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# Age, comorbidity, frailty status: effects on disposition and resource allocation during the COVID-19 pandemic

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## Age, comorbidity and frailty

As of now, studies on COVID-19 have consistently shown that older age and comorbidity are major risk factors for adverse outcomes and mortality [1–3]. However, it is unknown which of these components has the strongest prognostic power for prediction of adverse health outcomes in COVID-19, because there is a substantial overlap between them [4]. Atypical disease presentation in older adults may contribute to an unfavourable course of disease [5, 6]. Nursing home residents appear to be particularly at risk for adverse outcomes from COVID-19 [7, 8], especially if requiring mechanical ventilation [9]. It can be speculated that this increased vulnerability is due to a high frailty prevalence in nursing home facilities [10].

Not all older adults appear to be equally vulnerable to COVID-19. A recent case series presented five patients aged 98 years and older who recovered from COVID-19 and were discharged from hospital, being China's oldest COVID-19 survivors [11].

On the other hand, frail older adults have an increased vulnerability to such a stressor event – they tend to be more seriously affected by acute disease in general and they often do not regain their baseline level of health and independence, as compared with non-frail older adults of the same age group [12]. To date, there is no consensus on a frailty definition and the two most relevant concepts are the phenotype model and the cumulative deficit model [12, 13].

There is evidence that frailty status by itself is as predictive of adverse outcomes as older age in several different conditions including pneumonia (see table 1 for summary, for systematic review see [20]).

## Frailty assessment

To determine frailty status, several tools have been developed. The Clinical Frailty Scale (CFS) [21] is an easy-to-use screening tool for frailty. A pictograph and a short clinical description help to assign scores from 1 (very fit) to 9 (terminally ill). The CFS score should be based on the person's baseline status, for example, 2 weeks ago. The CFS is a predictor for in-hospital mortality independent of age and gender [15, 22, 23] and was recently validated in a consecutive sample of patients aged 65 years and older in an emergency department (ED) setting [24]. Early determination of frailty status, preferably during ED triage, could therefore be useful to identify older adults who may benefit from a comprehensive geriatric assessment [25]. In addition, it could assist disposition decisions [26] and possibly resource allocation, particularly at times of high patient influx, such as during the current COVID-19 pandemic. Disposition in this context means the decision for either discharge, admission or transfer after ED triage and work-up.

## Disposition decisions during the COVID-19 pandemic

Admission to acute medicine or transfer to geriatric medicine should not be based simply on age. On the contrary, the balance between frailty status and disease acuity/severity should be gauged individually, with consideration of the patients' preferences and goals of care. The combination of the CFS with an aggregated vital sign score as a marker of acute illness severity appears to improve outcome prediction [27]. Disposition decisions must take outcome prediction into account [28] as, for example, unexpected death after ED discharge should not occur, and in a situation of very high acuity/severity transfer to the intensive care unit has to be considered.

## Resource allocation during the COVID-19 pandemic

Resource allocation should be based on concepts similar to those of disposition decisions, because short-term prognosis and the patients' preferences and goals of care are the cornerstones of vitally important choices. "Left digit bias" (e.g., patients admitted 2 weeks after their 80th birthday were less likely to undergo bypass surgery than patients admitted 2 weeks before [29]) must affect neither disposition nor resource allocation. Whereas disposition decisions should ideally be independent of available resources, they

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**Table 1:** Summary of selected studies examining the effect of age and frailty.

| Clinical situation | Age (years) | Sample size | Outcomes | Frailty assessment tool | Effect of frailty independent of age? |
|---|---|---|---|---|---|
| CPR of in-patients [14] | Median: 74 | Included: 179<br>Frail: 31.3%<br>Non-frail: 68.7% | **Survival to discharge:**<br>Frail: 1.8%<br>Non-frail: 31.7% | Clinical Frailty Scale. Frailty defined as CFS levels 6 to 9. | Yes (logistic regression analysis) |
| Emergency surgical patients [15] | Median: 54 | Included: 2279<br>Frail: 12.7%<br>Non-frail: 87.3% | **Mortality at day 30 (adjusted OR):**<br>CFS 1: reference<br>CFS 5: 2.24<br>CFS 6: 3.78<br>CFS 7: 22.33 | 7-Point Clinical Frailty Scale. Frailty defined as CFS levels 5 to 7. | Yes (logistic regression analysis) |
| Geriatric trauma [16] | Mean: 78 | Included: 250<br>Frail: 44%<br>Non-frail: 56% | **In-hospital mortality, primary outcome (unadjusted):**<br>Frail: 4.5%<br>Non-frail: 0%<br>**Discharge to skilled nursing facility or in-hospital mortality (adjusted OR):**<br>Frail: 1.6<br>Non-frail: reference | Frailty defined as Frailty Index ≥0.25. | Yes (logistic regression analysis) |
| Pneumonia [17] | Mean: 79 | Included: 270,308<br>High HFRS: 11.5%<br>Intermediate HFRS: 55.2%<br>Low HFRS: 33.4% | **Mortality at day 30 (adjusted OR):**<br>HFRS low risk: reference<br>HFRS intermediate risk: 2.08<br>HFRS high risk: 2.45 | Hospital Frailty Risk Score (HFRS).<br>Low risk HFRS <5,<br>Intermediate risk HFRS 5–15<br>High risk HFRS >15 | Yes (logistic regression analysis) |
| Sepsis [18] | Mean: 65 (estimated) | Included: 30,239<br>Frail: 20.6%<br>Non-frail: 79.4%<br>Sepsis cases: 1479<br>Frail: 34.4%<br>Non-frail: 65.6% | **30-day case fatality (adjusted OR):**<br>Non-frail: reference<br>Frail: 1.62<br>1 indicator: 1.05<br>2 indicators: 1.53<br>3 indicators: 2.03 | Frailty defined by the presence of at least 2 frailty indicators (weakness, exhaustion, low physical activity) | Yes (logistic regression analysis) |
| Critically ill patients [19] | Mean: 67 | Included: 421<br>Frail: 32.8%<br>Non-frail: 67.2% | **In-hospital mortality:**<br>Frail: 1.81<br>Non-frail: reference | Clinical Frailty Scale. Frailty defined as CFS levels 5 to 8. | Yes (logistic regression analysis) |
| COVID-19 in Italy [3] | NA | Included: 22,512 | **Case fatality rate:**<br>Age 0–29: 0%<br>Age 30–39: 0.3%<br>Age 40–49: 0.4%<br>Age 50–59: 1.0%<br>Age 60–69: 3.5%<br>Age 70–79: 12.8%<br>Age ≥80: 20.2% | Not assessed | Not tested |
| COVID-19 in China [2] | Median: 47 | Included: 1099<br>Age ≥65: 15.1%<br>Age <65: 84.9% | **Composite outcome** (ICU admission, mechanical ventilation, death):<br>Age ≥65: 49.2%<br>Age <65: 25.4% | Not assessed | Not tested |

CFS = Clinical Frailty Scale; CPR = cardiopulmonary resuscitation; HFRS = Hospital Frailty Risk Score; ICU = intensive care unit; NA = not available; OR = odds ratio For readability, confidence intervals and standard deviations are not shown, please refer to referenced articles.

pose an even greater challenge in times of resource scarcity due to COVID-19. Although age and comorbidity are considered to be important outcome predictors in Swiss [30] and Italian [31] guidelines on resource allocation, frailty intensive care assessment (with the Clinical Frailty Scale) has so far only been endorsed by guidelines of the UK National Institute for Health and Care Excellence (NICE) [32], as well as the guidelines of the German Society of Intensive Care [33].

Due to the lack of data in the present COVID-19 pandemic, we can only speculate that frailty status, rather than chronological age, largely determines outcome in patients with COVID-19. However, in many other conditions, this has already been demonstrated (table 1).

As suggested by Canadian experts [34, 35], three aspects are of utmost importance: first, determination of *frailty status* (and not just the patient's age), second, *balancing of benefits and harms* while considering the most likely outcome taking comorbidity into account, and third, *shared decision-making* focusing on the individual's goals of care.

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