3)	13 (15.9)	Fall Prevention	61(74.2)	59 (72)
			Exercise Therapy: Joint Mobility	16 (19.6)	15 (18.3)
Deficient knowledge	8 (10.3)	8 (9.8)	Counseling	21 (25.8)	24 (29.3)
			Decision-Making Support	10 (12.4)	14 (17.1)
Impaired verbal communication	8 (10.3)	13 (15.9)	Active listening	40 (48.5)	45 (54.9)
			Dementia Management	13 (15.5)	10 (12.2)
Risk for unstable blood glucose level	7 (8.2)	8 (9.8)	Health Education	57 (69.1)	61 (74.4)
			Drug management	16 (19.6)	19 (23.2)
Constipation	4 (5.2)	8 (9.8)	Constipation Management	8 (9.3)	10 (12.2)
Impaired social interaction	4 (5.2)	15 (18.3)	Active listening	40 (48.5)	45 (54.9)
			Anxiety Reduction	11 (13.5)	7 (8.5)
Risk of loneliness	4 (5.2)	8 (9.8)	Emotional support	27 (33)	27 (32.9)
			Counseling	21 (25.8)	24 (29.3)
Hopelessness	2 (2.1)	4 (4.9)	Active listening	40 (48.5)	45 (54.9)
			Emotional support	27 (33)	27 (32.9)
			Counseling	21 (25.8)	24 (29.3)
			Decision-Making Support	10 (12.4)	14 (17.1)

Limitations

We should mention that the study has sheer number of variables, and the limited size of the sample could be insufficient and affect its statistical power, leading to the underdetection of significant changes in some of the variables studied. On the other hand, the temporal and unprecedented characteristics of the study did not allow us to obtain a comparison cohort, which could have allowed us to assess if the changes observed would have been different under a different caregiving model. Lastly, the duration of the assessment did not allow us to observe the long-term results of the decrease in the number of visits and consultations to health services.

CONCLUSIONS

Throughout the year-long monitoring of the patients, which included the first 6 months of the Covid-19 pandemic, the multimorbid elderly suffered a significant worsening in their functional and cognitive capacities. Despite living with other individuals, and obtaining help from a caregiver, there was an eventual worsening of moderate loneliness. The system of care of multimorbid elderly in primary care is fundamentally based on nurse care and meetings. These health professionals diagnosed an increase in problems associated with mobility, cognitive abilities, social contact, and communication. However, their interventions were focused on resolving clinical matters, about which they have a great experience for their management, and which require immediate attention. A significant decrease was found in the frequency of use of health services, and in the number of falls, which could be explained by the restrictions

imposed due to the pandemic, and which in the long-term could have negative consequences for these patients.

CLINICAL RESOURCES

1. Multimorbidity Care Model CHRODIS+. <http://chrodis.eu/06-multimorbidity-care-model/>
2. Coronavirus disease (COVID-19) pandemic (WHO). <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

ETHICAL CONSIDERATIONS

The study was approved by the Research Committee from the Health Area (209/2018). The participants were informed about the objective of the study. The participant's consent was solicited in writing to be included in the registry. The data were pseudo-anonymized before analysis and processing to avoid the identification of any user. The information was utilized in a strictly confidential manner.


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