Title

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Journal

Journal of Cardiac Failure, 27(2)

ISSN

1071-9164

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Publication Date

2021-02-01

DOI

10.1016/j.cardfail.2020.09.473

Peer reviewed

HHS Public Access

Author manuscript

J Card Fail. Author manuscript; available in PMC 2022 February 07.

Published in final edited form as:

J Card Fail. 2021 February ; 27(2): 190–197. doi:10.1016/j.cardfail.2020.09.473.

Inclusion of Performance Parameters and Patient Context in the Clinical Practice Guidelines for Heart Failure

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Abstract

Background: To facilitate evidence-based medicine (EBM) on an individual level, it may be important for clinical practice guidelines (CPGs) to incorporate the performance parameters of diagnostic studies and therapeutic interventions (such as likelihood ratio and absolute benefit/harm), and to incorporate relevant patient contexts that may influence decision-making. We sought to determine the extent to which heart failure CPGs currently incorporate this information.

Methods: We reviewed the American College of Cardiology Foundation/American Heart Association (ACCF/AHA) 2013 Heart Failure CPG, the 2017 ACCF/AHA/HFSA update, and European Society of Cardiology (ESC) 2016 Heart Failure CPG. We abstracted variables for each CPG recommendation from the following domains: quality of evidence, strength of recommendation, diagnostic and therapeutic performance parameters, and patient context.

Results: We examined 169 recommendations from the ACCF/AHA 2013 CPGs and 2017 update, and 187 recommendations from the 2016 ESC CPGs. Performance parameters for diagnostic studies (2013 ACCF/AHA: 13%; 2017 ACCF/AHA/HFSA update: 0%; 2016 ESC: 0%) and therapeutic interventions (2013 ACCF/AHA: 65%; 2017 ACCF/AHA/HFSA update: 64%;

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Disclosures:
None.

2016 ESC: 16%) were not commonly included in CPGs. Patient context was included in about half of ACCF/AHA recommendations, and a quarter of ESC recommendations.

Conclusions: The majority of recommendations from heart failure CPGs lack information on diagnostic and therapeutic performance parameters and patient context. Given the importance of these components to effectively implement EBM, particularly for a heterogeneous heart failure population, innovative strategies are needed to optimize CPGs so they provide comprehensive yet succinct recommendations that can improve population-level outcomes and ensure optimal patient-centered care.

Keywords

heart failure; evidence-based medicine; decision making; practice guidelines

Subject Term List:

Heart Failure and Cardiac Disease; Heart Failure

INTRODUCTION

Evidence-based medicine (EBM) “is the conscientious, explicit, and judicious use of best evidence in making decisions about the care of individual patients.”[1] The primary documents often used by clinicians to practice EBM are clinical practice guidelines (CPGs), which offer disease-specific recommendations based on the synthesis of best available literature. Naturally, CPG recommendations are limited by the quality of the underlying data supporting a given diagnostic study or therapeutic intervention. Another key limitation inherent to CPG recommendations is that they are based on the average effects observed within a population, and thus do not provide information on how diagnostic studies or therapeutic interventions will affect any given individual.[2] Given these limitations, CPGs should not be considered as rules that must be followed at all times, and should not yield rote, cookbook medicine.[1] Instead, CPGs, as a synthesis and appraisal of the available evidence, should provide guidance to clinicians regarding the use of diagnostic studies and interventions that are subsequently coupled with the proficiency and judgment of individual clinicians to facilitate shared decision-making and optimize patient care.

CPGs often differ across professional societies.[3] This reflects the fact that available data may be interpreted differently by experts. Clinicians may also differ on how they interpret data, and more importantly, how they believe the data applies to their patients. This can have dramatic effects on patient-physician discussions about the potential harms and benefits of various diagnostic studies and therapeutic interventions, and subsequently shape the shared decision-making process. Consideration of the applicability of CPGs to patients with heart failure (HF) is especially important, as HF is predominantly a disorder that afflicts adults 75 years of age or older who have not been well represented in clinical trials.[4, 5] In addition, the older HF population is highly heterogeneous,[6] with varying pathophysiologic mechanisms, frequent presence of other chronic medical conditions, and impairments in function and cognition that can significantly impact the utility and value of diagnostic studies and therapeutic interventions.[7, 8] Consequently, to allow clinicians to engage in EBM

and shared decision-making on an individual patient level, easily accessing performance parameters of diagnostic studies and therapeutic interventions recommended by CPGs, and understanding the impact of patient context on the applicability of CPG recommendations are important. For example, sensitivity, specificity, and/or likelihood ratios are needed to understand the utility of diagnostic studies; and absolute risk reduction, number needed to treat or harm, and time horizon to benefit are important parameters to assess the value of therapeutic interventions. Aspects relating to patient context such as comorbidity, socio-personal factors, life expectancy, and patient preference are similarly important. With access to this information, clinicians may be better positioned to make tailored recommendations to their patients, leading to more individualized diagnostic and treatment decisions.

Despite their particular relevance for adults with HF, the extent to which performance parameters and patient context are incorporated into the HF CPGs from major cardiovascular medicine societies has not been formally described. With this study, we sought to determine the extent of to which HF CPGs from the American College of Cardiology Foundation/American Heart Association/Heart Failure Society of America (ACCF/AHA/HFSA) and European Society of Cardiology (ESC) incorporate performance parameters and patient context.

METHODS

We reviewed the 2013 ACCF/AHA HF CPG,[9] the 2017 ACCF/AHA/HFSA HF CPG update[10] (which included an additional 32 recommendations), and the 2016 ESC HF CPG.[11] We reviewed the main documents as well as their accompanying supplementary materials. For multi-component recommendations, we reviewed each component with a unique strength of recommendation and level of evidence, and evaluated each as a unique individual recommendation.

For all CPGs, two study team members (OU and PK) independently abstracted variables for each CPG recommendation from the following domains: type of recommendation (therapeutic, diagnostic, monitoring, screening), quality of evidence, strength of recommendation, diagnostic and therapeutic performance parameters (such as likelihood ratio and absolute benefit/harm), and patient context (such as comorbidity and life expectancy). We reconciled differences in abstraction data between reviewers by negotiated consensus involving a third reviewer (PG).

For the ACCF/AHA CPGs, each recommendation received a class of recommendation, which reflects an estimate of the treatment effect based on the usefulness/effectiveness of a given diagnostic study or therapeutic intervention. Class I is described as “Benefit >>> Risk;” Class IIa is “Benefit>>Risk;” Class IIb is Benefit ≥ Risk; and Class III is “No benefit” or “Harm.” Each recommendation also received a level of evidence, which provides an estimate of the certainty or precision of the treatment effect. Level A evidence reflects data derived from multiple randomized controlled trials or meta-analyses; Level B reflects data derived from a single randomized trial or nonrandomized studies; and Level C reflects only consensus opinion of experts, case studies, or standard of care.

Each recommendation from the ESC CPG also received a class of recommendation and level of evidence, using a similar scoring system. For class of recommendation: Class I is “recommended or indicated;” Class IIa is “should be considered;” Class IIb is “may be considered;” and Class III is “not recommended.” For level of evidence: Level A reflects data derived from multiple randomized controlled trials or meta-analyses; Level B reflects data derived from a single randomized clinical trial or large nonrandomized studies; and Level C reflects consensus opinion of experts and/or small studies, retrospective studies, or registries.

To determine if CPGs provided necessary information to best facilitate EBM, we evaluated whether each recommendation included key performance parameters for diagnostic studies and therapeutic interventions, and whether patient context was incorporated into each recommendation. These domains were based on prior conceptual frameworks for practicing EBM, which calls for integrating best available evidence with relevant patient context.[1, 12–14] We examined the main CPG documents as well as their data supplements/addenda. For recommendations on diagnostic testing, we examined the following performance parameters: sensitivity, specificity, likelihood ratio, positive predictive value, and negative predictive value. For recommendations on therapeutic interventions, we examined absolute benefit and absolute harm (inclusive of absolute risk reduction or increase; and number needed to treat or number needed to harm). We also evaluated whether the therapeutic recommendations included time horizon to benefit. Time horizon to benefit is defined as the approximate time required until the patient may realize a meaningful benefit,[13] and is a particularly important concept for adults with HF, a population frequently affected by multi-morbidity, functional and cognitive impairment, and subsequently limited life expectancy.[8] Time horizon to benefit may not be as relevant for treatment recommendations related to acute HF, which frequently target symptoms and congestion with potential benefits that are often realized imminently; accordingly, we did not evaluate time horizon to benefit for therapeutic recommendations for hospitalized patients (2013 ACCF/AHA CPG; N=17) or acute HF patients (2016 ESC CPG; N=31).

For patient context, we examined whether CPGs included the following domains: comorbid conditions, socio-personal factors, personal preference, and life expectancy.[12] We defined comorbid conditions as any other acute or chronic medical condition beyond HF; and socio-personal factors as a person’s living conditions as it relates to their ability to adhere to the recommendation such as financial status, access to healthcare, or caregiver support. Financial status may be particularly important given high costs of newer therapies like sacubitril-valsartan and ivabradine;[15] and caregiver support may be particularly important given the high prevalence of cognitive impairment and other geriatric conditions observed among older adults with HF,[8] during an era when medication regimen complexity is increasing.[16] We defined personal preference as a person’s goals of treatment, lifestyle considerations, and/or preferred treatment intensity;[12] and life expectancy as the person’s age and/or expected prognosis.

Reviewers used the most conservative and inclusive definitions when assessing whether recommendations included performance parameters and patient context domains. If

reviewers disagreed, we used the most conservative and inclusive interpretation to achieve consensus.

Data Synthesis

We described the frequency of strength of recommendation, level of evidence, and performance parameters for diagnostic studies and therapeutic interventions, and patient context domains among CPGs. We conducted chi-square analyses to determine whether the presence of diagnostic and therapeutic performance parameters and incorporation of patient context in CPG recommendations differed according to level of evidence.

RESULTS

We examined 169 recommendations from the ACCF/AHA 2013 CPG and 2017 update, and 187 recommendations from the 2016 ESC CPG. Table 1 provides a summary of the recommendation classifications and levels of evidence for each CPG. The most common recommendation classification across the CPGs was Class I, and the most common level of evidence was B.

Performance Parameters

Performance parameters for diagnostic studies such as sensitivity and specificity, likelihood ratios, and positive and negative predictive values were infrequently included in either the ACCF/AHA or ESC CPGs (Figure 1). For example, sensitivity or specificity was included in just 18% of the 2013 ACCF/AHA CPGs, all of which were included in the data supplement only (Table 2A). For therapeutic interventions, performance parameters were occasionally included in the ACCF/AHA CPGs, and infrequently included in the ESC CPGs (Figure 1). The 2013 ACCF/AHA CPGs included absolute benefits in over half of the recommendations; and the 2017 ACCF/AHA/HFSA update included time horizon to benefit in over half of the recommendations (Table 2B). Again, the majority of these parameters appeared in the data supplement rather than the main CPG documents. Notably, absolute harms were numerically less likely to be included in any of the CPGs compared to either absolute benefits or time horizon to benefit.

Table 3 shows the inclusion of performance parameters into recommendations, stratified by level of evidence. For the 2013 ACCF/AHA and 2017 ACCF/AHA/HFSA CPGs, Level A recommendations were more likely to include absolute benefits compared to Level B and C recommendations. For the 2016 ESC CPG, Level B recommendations were slightly more likely to include absolute benefits compared to Level A and C recommendations.

Patient Context

There was considerable variability with regard to inclusion of patient context (comorbid conditions, socio-personal factors, personal preference, and life expectancy) into treatment recommendations. Whereas the ACCF/AHA CPGs (both the 2013 CPGs and 2017 update) included patient context in over half of the recommendations, the ESC CPGs included patient context in just a quarter of the recommendations (Figure 1). Comorbidity was by far the most common patient context component included in the CPGs (Table 4). Life

expectancy was included in 5–22% of the recommendations. Notably, patient preference was only explicitly included in the 2013 ACCF/AHA CPG, and was only included in 14% of those recommendations; and patient preference was not explicitly mentioned in any of the HF CPG recommendations for implantable cardioverter-defibrillators. Socio-personal factors were included in just 1 recommendation across all CPGs. Neither financial status nor caregiver support was mentioned at all.

Table 3 shows the inclusion of patient context into recommendations, stratified by level of evidence. For the 2013 ACCF/AHA and 2017 ACCF/AHA/HFSA CPGs, Level A recommendations were more likely to include any patient context (primarily driven by comorbidity) compared to Level B and C recommendations (Table 3). For the 2016 ESC CPG, the frequency of including patient context did not differ according to level of evidence.

DISCUSSION

There has been substantial progress in the field of HF regarding both diagnosis and treatment over the past 2 decades. This is well-illustrated by the sheer number of recommendations now put forth by professional society-sponsored CPGs for a single condition; the ACCF/AHA[9, 10] now offers 169 recommendations for HF (including recommendations from both the 2013 guideline and the 2017 update) and the ESC[11] offers 187 recommendations for HF, spanning both diagnosis and treatment. For a field deeply committed to generating and reproducing high-level evidence, it is not surprising that a larger proportion of Class I recommendations from major cardiology professional societies are supported by high quality evidence (Level A) than other society CPGs.[17–21] However, it is also important to note that many of the CPG recommendations are based on Level B or C evidence. It may not be practical or feasible to attain Level A evidence for every diagnostic or therapeutic recommendation; but this observation, which is consistent with other evaluations of the cardiovascular CPGs,[22, 23] underscores the need to provide clinicians with information that will permit them to apply CPG recommendations to individual patients —such as the performance parameters of diagnostic studies and therapeutic interventions, and patient context.

It is implied that CPGs should not replace clinical judgment and that, instead, they should complement clinical judgment and enhance individual-level decision-making. To make this clear to clinicians, the 2016 ESC CPG explicitly states this in their preamble. This purpose further underscores the importance of incorporating relevant information into CPGs that can best permit clinicians to optimally practice EBM. Yet, we found that performance parameters for diagnostic studies and therapeutic interventions were not routinely incorporated into CPGs, despite ample data in the HF literature to facilitate calculating important performance parameters like sensitivity and specificity, likelihood ratios, positive and negative predictive value, absolute risk reduction or increase, and number needed to treat or harm.[24, 25] Even among recommendations with the highest level of evidence, performance parameters were often not included in CPGs. We also noted that, when these parameters were included, they were frequently included in the supplement rather than the main CPG document, and were not easy to find.

A major challenge for developing and applying CPG recommendations is accounting for the inherent heterogeneity of the target population. This is especially relevant for the HF population, where heterogeneity and care complexity rise sharply with the onset of various age-related comorbid conditions, as well as geriatric conditions like frailty and cognitive impairment. This highlights the importance of incorporating patient context into CPGs. Indeed, comorbidity, socio-personal factors, and life expectancy can have a profound impact on the applicability of various CPG recommendations.[8] Yet, we found that HF CPGs infrequently incorporated patient context into the recommendations. This finding is consistent with a recent observation that even high quality CPGs rate as having poor applicability[26] according to the Appraisal of Guidelines for Research and Evaluation Instrument, version II (AGREE-II), which was created by an international group of experts to support the process of development, assessment, and reporting of CPGs.[27, 28] Failure to include patient context into recommendations could simply relate to a paucity of data. For example, individuals with multi-morbidity and limited life expectancy have largely been excluded from major HF clinical trials to date.[4] Given the number of HF patients affected by comorbid conditions, socio-personal factors, and limited life expectancy,[8] our observations further underscore the need for additional research to better understand how these conditions impact the effectiveness of various diagnostic studies and therapeutic interventions.

Our findings also reflect important challenges when it comes to developing CPGs. On the one hand, performance parameters and patient context are important when clinicians are considering whether to pursue a specific diagnostic test or therapeutic intervention for individual patients. Decision-making is a complex process that requires careful consideration of the short and long-term risks and benefits, and cannot be replaced by simply deferring to CPG-based recommendations. Thus, including information that helps clinicians to determine whether and how CPG recommendations apply to a clinical circumstance may facilitate and enhance patient-centered care. On the other hand, including this information may be impractical, yielding long unwieldy guideline documents that may not be as useful to clinicians.[29] As more data are generated, developing and displaying CPGs that are succinct and easily-interpretable by clinicians, while also comprehensive enough to ensure EBM may paradoxically become more challenging. Our observations thus highlight the need to develop innovative strategies for CPGs to balance these issues. One possible solution would be to incorporate performance parameters and patient context in a more structured way, such as through tables or infographics that clinicians can refer to when needed. Future strategies that merit further investigation could include interactive digital applications that can provide CPG recommendations and display performance parameters quickly and efficiently. If this is an overambitious vision for CPGs, then alternative strategies to providing clinicians with performance metrics and patient context, such as through a complementary document, might warrant further consideration.

It may not be practical or necessary to address patient context in every recommendation. However, more explicit mention of these issues may be reasonable. Prior iterations of HF CPGs incorporated a section on special populations. For example, the 2010 HFSA CPGs provided recommendations for populations that have been under-represented in large randomized controlled trials—older adults, women, and African-Americans—and listed levels of evidence specific to these populations.[30] Since the current HF CPGs do

not explicitly address special populations, and the heterogeneity of the HF population extends well beyond demographics, it is essential that CPGs highlight the uncertainties of recommendations applicable to these populations. One potential strategy to address this would be to highlight areas of uncertainty through tables that outline some of the gaps in the literature with regard to specific patient-based circumstances.

While patient preference may be assumed as a part of applying CPGs, future CPGs may also benefit from providing strategies to elicit and incorporate patient preference into decision-making, especially for the most common scenarios clinicians face in practice. For example, it may be beneficial to include recommendations for high-quality decision-aids in future CPGs. This will be especially important in future iterations of CPGs for implantable cardioverter-defibrillators—an intervention where elicitation of patient preference and shared decision using evidence-based decision aids are now required by the Centers for Medicare and Medicaid Services.[31] Yet another practical solution to address some of the limitations outlined here would be to explicitly mention issues like financial status and caregiver support in CPGs, given their importance when optimizing pharmacotherapy. Financial status could impact patient access to pharmacotherapy, especially some of the newer agents like sacubitril-valsartan and ivabradine, which are high in cost and may not be affordable to some;[15] and caregiver support is becoming an increasingly recognized aspect of managing HF given the concurrence of geriatric conditions in adults with HF.[8] For example, individuals with cognitive impairment who lack a caregiver and already have polypharmacy and complex medication regimens may not be ideal candidates for pharmacotherapy that requires multiple divided doses over the course of the day (such as hydralazine and nitrates).

Study Limitations

When interpreting our findings, there are some important limitations worth noting. First, our assessment of whether CPGs included performance parameters and/or patient context may be subject to interpretation. We therefore had two study members (OU and PK) independently evaluate each CPG for each EBM component. This yielded an inter-rater agreement of 98% (2203/2241); among the discrepancies, we reached consensus on 100% after discussion and involvement of a third study team member (PG). Another important limitation is that we gave credit for inclusion of performance parameters and patient context aspects even if they were marginally mentioned in the guidelines (either in the main document or the associated supplements/addenda). Therefore, our findings may overestimate the degree to which performance parameters and patient context are included in CPGs. Even with this conservative approach to evaluating the CPGs, it is evident that components necessary to facilitate EBM and shared decision-making are not commonly incorporated into CPGs.

CONCLUSIONS

While CPGs for HF from the ACCF/AHA/HFSA and ESC provide many recommendations with high levels of supportive evidence, the majority of recommendations lack information on diagnostic and therapeutic performance parameters such as likelihood ratios and time

horizon to benefit. Contextual patient factors like comorbidity and life expectancy are also infrequently included in CPGs. These findings reflect the challenge of creating HF CPGs that are succinct enough for clinicians to easily identify and understand a recommendation yet comprehensive enough for clinicians to apply the recommendation to an individual patient. Given the importance of these components to effectively implement EBM among the complex and heterogeneous heart failure population, innovative strategies are needed to create CPGs that can improve population-level outcomes and ensure optimal patient-centered care.

ACKNOWLEDGEMENTS

Sources of Funding:

The authors acknowledge the National Institute on Aging (NIA) U19 conference in Bethesda, MD on March 26–27, 2018 (U13 AG 048721-04) for inspiring this collaboration. Dr. Goyal is supported by NIA grant R03AG056446 and American Heart Association grant 18IPA34170185. Dr. Gilstrap is supported by the National Heart, Lung and Blood Institute 5K23HL142835-03. Dr. Makam is supported by NIA grant K23AG052603.

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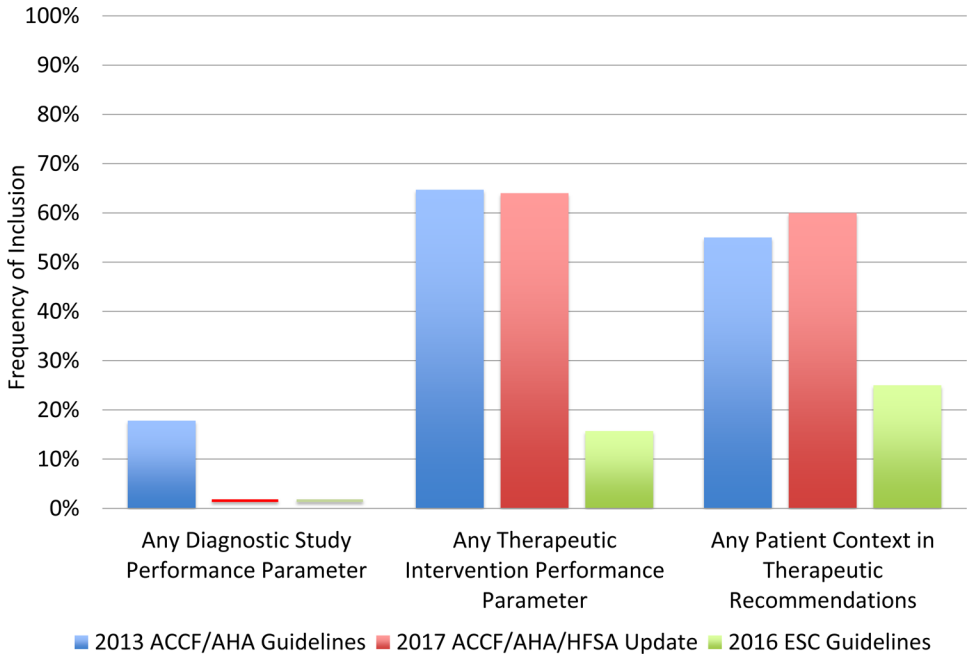

Figure 1:

Inclusion of performance parameters and patient context into heart failure clinical practice guidelines. Diagnostic performance parameters were rarely included in any of the heart failure clinical practice guidelines. Therapeutic performance parameters and patient context were occasionally included in the ACCF/AHA and ACCF/AHA/HFSA guidelines, and rarely included in the ESC guidelines.

Abbreviations: ACCF/AHA- American College of Cardiology Foundation/American Heart Association; ACCF/AHA/HFSA- American College of Cardiology Foundation/American Heart Association/Heart Failure Society of America; ESC- European Society of Cardiology

Table 1.

Summary of Recommendation Classifications and Levels of Evidence

		Recommendation Classification, N (%)				Level of Evidence, N (%)		
Clinical Practice Guideline	**N**	**I**	**IIa**	**IIb**	**III**	**A**	**B**	**C**
2013 ACCF/AHA*								
Overall†	137	58 (42)	41 (30)	20 (15)	18 (13)	27 (20)	66 (48)	44 (32)
Diagnostic	28	15 (54)	8 (29)	4 (14)	1 (4)	5 (18)	8 (29)	15 (54)
Therapeutic	102	41 (40)	30 (29)	16 (16)	15 (15)	22 (22)	57 (56)	23 (23)
2017 ACCF/AHA/HFSA‡								
Overall	32	14 (44)	7 (22)	5 (16)	6 (19)	7 (22)	16 (50)	9 (28)
Diagnostic	7	3 (43)	3 (43)	1 (14)	0 (0)	3 (43)	3 (43)	1 (14)
Therapeutic	25	11 (44)	4 (16)	4 (16)	6 (24)	4 (16)	13 (52)	8 (32)
2016 ESC§								
Overall†	187	79 (42)	44 (24)	39 (21)	25 (13)	38 (20)	57 (30)	92 (49)
Diagnostic	35	19 (54)	10 (29)	6 (17)	0 (0)	1 (3)	1 (3)	33 (94)
Therapeutic	140	52 (37)	33 (24)	30 (21)	25 (18)	37 (26)	54 (39)	49 (35)

*American College of Cardiology Foundation/American Heart Association

†Includes screening or monitoring recommendations

‡American College of Cardiology Foundation/American Heart Association/Heart Failure Society of America

§European Society of Cardiology

Table 2.

Inclusion of Evidence-based Medicine Components by Guideline

A. Diagnostic recommendations			
Clinical Practice Guideline	**Sensitivity or Specificity, N (%)**	**Likelihood Ratio, N (%)**	**Positive or Negative Predictive Value, N (%)**
2013 ACCF/AHA[*] (N=28)	5 (18)	2 (7)	2 (7)
Main document	0 (0)	0 (0)	0 (0)
Data supplement	5 (18)	2 (7)	2 (7)
2017 ACCF/AHA/HFSA[†] (N=7)	0 (0)	0 (0)	0 (0)
Main document	0 (0)	0 (0)	0 (0)
Data supplement	0 (0)	0 (0)	0 (0)
2016 ESC[‡] (N=35)	0 (0)	0 (0)	0 (0)
Main document	0 (0)	0 (0)	0 (0)
Addenda	0 (0)	0 (0)	0 (0)
B. Therapeutic recommendations			
Clinical Practice Guideline	**Absolute benefits, N (%)**	**Absolute harms, N (%)**	**Time horizon to benefit[§] N (%)**
2013 ACCF/AHA[*] (N=102)	56 (55)	25 (25)	35 (41)
Main document	22 (22)	0 (0)	0 (0)
Data supplement	34 (33)	25 (25)	35 (41)
2017 ACCF/AHA/HFSA[†] (N=25)	8 (32)	7 (28)	14 (56)
Main document	0 (0)	0 (0)	1 (4)
Data supplement	8 (32)	7 (28)	13 (52)
2016 ESC[‡] (N=140)	18 (13)	0 (0)	10 (9)
Main document	3 (2)	0 (0)	7 (6)
Addenda	15 (11)	0 (0)	3 (3)

[*] American College of Cardiology Foundation/American Heart Association

[†] American College of Cardiology Foundation/American Heart Association/Heart Failure Society of America

[‡] European Society of Cardiology

§Excluding therapeutic recommendations in the hospital setting since the potential benefits would be realized imminently (N=85 for 2013 ACCF/AHA guideline; N=25 for 2017 ACCF/AHA/HFSA; N=109 for 2016 ESC guideline)

Table 3.

Inclusion of Evidence-based Medicine Components by Levels of Evidence

A. 2013 American College of Cardiology Foundation/American Heart Association Clinical Practice Guideline				
	LOE A	**LOE B**	**LOE C**	**p-value**
Diagnostic Recommendations, N	**5**	**8**	**15**	
Any	0 (0)	3 (38)	2 (13)	0.27
Sensitivity or Specificity	0 (0)	3 (38)	2 (13)	0.27
Likelihood ratio	0 (0)	1 (13)	1 (7)	1.00
Positive or Negative Predictive Value	0 (0)	1 (13)	1 (7)	1.00
Therapeutic Recommendations, N	**22**	**57**	**23**	
Any	20 (91)	33 (58)	13 (57)	0.01
Absolute benefits	19 (86)	28 (49)	9 (39)	0.003
Absolute harms	5 (23)	13 (23)	7 (30)	0.78
Time horizon to benefit *	10 (48)	19 (45)	6 (27)	0.30
Patient Context, N	**22**	**57**	**23**	
Any	20 (91)	28 (49)	10 (43)	0.001
Comorbidity	19 (86)	27 (47)	9 (39)	0.002
Socio-personal	1 (5)	0 (0)	0 (0)	0.22
Patient preference	3 (14)	7 (12)	4 (17)	0.86
Life expectancy	5 (23)	12 (21)	5 (22)	0.99
B. 2017 American College of Cardiology Foundation/American Heart Association/Heart Failure Society of American Update				
	LOE A	**LOE B**	**LOE C**	**p-value**
Diagnostic Recommendations, N	**3**	**3**	**1**	
Any	0 (0)	0 (0)	0 (0)	1.00
Sensitivity or Specificity	0 (0)	0 (0)	0 (0)	1.00
Likelihood ratio	0 (0)	0 (0)	0 (0)	1.00
Positive or Negative Predictive Value	0 (0)	0 (0)	0 (0)	1.00
Therapeutic Recommendations, N	**4**	**13**	**8**	
Any	4 (100)	10 (85)	2 (25)	0.02

A. 2013 American College of Cardiology Foundation/American Heart Association Clinical Practice Guideline				
	LOE A	**LOE B**	**LOE C**	**p-value**
Absolute benefits	4 (100)	4 (31)	0 (0)	0.001
Absolute harms	0 (0)	7 (54)	0 (0)	0.01
Time horizon to benefit	4 (100)	8 (62)	2 (25)	0.04
Patient Context, N	**4**	**13**	**8**	
Any	4 (100)	9 (69)	2 (25)	0.04
Comorbidity	4 (100)	9 (69)	2 (25)	0.04
Socio-personal	0 (0)	0 (0)	0 (0)	1.00
Patient preference	0 (0)	0 (0)	0 (0)	1.00
Life expectancy	0 (0)	4 (56)	0 (0)	0.19
C. 2016 European Society of Cardiology Clinical Practice Guideline				
	LOE A	**LOE B**	**LOE C**	**p-value**
Diagnostic Recommendations, N	**1**	**1**	**33**	
Any	0 (0)	0 (0)	0 (0)	1.00
Sensitivity or Specificity	0 (0)	0 (0)	0 (0)	1.00
Likelihood ratio	0 (0)	0 (0)	0 (0)	1.00
Positive or Negative Predictive Value	0 (0)	0 (0)	0 (0)	1.00
Therapeutic Recommendations, N	**37**	**54**	**49**	
Any	6 (16)	13 (24)	3 (6)	0.04
Absolute benefits	5 (14)	11 (20)	2 (4)	0.04
Absolute harms	0 (0)	0 (0)	0 (0)	1.00
Time horizon to benefit *	6 (17)	3 (7)	1 (3)	0.17
Patient Context, N	**37**	**54**	**49**	
Any	12 (32)	16 (30)	7 (14)	0.10
Comorbidity	8 (22)	15 (28)	7 (14)	0.25
Socio-personal	0 (0)	0 (0)	0 (0)	1.00
Patient preference	0 (0)	0 (0)	0 (0)	1.00
Life expectancy	4 (11)	2 (4)	1 (2)	0.20

* Excluding therapeutic recommendations for acute heart failure since the potential benefits would be realized imminently (N=36 for LOE A; N=42 for LOE B; N=31 for LOE C)

J Card Fail. Author manuscript; available in PMC 2022 February 07.

* Excluding therapeutic recommendations in the hospital setting since the potential benefits would be realized imminently (N=21 for LOE A; N=42 for LOE B; N=22 for LOE C)

Table 4.

Summary of Inclusion of Patient Context into Therapeutic Recommendations

Clinical Practice Guideline	N	Comorbidity, N (%)	Socio-personal, N (%)	Life expectancy, N (%)	Patient preference, N (%)
2013 ACCF/AHA *	102	55 (54)	1 (1)	22 (22)	14 (14)
2017 ACCF/AHA/HFSA †	25	15 (60)	0 (0)	4 (16)	0 (0)
2016 ESC‡	140	30 (21)	0 (0)	7 (5)	0 (0)

*American College of Cardiology Foundation/American Heart Association

†American College of Cardiology Foundation/American Heart Association/Heart Failure Society of America

‡European Society of Cardiology