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REVIEW

Do we need new quality markers for chronic heart failure?

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Abstract: Guidelines are not cookbook medicine. Medical decisions for the treatment of chronic heart failure (CHF) are more determined by patient's characteristics than by knowledge of physicians or drug patterns. New quality markers are more favourable, because they have qualitative attributes (are more flexible and adaptable for each CHF patient due to considering objective reasons for deviation from guidelines) (Ref. 44). Full Text in free PDF *www.bmj.sk.*
Key words: quality markers, clinical audit, guidelines, chronic heart failure, therapy.

Donabedian (1) offered the concept that quality could be measured based on structure, process and outcome quality markers (QM). Structure encompasses static, technical and organization aspects of care (CHF register, heart failure improvement program, CHF disease management program, specialist – cardiologist or internist), process refers to the actions that healthcare providers take in delivering medical care and outcomes are the end result of the structure and process. Early attempt for measuring the quality of healthcare focused on the structure (accreditation of healthcare facilities), currently focus relates to processes and outcomes.

Although outcomes are ultimate judge of the quality of care, there are several advantages to using process QM for purposes of performance measurement (with the presumption that these processes are associated with improved outcomes). Most notably, it is much easier for physicians to accept responsibility for their actions in providing care (process QM) than for prognosis (outcome QM) of their patients, because there are many factors affecting patient outcomes that are not directly under the control of doctors. Current process QM specific for CHF have little relationship to patient outcomes and new QM may be needed to improve care of patients with heart failure (2).

Quality markers (3) are the quantitative measures that can be used to quantify the quality of care. They measure the effect of quality improvement efforts, assess compliance with guidelines (and compare actual routine practice with guidelines which represent ideal practice). So all QM have *quantitative attributes*: a) valid – scientific evidence or professional consensus exists supporting better benefit for patients who receive higher rate of adherence to QM and higher percentage of adherence to QM identifies higher quality, b) feasible – data should be routine part of medical chart and failure to document it is itself an indicator for poor quality.

Only new QM have qualitative attributes (are more flexible and adaptable for individual patient due to considering objective reasons for deviation from guidelines): a) flexible – respect the clinical judgment of physicians (guidelines do not represent a cookbook medicine, they supplement rather than replace clinical judgment), b) adaptable – take into consideration individual characteristics of each CHF patient.

Medical decision making (4) is complex and can be depicted by a set of overlaping domains in a dynamic model in which is patient domain relatively small during acute clinical condition, but in chronic condition is the patient domain far more prominent. For acute clinical conditions there is enough to have standard QM, but for chronic heart failure we need new QM.

Standard quality markers

The guidelines are systematically developed statements which assist in physician's decisions about APPROPRIATE health care for specific clinical condition (5-6; CHF guidelines released by European Society of Cardiology - ESC). The quality markers are designed to measure the APPROPRIATENESS of specific health care (7-8; CHF- specific QM). Quality markers are derived from guidelines and therefore are often confused with them, but they are distinct.

Guidelines emphasize management of CHF patients only with left ventricular systolic dysfunction (with left ventricular ejection fraction, LVEF, usually lower than 40%). The improvement of LVEF from 30% to 60% over time is still sign for systolic CHF. Evaluation of left ventricular systolic function (before arrival, during hospitalization, or planned for after discharge) is CCORT/CCS and ACC/AHA performance measure (7-8). We do not accept it as standard QM, because chart documentation of relevant LVEF values could be only a surrogate for other QM that may influence outcomes (ACEi and BB are indicated in patients with reduced LVEF).

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Prescription rate (Rx) is defined as percentage of (ideal) CHF patients with a drug; for ACE- inhibitors (*ACEi Rx)* and for beta- blockers ***(BB Rx).*** None ACC/AHA performance measures (8) was significantly associated with reduced early mortality risk in a real world setting, and only ACEi Rx at discharge was associated with 60- to 90-day postdischarge mortality or rehospitalization (2). But BB Rx at discharge, currently NOT a performance measure according to ACC/AHA (8), was strongly associated with reduced risk of mortality during follow-up (2). Conversely, it is included in CCORT/CCS measure set (8), according the results from OPTIMIZE-HF (9). BB Rx during outpatient period is included in ACC/AHA performance measurement (8).

Target dose rate (target) is defined as percentage of (ideal) patients with a drug only in target dose; for ACE- inhibitors (*ACEi target*) and for beta- blockers (*BB target*). However, ACEi dosing, as alternative standard QM was suggested (CHF patients with at least 50% of target dose), too. Target dose (in mg/day) was derived from ESC guidelines (5–6) for beta- blockers (bisoprolol and nebivolol 10 mg, metoprolol succinate 200 mg, metoprolol tartrate 150 mg bid, carvedilol 50 mg bid) and for ACE- inhibitors (perindopril 4 mg, trandolapril 2–4 mg, fosinopril 20 mg, ramipril 2.5–5 mg bid, enalapril 10 mg bid).

New quality markers

Into evaluation of new QM were included all CHF patients who were alive at the discharge. Patients with terminal illnesses were excluded, because do-not-resuscitate (DNR) orders have impact on the quality of treatment of patients hospitalized for acute HF (10). Exclusion criterion according to CCORT/CCS (7) is the first acute HF episode complicating acute coronary syndromes, but beyond the acute phase of myocardial infarction may develop CHF in a time-dependent fashion (11).

1. Coding accuracy of CHF (I50) is defined as the percentage of patients with accurate diagnostic code for CHF (or ascertained from the International Classification of Disease, 9th edition, code 428). Some patients may be *false positive* or negative (not true) CHF cases. It is difficult to diagnose CHF accurately based only on clinical symptoms in primary health care (12) and in hospital (13), especially in women. It was recommended that charts should be reviewed to ensure that these patients have symptoms and signs consistent with the *clinical validation criteria for CHF* adapted from the Framingham or Carlson (7): 1. Framingham criteria (the CHF diagnosis is valid when there is presentation of 2 major or 1 major plus 2 minor criteria): a) major: paroxysmal nocturnal dyspnea, orthopnea, neck vein distension, elevated jugular venous pressure, positive hepatojugular reflux, rales, third heart sound, cardiomegaly (radiografic), pulmonary edema; b) minor: peripheral edema, nocturnal cough, dyspnea, hepatomegaly, pleural effusion, tachycardia, weight loss in response to diuretics; 2. Carlson criteria (if 8–12 items are present, the CHF diagnosis is definite, 5–7 possible, 4 or less unlikely): a) history: rest dyspnea, dyspnea on exertion, orthopnoea, paroxysmal nocturnal dyspnea; b) physical examination: increased heart rate, elevated jugular venous pressure, crackles, wheeze, third heart sound; c) radiographic: alveolar pulmonary edema, intersticial pulmonary edema, bilateral pleural effusions, cardiothoracic ratio > 0.50, upper zone vascular redistribution.

It is needed to avoid *false negative CHF* cases, too. If relying on administrative data, CHF is not common disease. It was estimated that reliance on International Classification of Diseases codes results in the exclusion of the one third of the CHF patients. The validity of the use of I50 code to identify hospitalizations with CHF had high-level specificity (95.4%), but only 62.8 % sensitivity and was associated with a 24.8% underestimation of CHF- related hospitalizations (14-15).

Moreover, up to 75% of CHF patients are "secondary" CHF (a patient being admitted to the hospital for another reason, mostly under the code diagnosis of coronary heart disease). Patients with "primary" CHF are more likely to be discharged on an ACEi than those with a secondary diagnosis (16).

2. Appropriate use (use) is defined as the percentage of CHF patients with a drug or without a drug because of objective reasons; for ACE- inhibitors (*ACEi use*) and for beta- blockers (*BB use*). Calculation of compliance to guidelines uses simple formula*: BB use = (BB Rx + O) / N*, where (BB Rx) as standard QM means a number of ideal CHF candidates for BB prescription, a number of CHF patients with objective (means O) or subjective (means S) reasons for BB non-use and (N) means a total number of CHF patients: N = I + S + O.

As *objective* reasons (7-8) for non-use of ACEi we consider hypotension (symptomatic or systolic blood pressure, SBP <90 mmHg), hyperkaliaemia (peak or last pre-discharge serum potassium >5.5 mEq/L), severe renal dysfunction (peak or last predischarge serum creatinine >200 μmol/L), moderate or severe aortic stenosis (3+ or 4+, AVA < 1.0 cm^2), allergy or any intolerance to ACEi (cough, angiooedema, hives, rash) or another physician documented reason. As objective reasons for non-use of BB we consider conduction disorders (bi- or trifascicular block, PR interval >0.24 seconds and second or third degree AV block during hospital stay on 12- lead ECG), bradycardia (heart rate <50–55 beats per minute during hospital stay while not on BB), hypotension (symptomatic or SBP <90 mmHg), asthma (any degree of severity), severe chronic obstructive pulmonary disease, allergy or intolerance to BB, recent need for intravenous inotropic support with dopamine, dobutamine within 4 days and another physician documented reason. The list of objective reasons is not intended to be exhaustive.

Subjective reasons may be: *a) unknown*: Non-administering of BB should be only exception because they have wide spectrum of indications (CHF, angina pectoris, hypertension, arrhythmias, myocardial infarction, etc.) and BB can be with caution indicated even for CHF patients with relative contraindications, such as chronic obstructive pulmonary disease (17), NYHA IV class (18) and peripheral arterial disease. ACEi have wide spectrum of indications (CHF, hypertension, left ventricular dysfunction after myocardial infarction, stable coronary heart disease,

prevention of cardiovascular events in diabetics and high-risk patients, prevention and treatment of nephropathy progression), too.

b) Exaggerated fears of adverse events: The list of objective reasons for non-use of ACEi and BB is moderately conservative. Some CHF patients may receive these drugs, even though they are not ideal candidates. Good candidates may be with caution also in presence of relative contraindications (19). Physicians may be reluctant to prescribe ACEi to patients with concomitant renal insufficiency but moderate renal insufficiency should not be considered as a contraindication to the use of ACEi (20).

Low systolic blood pressure (SBP) is often reported as a reason for not administering of ACEi and BB, but it should not preclude a treatment with such drugs. Relative benefits of BB were similar in patients with low pretreatment SBP compared to those with higher SBP. However, because patients with the lowest SBP were at highest risk of an event (hypotension is a predictor of poor prognosis in CHF), they experienced the greatest absolute benefit from treatment with BB, but they were more likely intolerant of higher doses of BB or require permanent withdrawal of treatment. However, these risks were primarily related to the severity of CHF and not to treatment with carvedilol (21).

Most clinicians discourage the initiation of BB in the hospital settings after treatment for CHF decompensation (with or without inotropic administration) because acute heart failure has been considered as a contraindication for BB use. To minimize the likelihood of CHF worsening we need proceed very carefully during initiation and up-titration of BB (22-23). ESC guidelines (5) favor a minimum of 2–4 weeks of clinical stability (without symptoms of congestion and hypoperfusion) on standard therapy before BB are instituted. But in selected CHF patients is early hospital initiation of BB possible (24) with an advantage that CHF patients who begin ACEi or BB before discharge from hospital are more likely than others to still be taking these agents later (25). This is in accordance with updated ESC guidelines (6): in CHF patients BB should be initiated when the patient is stabilized after the acute episode (usually after 4 days; Class I recommendation, level of evidence A).

c) Pseudo(contra)indication: If CHF occurs it is desirable to switch from verapamil to BB (verapamil should be avoided, BB are preferred and their concomitant use is usually contraindicated). For ACEi it is inappropriate to switch arbitrarily from ACEi to sartans (exception are CHF patients intolerant to ACEi). Triple combination of ACEi, BB and sartans is possible according to the CHARM trial (26), however the ValHeFT study (27) raised here some concerns about the safety.

3. Appropriate dose (dose) is defined as the percentage of CHF patients treated with a target dose and also CHF patients with lower than target dose due to objective reasons; for ACE-inhibitors (*ACEi dose*) and for beta- blockers (*BB dose*). Calculation of compliance to guidelines uses simple formula: *BB dose = (BB target + O) / n,* where (BB target) as standard QM means a number of CHF patients with target dose of BB, a number of CHF patients with objective (means O) or subjective (means S) reasons for BB under-dosing and (n) means a number of ideal CHF candidates for BB prescription, it is a total number of CHF patients for purposes of this calculation: n = T + O + S.

Objective reasons for under-dosing of ACEi and BB can be: a) adverse drug events (compare with the objective reasons for non-use of ACEi and BB), b) severe renal, hepatic disease (it requires adequate dose reduction to prevent a drug accumulation), c) *start dose or some steps of dose up-titration scheme during actual hospital stay:* BB and ACEi (22–23) should be initiated with low start dose and the dose have to be up-titrated during hospitalization, but next titration steps are needed ("go slow") until target dose is reached ("sustain") or CHF worsening do not require modification of this tactics ("keep cool"). Then the highest tolerated (ideally target) dose will be given to the patient. d) *"Space" reserved for adding BB to ACEi*: ESC guidelines (5) recommend that treatment for CHF should begin with an ACEi in dose titrated to the target dose followed by adding of BB, but this management possesses the increased risk of intolerance of BB (for example, due to hypotension associated with ACEi). This drug sequence (ACEi first, then BB) is historically determined, we can consider to use BB earlier than CHF patient reaching the target dose of ACEi. Even further CIBIS III trial (28) supports BB in selected patients as choice for first-line therapy in CHF. Low-dose combination of ACEi and BB is preferred before monotherapy in treatment of hypertension (29), too.

As *subjective* reasons we regarded: *a) unknown:* Generally chart documentation of objective reasons is suboptimal (some patients may have had contraindications or intolerances that are not documented), unknown reasons may be the leading causes for non-adherence to guidelines. Clear reasons for withholding a drug are required by registries (see feasibility as quantitative attribute of all QM).

b) Exaggerated fears of adverse drug events: Abnormal low values of blood pressure, high serum creatinine and high serum potassium should not preclude the use of a drug (ACEi, BB) in maximally tolerated dose (30), and rather a small dose of BB or ACEi can be given than none drug (31–32). Clinical deterioration of CHF status during stable maintenance treatment is less likely caused by chronic BB therapy than by others factors (diet or medication noncompliance, ischeamia, arrhythmia, infection, concomitant illnesses or disease progression). But in these situations clinicians often stop administration of BB. However the withdrawal of BB may lead to a rebound phenomenon and discontinuation of BB was associated with worse outcomes in OPTIMIZE-HF program (33). Thus according to ESC guidelines (6) it is advisable to leave the CHF patient on BB unless inotropic support is needed, perhaps only reducing the dose slightly if signs of excessive dosage are suspected (bradycardia and/or hypotension).

c) Not respected pharmacokinetics: According to guidelines for CHF (5-6) enalapril, ramipril, carvedilol and metoprolol tartrate should be administered twice daily (ramipril 2.5 mg bid means total 5 mg a day, for example: 2.5–0–2.5 mg; exception is only the start dose). This fundamental pharmacokinetic requirement may not be respected in relatively high proportion of CHF patients, very possible due to information disseminated by

pharmaceutical companies. They suggest in the Summary of Product Characteristics for ramipril and enalapril (34) in CHF indication possibility to administer a drug at once or divided into two daily doses.

d) Arbitrary drug switch: There are four evidence-based BB for the treatment of CHF (bisoprolol, carvedilol, metoprolol succinate CR/XL and nebivolol), thus CHF patients treated with metoprolol tartrate 50 mg bid should be switched to carvedilol 25 mg bid in the light of the COMET trial results (35–36). Lower adherence to metoprolol tartrate was associated with significantly higher rate of emergency room visits and hospital admissions (37). We can correctly substitute original drug to generic product (in the same active substance, dose and galenic form), too.

Cave: Each drug switching should always be in equivalent dosages. The pathophysiologic correlates for possible worse prognosis of CHF patients associated with drug switch of BB in non-equivalent dosages are rebound phenomenon and withdrawal syndrome. This problem, showed for statins (38), can be supposed for ACEi, too. Equivalent dosages of ACEi (39) can be identified according to target daily doses (enalapril 20 mg equivalents are ramipril 10 mg and perindopril 4 mg). This is an alternative for the defined daily dosage (DDD) method, which can not be applied in this case since the DDDs for ACEi are based on their use for hypertension.

The practical details of strategy (recommended algorithms) for switching patients with CHF from 2 common non–evidence-based BB (such as metoprolol tartrate or atenolol) to bisoprolol, carvedilol CR or metoprolol succinate were developed (40–41). The suggested equivalent dose conversions have not been studied in clinical trials; they are based on references that discuss dose equivalency and clinical judgment, experience (derived from the degree of heart rate lowering that can be expected with each dose).

4. Perfect CHF care at discharge (perfect) is defined as the percentage of CHF patients for whom ALL components of proper CHF care were performed at discharge (if a component of care is not applied due to objective reasons, count it as appropriately performed for the purpose of this measure). It includes following *components:* ACEi/BB use and ACEi/BB dose, warfarin prescription rate, patient education, smoking cessation counseling, influenza/pneumococcal immunization (7–8). Patient education is defined as percentage of CHF patients with documentation of having received written instructions addressing all of the following: diet (salt/fluid restriction), activity/exercise level, avoiding or minimizing use of NSAIDs and excessive alcohol consumption, discharge medication schedule, weight monitoring (self-measurement of daily weights at home), follow-up appointment (arranged within 4 weeks of discharge) and instructions regarding action to take in event of (what to do if) weight increase or CHF symptoms worsening (prompt seek medical attention, increase diuretic dose). Patient education may be documented in the medical record even if it was done in a rushed or superficial manner at discharge, making it unlikely to affect outcomes.

Often, several individual QM are used to assess care of the same condition. Guidelines recommend that ALL patients with systolic CHF undergo treatment with an ACEi and BB, unless contraindicated (5–6). Adherence is determined by applying *"ALL-or-none"* approach to QM measurement at the patient level because improvement in patient outcomes requires improvement in ALL components of care (42). These components interact each other synergistically and partial execution may be insufficient to achieve better outcome. It is true that all components are not equal with respect to their influence on patient outcomes. As researchers learn more about their relative contribution, weighting schemes can be developed and tested. The component, which does not add significantly to improved outcomes when it is included in the combined bundle, should be eliminated to reduce waste of time, effort and cost, which is also one of the general goals of improvement. We should aspire to provide CHF patient with perfect care. This patient-centered philosophy is an important milestone and it offers a more sensitive scale for assessing improvements (many hospitals are achieving more than 90% compliance with individual components of care, this leaves little room on the scale for setting goals and measuring progress).

Conclusions

These QM is a first set of CHF- specific QM developed specifically for ALL patients with chronic heart failure. They look similar but are fairly distinct from other CHF indicator projects (7–8). We hope that they may be potentially employed in internal or cardiology departments for local CHF quality improvement initiatives. The health insurance companies have theoretically dominant and direct impact on quality of CHF care through rejection of payment for inappropriate treatment (these QM could serve as a more objective basis for inspection and control activities). Significant variations in QM between healthcare facilities should be an important issue for national cardiology societies.

The precise nature of the definition of QM may give the impression that an individual practice could be an error, when full (100%) compliance with guidelines and QM is not achieved. Maximally acceptable deviation (benchmark) from the standard QM (7), was stated for ACEi Rx > 85%, for BB Rx > 50% (for BB it is lower than for ACEi because it was recognized that BB may be more appropriately started in the outpatient setting). Physicians can deviate in certain cases from guidelines due to objective reasons, but should also document a reason(s) for this decision. Guidelines are not prescriptive. Patients vary so much from one to another in real practice that individual care is of paramount evidence and there is still an important place for clinical judgment, experience and common sense – see qualitative attributes of QM. Thus, these QM should not be used for medicolegal purposes because of these limitations. They are intended primarily for CHF quality improvement. It is needed to shift the emphasis from detection and correction of individual clinical errors to a focus on helping clinicians to improve patient care. Most medical errors are attributable more to system flaws rather than to incompetence or negligence. When an "accident" occurs,

the first question should not be who (but what) caused the accident (43). Patients give more weight to unmeasured aspects of care than to compliance with QM when choosing clinicians (44).

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