Received: 23 September 2020 | Revised: 10 November 2020 | Accepted: 31 December 2020

DOI: 10.1111/jocn.15637

Journal of Clinical Nursing WILEY

ORIGINAL ARTICLE

Patients recovering from COVID-19 pneumonia in sub-acute care exhibit severe frailty: Role of the nurse assessment

Elena Mandora Nurse[1] | Laura Comini BSc, PhD, Biologist[2] | Adriana Olivares CLS, Laboratory Technician[2] | Michela Fracassi Nurse[1] | Maria Grazia Cadei Nurse[3] | Mara Paneroni PT, MSc, Physioterapist[4] | Lucia Marchina Nurse[5] | Adrian Suruniuc Nurse[5] | Alberto Luisa MD[5] | Simonetta Scalvini MD[1] | Giacomo Corica MD[3] | Michele Vitacca MD[4]

[1]Istituti Clinici Scientifici Maugeri IRCCS, Cardiac Rehabilitation of the Institute of Lumezzane, Brescia, Italy

[2]Istituti Clinici Scientifici Maugeri IRCCS, Scientific Direction of the Institute of Lumezzane, Brescia, Italy

[3]Istituti Clinici Scientifici Maugeri IRCCS, Health Direction of the Institute of Lumezzane, Brescia, Italy

[4]Istituti Clinici Scientifici Maugeri IRCCS, Respiratory Rehabilitation of the Institute of Lumezzane, Brescia, Italy

[5]Istituti Clinici Scientifici Maugeri IRCCS, Neurological Rehabilitation of the Institute of Lumezzane, Brescia, Italy

Correspondence
Michele Vitacca, Respiratory Rehabilitation Department, Istituti Clinici Scientifici Maugeri IRCCS Via Salvatore Maugeri 4, 27100 Pavia, Italy.
Email: michele.vitacca@icsmaugeri.it

Funding information
This work was supported by the 'Ricerca Corrente' funding scheme of the Italian Ministry of Health.

Abstract

Aims and Objectives: To document the level of frailty in sub-acute COVID-19 patients recovering from acute respiratory failure and investigate the associations between frailty, assessed by the nurse using the Blaylock Risk Assessment Screening Score (BRASS), and clinical and functional patient characteristics during hospitalisation.

Background: Frailty is a major problem in patients discharged from acute care, but no data are available on the frailty risk in survivors of COVID-19 infection.

Design: A descriptive cross-sectional study (STROBE checklist).

Methods: At admission to sub-acute care in 2020, 236 COVID-19 patients (median age 77 years – interquartile range 68–83) were administered BRASS and classified into 3 levels of frailty risk. The Short Physical Performance Battery (SPPB) was also administered to measure physical function and disability. Differences between BRASS levels and associations between BRASS index and clinical parameters were analysed.

Results: The median BRASS index was 14.0 (interquartile range 9.0–20.0) denoting intermediate frailty (32.2%, 41.1%, 26.7% of patients exhibited low, intermediate and high frailty, respectively). Significant differences emerged between the BRASS frailty classes regards to sex, comorbidities, history of cognitive deficits, previous mechanical ventilation support and SPPB score. Patients with no comorbidities (14%) exhibited low frailty (BRASS: median 5.5, interquartile range 3.0–12.0). Age ≥65 years, presence of comorbidities, cognitive deficit and SPPB % predicted <50% were significant predictors of high frailty.

Conclusions: Most COVID-19 survivors exhibit substantial frailty and require continuing care after discharge from acute care.

Relevance to clinical practice: The BRASS index is a valuable tool for nurses to identify those patients most at risk of frailty, who require a programme of rehabilitation and community reintegration.

KEYWORDS
coronavirus, disability, nursing, outcome, physical function, rehabilitation

1 | INTRODUCTION

There is wide variation in the clinical presentations of coronavirus disease 2019 (COVID-19) infectious disease, ranging from no symptoms at all to pneumonia with Acute Respiratory Failure (ARF; Grasselli et al., 2020; Lian et al., 2020). ARF is associated with prolonged functional impairment in many individuals, and the recovery from this critical illness is fraught with challenges (Gandotra et al., 2019).

After severe COVID-19 disease, many patients will experience a variety of problems in normal functioning and will require either rehabilitation to overcome these problems (Brown et al., 2017; Herridge et al., 2016) or continuity of care when at home to improve their self-management, functional ability, physical disability and return to participation in society.

What does this paper contribute to the wider global community?

- The majority of COVID-19 survivors exhibit substantial frailty after discharge from acute hospital and require continuity of care.
- Predicting high-risk patients and identifying them early for optimal discharge planning and rehabilitative needs should be one of the aims of post-acute care.
- BRASS index could be a valuable tool in directing nurses' attention to patients at highest risk of frailty.

2 | BACKGROUND

The problem of frailty—defined as a multidimensional loss of reserves, energy, physical ability, cognition and health (Rockwood, 2005)—is a major issue in people following discharge from hospital—and nursing attention worldwide is focused to capture patients' unmet needs (Allen et al., 2014; Blaylock & Cason, 1992; Carroll & Dowling, 2007; Mistiaen et al., 1997; Wolock et al., 1987). Screening prior to discharge on these problems is a necessary basis for correct discharge planning (DP) to decide when, where and how to discharge frail subjects (Carroll & Dowling, 2007; Wolock et al., 1987). The Blaylock Risk Assessment Screening Score (BRASS) was designed to identify patients in need of DP (Blaylock & Cason, 1992; Cammilletti et al., 2018) who are 'at risk' of long-term hospitalisation and with a home environment that is challenging. Although clinical recommendations on the use of frailty tools were proposed during the COVID-19 pandemic, mainly to support decision-making about an escalation plan and to avoid ageism (Maltese et al., 2020), no data are available, on the frailty risk in COVID-19 infectious disease survivors.

2.1 | Aim

The aim of this cross-sectional study was to evaluate the level of frailty in a large cohort of COVID-19 patients with ARF admitted to a sub-acute unit to stabilise their clinical condition after discharge from acute care. We investigated potential associations between frailty assessed by BRASS and patients' clinical characteristics during hospitalisation. The secondary aim was to re-evaluate, in a subgroup of patients referred to rehabilitation, the BRASS index at admission to the programme.

3 | METHODS

3.1 | Design

A descriptive cross-sectional study design was employed to explore the relationships between BRASS index and clinical/functional patient characteristics during hospitalisation (Figure 1). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional study was used as guideline (File S1).

3.2 | Sample/participants

All consecutive patients with COVID-19 infection and pneumonia transferred from an acute hospital setting to the sub-acute unit of the Lumezzane (Brescia) centre of Istituti Clinici Scientifici (ICS) Maugeri between 10 March–10 June 2020 were screened for inclusion (see study flow chart, Figure 1).

3.3 | Data collection

At admission to the ICS sub-acute unit, anthropometric measures (age and body mass index), number of comorbidities and presence or not of cognitive deficits (from the medical history) were collected. Information regarding the patient's respiratory conditions such as need of inspiratory fraction of oxygen (FiO_2), value of pulsed oxygenation (SpO_2), ratio between SpO_2/FiO_2, presence of tracheostomy and use during the acute stay of mechanical ventilation (intubation, non-invasive ventilation [NIV] or continuous positive airway pressure [CPAP]) was also analysed. In addition, at admission, physical performance—that is motor disability, walking ability, muscle leg function and balance—was assessed by the Short Physical Performance Battery (SPPB; Guralnik et al., 1994) and normalised for the predicted normal values (Bergland & Strand, 2019). SPPB results were expressed as ratio % of predicted.

Patients were also administered the BRASS index to verify risk of frailty and identify patients 'at risk' of long-term hospitalisation and/or a complicated discharge procedure. The BRASS index (see Figure 1 in Appendix 1) investigates the following items: age, functional status, cognitive status, social support and living conditions, number of previous hospitalisations/emergency room visits, number of active clinical problems, behavioural model, mobility, sensory deficits and number of medications. Predicted validity and reliability of BRASS Index were investigated in a large population

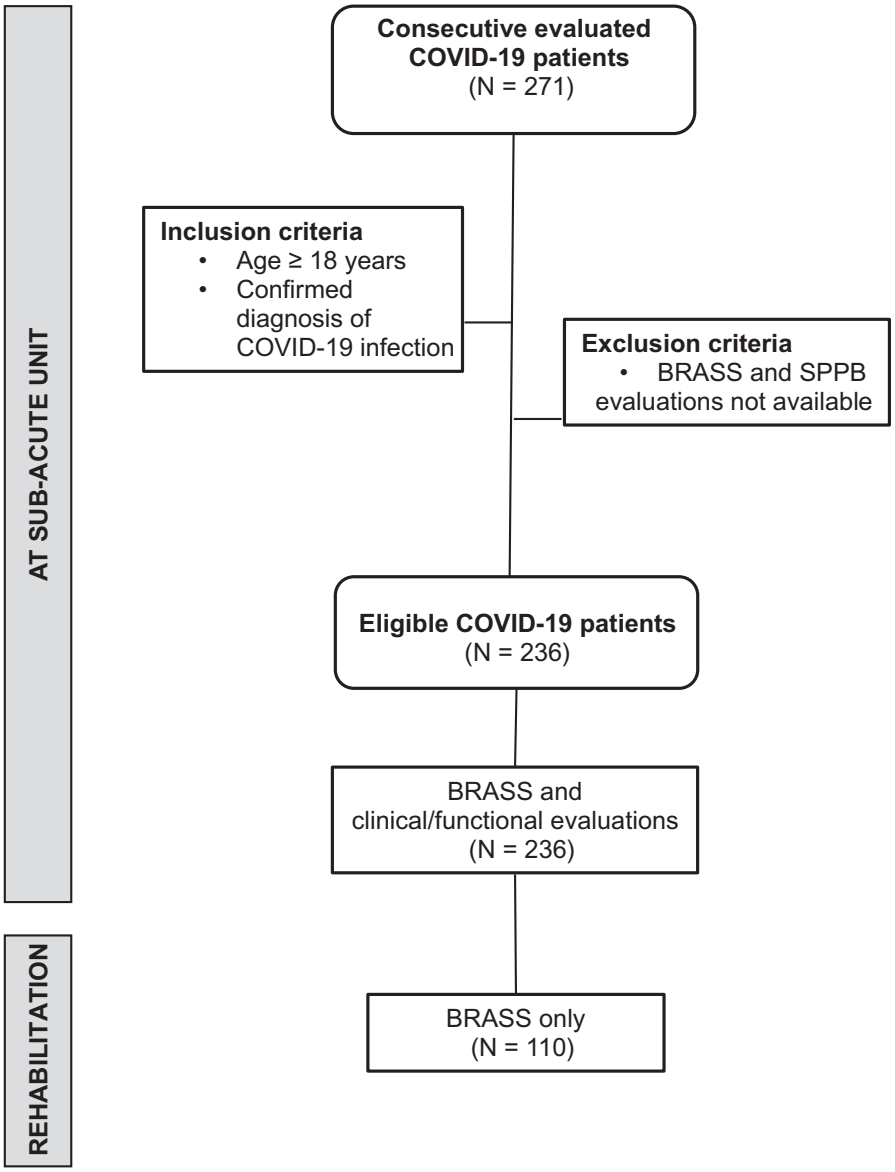

FIGURE 1 Flow chart of the study. BRASS, Blaylock Risk Assessment Screening Score; SPPB, Short Physical Performance Battery

of Italian patients by Dal Molin et al. (2014). Patients are classified into three risk classes: low risk (score from 0–10), that is individuals with limited disability not requiring special efforts to organise their discharge; medium risk (score 11–19), that is patients with complex clinical situations requiring discharge planning, but probably without risk of institutionalisation; and high risk (score ≥20), that is patients with problems probably requiring continuity of care in a rehabilitation facility or institution (Blaylock & Cason, 1992; Cammilletti et al., 2018).

During their stay in the sub-acute unit, patients underwent medical and nursing care according to their needs with the aim to stabilise their clinical condition and wean them from oxygen and mechanical ventilation if present. Mobilisation and callisthenic/walking exercises were also proposed by physiotherapists. The BRASS index was evaluated at admission to the sub-acute unit.

At discharge from the sub-acute unit, when signs of COVID-19 infection were negative, patients were evaluated to determine whether they could be discharged home or should be referred for rehabilitation. Criteria for inpatient rehabilitation in our institute were residual disability, multi-comorbidity, hypoxaemia and/or dyspnoea during exercise or at rest, and a reduced exercise tolerance (Vitacca, Lazzeri, et al., 2020). In the subgroup of patients referred to rehabilitation, the BRASS index was repeated on admission to inpatient rehabilitation, and the score was compared with the previous test. The length of stay in the sub-acute unit (approximately three weeks) was similar in this subgroup of patients; thus, the pre– to post–BRASS comparison was applicable.

3.4 | Ethical considerations

The study was approved by Local Review Board and Ethics Committee (2440 CEC, 26 May 2020). All evaluations were in conformity with the Declaration of Helsinki. All patients signed an informed written consent prior to participation.

3.5 | Data analysis

Statistical analysis was performed using Prism (GraphPad Prism version 8.0 for Windows, GraphPad Software). The Shapiro–Wilk test was used to assess the normality of data. Continuous variables were expressed as median and interquartile range (IQR). Binary and categorical variables were described as number and percentage. Kruskal–Wallis was performed to evaluate differences between the three BRASS classes of risk. If Kruskal–Wallis was significant, post hoc multiple comparisons by Dunn's test were applied. To compare frequencies between the different groups, we used the Pearson chi-square test applying the Montecarlo correction in the case of low numbers.

Association between variables at admission was assessed by Spearman's correlation analysis. To identify the measure of association between baseline characteristics and a high BRASS (≥20, i.e. those patients requiring continuity of care after discharge), we estimated the Odds ratio (OR) to assess the risk of having high frailty on the following variables: sex, age ≥65 years, presence of comorbidities, presence of cognitive deficits, use of mechanical ventilation, SpO_2/FiO_2 <300 and SPPB% of predicted <50%. Logistic regression was performed and OR value with 95% confidence intervals (CI) reported.

For the subgroup of patients with BRASS evaluation at discharge from the sub-acute unit (i.e. patients referred to rehabilitation), BRASS pre- to post-evaluations in the BRASS classes were assessed by Wilcoxon signed-rank test. Comparison between the percentage of patients belonging to the three different classes of BRASS risk at admission (low, medium and high) and the percentage of patients who modified the socioclinical status at discharge (stable, worsened or improved) was assessed by Pearson chi-squared test applying the Montecarlo correction in the case of low numbers.

For all tests, a p value <.05 was considered as statistically significant.

4 | RESULTS

Of 271 sub-acute patients screened, 35 were excluded due to incomplete data in some BRASS and SPBB items; the remaining 236 patients formed the study population and underwent statistical analysis (Figure 1).

The median value of BRASS was 14.0 (IQR 9.0–20.0) denoting patients with intermediate frailty. Details for BRASS sub-items are reported in Figure 2.

Patients (median age 77 years) lived in the majority of cases with spouse or family, and were impaired in all activities of daily living (ADLs), in particular bathing/grooming and transferring. Almost one-third of patients (31%) were disoriented, 20% presented pathological behaviour (mostly, confusion), 72% had limitations in mobilisation and 34% were bedridden, 43% had sensory deficits, and more than 85% had had at least 1 hospitalisation in the 3 months prior. All patients presented medical problems (56% had more than 5 problems) and 65% were taking more than 5 drugs.

Table 1 shows demographic and clinical data of the study group as a whole as well as of patients subdivided according to the level of 'frailty' (BRASS). According to risk class, 32.2% of patients had a low level of frailty, 41.1% had an intermediate level, and 26.7% showed high frailty. The low frailty subgroup was younger (median 70 years), predominantly male, with fewer comorbidities (29% of them had no

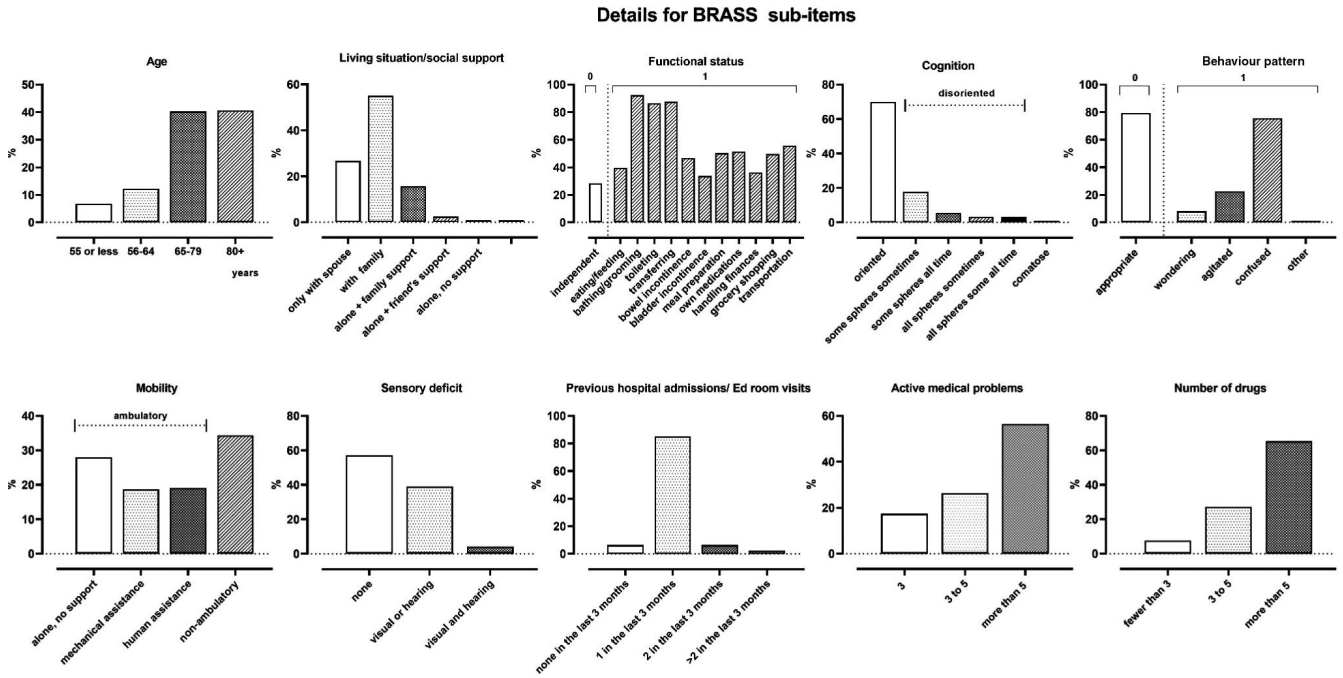

FIGURE 2 Details for BRASS sub-items evaluated in the whole sample. BRASS, Blaylock Risk Assessment Screening Score

comorbidities), and no cognitive deficit; one-third of them had had MV support in acute care; they had a better exercise capacity, despite being severely compromised (median SPPB: 59% of predicted). The medium- and high-risk subgroups were older (78 and 84 years, $p < .0001$), and more than 55% were female, with 4 to 5 comorbidities ($p = .0169$); 32% and 8%, respectively, had used MV in acute care, and they had very severe exercise disability (median SPPB: 0% of predicted for both, $p = .0530$). Need for transfer to an acute hospital and the need for rehabilitation were prevalent in the medium- and high-risk BRASS classes; in contrast, patients in the low frailty subgroup were most frequently discharged home. Patients without any comorbidities ($n = 32$, 14% of the whole sample) had a lower BRASS index than those with comorbidities [5.5 (IQR 3.0–12.0) vs. 16.0 (IQR 10.0–21.0), $p < .0001$]. Of patients without any comorbidities, more than two-thirds were in the low frailty group; only 21.9% were in the medium frailty group, and 9.4% were in the high frailty class.

Significant correlations between BRASS and age ($r = .565$; 95% CI: 0.4683–0.6483; $p < .0001$), number of comorbidities ($r = .4294$; 95% CI: 0.3158–0.5309; $p < .0001$) and total SPPB ($r = -.697$; 95% CI: −0.7589 to −0.6225; $p < .0001$) were found. Odds ratio (OR) analysis (Table 2)—assessed on categorical variables at baseline in relation to higher BRASS (≥20)—showed that major risk of frailty (i.e. needs after discharge) was associated with older age (≥65 years; OR 10.72), multi-comorbidity (OR 4.02), cognitive deficits (OR 8.83) and SPPB score <50% of predicted (OR 12.05).

Of the 236 patients, 110 had criteria for rehabilitation. In this specific sample, there was no significant change in BRASS index between the sub-acute unit and admission to rehabilitation [18.0 (IQR 12.0–22.0) vs. 19.0 (IQR 11.0–25.0), $p = .1345$]. Nor was there any difference in the three levels of frailty risk [6.5 (IQR 4.8–8.3) vs. 7.0 (IQR 4.5–8.5) low risk, 16.0 (IQR 14.0–18.0) vs. 16.0 (IQR 14.0–19.0) medium risk, 23.0 (IQR 22.0–25.0) vs. 25.0 (IQR 22.0–26.0) high risk, for all: p = ns].

However, the distribution of patients belonging to the classes significantly changed, as shown in Table 3 ($p < .0001$). The medium-risk class was the most unstable one and showed the highest rate of worsening with respect to the other two classes, and the rate of improvement in the high-risk class was greater than the rate of worsening observed in the low-risk class.

5 | DISCUSSION

These findings show that frailty is highly prevalent in patients with COVID-19 infection in sub-acute care; approximately 68% of patients had a medium or high risk of frailty. This frailty influenced their clinical recovery, as more than 50% of patients in these classes of risk required a rehabilitation process following discharge from sub-acute care.

Use of the BRASS index allows to predict the need for care after hospitalisation. Planned discharge improves the perceived quality of

TABLE 1 Patient characteristics in the overall sample of sub-acute patients and in subgroups according to the level of frailty at BRASS

	All, $n = 236$	Low risk, $n = 76$	Medium risk, $n = 97$	High risk, $n = 63$	p
Age, years	77 (68–83)	70 (59–77)	78 (68–82)	84 (79–89)	**<.0001**
Males, *n* (%)	122 (51.6)	50 (65.8)	44 (45.4)	28 (44.4)	**.0115**
BMI, kg/m^2	25 (23–28)	26 (24–29)	25 (23–29)	23 (22–26)	**.0365**
Absence of any comorbidities, *n* (%)	32 (13.5)	22 (28.9)	7 (7.2)	3 (4.7)	**<.0001**
Comorbidities, *n*	4 (2–5)	2 (0–3)	4 (2–5)	5 (4–7)	**<.0001**
Cognitive deficits Yes[a], *n* (%)	33 (17.0)	0	11 (11.3)	22 (34.9)	**<.0001**
Length of acute hospital stay, days	12 (7–23)	13 (8–20)	15 (8–28)	10 (6–17)	**.0341**
Use of previous MV, *n* (%)	60 (25.4)	24 (31.6)	31 (31.9)	5 (7.9)	**.0010**
Mortality, *n* (%)	5 (2.1)	1 (1.3)	1 (1.0)	3 (4.8)	.2752
Transfer to acute H, *n* (%)	5 (2.1)	0 (0.0)	3 (3.1)	2 (3.1)	.3802
Discharge home, *n* (%)	116 (49.2)	55 (72.4)	44 (45.4)	17 (27.0)	**<.0001**
Rehabilitation, *n* (%)	110 (46.6)	20 (26.3)	49 (50.5)	41 (65.1)	**<.0001**
FiO_2, %	21 (21–31)	23 (21–31)	21 (21–31)	21 (21–28)	.3866
SpO_2, %	95 (94–97)	96 (94–97)	95 (94–97)	95 (93–97)	.1998
SpO_2/FiO_2, rate	438.1 (309.7–457.1)	420.8 (300.0–457.1)	438.1 (309.7–457.1)	438.1 (332.1–452.4)	.8260
Total SPPB, % of pred	0 (0–43)	59 (28–82)	0 (0–19)	0 (0–0)	**<.0001**

Note: Values expressed in median (IQR) except for categorical variables. The bold values evidenced those of statistical significance.

Abbreviations: BRASS low risk (LR): score 0–10; BRASS medium risk (MR): score 11–19; BRASS high risk (HR): score ≥20; BRASS, Blaylock Risk Assessment Screening Score; FiO_2, Inspiratory Fraction of Oxygen; MV, Mechanical Ventilation; SpO_2, Percentage of oxygen saturation; SPPB% of pred., Short Physical Performance Battery % of predicted values.

[a] These data are available in 190 patients.

TABLE 2 Evaluation of the risks associated with BRASS ≥20

	OR	95% CI	*p*
Age ≥65 years	10.72	2.53: 45.66	.001
Comorbidities, yes	4.02	1.18: 13.73	.026
Cognitive deficits, yes	8.83	3.86: 20.21	<.001
SPPB% of pred. <50%	12.05	2.84: 51.21	.001

Note: Only statistical and clinical significant variables were reported.
Abbreviations: CI, confidence interval; OR, odds ratio; SPPB% of pred., Short Physical Performance Battery % of predicted values.

TABLE 3 Evaluation of changes according to the three BRASS risk classes between sub-acute care and admission to rehabilitation in the subgroup of patients referred to rehabilitation (*n* = 110)

BRASS level at admission in the sub-acute unit		BRASS level at admission at rehabilitation unit		
		Stable	Improved	Worsened
Low risk, *n*	22	20 (91.0%)	–[a]	2 (9.0%)
Medium risk, *n*	43	20 (46.5%)	4 (9.3%)	19 (44.2%)
High risk, *n*	45	34 (75.6%)	11 (24.4%)	–[b]

Abbreviations: BRASS low risk: score 0–10; BRASS medium risk: score 11–19; BRASS high risk: score ≥20. Where not indicated, data are reported as number (percentage).

[a] For low risk, no possibility of improved level.

[b] For high risk, no possibility of worsened level.

the health service and reinforces the sense of teamwork in all care conditions. Assessment of an individualised, progressive treatment plan which focuses on function, disability and return to participation in society would help each patient to maximise his/her functional ability and quality of life (Allen et al., 2014; Blaylock & Cason, 1992; Carroll & Dowling, 2007; Mistiaen et al., 1997; Wolock et al., 1987). Careful consideration of the frailty risk is a mandatory need for nursing care (Allen et al., 2014; Blaylock & Cason, 1992; Carroll & Dowling, 2007; D'Souza et al., 2020).

After severe COVID-19 disease, many patients experience a deficit in self-management, functional ability and participation (Brown et al., 2017; Herridge et al., 2016): a continuity of care plan to improve these handicaps would be welcome. In a recent nursing consensus (Zhang et al., 2020) on caring for patients with COVID-19, the authors stressed the need to assess the health needs of patients using scales to evaluate and find abnormalities during this process, and intervene early to improve connections with the community, hospitals, and other institutions to provide extended care for the patient. During the first pandemic wave of COVID-19, many rehabilitative services had, like ours, to be re-adapted (Simonelli et al., 2020; Vitacca, Migliori, et al., 2020) to sustain health care in patients coming from the acute wards. Since there is no validated generic checklist for all conditions, our nurses used the BRASS index to classify the frailty condition of each patient with COVID-19. The BRASS index may present low specificity (Mistiaen et al., 1999) but it has good sensitivity (Chaboyer et al., 2002; Signorini et al., 2016) and it is easy to use (Dal Molin et al., 2014). The BRASS index meets three fundamental psychometric criteria. It is (a) multidimensional (outcomes are measured by a range of parameters, both clinic-functional and psycho-social); (b) multi-axial (outcomes are measured from different points of view, that is the patient's, doctor's, nurse's, physiotherapist's, social worker's and caregiver's); and (c) longitudinal (the outcomes should be measured at repeated points across a protracted period of time).

As expected, the BRASS items found to be most frequently pathological related to both physical and cognitive dysfunctions: impairment in ADLs such as bathing/grooming and transferring, altered behaviour, confusion, limitation in mobilisation, sensory deficit, history of previous hospitalisation, medical problems and need of >5 drugs. Variables that predicted a pathological value of the BRASS index were age, multi-comorbidity, disability and cognitive deficits.

The findings of impaired physical function status related to frailty in our study population validate recommendations to refer COVID-19 survivors to individualised and multicomponent assessment. Accordingly, an alert score for the early detection of frailty should be considered for all patients, but in particular for those with comorbidities. Undoubtedly, patients with comorbidities usually take a longer period to return to their former condition (Gandotra et al., 2019). It is not surprising that patients with comorbidities are also those with higher frailty. However, of note, even amongst patients without comorbidities, we found that 31.4% had an intermediate or high level of frailty.

It is of particular interest that the patients with the greatest frailty were those who also had least recourse to mechanical ventilation during their period of stay in the acute hospital. In contrast, patients with low frailty had greater access to mechanical ventilation. These patients were also of younger age and had no or few comorbidities, so they were ideal candidates for intensive care therapies (i.e. they had more chance of a good outcome) especially in a period of health catastrophe re-organisation such as that during the dramatic COVID spread.

Another important finding of our study is that the BRASS index may be a useful tool to apply when one suspects the need to transfer the patient to an acute hospital or to a structured rehabilitation programme. Indeed, patients at medium and high risk required admission to a rehabilitation facility in more than half of the cases (Table 1).

Traditionally, the BRASS index is used to 'move' a patient from hospital to home, but it has also been used to transfer patients from one hospital structure to another (Allen et al., 2014). Based on the results of our study, the BRASS index should be administered both at the time of admission and in an intermediate stage of recovery when the problem that triggered the hospitalisation is solved or partially solved or, on the contrary, may have worsened. In fact, from our data it is evident that, at discharge, some patients presented low frailty because they had improved but most patients presented high frailty because their status had deteriorated. By repeating the BRASS assessment during the hospital stay, the nursing staff would be able to

target patients' needs more precisely. Using the BRASS index as a process rather than as an isolated event seems the best modality to combine shared decisions between health staff and patient/family.

5.1 | Limitations

Two methodological considerations could limit the strength and interpretation of our findings. First, the presence of cognitive deficits was derived from the patient's medical history, collected in the acute hospital, and was not available for the whole sample due to the COVID-19 emergency. Second, the change in BRASS index between the two admission points (sub-acute unit and rehabilitation) was assessed only in a select group of patients and not in the overall sample.

6 | CONCLUSION

The majority of COVID-19 survivors exhibit substantial frailty after discharge from acute hospital and require continuity of care. Such a care programme could be better planned if based on the needs identified by the BRASS index as this is a valuable tool in directing nurses' attention to patients at highest risk of frailty and can indicate the need for rehabilitation and community reintegration.

7 | RELEVANCE TO CLINICAL PRACTICE

Our study shows that patients with COVID-19 may experience a wide variety of limitations and problems shortly after discharge from hospital and have unmet needs. It is consequently important for nurses to look critically at the information strategies they currently use and find ways to improve them. Predicting high-risk patients and identifying them early for optimal discharge planning and rehabilitative needs seems the most useful strategy.

ACKNOWLEDGMENTS

We thank all doctors, nurses and physiotherapists employed in the ICS Maugeri Hospital of Lumezzane (Bs) Italy involved in the COVID-19 crisis for their tireless dedication (see Appendix 2). We thank Rosemary Allpress for the English revision of the manuscript.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHOR CONTRIBUTIONS

Data: MV; Data integrity: GC; Accuracy of the data analysis: LC and AO. Study design, data analysis and interpretation, investigation on the accuracy and integrity of the contents, approval of the final version and writing of the manuscript: All authors; Guarantor of the paper, taking responsibility for the integrity of the work as a whole, from inception to published article: MV.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Michele Vitacca https://orcid.org/0000-0002-9389-7915

REFERENCES

Allen, J., Hutchinson, A. M., Brown, R., & Livingston, P. M. (2014). Quality care outcomes following transitional care interventions for older people from hospital to home: A systematic review. *BMC Health Services Research*, *14*, 346. https://doi.org/10.1186/1472-6963-14-346

Bergland, A., & Strand, B. H. (2019). Norwegian reference values for the Short Physical Performance Battery (SPPB): The Tromsø Study. *BMC Geriatrics*, *19*(1), 216. https://doi.org/10.1186/s12877-019-1234-8

Blaylock, A., & Cason, C. L. (1992). Discharge planning predicting patients' needs. *Journal of Gerontological Nursing*, *18*(7), 5–10. https://doi.org/10.3928/0098-9134-19920701-05

Brown, S. M., Wilson, E. L., Presson, A. P., Dinglas, V. D., Greene, T., Hopkins, R. O., & Needham, D. M. (2017). Understanding patient outcomes after acute respiratory distress syndrome: Identifying subtypes of physical, cognitive and mental health outcomes. *Thorax*, *72*(12), 1094–1103. https://doi.org/10.1136/thoraxjnl-2017-210337

Cammilletti, V., Forino, F., Palombi, M., Donati, D., Tartaglini, D., & Di Muzio, M. (2018). BRASS score and complex discharge: A pilot study. *Acta Biomed*, *88*(4), 414–425. https://doi.org/10.23750/abm.v88i4.6191

Carroll, A., & Dowling, M. (2007). Discharge planning: Communication, education and patient participation. *British Journal of Nursing*, *16*(14), 882–886. https://doi.org/10.12968/bjon.2007.16.14.24328

Chaboyer, W., Kendall, E., & Foster, M. (2002). Use of the 'BRASS' to identify ICU patients who may have complex hospital discharge planning needs. *Nursing in Critical Care*, *7*(4), 171–175.

Dal Molin, A., Gatta, C., Derossi, V., Guazzini, A., Cocchieri, A., Vellone, E., Alvaro, R., & Rasero, L. (2014). Hospital discharge: Results from an Italian multicenter prospective study using Blaylock Risk Assessment Screening Score. *International Journal of Nursing Knowledge*, *25*(1), 14–21. https://doi.org/10.1111/2047-3095.12016

D'Souza, A. N., Granger, C. L., Patrick, C. J., Kay, J. E., & Said, C. M. (2020). Factors associated with discharge destination in community-dwelling adults admitted to acute general medical units. *Journal of Geriatric Physical Therapy*. https://doi.org/10.1519/jpt.0000000000000272. [Epub ahead of print].

Gandotra, S., Lovato, J., Case, D., Bakhru, R. N., Gibbs, K., Berry, M., Files, D. C., & Morris, P. E. (2019). Physical function trajectories in survivors of acute respiratory failure. *Annals of the American Thoracic Society*, *16*(4), 471–477. https://doi.org/10.1513/AnnalsATS.201806-375OC

Grasselli, G., Tonetti, T., Protti, A., Langer, T., Girardis, M., Bellani, G., Laffey, J., Carrafiello, G., Carsana, L., Rizzuto, C., Zanella, A., Scaravilli, V., Pizzilli, G., Grieco, D. L., Di Meglio, L., de Pascale, G., Lanza, E., Monteduro, F., Zompatori, M., … Seccafico, C. (2020). Pathophysiology of COVID-19-associated acute respiratory distress syndrome: A multicentre prospective observational study. *The Lancet Respiratory Medicine*, *8*(12), 1201–1208. https://doi.org/10.1016/S2213-2600(20)30370-2

Guralnik, J. M., Simonsick, E. M., Ferrucci, L., Glynn, R. J., Berkman, L. F., Blazer, D. G., Scherr, P. A., & Wallace, R. B. (1994). A short physical performance battery assessing lower extremity function: Association with self-reported disability and prediction of

mortality and nursing home admission. *The Journal of Gerontology*, *49*(2), M85–M94. https://doi.org/10.1093/geronj/49.2.m85

Herridge, M. S., Chu, L. M., Matte, A., Tomlinson, G., Chan, L., Thomas, C., Friedrich, J. O., Mehta, S., Lamontagne, F., Levasseur, M., Ferguson, N. D., Adhikari, N. K. J., Rudkowski, J. C., Meggison, H., Skrobik, Y., Flannery, J., Bayley, M., Batt, J., Santos, C. D., … Cameron, J. I. (2016). The RECOVER program: Disability risk groups and 1-year outcome after 7 or more days of mechanical ventilation. *American Journal of Respiratory and Critical Care Medicine*, *194*(7), 831–844. https://doi.org/10.1164/rccm.201512-2343OC

Lian, J., Jin, X. I., Hao, S., Cai, H., Zhang, S., Zheng, L., Jia, H., Hu, J., Gao, J., Zhang, Y., Zhang, X., Yu, G., Wang, X., Gu, J., Ye, C., Jin, C., Lu, Y., Yu, X., Yu, X., … Yang, Y. (2020). Analysis of epidemiological and clinical features in older patients with coronavirus disease 2019 (COVID-19) outside Wuhan. *Clinical Infectious Diseases*, *71*(15), 740–747. https://doi.org/10.1093/cid/ciaa242

Maltese, G., Corsonello, A., Di Rosa, M., Soraci, L., Vitale, C., Corica, F., & Lattanzio, F. (2020). Frailty and COVID-19: A systematic scoping review. *Journal of Clinical Medicine*, *9*(7), 2106. https://doi.org/10.3390/jcm9072106

Mistiaen, P., Duijnhouwer, E., Prins-Hoekstra, A., Ros, W., & Blaylock, A. (1999). Predictive validity of the BRASS index in screening patients with post-discharge problems. Blaylock Risk Assessment Screening Score. *Journal of Advanced Nursing*, *30*(5), 1050–1056. https://doi.org/10.1046/j.1365-2648.1999.01203.x

Mistiaen, P., Duijnhouwer, E., Wijkel, D., de Bont, M., & Veeger, A. (1997). The problems of elderly people at home one week after discharge from an acute care setting. *Journal of Advanced Nursing*, *25*(6), 1233–1240. https://doi.org/10.1046/j.1365-2648.1997.19970251233.x

Rockwood, K. (2005). What would make a definition of frailty successful? *Age and Ageing*, *34*(5), 432–434. https://doi.org/10.1093/ageing/afi146

Signorini, G., Dagani, J., Bulgari, V., Ferrari, C., & de Girolamo, G. (2016). Moderate efficiency of clinicians' predictions decreased for blurred clinical conditions and benefits from the use of BRASS index. A longitudinal study on geriatric patients' outcomes. *Journal of Clinical Epidemiology*, *69*, 51–60. https://doi.org/10.1016/j.jclinepi.2015.08.017

Simonelli, C., Paneroni, M., Fokom, A. G., Saleri, M., Speltoni, I., Favero, I., Garofali, F., Scalvini, S., & Vitacca, M. (2020). How the COVID-19 infection tsunami revolutionized the work of respiratory physiotherapists: an experience from Northern Italy. *Monaldi Archives for Chest Disease*, *90*(2). https://doi.org/10.4081/monaldi.2020.1085

Vitacca, M., Lazzeri, M., Guffanti, E., Frigerio, P., D'Abrosca, F., Gianola, S., Carone, M., Paneroni, M., Ceriana, P., Pasqua, F., Banfi, P., Gigliotti, F., Simonelli, C., Cirio, S., Rossi, V., Beccaluva, C. G., Retucci, M., Santambrogio, M., Lanza, A., … Arir Associazione Riabilitatori dell'Insufficienza Respiratoria Sip Società Italiana di Pneumologia Aifi Associazione Italiana Fisioterapisti And Sifir Società Italiana di Fisioterapia E Riabilitazione OBOAAIPO (2020). Italian suggestions for pulmonary rehabilitation in COVID-19 patients recovering from acute respiratory failure: results of a Delphi process. *Monaldi Archives for Chest Disease*, *90*(2). https://doi.org/10.4081/monaldi.2020.1444

Vitacca, M., Migliori, G. B., Spanevello, A., Melazzini, M. G., Ambrosino, N., Ceriana, P., Fanfulla, F., Braghiroli, A., Fracchia, C., & Balbi, B. (2020). Management and outcomes of post-acute COVID-19 patients in Northern Italy. *European Journal of Internal Medicine*, *78*, 159–160. https://doi.org/10.1016/j.ejim.2020.06.005

Wolock, I., Schlesinger, E., Dinerman, M., & Seaton, R. (1987). The post-hospital needs and care of patients: Implications for discharge planning. *Social Work in Health Care*, *12*(4), 61–76. https://doi.org/10.1300/J010v12n04_05

Zhang, F. J., Hu, D. Y., Liu, Y. L., Li, H., Zhu, X. P., & Pan, S. S. (2020). Expert consensus on nurses' human caring for COVID-19 patients in different sites. *Current Medical Science*, *40*(4), 602–607. https://doi.org/10.1007/s11596-020-2222-0

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Mandora E, Comini L, Olivares A, et al. Patients recovering from COVID-19 pneumonia in sub-acute care exhibit severe frailty: Role of the nurse assessment. *J Clin Nurs*. 2021;30:952–960. https://doi.org/10.1111/jocn.15637

APPENDIX 1

FIGURE 1 BRASS scale reproduced as reported in Blaylock and Cason (1992)

BLAYLOCK DISCHARGE PLANNING RISK ASSESSMENT SCREEN

Circle all that apply and total. Refer to scoring index for recommendations regarding discharge planning.

Age
0 = 55 years or less
1 = 56–64 years
2 = 65–79 years
3 = <80 years
Living situation/social support
0 = Lives only with spouse
1 = Lives with family
2 = Lives alone with family support
3 = Lives alone with friend's support
4 = Lives alone with no support
5 = Nursing home/Residential care
Functional status
0 = Independent in activities of daily living and instrumental activities of daily living
Dependent in:
1 = Eating/Feeding
1 = Bathing/Grooming
1 = Toileting
1 = Transferring
1 = Incontinent of bowel function
1 = Incontinent of bladder function
1 = Meal Preparation
1 = Responsible for own medication administration
1 = Handling own finances
1 = Grocery Shopping
1 = Transportation
Cognition
0 = Oriented
1 = Disoriented to some spheres (person, place, self, time) some of the time
2 = Disoriented to some spheres (person, place, self, time) all of the time
3 = Disoriented to all spheres (person, place, self, time) some of the time
4 = Disoriented to all spheres (person, place, self, time) all of the time
5 = Comatose
Behaviour pattern
0 = Appropriate
1 = Wondering
1 = Agitated
1 = Confused
1 = Other
Mobility
0 = Ambulatory
1 = Ambulatory with mechanical assistance
2 = Ambulatory with human assistance
3 = Non ambulatory
Sensory deficits
0 = None
1 = Visual or hearing deficits
2 = Visual and hearing deficits
Number of previous admissions/Emergency room visits
0 = None in the last 3 months
1 = One in the last 3 months
2 = Two in the last 3 months
3 = More than two in the last 3 months
Number of active medical problems
0 = Three medical problems
1 = Three to five medical problems
2 = More than five medical problems
Number of drugs
0 = Fewer than three drugs
1 = Three to five drugs
2 = More than five drugs
Total score: _____

Risk Factor Index:

- 0–10 = At risk for home care resources
- 11–19 = At risk for extended discharge planning
- Greater than 20 = At risk for placement other than home. If score is 10 or greater, refer the patient for discharge coordination or discharge planning team

APPENDIX 2

See in details all doctors, nurses and physiotherapists employed in the ICS Maugeri Hospital of Lumezzane (Bs) Italy and involved in the COVID-19 crisis.

Doctors: Barbano Luca, Bertella Enrica, Bertolinelli Maurizio, Bresciani Elena, Cinelli Angelo, Fiorenza Domenico, Gatti Simonetta, Ghianda Diego, Marino Simona, Pasini Evasio, Prometti Paola, Rivadossi Francesca, Santoro Raffaele, Scotti Carla, Zanelli Emanuela.

Nurses: Botelli Simona, Tutuianu Nicoletta, Belba Alida, Polanco Kenia, Britos Lidia, Kambo Katerina, Mino Maria, Cerqui Lisa, Mensi Valentina, Rodriguez Kelly, Gonzales Rosa, Salazar Maria Elena, Echangue Joana, Botti Daniela, Guerini Mariarosa, Corini Sabina, Gatta Ottavia, Duarte Pabla, Panibra Jackeline, Valenzise Andreina, Bolandu Vasile, Ragnoli Valeria, Leuci Rosanna, Abrati Elena, Frazzetto Giuseppe, Lerma Marisol, Salas Carolay, Rizzelli Francesca, Mascia Massimo, Lozano Ely, Suca Halcuna Carina, Apaza Rocio, Del Vecchio Claudia, Lombardi Sara, Biagioni Saul, Mazzini Romina, Coaquira Elisabeth, Martinez Diana.

Physiotherapists: Fokom Aubin Georges, Speltoni Ilaria, Favero Irene, Simonelli Carla, Saleri Manuela, Garofalo Francesca, Damiani Silvia, Manjola Toska, Gelmini Elena, Massussi Davide, Vanoglio Fabio.