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Title	Factors influencing prescribing by critical care physicians to heart failure patients in Egypt: a cross-sectional survey
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Publication date	2022-09-30
Original citation	El Hadidi, S., Bazan, N. S., Byrne, S., Darweesh, E. and Bermingham, M. (2022) 'Factors influencing prescribing by critical care physicians to heart failure patients in Egypt: a cross-sectional survey', Future Journal of Pharmaceutical Sciences, 8(40), pp. 1-9. doi: 10.1186/s43094-022-00429-1
Type of publication	Article (peer-reviewed)
Link to publisher's version	http://dx.doi.org/10.1186/s43094-022-00429-1 Access to the full text of the published version may require a subscription.
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Factors influencing prescribing by critical care physicians to heart failure patients in Egypt: a cross-sectional survey

Seif El Hadidi[1,2], Naglaa Samir Bazan[2,3], Stephen Byrne[1], Ebtissam Darweesh[2] and Margaret Bermingham[1*]

Abstract

Background: Heart failure (HF) guideline-led prescribing improves patient outcomes; however, little is known about the factors influencing guideline-led prescribing in critical care settings. This study used a cross-sectional survey to assess the factors that influence physicians when prescribing to heart failure patients in a critical care setting in Egypt.

Results: The response rate was 54.8%. The international HF guidelines were the primary source of prescribing information for 84.2% of respondents. Staff were more familiar with the latest guideline recommendations than associate staff (86.7% vs 36.8%, $p = 0.012$) and considered patient's perspectives more often (86.7% vs 26.3%, $p = 0.036$). Renal function was the clinical factor that most frequently influenced the prescribing of loop diuretics or renin–angiotensin–aldosterone system inhibitors. Pulmonary function influenced beta-blockers prescription. The most frequently cited barrier to guideline-led prescribing was the absence of locally drafted guidelines. A majority of prescribers agreed that implementation of clinical pharmacy services, physician education and electronic reminders may improve the implementation of guideline-led prescribing.

Conclusions: Although experienced physicians are familiar with and use international guidelines, physicians would welcome local guidance on HF prescribing and greater clinical pharmacist input.

Keywords: Heart failure, Critical care, Guideline-directed medical therapy, Pharmacist, Egypt

Background

Heart failure (HF) guidelines provide an evidence-based tool intended in part to guide the prescribing decisions of physicians [1]. In HF, guideline-led prescribing improves the quality of clinical decisions and promotes consistent and standardised care [1, 2] as well as leading to beneficial clinical outcomes in terms of mortality, morbidity, and quality of life [2, 3]. However, international reports suggest that prescribers do not optimally adhere to the recommended HF guideline-led prescribing at discharge from certain clinical settings [2, 4]. In one study, more than one-third of eligible HF patients was not prescribed the full list of the recommended HF disease-modifying therapies at discharge [2]

Many physicians report poor awareness of the recommendations of the guidelines [5, 6]. A national survey in the UK showed that 27% of cardiologists do not use the HF guidelines in managing the disease [7]. In the SHAPE survey, just 34% of the European cardiologists reported the use of HF guidelines in their daily prescriptions, indicating that guidelines have a modest influence on physicians' prescribing decisions [8].

Guideline-led prescribing in heart failure may be challenging due to patients' age [9], gender [10], low blood pressure [11], renal impairment [11], presence of pulmonary disease [12] and the complexity of medication regimens [13]. Women and the elderly are generally under-represented in clinical trials, which may lead to

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physician uncertainty as to the applicability and safety of guideline-led prescribing to these patients [14, 15]. The high risk of medication-related adverse events and contraindications to medications also represent major barriers to guideline-led prescribing [8, 15]. Furthermore, lack of resources and the geographical location may impede the affordability and applicability of prescribing the full list of HF disease-modifying therapies [6, 16, 17]. For instance, the prescription rates of disease-modifying therapies range from 85% in Germany to 50% in Brazil and to 30% in Egypt [18–20]. In Egypt, HF patients are cared for in the acute setting such as in a critical care unit. When patients are stabilised, they may be discharged with limited follow-up plans. Therefore, the medications prescribed during the acute inpatient phase are key to ensuring optimal medications in the longer term.

Aim of the study

This study aims to assess the behaviours and perspectives of Egyptian physicians towards prescribing to HF patients in the acute phase, to investigate the potential barriers, and to identify the possible solutions to improve HF guideline-led prescribing in a critical care setting.

Ethics approval

The Research and Ethics Committee of Future University in Egypt granted ethics approval for the study (Serial number REC—FPSPI—11/76). The management board of the Critical Care Medicine Department, Cairo University Hospitals granted permission for the work to proceed in the department. Written information about the study was provided prior to participation, and all participants provided informed consent prior to questionnaire completion.

Method

Study design and measurements

A descriptive questionnaire was designed in line with the Academy of Critical Care: Development, Evaluation, and Methodology recommendations [21]. The questionnaire was developed based on (i) the class I recommendations of the European Society of Cardiology Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure [1] and (ii) the literature on HF guideline-led prescribing [4, 6, 12, 22]. The questionnaire wording was agreed by the research team (SEH, NB, SB, ED, MB). The face validity of the questionnaire was tested using a convenience sample of two physicians working in the Critical Care Medicine Department. Minor modifications were then made to some of the questions to improve clarity. A native English speaker (MB) reviewed the questionnaire for grammar, meaning, and clarity and all authors approved the final questionnaire.

The questionnaire consisted of 11 questions with some questions containing multiple Likert scale items (Additional file 1). Therefore, in total the questionnaire contained 43 items. The first question examined participant experience and qualifications. Question 2 concerned information sources used by prescribers and was informed by practice in an Egyptian setting. Questions 3 and 4 concerned familiarity and compliance with the ESC guidelines. Questions 5–7 asked prescribers which patient related clinical factors they consider when prescribing a loop diuretic, a renin–angiotensin–aldosterone system inhibitor (RAASi), and a beta-blocker. A RAASi was defined as an ACE inhibitor, angiotensin receptor blocker, or mineralocorticoid receptor antagonist. The list was informed by the patient-monitoring requirements, cautions, and contraindications associated with each of the three medication classes. The same list of patient factors was given for each medication class to identify where prescribers may be withholding medications based on inaccurate understanding of the guidelines for each medicine. Question 8 concerned the involvement of patients in prescribing decisions, as recommended in the ESC Guidelines. Questions 9 and 10 explored barriers and facilitators to guideline-directed prescribing. Questions 3–9 used a Likert scale. In Question 3, the Likert scale was anchored by '*Completely Unfamiliar*' and '*Very Familiar*'. In Questions 4–9, the Likert scale was anchored by '*Never*' and '*Always*'. The final question was an open question, and this question was optional for respondents.

Setting

The setting of the questionnaire was the Critical Care Medicine Department in Cairo University Hospitals. The Critical Care Unit (CCU) is a 53-bed unit that cares for patients presenting to the hospital with serious illness requiring acute care. Physicians in the CCU may be (i) associate staff who are junior residents and senior residents and (ii) staff who are specialists (Master's degree) and consultants (Doctor of Medicine degree) in critical care medicine. Typically, patients are discharged directly from the CCU to home once they are deemed medically stable.

Data collection

All 62 physicians working in the Critical Care Medicine Department were invited to complete the questionnaire. The questionnaire was disseminated in hardcopy and electronically in July and August 2018. The hardcopy of the questionnaire was distributed to staff at the monthly departmental clinical meeting and to associate

staff during their scheduled morning shifts. An identical electronic version of the questionnaire was hosted on the Survey Monkey website (www.surveymonkey.com), and a link to this version was distributed via the institutional email addresses and the LinkedIn (www.linkedin.com) profiles (where available) of the 62 physicians. The electronic questionnaire was open to receiving responses from July to November 2018. One reminder message was sent via the institutional email system. All responses were recorded anonymously. No incentive was offered to respondents to participate in the study.

Data analysis

Data were analysed using SPSS® version 22.0 for Microsoft Windows 10. Continuous variables were presented as mean ± standard deviation (SD) and categorical variables as frequencies (percentage). The study population was subdivided based on the physician's position as staff or associate staff. Categorical data were compared using the Chi-square test or Fischer's exact test. All statistical tests were exact two-tailed tests, and a point $p\text{-}value < 0.05$ was regarded as statistically significant. In order to assess content reliability, Cronbach's alpha was calculated for questions 5, 6 and 7 of the survey. These questions used a repetitive Likert scale to assess HF prescribing behaviour.

Results

Completion and response rates

The questionnaire was returned by 34 of the 62 physicians in the CCU giving a response rate of 54.8%. All medical grades were represented among the respondents with 15 staff (44.2%) and 19 associate staff (55.8%) completing the questionnaire. The breakdown of the respondents was as follows: junior residents, $n = 8$; senior residents, $n = 11$; specialists, $n = 4$; and consultants, $n = 11$. The electronic questionnaire was responded to by 13 participants; the remainder of responses were collected via the hardcopy. All respondents completed the questionnaire in full.

Information sources for prescribing heart failure medicines

International clinical guidelines were the most frequently used sources of information, with 82.4% of respondents reporting using these guidelines. Half of the respondents stated that they rely on their own clinical knowledge. A minority (2.9%) of the respondents reported that they used informal information sources such as *Facebook* medical groups; however, no respondent reported accessing information in the Egyptian National Formulary or the informal local medical books. More than one source of prescribing information was chosen by 64.7% of respondents (Fig. 1).

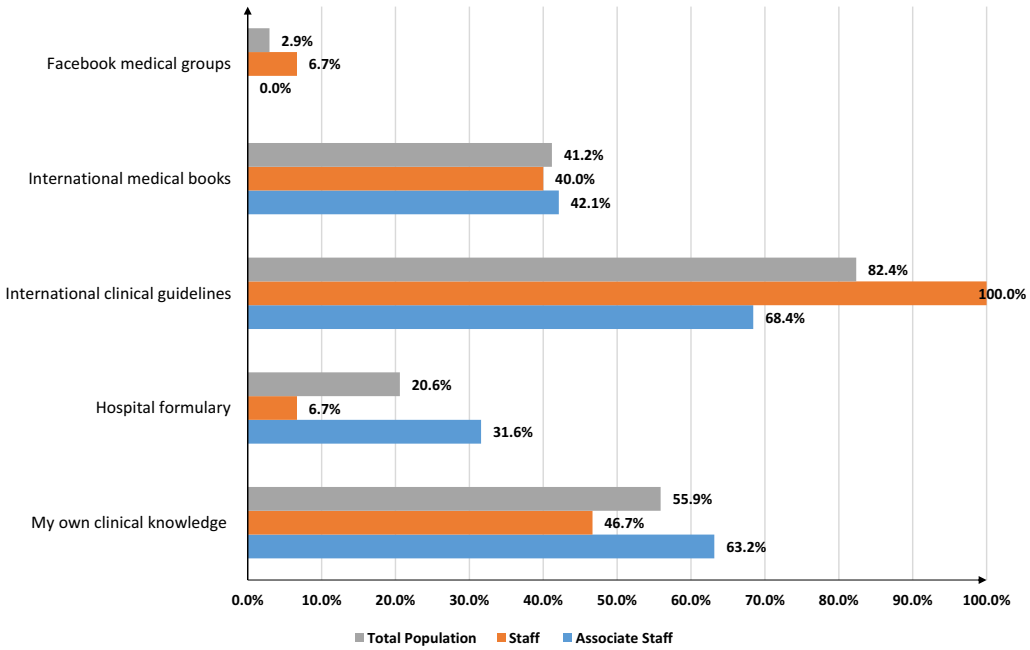

Fig. 1 Information sources for prescribing heart failure guideline-directed medicines. Survey question: What information sources guide you for prescribing heart failure medicines? You may choose more than one option. Data are presented as total respondents, staff (specialists and consultants), and associate staff (junior and senior residents)

Familiarity with and adherence to guidelines

Respondents were asked to rate their familiarity with the most recent European HF guidelines (Fig. 2). The majority of respondents (55.9%) described themselves as '*Familiar*' or '*Very Familiar*' with these guidelines. Staff were more likely to be '*Familiar*' or '*Very Familiar*' with these guidelines than associate staff (80.0% vs. 36.8%, $p=0.012$). Notably, 5.3% of associate staff reported that they are '*Completely Unfamiliar*' with the latest European guidelines. However, when asked about compliance with the guidelines, 76.5% of respondents stated that they '*Always*' or '*Often*' comply with the guidelines recommendations. While no staff reported not complying with the guidelines, 10.5% of associate staff reported that they '*Rarely*' *or* '*Never*' comply with the guidelines.

Patient clinical factors influencing heart failure prescribing

A majority of respondents identified renal function (88.2%) and serum potassium levels (85.3%) as the patient factors that influence them when prescribing a loop diuretic (Table 1). When prescribing a RAASi, the majority of respondents reported that they are influenced by serum potassium level (88.2%), renal function (85.3%), and blood pressure (79.4%). When prescribing a beta-blocker, heart rate (88.2%), blood pressure (82.4%), and pulmonary function (76.5%) were the patient factors most likely to influence prescribers. Gender was reported as a consideration when prescribing a beta-blocker by 29.4% of respondents. The only difference between staff and associate staff was that associate staff were more likely to be influenced by the patient's pulmonary function when prescribing a loop diuretic (73.7% vs. 33.3%, $p=0.036$).

Patient involvement in medication decisions

Respondents were asked whether they discuss medication choice with their patients; 44.1% of respondents stated that they '*Always*' or '*Often*' do so. Staff were more likely to discuss medication choice with patients than associate staff (86.7% vs. 26.3%, $p=0.036$).

Barriers to prescribing guideline-directed medical therapies in a heart failure patient

Respondents were asked to what extent they consider certain issues to be a barrier or obstacle to prescribing guideline-directed medical therapies to HF patients (Fig. 3). The factors most frequently cited as "Always" or "Often" a barrier were the lack of hospital guidelines (79.4% combined *Always/Often*); medication cost (76.5% combined *Always/Often*); and lack of Egyptian national guidelines (67.6% combined *Always/Often*). The most frequently cited barriers for staff were the lack of Egyptian national guidelines and the lack of hospital guidelines (80.0% combined *Always/Often* for both) while associate staff most frequently cited medication cost as a barrier to guideline-led prescribing (84.2% combined *Always/Often*). Workload was deemed a barrier by associate staff more so than by staff (52.3% vs. 13.3%, $p=0.026$). In the

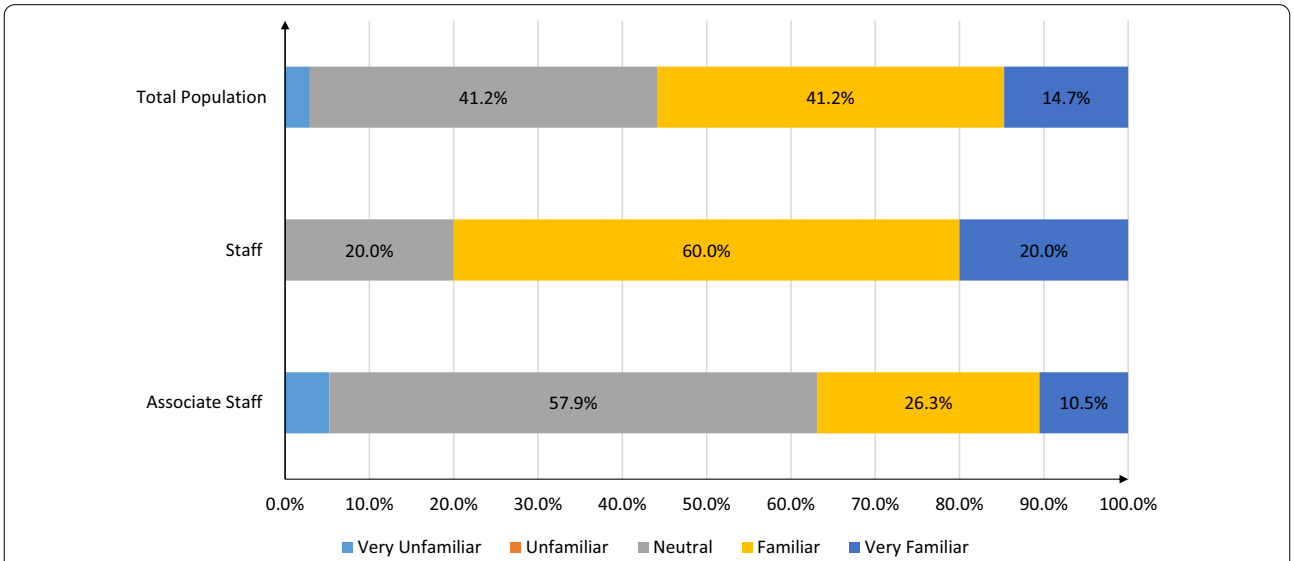

Fig. 2 Familiarity of respondents with the European Society of Cardiology Guidelines on the Management of Acute and Chronic Heart Failure [1]. Survey question: The European Society of Cardiology published a new guideline on Acute and Chronic Heart Failure in 2016. Please rate your familiarity with this guideline using the scale from '*Completely Unfamiliar*' up to '*Very Familiar*'. Data are presented as Total respondents, Staff members (specialists and consultants) and Associate Staff (junior and senior residents)

Table 1 Patient clinical factors influencing the prescribing choices of heart failure guideline-directed medicines

Percentage of respondents who only chose '*Often*' or '*Always*'	Total ($n=34$) *N* (%)	Associate staff ($n=19$) *N* (%)	Staff ($n=15$) *N* (%)	*p*-value
Loop diuretic				
Age	10 (29.4)	5 (26.3)	5 (33.3)	*0.718*
Blood pressure	22 (64.7)	10 (52.6)	12 (80.0)	*0.152*
Gender	2 (5.9)	2 (10.5)	0 (0.0)	*0.492*
Heart rate	12 (35.3)	8 (42.1)	4 (26.7)	*0.476*
Liver function	7 (20.6)	5 (26.3)	2 (13.3)	*0.426*
Pulmonary function	19 (55.9)	14 (73.7)	5 (33.3)	*0.036*
Renal function	30 (88.2)	16 (84.2)	14 (93.3)	*0.613*
Serum potassium	29 (85.3)	15 (78.9)	14 (93.3)	*0.355*
Renin–angiotensin–aldosterone system inhibitor (RAAS)				
Age	12 (35.3)	7 (36.8)	5 (33.3)	*0.832*
Blood pressure	27 (79.4)	13 (68.4)	14 (93.3)	*0.104*
Gender	3 (8.8)	3 (15.8)	0 (0.0)	*0.238*
Heart rate	9 (26.5)	7 (36.8)	2 (13.3)	*0.240*
Liver function	7 (20.6)	2 (10.5)	5 (33.3)	*0.199*
Pulmonary function	11 (32.4)	8 (42.1)	3 (20.0)	*0.217*
Renal function	29 (85.3)	15 (78.9)	14 (93.3)	*0.355*
Serum potassium	30 (88.2)	16 (84.2)	14 (93.3)	*0.613*
Beta-blocker				
Age	13 (38.2)	9 (47.4)	4 (26.7)	*0.296*
Blood pressure	28 (82.4)	17 (89.5)	11 (73.3)	*0.370*
Gender	10 (29.4)	5 (26.3)	5 (33.3)	*0.718*
Heart rate	30 (88.2)	18 (94.7)	12 (80.0)	*0.229*
Liver function	5 (14.7)	4 (21.1)	1 (6.7)	*0.355*
Pulmonary function	26 (76.5)	15 (78.9)	11 (73.3)	*1.000*
Renal function	5 (14.7)	4 (21.1)	1 (6.7)	*0.355*
Serum potassium	10 (29.4)	7 (36.8)	3 (20.0)	*0.451*

The *p*-value for each comparison is presented in italics

Survey question: When prescribing (i) a loop diuretic, (ii) renin–angiotensin–aldosterone system inhibitor, or (iii) beta-blocker to a heart failure patient, to what extent do the following patient factors influence your prescribing choices? Please use the scale from '*Never*' to '*Always*'

The proportion of respondents who indicated '*Often*' or '*Always*' in response to the question is given. Data are presented for the total population, associate staff and staff. The *p*-value presented is for the comparison between associate staff and staff

free-text section of this question, two respondents suggested the need for guidelines about the management of multi-morbid patients rather than a disease-specific guideline.

Potential facilitators to improve heart failure prescribing outcomes

Respondents were given four potential facilitators and were asked which of these they believed could be implemented to optimise guideline-led prescribing. Respondents could choose more than one option. Greater involvement of clinical pharmacists in HF patient care was chosen by 67.6% of respondents, while regular email bulletins about HF medicines was chosen by 64.7% of respondents. Differences emerged between staff and associate staff preferences. Staff were supportive of clinical pharmacist involvement in patient care (73.3% chose this option) but were less supportive of receiving education from clinical pharmacists (53.3% chose this option). Associate staff were most supportive of receiving regular emails about HF medicines (68.4% chose this option) and least supportive of using the hospital IT system to receive prescribing recommendations for individual patients (42.1% chose this option). More than one facilitator option was chosen by 35.3% of respondents.

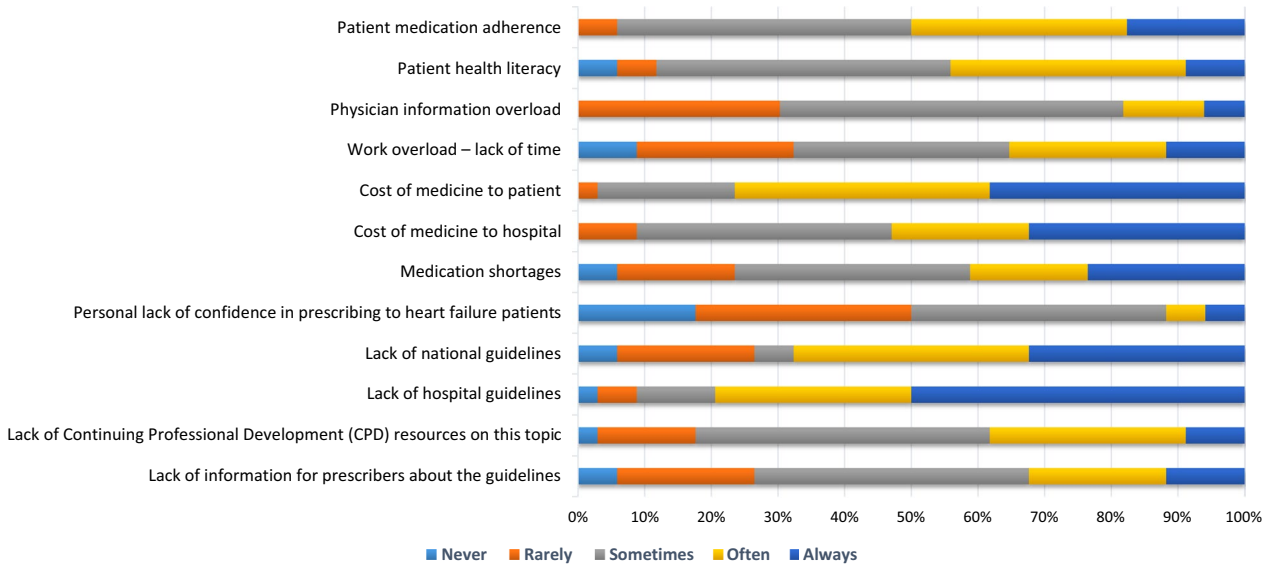

Fig. 3 Barriers to prescribing the guideline-directed therapies from the perspective of respondents. Survey question: To what extent do you agree or disagree that each of the following is a barrier/obstacle to prescribing guideline-directed therapies in your patients? Please use the scale from '*Never*' up to '*Always*'. Data are presented for the total population

Survey reliability

A Cronbach's alpha = 0.805 was calculated for items in questions 5, 6 and 7 of the survey, indicating strong reliability with the survey.

Discussion

This survey is a novel analysis in the HF literature quantifying the perspectives and behaviours of prescribers in a critical care setting regarding the evidence-practice mismatch in HF prescribing. The majority of respondents use the international guidelines, and over half are familiar with the most recent guidelines. However, over three-quarters of respondents identified the lack of locally drafted guidelines and the cost of medications to the patient as limiting their adherence to guideline-led prescribing practice. Furthermore, the respondents identified vital solutions to improve guideline-led prescribing, including enhancement of clinical pharmacist role and electronic interventions.

Clinical practice guidelines serve as a framework for clinicians managing HF patients [1]. The current European HF guidelines were identified as the most frequently used source of HF prescribing information in the present setting, particularly amongst staff. This suggests that greater postgraduate clinical experience changes prescribers practice and that more junior clinicians may continue to rely on knowledge gained in medical school where guideline-directed care may not be strongly emphasised [23]. This evidence-based knowledge of the staff members was positively translated into two prescribing practices demonstrated in their responses. First, the staff members placed higher importance on discussing medications with their patients, which is strictly in line with the latest guidelines' recommendations [1]. Secondly, staff broadly supported the greater implementation of clinical pharmacy services and electronic updates. This support reflects an understanding of the important role of the multidisciplinary teamwork to offer a guideline-directed HF care [1, 24, 25].

Low prescribing rates of beta-blockers have been reported among Egyptian HF patients. In the present survey, 77% of respondents identified pulmonary function as a factor to consider prior to prescribing a beta-blocker. In the SHAPE survey, poor pulmonary function was identified by 68% of respondents as a reason for beta-blocker omission or discontinuation [8]. In a UK-based study, poor pulmonary function was reported as the major reason for omitting beta-blocker prescription in up to 11% of eligible ambulatory HF patients [12]. According to the HF guidelines [1], chronic obstructive lung disease or dyspnoea are not contraindications to beta-blocker therapy; however, it appears that there is ongoing clinician concern regarding the risk of beta-blocker-induced bronchospasm despite evidence of patient tolerance and confirmed safety of beta-blockers in pulmonary diseases [26, 27].

Clinicians reported that gender influenced the prescribing of beta-blockers but not the prescribing of RAASi or loop diuretics. An Egyptian HF registry found that compared to males, female HF patients were less

likely to receive guideline-recommended loop diuretics and RAASi due to their different comorbidity and cardiovascular risk factor profiles [10]. However, the same registry found a considerable underutilisation of beta-blockers regardless of gender. The discrepancy between the registry findings and the current survey results might reflect concerns related to the adverse drug reaction profile of beta-blockers [12]. The onset of HF occurs a decade younger in the Egypt population than in European or North American populations, and adverse events may exert a greater effect on the quality of life of these younger patients [18].

The survey inquired about the barriers to implementation of HF guidelines at the level of the patient, physician, and healthcare setting. The lack of local hospital-developed guidelines or nationally developed Egyptian guidelines was cited as a substantial barrier to guideline-led HF care by over 75% of respondents. The barriers identified in the current survey are similar to previous reports from Europe and the USA [7, 15, 22] where this has been reported as a barrier in primary care settings [7, 22]. Several reasons may explain this barrier in a hospital-based setting. First, the HF clinical trials are often highly selective and may not include patients whom physicians consider to be similar to the real-world patients [7, 14]. This disparity may lead to physician uncertainty about guidelines' applicability, particularly in an HF population who might be older, multi-morbid, or acutely ill [7, 8]. This perspective was commented on by two of the survey respondents who highlighted the need for guidelines for the management of multi-morbid patients rather than a disease-specific guideline [9, 11].

The evidence-practice mismatch is of particular importance in low-middle-income countries [6, 16, 17, 28]. International evidence illustrates the adverse effects of limited patient literacy and socio-economic status on HF clinical outcomes and management in terms of prescription of medications, use of device-based therapy, patient adherence, and even mortality [16, 17]. This may be why 50% of the survey respondents stated that they base their clinical decisions on their clinical experience rather than on guidelines. The setting of the survey in a middle-income country may also explain why respondents consider medication cost as an essential barrier to guideline-led prescribing. In this setting, costs to the patient or the healthcare provider may constrain the prescriber in the provision of some of the recommended long-term therapeutic strategies [6, 16, 17, 28]. In a European HF population, the prescription rates of the guideline-recommended therapies exceeded 85% [19], while the cost implications of some medications and the lack of standardised outpatient records may limit the prescription of the full list of medications in some Egyptian settings [18, 28].

Respondents supported the greater implementation of clinical pharmacy services as a means to improve guideline-led prescribing. This solution was supported more strongly by staff than by associate staff. Several guideline authorities endorse the inclusion of clinical pharmacy services in the HF multidisciplinary team [1, 24, 29]. Clinical pharmacists in hospitals are uniquely positioned to manage prescribing problems encountered by prescribers in caring for complex and often multi-morbid HF patients [25, 30]. In Canada, the inclusion of a clinical pharmacist in an HF multidisciplinary team brought about a significant reduction in patient mortality over a four-year follow-up period [24]. Elsewhere, the inclusion of clinical pharmacy services in HF care reduced rehospitalisation rates by 20% [25, 30]. The acceptability of clinical pharmacy in the present study would seem at odds with previous reports from Egypt and other Middle East and North Africa countries that revealed prescribers' reluctance to alter a colleague's prescription despite the appropriate course of action recommended by the pharmacist [31, 32]. Staff were also in favour of electronic notifications about prescribing in individual HF patients, while associate staff preferred email updates about HF prescribing. While such interventions may be effective [33], it has been shown that multiple and repetitive electronic interventions can lead to a risk of alert fatigue and the prescriber may be less likely to accept the suggested interventions due to desensitisation or cognitive overload [34].

All respondents completed the survey in full, the response rate is over 50% and there is a balance of associate staff and staff responses. However, it is possible that survey non-responders may have expressed different perspectives to those expressed by respondents. To maximise response rates and minimise this risk of bias, we used a systematic method for following-up with the non-responders and made the study questionnaire available in both paper and online formats. Future research should aim to conduct this survey among a larger sample size, either at a national level within Egypt or as a multinational study of critical care physicians.

Conclusions

Experienced physicians are familiar with and use international guidelines in their prescribing practice; however, they also rely on clinical experience to influence their prescribing decisions. The availability of hospital or national HF prescribing guidelines and increased input

from clinical pharmacy services may improve guideline-led prescribing in this setting.

Abbreviations
CCU: Critical care unit; HF: Heart failure; RAASi: Renin–angiotensin–aldosterone system inhibitor.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43094-022-00429-1.

Additional file 1: Survey instrument.

Acknowledgements
The authors would like to thank Ms. Dina Mahmoud, Clinical Pharmacist in the Critical Care Medicine Department, Cairo University Hospitals, for her assistance in coordinating the data collection.

Author contributions
Author (SEH) contributed to the study design, data collection, data analysis, report design and writing. Co-author (NB) was the responsible contact person in the hospital of data collection, data collection progress notes and head of Cairo University Hospitals Clinical Pharmacy Department. NB participated in study design, data interpretation and critical review of the manuscript. Co-author (SB) was the principal of the academic collaboration between University College Cork, Ireland, and Future University Egypt, and contributed to the research study design, supervision and critical review of the manuscript. Co-author (ED) was an academic supervisor of the primary author. ED also acted as the medical sector representative for this work as the target participants were all medical doctors. ED participated in study design, data interpretation, and critical review of the manuscript. Co-author (MB) contributed to the idea production, data visualisation and collection and final critical review of the manuscript. MB is a corresponding author of the work and acted as the academic supervisor of the author. All authors read and approved the final manuscript.

Funding
The research was funded through an academic collaboration between University College Cork, Ireland, and Future University in Egypt. However, the funding had no role in the design of the study, collection, analysis, and interpretation of data or in writing the manuscript.

Availability of data and materials
Data are available and can be furnished upon reasonable request to the corresponding author (MB) and to the Pharmaceutical Care Research Group, School of Pharmacy, University College Cork, Ireland.

Declarations

Ethics approval and consent to participate
The Research and Ethics Committee of Future University in Egypt granted ethics approval for the study (Serial number REC—FPSPI—11/76). The management board of the Critical Care Medicine Department, Cairo University Hospitals granted permission for the work to proceed in the department. Written information about the study was provided prior to participation, and all participants provided informed consent prior to questionnaire completion. Informed consent was obtained from all individual participants included in the study.

Consent for publication
All authors confirm their approval to publish this manuscript. Patients or their legally authorised relatives signed informed consent regarding publishing their data.

Competing interests
The authors declare that they have no competing interests.

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Received: 24 January 2022 Accepted: 21 September 2022
Published online: 30 September 2022

References

1. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, Falk V, González-Juanatey JR, Harjola V, Jankowska E, Jessup M, Linde C, Nihoyannopoulos P, Parissis JT, Pieske B, Riley JP, Rosano GMC, Puilope LM, Ruschitzka F, Rutten FH, van der Meer P, ESC Scientific Document Group (2016) ESC 2016 Guidelines for the diagnosis and treatment of acute and chronic heart failure: the task force for the diagnosis and treatment of acute and chronic heart failure of the European society of cardiology (ESC). Developed with the special contribution of the heart failure association (HFA) of the ESC. Eur Heart J 37(27):2129–2200. https://doi.org/10.1093/eurheartj/ehw128
2. Komajda M, Cowie MR, Tavazzi L, Ponikowski P, Anker SD, Filippatos GS, QUALIFY Investigators (2017) Physicians' guideline adherence is associated with better prognosis in outpatients with heart failure with reduced ejection fraction: the QUALIFY international registry. Eur J Heart Fail 19(11):1414–1423. https://doi.org/10.1002/ejhf.887
3. Ouwerkerk W, Voors AA, Anker SD, Cleland JG, Dickstein K, Filippatos G, van der Harst P, Hillege HL, Lang CC, Ter Maaten JM, Ng LL, Ponikowski P, Samani NJ, van Veldhuisen DJ, Zannad F, Metra M, Zwinderman AH (2017) Determinants and clinical outcome of uptitration of ACE-inhibitors and beta-blockers in patients with heart failure: a prospective European study. Eur Heart J 38(24):1883–1890. https://doi.org/10.1093/eurheartj/ehx026
4. El Hadidi S, Darweesh E, Byrne S, Bermingham M (2018) A tool for assessment of heart failure prescribing quality: a systematic review and meta-analysis. Pharmacoepidemiol Drug Saf 27(7):685–694. https://doi.org/10.1002/pds.4430
5. Mayyas F, Ibrahim K, Alzoubi KH (2017) Awareness of physicians and pharmacists of aldosterone antagonists in heart failure and myocardial infarction in Jordan. Pharm Pract (Granada) 15(3):994. https://doi.org/10.18549/PharmPract.2017.03.994
6. McEntee ML, Cuomo LR, Dennison CR (2009) Patient-, provider-, and system-level barriers to heart failure care. J Cardiovasc Nurs 24(4):290–298. https://doi.org/10.1097/JCN.0b013e3181a660a0
7. Hancock HC, Close H, Fuat A, Murphy JJ, Hungin AP, Mason JM (2014) Barriers to accurate diagnosis and effective management of heart failure have not changed in the past 10 years: a qualitative study and national survey. BMJ Open 4(3):e003866. https://doi.org/10.1136/bmjopen-2013-003866
8. Remme WJ, McMurray JJ, Hobbs FD, Cohen-Solal A, Lopez-Sendon J, Boccanelli A, Zannad F, Rauch B, Keukelaar K, Macarie C, Ruzyllo W, Cline C, Shape Study Group (2008) Awareness and perception of heart failure among European cardiologists, internists, geriatricians, and primary care physicians. Eur Heart J 29(14):1739–1752
9. Mogensen UM, Ersboll M, Andersen M, Andersson C, Hassager C, Torp-Pedersen C, Gustafsson F, Kober L (2011) Clinical characteristics and major comorbidities in heart failure patients more than 85 years of age compared with younger age groups. Eur J Heart Fail 13(11):1216–1223. https://doi.org/10.1093/eurjhf/hfr116
10. Hassanein M, Abdelhamid M, Ibrahim B, Sobhy M, Nasr G, Aboleineen MW, Reda A, Farag N, Elshazly A, Abdeldayem TK, Elmesseiry F, Boshra H, Sobhy H, Elbahry A, Youssef A, Ashmawy M, Abdelmoneim A, Saleh A, Elrakshy Y, Ebeid H (2018) Gender differences in Egyptian patients hospitalized with heart failure: insights from the European society of cardiology heart failure long-term registry. ESC Heart Fail 5(6):1159–1164. https://doi.org/10.1002/ehf2.12347
11. Gilstrap LG, Stevenson LW, Small R, Parambi R, Hamershock R, Greenberg J, Carr C, Ghazinouri R, Rathman L, Han E, Mehra MR, Desai AS (2018) Reasons for guideline non-adherence at heart failure discharge. J Am Heart Assoc 7(15):e008789. https://doi.org/10.1161/JAHA.118.008789

12. Kalra PR, Morley C, Barnes S, Menown I, Kassianos G, Padmanabhan S, Gupta S, Lang CC (2013) Discontinuation of beta-blockers in cardiovascular disease: UK primary care cohort study. Int J Cardiol 167(6):2695–2699. https://doi.org/10.1016/j.ijcard.2012.06.116
13. Allen LA, Fonarow GC, Liang L, Schulte PJ, Masoudi FA, Rumsfeld JS, Ho PM, Eapen ZJ, Hernandez AF, Heidenreich PA, Bhatt DL, Peterson ED, Krumholz HM, American Heart Association's Get With The Guidelines Heart Failure (GWTG-HF) Investigators (2015) Medication initiation burden required to comply with heart failure guideline recommendations and hospital quality measures. Circulation 132(14):1347–1353. https://doi.org/10.1161/CIRCULATIONAHA.115.014281
14. Niederseer D, Thaler CW, Niederseer M, Niebauer J (2013) Mismatch between heart failure patients in clinical trials and the real world. Int J Cardiol 168(3):1859–1865. https://doi.org/10.1016/j.ijcard.2012.12.069
15. Steinman MA, Dimaano L, Peterson CA, Heidenreich PA, Knight SJ, Fung KZ, Kaboli PJ (2013) Reasons for not prescribing guideline-recommended medications to adults with heart failure. Med Care 51(10):901–907. https://doi.org/10.1097/MLR.0b013e3182a3e525
16. Zwolsman S, te Pas E, Hooft L, Wieringa-de Waard M, van Dijk N (2012) Barriers to GPs' use of evidence-based medicine: a systematic review. Br J Gen Pract 62(600):e511–e521. https://doi.org/10.3399/bjgp12X652382
17. Hawkins NM, Jhund PS, McMurray JJ, Capewell S (2012) Heart failure and socioeconomic status: accumulating evidence of inequality. Eur J Heart Fail 14(2):138–146. https://doi.org/10.1093/eurjhf/hfr168
18. Hassanein M, Abdelhamid M, Ibrahim B, Elshazly A, Aboleineen MW, Sobhy H, Nasr G, Elmesseiry F, Abdelmoniem A, Ashmawy M, Farag N, Youssef A, Elbahry A, Elrakshy Y, Sobhy M, Dayem TMKA, Ebeid H, Reda A, Boshra H, Saleh A, Maggioni AP (2015) Clinical characteristics and management of hospitalized and ambulatory patients with heart failure-results from ESC heart failure long-term registry-Egyptian cohort. ESC Heart Fail 2(3):159–167. https://doi.org/10.1002/ehf2.12046
19. Hirt MN, Muttardi A, Helms TM, van den Bussche H, Eschenhagen T (2016) General practitioners' adherence to chronic heart failure guidelines regarding medication: the GP-HF study. Clin Res Cardiol 105(5):441–450. https://doi.org/10.1007/s00392-015-0939-8
20. Oliveira MG, Passos LC, Santos Junior EG, Barbosa AC, Santos DB (2013) Use of an indicator to evaluate physician adherence to prescription guidelines for the treatment of heart failure. Bras J Pharm Sci 49(4):831–836. https://doi.org/10.1590/S1984-82502013000400023
21. Burns KE, Duffett M, Kho ME, Meade MO, Adhikari NK, Sinuff T, Cook DJ, ACCADEMY Group (2008) A guide for the design and conduct of self-administered surveys of clinicians. Can Med Assoc J 179(3):245–252. https://doi.org/10.1503/cmaj.080372
22. Smeets M, Van Roy S, Aertgeerts B, Vermandere M, Vaes B (2016) Improving care for heart failure patients in primary care, GPs' perceptions: a qualitative evidence synthesis. BMJ Open 6(11):e013459. https://doi.org/10.1136/bmjopen-2016-013459
23. Norcini JJ, Boulet JR, Opalek A, Dauphinee WD (2017) Patients of doctors further from medical school graduation have poorer outcomes. Med Educ 51(5):480–489. https://doi.org/10.1111/medu.13276
24. Wijeysundera HC, Trubiani G, Wang X, Mitsakakis N, Austin PC, Ko DT, Lee DS, Tu JV, Krahn M (2013) A population-based study to evaluate the effectiveness of multidisciplinary heart failure clinics and identify important service components. Circ Heart Fail 6(1):68–75. https://doi.org/10.1161/circheartfailure.112.971051
25. Milfred-LaForest SK, Gee JA, Pugacz AM, Pina IL, Hoover DM, Wenzell RC, Felton A, Guttenberg E, Ortiz J (2017) Heart failure transitions of care: a pharmacist-led post-discharge pilot experience. Prog Cardiovasc Dis 60(2):249–258. https://doi.org/10.1016/j.pcad.2017.08.005
26. Le Jemtel TH, Padeletti M, Jelic S (2007) Diagnostic and therapeutic challenges in patients with coexistent chronic obstructive pulmonary disease and chronic heart failure. J Am Coll Cardiol 49(2):171–180. https://doi.org/10.1016/j.jacc.2006.08.046
27. Jabbour A, Macdonald PS, Keogh AM, Kotlyar E, Mellemkjaer S, Coleman CF, Elsik M, Krum H, Hayward CS (2010) Differences between beta-blockers in patients with chronic heart failure and chronic obstructive pulmonary disease: a randomized crossover trial. J Am Coll Cardiol 55(17):1780–1787. https://doi.org/10.1016/j.jacc.2010.01.024
28. Ibrahim MM (2013) Problem of hypertension in Egypt. Egypt Heart J 65(3):233–234
29. Donovan AL, Aldrich JM, Gross AK, Barchas DM, Thornton KC, Schell-Chaple HM, Gropper MA, Lipshutz AKM, University of California, San Francisco Critical Care Innovations Group (2018) Interprofessional care and teamwork in the ICU. Crit Care Med 46(6):980–990. https://doi.org/10.1097/ccm.0000000000003067
30. Dempsey J, Gillis C, Sibicky S, Matta L, MacRae C, Kirshenbaum J, Faxon D, Churchill W (2018) Evaluation of a transitional care pharmacist intervention in a high-risk cardiovascular patient population. Am J Health Syst Pharm 75(17 Supplement 3):S63–S71. https://doi.org/10.2146/ajhp170099
31. Stewart D, Thomas B, MacLure K, Pallivalapila A, El Kassem W, Awaisu A, McLay JS, Wilbur K, Wilby K, Ryan C, Dijkstra A, Singh R, Al Hail M (2018) Perspectives of healthcare professionals in Qatar on causes of medication errors: a mixed methods study of safety culture. PLoS ONE 13(9):e0204801. https://doi.org/10.1371/journal.pone.0204801
32. Sabry NA, Farid SF (2014) The role of clinical pharmacists as perceived by Egyptian physicians. Int J Pharm Pract 22(5):354–359. https://doi.org/10.1111/ijpp.12087
33. Braun V, Heintze C, Rufer V, Welke J, Stein T, Mehrhof F, Dini L (2011) Innovative strategy for implementing chronic heart failure guidelines among family physicians in different healthcare settings in Berlin. Eur J Heart Fail 13(1):93–99. https://doi.org/10.1093/eurjhf/hfq181
34. Ancker JS, Edwards A, Nosal S, Hauser D, Mauer E, Kaushal R (2017) Effects of workload, work complexity, and repeated alerts on alert fatigue in a clinical decision support system. BMC Med Inform Decis Mak 17(1):36. https://doi.org/10.1186/s12911-017-0430-8

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