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Short-term mortality and associated factors among older hospitalized patients: A narrative retrospective analysis of end-of-life care in an acute geriatric unit

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ABSTRACT

Objectives: To explore short-term mortality and its predictors among older patients hospitalized in a acute geriatric ward (AGW) in Northwestern Italy.
Design: Retrospective observational single-center cohort study.
Material and methods: Patients consecutively admitted for any reason between June 2021 and May 2022 were included in the analysis. Along with sociodemographic, clinical, and functional variables, prognosis estimation (Palliative Prognostic Index; PPI) at the time of admission was registered. Short-term all-cause mortality (in-hospital and within 3 months of discharge) was the primary outcome.
Results: About one-third of the total sample died in the short-term (32.4 %). Along with PPI score (OR 1.115, 95 %CI 1.034–1.202), short-term mortality was independently associated with functional dependency (OR 1.278, 95 %CI 1.170–1.395).
Conclusions: The high short-term mortality in our sample should call for the inclusion of palliative prognostic tools within the in-hospital comprehensive geriatric assessment to better recognize and appropriately manage older patients at the end of life.

Introduction

The changing demographics of the population and the rise in chronic diseases have significantly altered the profile of patients admitted to hospitals and long-term care facilities. In contrast to a few decades ago, hospitalized patients are now predominantly older, with a higher burden of diseases, and some of them show functional and cognitive impairments.[1–3] Although some patients are admitted due to general physical decline or inability to be cared for at home,[3,4] most of them are hospitalized because of acute clinical worsening in the context of compromised overall health status.[3–5]

Within the hospital setting, these older patients are primarily cared for in acute internal medicine and geriatric wards, especially those who, by reason of complex clinical scenarios, frailty, and multiple comorbidities,[6] are at a high risk of in-hospital and short-term mortality.[3,6–8] Therefore, in these settings medical staff regularly cares for patients that are approaching the end of their lives. The concept of end-of-life trajectory has evolved over many years according to the individual needs of these heterogeneous patients at the end of life.[9] The frailty trajectory is particularly prevalent, highlighting the importance of improving medical practices in this context.[10] Therefore, palliative tools should be integral within the geriatric assessment,[11] and the adoption of comfort care, defined as a set of basic palliative care interventions providing symptom relief at the end of life, is expected to be a common practice.[12,13]

However, the extent to which physicians are able to perceive and capture the general health status and end-of-life trajectory of

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hospitalized older patients, especially in countries where advance care decisions are not widely adopted, remains unclear.

To address this gap, we are conducting a prospective observational study in our Center to assess the healthcare personnel's perception of the end-of-life trajectory in hospitalized patients. This retrospective narrative study outlines the clinical background prompting the prospective research, exploring whether there is a sub-population of inpatients at high risk of short-term mortality and how these patients can be identified.

Materials and methods

Study design and participants

This retrospective observational single-center cohort study was conducted at the A.O.U. Città della Salute e della Scienza di Torino University Hospital in Turin, Northwestern Italy. The study included all patients consecutively admitted to our acute geriatric ward (AGW) for any reason between June 2021 and May 2022. Patients who died within the first 72 h of admission and those hospitalized for SARS-CoV-2 infection (for whom different protocols were applied) were excluded from the analysis. Short-term all-cause mortality (in-hospital and within 3 months of discharge) was recorded as the primary outcome measure.

The study adhered to the Recommendations Guiding Physicians in Biomedical Research Involving Human Subjects, received approval from the local Ethics Committee, and was reported in accordance with the Strengthening The Reporting of Observational Studies in Epidemiology statements (STROBE checklist available in the Supplementary Material).[14]

Descriptive and outcome variables

Data were retrospectively collected from medical records using standardized evaluation protocols by resident doctors from the local section of Geriatrics under the supervision of senior specialists in Geriatrics.

At the time of admission, age, sex, and living situation (i.e., whether the patient lives with their spouse, alone, with other family members, with home caregiver or in a long-term care facility) were recorded, as well as the main diagnosis made in the Emergency Department. The date of discharge and if the patient was dead or alive at discharge was recorded. Death within 3 and 12 months of enrollment was assessed by consulting local electronic registries.

Standardized multidimensional assessment

Each patient underwent a routine multidimensional geriatric evaluation at admission. Functional status was assessed using Katz's Basic Activities of Daily Living (BADL, range 0–6, with scores $\geq$ 2 identifying functional dependency)[15] and a modified version of the Instrumental Activities of Daily Living scale (IADL, range 0–14, with scores < 10 identifying partial or complete absence of autonomy).[16] Disease burden and severity were evaluated using the Cumulative Illness Rating Scale (CIRS).[17] This tool rates the severity of diseases (range 1–5, with 1 indicating no affection and 5 severe impairment) according to major organ groups, hypertension, and psychiatric/behavioral area for a total of 14 items. From CIRS ratings, the composite measures of Comorbidity Index (CIRS-CI) and Severity Index (CIRS-SI) are derived, representing respectively the number of items scoring 3 or more and the mean of CIRS items, both excluding the psychiatric/behavioral category.[17]

General physical status was evaluated using the Palliative Performance Scale (PPS). This tool considers ambulation, activity level, burden of disease, self-care, oral intake, and level of consciousness (range 0–100 % by 10 %-point intervals, with 100 % fully ambulatory and healthy subjects and 0 % identifying terminal conditions) and has been associated with life expectancy in both oncologic and non-oncologic patients.[18]

The prognosis was estimated with the Palliative Prognostic Index (PPI) (range 0–15) that considers oral intake and the presence of edema, dyspnea at rest, and delirium besides the PPS.[19]

Statistical analysis

Statistical analysis was performed using SPSS software (IBM SPSS Statistics, version 28.0.1.0). The absolute and relative frequencies of dichotomous and categorical variables were calculated, as well as the mean and standard deviation or median and 25th and 75th percentiles for normally distributed and not normally distributed continuous variables, as appropriate. The overall sample was divided into four groups upon the time from discharge to death (i.e., in-hospital, within 3 months, within 12 months, alive after 12 months). Univariate analysis of potential association between baseline variables and short-term mortality (in-hospital and within 3 months of discharge) was conducted using the analysis of variance for normally distributed continuous variables, the Mann-Whitney test for not normally distributed continuous variables and the Chi square test for dichotomous and categorical variables. Clinically relevant variables were then introduced in a multivariable logistic regression model, with short-term mortality as the dependent variable, and adjusted odds ratios (OR) and their 95 % CIs were calculated. Significance level was set at $\alpha < 0.05$ for all tests.

Results

During the study period, 715 patients were admitted to our AGW; 43 died within 72 h of admission (6.0 %) and were consequently excluded. The key variables of the 672 included patients (median age 85 years, 53.6 % female) according to their survival are detailed in Table 1. Primary reasons for admission included heart failure (17.8 %) and respiratory failure (12.2 %). The median length of stay was 11 days. Most patients exhibited a high functional dependency (median lost functions at BADL 3, median IADL 5), along with a huge burden of comorbidities (median CIRS-CI: 4) and poor general performance (median PPS score 50; median PPI score 3.5).

Roughly one-third of the total sample died in the short-term (218, 32.4 %): 93 patients died during hospitalization (13.8 %), and 125 died within 3 months of discharge (18.6 %). A smaller portion of patients died after 3 months but within 12 months (92; 13.7 %). The main characteristics of the overall sample and across the four groups of patients according to their survival are described in Table 1.

At univariate analysis, compared with patients surviving >3 months, those who died within 3 months were more dependent in BADL (73.4% vs 46.3 %, $p < 0.001$) and less autonomous in IADL (64.2% vs 36.3 %, $p < 0.001$), with worse PPS and PPI scores (50 vs 60, $p < 0.001$ and 5 vs 3.5, $p < 0.001$) (Table 2). After multivariable analysis, short-term mortality was positively associated with worse PPI (OR 1.115, 95 % CI 1.034–1.202; $p = 0.005$) and functional dependency in BADL (OR 1.278, 95 % CI 1.170–1.395; $p < 0.001$) (Table 3).

In contrast, there were no significant differences in terms of functional dependency and comorbidity burden between patients deceased during their hospital stay and within 3 months of discharge, except for slightly worse PPS score (40 vs 50, $p = 0.007$) and PPI score (5 vs 3.5, $p = 0.001$) in patients who died in the hospital (Table 4); however, after multivariable analysis no variable was found to have an independent association with in-hospital mortality.

Conversely, patients alive after 12 months of discharge were compared to those who died within one year (Supplementary Table 1). Long-term survivors had a shorter hospital stay and were less

Table 1
Characteristics of the overall sample and by vital status at discharge and after 3 and 12 months.

	Overall sample (*n* = 672)		**In-hospital death (*n* = 93)**		**Death within 3 months (*n* = 125)**		**Death within 12 months (*n* = 92)**		**Living at 12 months (*n* = 362)**	
Patients' characteristics										
Age (years), median (25^{th}-75^{th})	85.1	(80.5–89.5)	87.3	(82.5–90.6)	86.1	(80.2–90.8)	86.8	(83.2–91.2)	84.3	(79.6–88.3)
Sex female, n (%)	360	(53.6)	41	(44.1)	64	(51.2)	44	(47.8)	211	(58.3)
Hospitalization characteristics										
Diagnosis at admission										
General deterioration, n (%)	70	(10.4)	35	(37.6)	6	(4.8)	3	(3.3)	26	(7.2)
Dementia/delirium, n (%)	47	(7.0)	1	(1.1)	11	(8.8)	12	(13.0)	23	(6.4)
Sepsis, n (%)	46	(7.0)	4	(4.3)	5	(4.0)	4	(4.3)	33	(9.1)
Cardiovascular/PTE, n (%)	120	(17.8)	8	(8.6)	24	(19.2)	25	(27.2)	63	(17.4)
AKI, n (%)	37	(5.5)	4	(4.3)	5	(4.0)	4	(4.3)	24	(6.6)
Respiratory failure, n (%)	82	(12.2)	8	(8.6)	16	(12.8)	12	(13.0)	46	(12.7)
Cancer, n (%)	41	(6.1)	12	(12.9)	13	(10.4)	8	(8.7)	8	(2.2)
Stroke, n (%)	40	(6.0)	7	(7.5)	8	(6.4)	4	(4.3)	21	(5.8)
Anemia/bleeding, n (%)	36	(5.4)	0	(0)	8	(6.4)	7	(7.6)	21	(5.8)
UTI, n (%)	27	(4.0)	0	(0)	4	(3.2)	2	(2.2)	21	(5.8)
GI/hepatopancreatic, n (%)	50	(7.4)	0	(0)	14	(11.2)	4	(4.3)	32	(8.8)
Syncope/fall/trauma, n (%)	42	(6.3)	14	(15.1)	4	(3.2)	2	(2.2)	22	(6.1)
Length of stay, median (25^{th}-75^{th})	11	(7–18)	10	(7–19)	14	(9–22)	10	(6–16)	10	(6–16)
Length of stay in the Geriatric Unit, median (25^{th}-75^{th})	9	(5–14)	8	(5–14)	12	(8–18)	9	(5–14)	8	(5–14)
Functional autonomy and comorbidities										
BADL (lost functions), median (25^{th}-75^{th})	3	(0–5)	4	(2–6)	5	(2.25–6)	2	(0–4.75)	1	(0–4)
IADL, median (25^{th}-75^{th})	5	(2–10)	3	(1–5.5)	3	(1–7)	5	(2–9)	7	(3–12)
PPS, median (25^{th}-75^{th})	50	(40–60)	40	(30–50)	50	(40–60)	60	(50–67.5)	60	(50–62.5)
PPI, median (25^{th}-75^{th})	3.5	(1–6)	5	(3.5–7.5)	3.5	(2.5–6.5)	3.5	(0–4.5)	3.5	(1–5)
CIRS-CI, median (25^{th}-75^{th})	4	(3–5)	4	(4–5)	4	(3–5)	4	(3–6)	4	(2–5)
CIRS-SI, median (25^{th}-75^{th})	1.9	(1.7–2.1)	1.9	(1.8–2.1)	1.9	(1.7–2.1)	2	(1.8–2.2)	1.8	(1.6–2.1)

AKI: acute kidney injury; BADL: Basic Activities of Daily LIving; CIRS-CI/SI: Cumulative Illness Rating Scale – Comorbidity Index/Severity Index; GI: gastrointestinal; IADL: Instrumental Activities of Daily Living; PPI: Palliative Prognostic Index; PPS: Palliative Performance Scale; PTE: pulmonary thromboembolism; UTI: urinary tract infection.

Table 2
Variables in patients with short-term mortality (in-hospital and within 3 months of discharge) compared with patients alive after 3 months (univariate analysis).

	Died within 3 months (*n* = 218)		**Alive after 3 months (*n* = 454)**		**p**
Patients' characteristics					
Age (years), median (25^{th}-75^{th})	86.3	(81.9–90.8)	84.9	(80.3–88.9)	0.009
Sex female, n (%)	136	(62.4)	232	(51.1)	0.006
Hospitalization characteristics					
Length of stay, median (25^{th}-75^{th})	12	(8–20)	10	(6–16)	< 0.001
Length of stay in the Geriatric Unit, median (25^{th}-75^{th})	10	(6–17)	8	(5–13.3)	0.002
Functional autonomy and comorbidities					
BADL lost functions, median (25^{th}-75^{th})	4	(2–6)	1	(0–4)	< 0.001
BADL ≥ 2 lost functions (dependent), n (%)	160	(73.4)	210	(46.3)	< 0.001
IADL preserved functions, median (25^{th}-75^{th})	3	(1–6)	6	(3–11)	< 0001
IADL 0–4 (not autonomous), n (%)	140	(64.2)	165	(36.3)	< 0.001
IADL 5–9 (partially autonomous), n (%)	41	(18.8)	128	(28.2)	
PPS, median (25^{th}-75^{th})	50	(30–60)	60	(50–62.5)	< 0.001
PPI, median (25^{th}-75^{th})	5	(3–7)	3.5	(0.75–4.5)	< 0.001
CIRS-CI, median (25^{th}-75^{th})	4	(3–5)	4	(3–5)	0.003
CIRS-SI, median (25^{th}-75^{th})	1.9	(1.8–2.1)	1.9	(1.7–2.2)	ns

BADL: Basic Activities of Daily Living; CIRS-CI/SI: Cumulative Illness Rating Scale – Comorbidity Index/Severity Index; IADL: Instrumental Activities of Daily Living; PPI: Palliative Prognostic Index; PPS: Palliative Performance Scale.

Table 3
Variables independently associated with in short-term death (in hospital-3 months): multivariable logistic regression model results*.

Variables	**OR (95 % CI)**		**p**
BADL (lost functions)	1.278	(1.170–1.395)	< 0.001
PPI	1.115	(1.034–1.202)	0.005

* The following variables have been included in this model: age, BADL (lost functions), IADL, PPS, PPI, CIRS-CI.
BADL: Basic Activities of Daily Living; CIRS-CI: Cumulative Illness Rating Scale – Comorbidity Index; IADL: Instrumental Activities of Daily Living; PPI: Palliative Prognostic Index; PPS: Palliative Performance Scale.

dependent in BADL (44.2% vs 67.7 %, $p < 0.001$) and more autonomous in IADL (34.5% vs 58.1 %, $p < 0.001$) with better PPS (60 vs 50, $p < 0.001$) and PPI scores (3.5 vs 4.5, $p < 0.001$). After multivariable analysis, 12-month survival was inversely associated with age (OR 0.949, 95 % CI 0.924–0.974; $p < 0.001$), functional dependency in BADL (OR 0.761, 95 % CI 0.685–0.846; $p < 0.001$) and comorbidity burden (OR 0.791, 95 % CI 0.714–0.876; $p < 0.001$) (Supplementary Table 2).

Discussion

Increased life expectancy and the rising number of individuals living with complex chronic illnesses have heightened the

Table 4
Variables in patients with short-term mortality and according to in-hospital death and death within 3 months of discharge (univariate analysis).

	Short term death (in-hospital/ within 3 months) (*n* = 218)		In-hospital death (*n* = 93)		Death within 3 months (*n* = 125)		p
Patients' characteristics							
Age (years), median (25^{th}-75^{th})	86.3	(81.9–90.8)	87.3	(82.5–90.6)	85.9	(80.2–90.8)	ns
Sex female, n (%)	105	(48.2)	41	(44.1)	64	(51.2)	ns
Hospitalization characteristics							
Length of stay, median (25^{th}-75^{th})	12.5	(8–20.25)	10	(7–19)	14	(9–25)	0.007
Length of stay in the Geriatric Unit, median (25^{th}-75^{th})	10	(6–18)	8	(5–15)	13	(8–19)	0.004
Functional autonomy and comorbidities							
BADL lost functions, median (25^{th}-75^{th})	4	(2–6)	4	(2–6)	5	(2.3–6)	ns
IADL, median (25^{th}-75^{th})	3	(1–6)	3	(1–5,5)	3	(1–7)	ns
PPS, median (25^{th}-75^{th})	50	(30–60)	40	(30–50)	50	(40–60)	0.007
PPI, median (25^{th}-75^{th})	5	(3–7)	5	(3,5–7,5)	3.5	(2.5–6.5)	0.001
CIRS-CI, median (25^{th}-75^{th})	4	(3–5)	4	(4–5)	4	(3–5)	ns
CIRS-SI, median (25^{th}-75^{th})	1.9	(1.8–2.1)	1.9	(1.8–2.1)	1.9	(1.7–2.1)	ns

BADL: Basic Activities of Daily Living; CIRS-CI/SI: Cumulative Illness Rating Scale – Comorbidity Index/Severity Index; IADL: Instrumental Activities of Daily Living; PPI: Palliative Prognostic Index; PPS: Palliative Performance Scale.

demand for appropriate end-of-life care in the acute setting.[20] This retrospective observational study aimed to explore the prevalence and predictors of short-term death (in-hospital and within 3 months of discharge) in a single-center sample of older patients hospitalized in an AGW. Our findings demonstrated that: i) although nearly half of the total sample died within 12 months of discharge, 70.3 % of them died within the first 3 months; ii) along with PPI score, short-term mortality (in-hospital and within 3 months of discharge) was independently associated with functional dependency; iii) in-hospital deceased patients had similar levels of functional dependency and comorbidities but worse palliative prognostic scores (PPS and PPI) compared to those who died within 3 months; iv) conversely, patients alive after 12 months of discharge exhibited a significantly better overall performance profile, with higher functional independence, fewer comorbidities and a better general performance. Overall, these findings demonstrated a very high short-term mortality among older AGW inpatients and that including palliative performance scores within the comprehensive geriatric assessment of older inpatients may assist clinicians and healthcare personnel to identify patients near the end-of-life to provide them with the appropriate medical care.

According to the 2010 General Medical Council definition, end-of-life patients are those likely to die within the next 12 months, encompassing individuals with advanced incurable pathology, severe frailty, greater burden of comorbidities, and those at risk of dying from exacerbation of pre-existing pathology or sudden catastrophic events.[21] Although most patients and families do not consider hospitals an ideal location to die,[22] and despite policy initiatives to increase end-of-life care in the community,[23] hospital admissions for patients at the end of life have been steadily increasing in recent years.[24–26] Moreover, older people with chronic diseases, frailty, and dementia are frequently admitted to hospitals towards the end of life in need of a response to distressing physical, psychological, social, and spiritual symptoms, but their fluctuating trajectory is often hard to predict.[27–30] Indeed, older patients approaching the end of life are not routinely identified, with scarce or delayed referral to specialty palliative care.[31,32] Identifying such patients would not only imply a better understanding of the probable life expectancy of the patient, but also acknowledging and anticipating their needs to provide the right care at the right time in line with personal preferences[33,34] and represent one of the most challenging issues across most healthcare settings, including hospitals.[34,35]

Although a rising number of validated tools and criteria have been proposed,[34,36] previous research has shown that prognostic resources are underutilized, with clinicians generally relying on their experience, knowledge, and intuition as prognostic strategies, even if with limited confidence.[37]

In our study, 46.1 % of older patients died within 12 months of discharge, thereby potentially representing end-of-life patients according to the General Medical Council definition, but most of them died in-hospital or within three months. Although this proportion is highly variable among hospitals and countries, it is in line with previous registry data from the United Kingdom and New Zealand, which report that around 90 % of older people spend time in hospitals in their final year of life, with over 50 % dying there.[5,38,39]

Furthermore, our study demonstrated a significant proportion of hospitalized patients at high risk of short-term death, emphasizing the importance of distinguishing these patients from those with longer, although still limited, life expectancy for optimal and personalized clinical management, potentially preventing unscheduled hospitalizations and ensuring appropriate care settings.[40,41] Along with functional dependency, short-term mortality (in-hospital and within 3 months of discharge) turned out to be associated with higher PPI score. This tool was originally developed for Japanese patients with advanced cancer in hospices and validated in Ireland in hospitals, hospices, and homecare, with prediction of positive predictive value of 86 % and 91 % for survival of less than three weeks and less than six weeks, respectively.[19] Although not generalizable, recent evidence supported the short-term prognostic utility of PPI even in older patients with non-cancer life-limiting conditions.[36,42] Therefore, our finding suggests that simple prognostic tools deriving from the oncology palliative care literature may significantly improve the clinicians' confidence in identifying the end of life of older patients[43] and should be embedded and integrated with a multidimensional geriatric assessment in clinical practice.[44]

Some limitations of the present study should be acknowledged. Although consistent with similar works, our single-center retrospective study reflects the reality of a definite geographical area, limiting the generalizability of our conclusions. Further studies are needed to prospectively investigate physicians' and nurses' ability to recognize worsening prognosis and need for transition to palliative care. Indeed, a prospective multicenter study is already ongoing at our Center to evaluate the prognostic utility of different validated tools in older patients.

The prediction of short-term mortality within 3 months was already adopted elsewhere in the literature[45,46] and was supported by similar characteristics between in-hospital and 3-months deceased patients. Indeed, it may represent an optimal time to explore models predicting short-term mortality as it would give the

clinician in charge the opportunity for adequate communication and shared decision-making about management of the end of life after discharge, considering patients' and/or families' preferences.[45,46]

In summary, the results of this study might help to foster early identification of older subjects nearing end-of-life in the hospital inpatient setting, thus resulting in a timely and tailored initiation of palliative care discussions and appropriate overall assessment of patient's needs, providing patient-specific support by clarifying the needs of individual patients and their caregivers and offering shared and established goals of care.[12,47,48]

Conclusions

Along with providing therapeutic care to resolve or manage acute and decompensated chronic diseases, hospitals should not neglect comfort care for patients with distressing symptoms approaching the end of life. This is especially crucial for older and frail patients. Our study indicates a high proportion of short-term mortality among older inpatients, emphasizing the need for a comprehensive assessment that includes the routine use of palliative performance scores. This approach may help identify the end-of-life trajectory and facilitate the provision of the most appropriate care for these patients.

The necessity for suitable end-of-life care is underscored by the increasing life expectancy and the growing number of individuals grappling with complex chronic illnesses, as well as severe functional and cognitive impairment. Further research is needed to investigate the capacity of physicians and nurses to fully identify end-of-life trajectories and facilitate the gradual shift from treatments focused on the disease to personalized symptomatic and palliative care.

Research ethics

As reported in the manuscript, the present study adhered to the Recommendations Guiding Physicians in Biomedical Research Involving Human Subjects, received approval from the local Ethics Committee, and was reported in accordance with the Strengthening The Reporting of Observational Studies in Epidemiology statements.

Data management and sharing

All Authors had all access to the data in this work and approved the submission of the present manuscript. All material in this assignment is Authors' own work and does not involve plagiarism. The data that support the findings of this study are available from the corresponding Author upon reasonable request.

Declaration of competing interest

The Authors of this manuscript declare they have no conflict of interest to disclose.

CRediT authorship contribution statement

Roberto Presta: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Enrico Brunetti:** Writing – review & editing, Supervision. **Bianca Salone:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Laura Anna Maria Schiara:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Cristina Villosio:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Martina Staiani:** Writing – review & editing, Formal analysis, Data curation, Conceptualization. **Francesca Lucchese:** Writing – review & editing, Formal analysis, Data curation, Conceptualization. **Gianluca Isaia:** Writing – review & editing, Conceptualization. **Renata Marinello:** Writing – review & editing, Conceptualization. **Mario Bo:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization.

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Supplementary materials

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