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Original article

Adherence to the Clinical Practice Guidelines for the hospital management of patients with decompensated heart failure in a Coronary Care Unit in Colombia

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ABSTRACT

Objective. To assess adherence to the recommendations for the diagnosis and management of hospitalized patients with Decompensated Heart Failure issued by the European Society of Cardiology in 2021 at a Coronary Care Unit at a fourth-level hospital in the city of Bogotá. **Materials and methods.** A descriptive cross-sectional study was conducted, including hospitalized patients in the Coronary Care Unit at Hospital San José in Bogotá, with a primary diagnosis of Decompensated Heart Failure, from September 2021 to January 2023. Patient data were collected from medical records. Adherence to the Decompensated Heart Failure guidelines was described in the study. **Results.** High adherence was observed for laboratory tests and medication prescriptions recommended by the 2021 European Society of Cardiology guidelines. However, there was low adherence to the request for thyroid function tests, troponin, and iron studies. The cause of heart failure and decompensation was adequately recorded. The most common cause of decompensation was acute coronary syndrome. Regarding the hemodynamic profile on admission, the majority presented as Stevenson B. Pharmacological adherence to Class I recommendations showed high compliance in prescribing betablockers, angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, and Angiotensin Receptor-Neprilysin Inhibitors. However, lower adherence was observed for Sodium-glucose co-transporter two inhibitors and Mineralocorticoid receptor antagonists. **Conclusions.** Variable adherence rates were recorded, emphasizing satisfactory compliance with class I recommendations for certain medications and laboratory tests. It is necessary to improve adherence in the request for paraclinicals, especially in thyroid function tests and ferrokinetic profiles.

Keywords: *Heart Failure; Medication Adherence; Coronary Care Units; Clinical Practice Guidelines* (source: MeSH-NLM).

Introduction

Cardiovascular diseases have ranked highest in prevalence and morbidity in recent decades. Currently, they constitute the leading cause of mortality attributable to non-communicable chronic diseases worldwide, according to data from the World Health Organization (WHO) [1]. Heart failure (HF) emerges as the outcome of multiple cardiovascular diseases, with the most common cause being ischemic heart disease and it is a frequent cause of hospital admissions, associated with high rates of mortality and morbidity [2,3].

Worldwide, the prevalence of HF has been estimated to range from 1 to 12% [4], with an incidence of 358 to 527 cases per 100,000 person-years, as indicated by studies [5], while 5-year survival rates have been estimated at 57% for outpatient cases and 25% for hospitalized patients [6]. In Latin America, the estimated incidence is 199 cases per 100,000 person-years, with in-hospital mortality rates of 11.7% and an annual mortality rate of 24.5% after hospitalization [7]. In Colombia, there is an approximate overall

prevalence of 2.3%, associated with an incidence of 2 cases per 1000 person-years between 35 and 64 years, rising to 12 per 1000 person-years among those aged 65 to 94 [8].

The adequate prescription and pharmacological adherence of patients with HF are essential for achieving good disease control, preventing decompensations, and related hospitalizations [9]. The rate of adequate prescription of medications for HF can be high in specialized settings such as HF clinics, where adequate prescriptions have been reported at 98.6% for beta-blockers (BB) and 93.4% for mineralocorticoid receptor antagonists (MRA) [10]. However, in other prescription contexts, these rates are lower, ranging from 33% to 79%, depending on the pharmacological group [11,12]. In our institution, a study in patients hospitalized by internal medicine showed a pharmacological adherence compliance with the evaluated guideline ranging between 52.6% and 78.5% [13].

In the context of coronary care units (CCU), there is a lack of data or studies in the literature that allow for establishing the level of compliance and adherence to recommendations issued by international guidelines. Therefore, the aim of this study is to evaluate adherence to the diagnostic and management recommendations issued by the European Society of Cardiology (ESC) in 2021 for patients hospitalized with decompensated heart failure (DHF) in a CCU at a fourth-level hospital in the city of Bogotá, by providing a detailed description of the pharmacological prescription, laboratory tests, and the use of medical devices in the CCU. The specific selection of recommendations from the ESC in DHF is carried out because they are adopted and implemented by the CCU. These recommendations have a rigorous scientific basis, involving the participation of experts in the field, a precise review process, a multidisciplinary approach, continuous updates, broad clinical applicability, and significant international recognition.

Materials and Methods

Study design and population

A cross-sectional descriptive study was conducted, involving patients hospitalized in the CCU at Hospital San José in Bogotá, with the primary diagnosis of DHF from September 2021 to January 2023. We excluded patients who were pregnant, patients who had been transferred or referred to another hospital unit, and patients who for any reason had limitations in medical interventions or were in palliative care.

Variables

Data were collected from patients' medical records, including demographic characteristics, left ventricular ejection fraction (LVEF), Stevenson's clinical classification, New York Heart Association (NYHA) functional classification, medical history, risk factors, congestion status, discharge location, mortality, and cause of death. The overall management of patients was assessed, with specific focus on the following aspects: the cause of decompensation, classification of presentation based on hemodynamic profile, interventions with cardiac devices, and the indication for non-invasive mechanical ventilation. Adherence to recommendations issued by the 2021 ESC guidelines was described, particularly in the sections related to the request for diagnostic tests and treatment upon discharge from the CCU. The diagnostic tests considered "recommended" by the guidelines included electrocardiogram (ECG), echocardiogram, troponin, creatinine, serum sodium, serum potassium, transferrin saturation percentage, and ferritin.

Adherence to recommendations categorized as Class I includes supplementary oxygen in patients with partial oxygen saturation (SpO_2) < 90% or arterial oxygen pressure (PaO_2) < 60 mmHg, intravenous loop diuretics for patients with signs or symptoms of fluid overload, prophylaxis for pulmonary thromboembolism in non-anticoagulated patients without contraindications for anticoagulation, evaluation of persistent signs of congestion before discharge from the CCU, evidence-based oral medical therapy (Class I) for patients with reduced LVEF (≤40%), and treatment for patients with mildly reduced (41%-49%) and preserved (≥50%) LVEF.

Statistical Analysis

The population was chosen by convenience during the study period. Continuous variables were reported with measures of central tendency and dispersion using median and interquartile range (IQR) for those variables with a non-normal distribution and mean and standard deviation (SD) for those variables with a normal distribution. Categorical variables are expressed as absolute frequencies and percentages. Stata V.18 software was used for statistical analyses.

Ethical aspects

The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Research Committee of the Faculty of Medicine at the Fundación Universitaria de Ciencias de la Salud, with expedited approval under the approval number DI - I - 0280 - 22. This work did not receive funding from internal or external calls.

Results

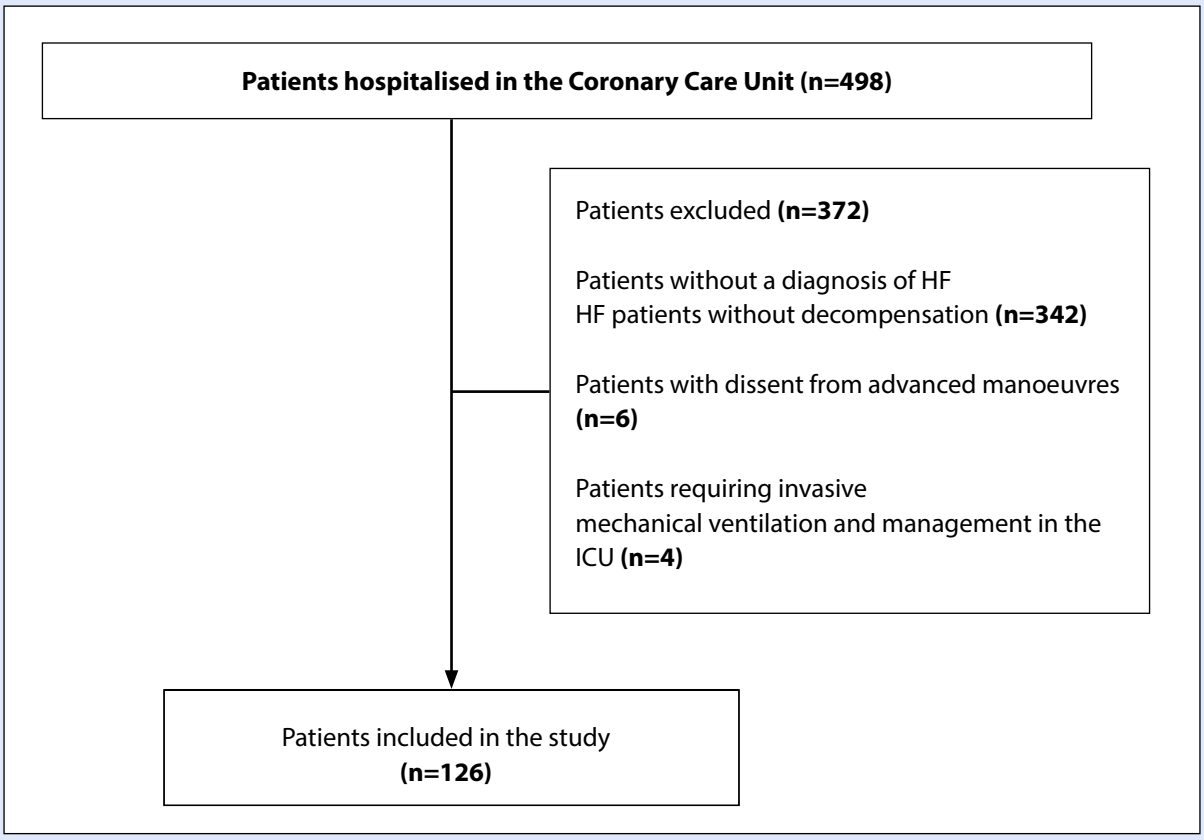
Out of 498 patients hospitalized in the CCU during the specified period, 126 met the inclusion criteria **(Figure 1)**. The median age

was 70 years (IQR: 59-77 years), 43 patients were female (34.1%). The median length of stay in the general ward was 11 days (IQR: 6-20 days), and in the CCU, it was 6 days (IQR: 3-9 days), with a mortality rate of 6.3%. The cause of HF was properly recorded in 108 patients (85.7%), and the cause of decompensation was reported in 101 patients (80.2%).

The most frequent cause of decompensation was acute coronary syndrome (n=24, 19%), and the most prevalent cause of HF was ischemic heart disease (n=47, 37.3%). Sociodemographic and background details are provided in **Table 1**. Within the hemodynamic profile at admission, the majority presented with a Stevenson category B (n=85, 67.5%), with a median heart rate of 76 beats per minute (IQR: 70-86) and a systolic blood pressure of 120 mmHg (IQR: 109-135). Clinical and laboratory data at the time of admission are detailed in **Table 2**.

Regarding the management received in the CCU, the most prescribed medications were diuretics 90.5% (n=114), vasodilators 12.7% (n=16), vasopressors 14.3% (n=18), and inotropics 32.5% (n=41). Dual-chamber pacemaker implantation was indicated in one patient and CRT-D in three patients (2.4%). Non-invasive mechanical ventilation was used in six patients (5.6%). Concerning the management at discharge from the CCU, 51.6% of patients (n=65) were prescribed angiotensin receptor-neprilysin inhibitors (ARNIs), 25.4% (n=32) angiotensin II receptor antagonists (ARBs), 15.1% (n=19) angiotensin-converting enzyme inhibitors (ACEIs), 88.9% (n=112) BB, 52.4% (n=66) MRA, 56.3% (n=71) sodium-glucose co-transporter-2 inhibitors (SGLT2 inhibitors), and 11.1% (n=14) ivabradine.

Regarding the adherence to recommendations by healthcare professionals, the following figures were recorded for ECG, blood urea nitrogen, electrolytes, and echocardiogram with 100% (n=126), 99.2% (n=125), 97.6% (n=123), and 95.2% (n=120), respectively. Only half of the patients had their transferrin values (n=63, 50%) and ferritin values (n=64, 50.8%) measured. From a pharmacological standpoint, 100% (n=126) received supplementary oxygen when needed, and 97.6% (n=123) received loop diuretics. The state of euvolemia at the time of discharge was recorded in only half of the cases (n=62, 49.2%). Pharmacological adherence to Class I recommendations in patients with HF and LVEF ≤ 40% (n=77) demonstrated high



HF: heart failure. ICU: intensive care unit

Figure 1. Patient selection.

Table 1. Sociodemographic characteristics of the population.

Demographic characteristics	
Median age - years (IQR)	70 (59-77)
Female - No (%)	43 (34.1)
Medical history - n (%)	
Hypertension	86 (68.3)
Smoking	51 (40.5)
Coronary artery disease	39 (31)
Diabetes mellitus	36 (28.6)
Atrial fibrillation	31 (24.6)
Valvular disease	27 (21.4)
Chronic Obstructive Pulmonary Disease	26 (20.6)
Chronic Kidney Disease	21 (16.7)
Obstructive Sleep Apnea-Hypopnea Syndrome	14 (11.1)
Stroke	9 (7.1)
Cardiovascular Surgical History- n (%)	
Implantable Cardioverter-Defibrillator	14 (11.1)
Valve Replacement	12 (9.5)
Coronary Revascularization	11 (8.7)
Cardiac Resynchronization Devices	7 (5.6)
Pacemaker	7 (5.6)
Primary Cause of Heart Failure - n (%)	
Myocardial Ischemia	47 (37.3)
Valvular	15 (11.9)
Dilated Idiopathic	12 (9.5)
Chronic Hypertensio	10 (7.9)
Cardiac Arrhythmia	10 (7.9)
Pulmonary Heart Disease	6 (4.8)
Chagas Heart Disease	2 (1.6)
Myocarditis	1 (0.8)
Infiltrative	1 (0.8)
Other	7 (5.6)
Not recorded	15 (11.9)
Causes of Decompensation - n (%)	
Acute Coronary Syndrome	24 (19)
Valvular Causes	19 (15.1)
Atrial Fibrillation	14 (11)
Systemic Infections	7 (5.6)
Poor Ambulatory Adherence	6 (4.8)
Hypertensive Emergency	5 (4)
Pulmonary Embolism	4 (3.2)
Other	22 (17.5)
Not recorded	25 (19.8)

IQR: interquartile range

Table 2. Clinical and Laboratory Variables at Admission.

Clinical Variables at Admission - median (IQR)	
Heart Rate (beats/minute)	76 (70-86)
Systolic Blood Pressure (mmHg)	120 (109-135)
Diastolic Blood Pressure (mmHg)	72 (64-79)
Weight (kg)	65 (58-76)
BMI (kg/m^2)	25 (22-27)
Oxygen Saturation (%)	92 (91-94)
Hemodynamic Profile According to Stevenson Classification (n=126) (%)	
B	85 (67.5)
C	19 (15.1)
L	3 (2.4)
Not recorded	19 (15.1)
Laboratory Values at Admission - Median (IQR)	
Hemoglobin* (g/dL)	13.6 (2.7)
Creatinine (mg/dL)	1.1 (0.9-1.5)
Blood Urea Nitrogen (mg/dL)	27 (19-37)
Sodium (mEq/L)	136 (134-139)
Potassium (mEq/L)	4.4 (3.9-6.3)
Tota iron (mg/dL)	66 (40-97)
Ferritin (mg/dL)	129.5 (55.6-284.5)
Transferrin Saturation (%)	21 (12-32)
Total Iron-Binding Capacity* (ug/dL)	289 (69.8)
pH	7.43 (7.39-7.46)
PCO_2 (mmHg)	33 (29-36)
PO_2 (mmHg)	72.5 (66-89)
Base Excess	-0.35 (-4.6-0)
Lactic Acid (mg/dL)	1.4 (1-1.8)
D-dimer (mg/dL)	1199 (480-3300)
NT-ProBNP (pg/dL)	5527 (809-16179)
Thyroid Stimulating Hormone (mUI/L)	3.4 (2.3-6)
LVEF ≤ 40 %	77 (61.1)
LVEF 41-49%	13 (10.3)
LVEF ≥ 50 %	34 (27)
Unreported LVEF	2 (1.6)

* Variables expressed as mean and standard deviation.
BMI: Body Mass Index. PCO2: Partial Pressure of Carbon Dioxide. PO2: Partial Pressure of Oxygen. NT-ProBNP: N-terminal pro-B-type natriuretic peptide. LVEF: Left Ventricular Ejection Fraction, IQR: interquartile range.

adherence to BB (n=75, 97.4%) and ACEIs, ARABs, or ARNIs (n=73, 94.8%). Lower adherence was recorded for the prescription of SGLT2 inhibitors and MRA with 80.5% (n=62) and 74% (n=57), respectively. Adherence to management recommendations is detailed in **Table 3**.

Discussion

Chronic HF is a condition that requires frequent hospitalizations due to episodes of acute decompensation. During these

Table 3. Adherence to Spanish Society of Cardiology (SSC) Care Recommendations.

Adherence to Requested Laboratory Tests - n (%)	
Electrocardiogram	126 (100)
Blood urea nitrogen	125 (99,2)
Serum creatinine	124 (98,4)
Sodium	123 (97,6)
Potassium	123 (97,6)
Echocardiogram	120 (95,2)
Chest X-ray	111 (88,1)
Troponin	71 (56,3)
Ferritin	64 (50,8)
Transferrin	63 (50)
TSH	63 (50)
Adherence to Prescription of Class I Medications in All Patients - n (%)	
Oxígeno suplementario si SpO2 < 90% o PaO2 < 60 mmHg	126 (100)
Diurético del asa endovenoso	123 (97.6)
Tromboprofilaxis	118 (93.7)
Adherence to Prescription of Class I Medications in Patients with HF and LVEF ≤ 40% - n (%)	
BB	75 (97,4)
ACEI, ARAB o ARNI	73 (94,8)
SGLT2 inhibitors	62 (80,5)
MRA	57 (74)

SSC: Spanish Society of Cardiology, TSH: Thyroid Stimulating Hormone, SpO2: Partial Oxygen Saturation, BB: Beta-Blockers, ACEI: Angiotensin-Converting Enzyme Inhibitors, ARAB: Angiotensin II Receptor Blockers, ARNI: Angiotensin Receptor-Neprilysin Inhibitor, SGLT2 inhibitors: Sodium-Glucose Cotransporter-2 Inhibitors, MRA: Mineralocorticoid Receptor Antagonists, HF: heart failure, LVEF: left ventricular ejection fraction.

hospitalizations, both in-hospital treatment and adequate prescription at discharge are crucial to ensure that patients obtain maximum therapeutic benefit, thereby reducing the rates of hospital readmission and mortality. In our study, we observed high adherence to the majority of diagnostic tests requested and to the prescription of medications recommended by the 2021 ESC guidelines. However, there was low adherence observed in the request for thyroid function tests and evaluation of iron kinetics parameters.

In the present study, a lower proportion of HF was observed in females, at 34.1%, which is similar to Colombian cohorts [14]. Regarding the cause of HF, the most common was ischemic heart disease, similar to findings in international cohorts, where it ranges between 40% and 67% [11,12]. The most common cause of decompensation was acute coronary syndrome, followed by valvular mechanical causes, which is also consistent with the European Society of Cardiology Heart Failure Long-Term Registry (ESC-HF-LT) study, where up to 68% of decompensation causes were attributed to acute coronary syndrome, followed by valvular causes at 27% [15]. The collected data showed that in 11.9% of cases, the search for the underlying cause of HF was not conducted, and in 17.5%, the cause of decompensation was not recorded. This result should encourage active efforts to identify the main cause of HF and its decompensation in our population. It is important to emphasize the significance of investigating the underlying cause and decompensation cause of HF based on the CHAMPIT acronym (acute coronary syndrome, hypertension, arrhythmias, mechanical issues, pulmonary embolism, infection, cardiac tamponade) recommended by the ESC, summarizing the most common causes of acute exacerbation of HF.

The adherence rate was similar to that reported in international studies such as Therapy in Outpatients with Heart Failure with Reduced Ejection Fraction (ATA) and the ESC-HF-LT [15,16], where the overall average adherence to the recommended diagnostic tests in the management guidelines was 88.3%. The results demonstrated high adherence with medications interacting with the renin-angiotensin-aldosterone system (RAAS), including ARBs, ACEIs, and ARNIs, which was higher than in cohorts from other studies such as ATA or ESC-HF-LT, where adherence rates of 79% and 92% were reported, respectively [15,16]. It is worth noting that most of the

reviewed studies did not include ARNI due to the guidelines used and their publication year.

BB are a central part of HF management; however, their indication in acute contexts has some limitations. In our study, there was a prescription adherence of 97.4% for these medications in patients with reduced LVEF, similar to the values reported in the ATA and ESC-HF-LT studies. In the case of MRAs, the adherence percentage was lower than that of other pharmacological groups; however, it is higher than reported in other studies such as the Quality of Adherence to guideline recommendations for Life-saving treatment in heart failure survey (QUALIFY), ATA, and ESC-HF-LT, corresponding to 67%, 43%, and 69%, respectively [15-17].

In our country, we did not identify studies that evaluated adherence to guideline recommendations in the context of UCC hospitalization. Some studies have assessed adherence to HF patient treatment using multidimensional assessment tools with Likert-type scales [18] to establish the effectiveness of certain interventions. One study reported an overall adherence to pharmacological and non-pharmacological treatment of 80.1%, which is similar to what was reported in our results for adherence to medication prescription according to recommendations [14]. The Colombian Heart Failure Registry (RECOLFACA) provided data on the formulation of outpatient pharmacological treatment when entered into the registry, where a prescription rate of >90% was observed for RAAS and BB [19]. Prescription of these medications is also high in studies reporting data on treatments for patients hospitalized for HF [14,20-21]. In one study, the prescription of MRA was shown to be 57% [21]. Although this value was lower than that obtained in our study, it is noteworthy that in our case, the prescription percentage for this pharmacological group was the lowest, below 80%, consistent with the results of a previous investigation at our institution [13]. This information is important as the causes of the low prescription of these drugs and interventions to improve this specific adherence point should be studied in particular. Regarding the use of diuretics, they were prescribed in 90.5%, with an adherence percentage of 97.6%, similar to national cohorts [22].

The prescription of recommended diagnostic tests is crucial for investigating both the etiology and the cause of cardiac decompensation and for assessing the need for adjustment or prescription of new pharmacological therapy. Considering the condition of patients hospitalized in the context of a UCC, the median value found for N-terminal pro-B-type natriuretic peptide (NT-proBNP) reported in our cohort correlates with the severity of patients with DHF. Adherence for the request of an ECG and echocardiogram was 100% and 95.2%, respectively; however, low levels were reported in the collection of ferritin, transferrin, and Thyroid Stimulating Hormone (TSH) with a percentage of 50%. In the literature consulted, no studies were found reporting the adherence percentage to recommendations in this section. This result shows the little emphasis placed on the search for important comorbidities in HF. It should also be noted that these are diagnostic tests, such as in the case of iron, whose importance in the evaluation and management of HF is more recent.

The assessment of adherence in the CCU is crucial as the results can be used as targets for improvement and can impact on patient mortality. We believe that our center adheres to these recommendations; however, there is a need to improve the aforementioned figures. These findings influence the in-hospital mortality rate, which was recorded in 6.3% of hospitalized patients, in contrast to international research reporting a percentage of 9.2% [23]. The percentage of recorded euvolemic status should be considered an area for improvement in the management of patients with DHF. As mentioned by Achury *et al.*, patient training in both pharmacological and non-pharmacological treatment, along with a proper doctor-patient relationship, leads to adequate treatment adherence [24]. Psychological support is also crucial to enhance outpatient adherence in HF patients, empowering both patients and their caregivers for proper pharmacological management to improve outcomes in these patients [25].

Among the limitations is the fact that it was a single-center study, which limits its external validity. Additionally, it had a retrospective component that introduced bias in the data collection. However, it is noted that in the CCU, a significant portion of the clinical information is collected in standardized formats, allowing for a certain degree of homogeneity in the information recording.

In conclusion, we observed variable adherence to the recommendations for diagnostic tests and medications outlined in the ESC 2021 guidelines. Low adherence was identified in the request for thyroid function tests, troponin, and iron kinetics. The accurate recording of the cause of HF and its decompensation was documented in the vast majority of patients. Regarding pharmacological adherence to class I recommendations, high compliance was observed in the prescription of BB, ACEIs, ARBs, and ARNIs. However, lower adherence was recorded in the prescription of SGLT2 inhibitors and MRA. These findings highlight specific areas that could benefit from interventions to improve adherence and optimize the clinical management of HF.

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Author contributions

JJD and DVV: Conceptualization, Formal analysis, Writing - Review & Editing. DHR, CMC and JPC: Formal analysis, Investigation, Writing - Review & Editing

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