

Plasma HbA1c in the investigation of suspected heart failure in general practice: An audit of the 2018 NICE guidelines update

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ABSTRACT

Introduction: Diabetes mellitus is a known risk factor for heart failure (HF); nevertheless, many HF patients remain undiagnosed. The National Institute for Health and Care Excellence in England updated their HF guidelines in 2018, replacing the use of fasting plasma glucose with glycated hemoglobin (HbA1c), in suspected HF investigation. This audit aimed to assess this update's uptake at a general practice partnership in Colchester, England. **Materials and Methods:** The audit cycle consisted of a two-round electronic record search, for approximately 29,000 patients registered at the partnership. From November 1, 2017 to November 1, 2018 for the first round and from November 1, 2018 to March 6, 2019 for the second round, patients who had their NT pro-brain natriuretic peptide levels measured for the initial investigation of suspected HF were included in the study. Interventions put in place after the first round included an oral presentation and an illustrated guide for the general practitioners (GPs). **Results:** One hundred and ten patients, 19 in cycle 1 and 91 in cycle 2, were identified and included in the analysis. At the first round, only 31.6% of the patients had their HbA1c level measured, while 36.8% had no diabetic investigation done. At the second round, the percentage of patients who had their HbA1c level assessed increased to 59.3%. A decrease from 36.8% of patients without diabetic status assessment to 20% was observed. **Conclusions:** Lack of awareness among GPs regarding this guideline update was identified and simple interventions achieved an increase in the guideline's uptake. Regular and complete audit cycles can help GPs adhere to up-to-date guidelines. Primary care can help other organizations such as pathology laboratories keep up to date with guidelines, while primary care technology can be amended in-house to help adherence to new guidelines. We recommend the National UK Heart Failure Audit considers auditing the use of HbA1c testing in inpatients investigated for new HF.

Keywords: Audit, diabetes, general practice, HbA1c, heart failure, NICE

Introduction

Heart failure (HF) is the term used to characterize a complex clinical syndrome, in which the heart is unable to maintain the cardiac output required to meet the body's metabolic demands.^[1] It is estimated that around 26 million people around the world are living with HF, while in the United Kingdom 1.3%

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of the population is affected.^[2] The most common etiologies of HF are ischemic heart disease, hypertension, and diabetes mellitus. Interestingly, clinical and epidemiological data from the past two decades have identified diabetes mellitus as an independent cause for myocardial dysfunction and HF, in the absence of ischemic or valvular disease or other risk factors of cardiovascular disease.^[3] These findings are further supported by a recent data analysis from 14,407 adults that showed diabetes mellitus, either alone or in combination with a previous myocardial infarction, to be the most potent predictor for developing HF in the future.^[4] A different study revealed diabetes

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mellitus as the only specific predictor of HF rehospitalization in patients over 80 years old.^[5] Furthermore, even prediabetes mellitus was shown to be a risk factor for the development of HF, with over a third of patients hospitalized with HF and without a previous diagnosis of diabetes mellitus showing impaired fasting plasma glucose (FPG) or impaired glucose tolerance.^[6] Indeed, the prevalence of prediabetes and diabetes mellitus in patients with HF ranges from 25% to 40% and appears to affect the prognosis of this patient group.^[6]

The European Society of Cardiology suggests that in the non-acute setting, the plasma concentration of natriuretic peptides should be measured, as the initial investigation in patients with symptoms of suspected HF.^[7] Therefore, in the context of general practice in the United Kingdom, measuring the level of plasma NT pro-brain natriuretic peptide (NT pro-BNP) is the investigation of choice to establish a working diagnosis of HF, before a referral for echocardiography is made. In addition to that, the National Institute for Health and Care Excellence (NICE) in England recommends several additional investigations in primary care, to assess aggravating factors of HF, including assessing glycemic status.^[8] Until September 2018, NICE recommended measuring FPG levels, to identify concomitant diabetes or prediabetes mellitus, at the time of initial investigation of suspected HF in primary care. The 2018 update recognizes the move toward measuring plasma glycated hemoglobin (HbA1c) levels when diagnosing and monitoring diabetes mellitus and therefore recommends measuring plasma HbA1c levels when investigating suspected HF.

The high prevalence of both diagnosed and undiagnosed diabetes or prediabetes mellitus in HF patients and its significantly adverse effect on the disease prognosis underline the need for early identification of abnormal glycemic status and its prompt management. Ideally, this should be achieved at the timepoint of suspected HF investigations and by using plasma HbA1c. General practitioners (GPs) have a unique role to play in this, as more often than not they encounter patients presenting in primary care with stable HF. This allows them to screen these patients for diabetes or prediabetes mellitus and treat it and thus effectively improve the prognosis of these patients. Taking these issues into consideration, the primary aim of this audit was to assess whether GPs are screening new suspected cases of HF for diabetes or prediabetes mellitus and to identify the degree of uptake of this updated guideline, in a partnership of general practice surgeries in Colchester, England.

Materials and Methods

In November 2018, the first round of the audit cycle was conducted, via a retrospective study of medical records of patients being investigated for previously undiagnosed, clinically suspected HF. Using the electronic medical record system “SystemOne,” the medical records of approximately 11,400 patients, registered with this practice partnership in Colchester at the time, were searched. During the period from

November 1, 2017 to November 1, 2018, all patients who had their plasma NT pro-BNP level measured for the initial investigation of clinically suspected HF were included in the study. Details of demographic variables, including age and gender, and laboratory tests, in particular whether FPG or plasma HbA1c levels were measured, were collected. In total, the records for 19 patients were identified in the first audit round and were included in the analysis.

After the completion of the first round of record searching, quality improvement interventions were put in place, to bring the attention of GPs working at the partnership to the recent NICE guideline update, as well as to the steps needed to comply with it. The interventions included an oral presentation of the first-round findings delivered at a practice meeting, which all GPs attended. Furthermore, it was identified that “SystemOne” had a preselected list of laboratory tests, as set by the regional pathology laboratory and including an FPG level in accordance with the older NICE guidelines. The system prompted the GPs to order these preselected tests every time they ordered a plasma NT pro-BNP level measurement. Having identified that, an illustrated guide for the partnership’s GPs was prepared, outlining how to customize the test order to include plasma HbA1c instead of FPG [Figure 1]. This was posted in various locations in the practice surgeries and was also disseminated to all practicing GPs via email.

In March 2019, the second round of the audit cycle was conducted, using the same record-searching method as the first audit round. The records of approximately 29,900 patients were searched during this round, as two more general practice surgeries of 5000 and 13,500 patients merged with the partnership. During the period from November 1, 2018 and March 6, 2019, all patients who had their plasma NT pro-BNP level measured for the initial investigation of clinically suspected HF were included in the study. Any duplicate patients who had appeared in the first audit cycle were excluded. The same details from the patients’ records as during the first cycle were collected. In total, the records for 91 patients were identified in the second audit round and were included in the analysis.

Results

In total, 110 patients, 19 in the first cycle and 91 in the second cycle, were included in the analysis. Of the total number of patients, 62 (56.4%) were female, and this percentage was more or less consistent in both the first and second audit rounds (52.7% and 57.1%, respectively) [Table 1]. The highest proportion of patients at 41.8% was in the 65–79 age group, which was again consistent in both audit rounds (first round at 52.6% and second round at 39.6%).

At the time of the first audit round, only 31.6% of the patients who were investigated by their GPs for clinically suspected new HF had their plasma HbA1c level measured [Table 2]. Over a third of patients (36.8%) had no investigation done to assess

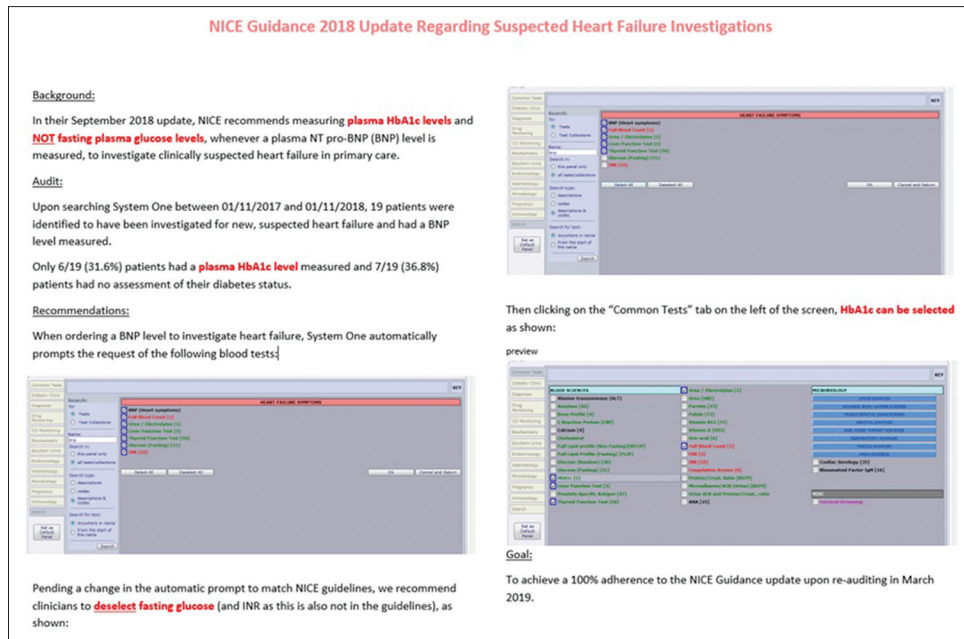


Figure 1: Illustrated poster guide outlining how to customize the blood test order to include plasma HbA1c instead of fasting plasma glucose, when ordering plasma NT pro-BNP levels

Table 1: Characteristics of suspected new heart failure patients at this general practice partnership from November 1, 2017 to March 6, 2019

| Characteristic | Audit round 1 | | Audit round 2 | | Total | |
|----------------|---------------|------------|---------------|------------|--------|------------|
| | Number | Percentage | Number | Percentage | Number | Percentage |
| Sex | | | | | | |
| Male | 9 | 47.4 | 39 | 42.9 | 48 | 43.6 |
| Female | 10 | 52.6 | 52 | 57.1 | 62 | 56.4 |
| Age | | | | | | |
| <50 | 0 | 0 | 7 | 7.7 | 7 | 6.4 |
| 50-64 | 1 | 5.3 | 21 | 23.1 | 22 | 20 |
| 65-79 | 10 | 52.6 | 36 | 39.6 | 46 | 41.8 |
| 80-94 | 8 | 42.1 | 27 | 29.6 | 35 | 31.8 |

Table 2: Laboratory investigations for diabetes mellitus status assessment in patients with suspected new heart failure at the time of NT pro-BNP plasma level measurement at this general practice partnership from November 1, 2017 to March 6, 2019

| Laboratory test | Audit round 1 | | Audit round 2 | |
|-----------------|---------------|------------|---------------|------------|
| | Number | Percentage | Number | Percentage |
| HbA1c | 6 | 31.6 | 54 | 59.3 |
| FPG | 6 | 31.6 | 30 | 33.0 |
| None | 7 | 36.8 | 18 | 20.0 |

HbA1c=Glycated hemoglobin, FPG=Fasting plasma glucose

their diabetes mellitus status, at the time of suspected HF investigation. At the second audit round, 4 months after the first round and the interventions undertaken, the percentage of patients who had their plasma HbA1c level assessed increased to a majority of 59.3%. The percentage of patients having their FPG level measured remained largely unchanged (31.6–33.0%), as a number of patients in the second audit round had both

FPG and HbA1c measured. Furthermore, the patients who had no assessment of their diabetes mellitus status during their initial HF investigation decreased from over a third (36.8%) to only a fifth.

Discussion

The importance of auditing the quality of care received by HF patients in the United Kingdom has been clearly demonstrated over the years, with annual reports from the National Cardiac Audit Program.^[9] The emphasis of these audits, however, is on hospital admissions for HF, focusing on in-hospital diagnostic investigations of the condition (electrocardiography and echocardiography), as well as treatment adherence after discharge and patient outcomes.^[10,11] This approach seems to be replicated in other countries, overlooking the importance of investigating comorbidities in HF such as diabetes mellitus.^[12] In fact, a recent prospective study of 8399 patients with HF has identified using plasma HbA1c levels, that 1106 (13% of total) patients had

undiagnosed diabetes mellitus and 2103 (25%) had prediabetes mellitus.^[13] Furthermore, the same study reported a hazard ratio for HF hospitalization or cardiovascular mortality of 1.39 for patients with undiagnosed diabetes mellitus and 1.27 for patients with prediabetes mellitus. The usefulness of plasma HbA1c level as a risk stratification tool in HF patients with comorbid diabetes mellitus was shown in a study of 6935 chronic HF patients.^[14] In the patient subgroup with diabetes mellitus, higher plasma HbA1c levels were independently associated with increased risk of all-cause death or cardiovascular hospitalization, within a median of 3.9 years. A different study in hospitalized HF patients concluded that higher plasma HbA1c was associated with prolonged hospital stay.^[15] Additionally, studies in the general population have indicated that FPG measurements tend to underestimate the burden of undiagnosed diabetes mellitus when compared to plasma HbA1c by a factor of 0.5.^[16,17] Moreover, plasma HbA1c was shown to be a more accurate predictor of progression of prediabetes to diabetes mellitus.^[18] These results emphasize the importance of early identification of diabetic status during the diagnostic work-up of patients with suspected HF, preferably using plasma HbA1c as a more accurate diagnostic and prognostic marker. Primary care physicians have a unique opportunity to achieve this in their practice, by encountering HF patients early in the disease course. This allows them to intervene early and potentially prevent some of the adverse effects on their patients.

Therefore, in light of these results and the NICE HF guidelines update coming into effect in September 2018, the purpose of this audit was to assess the adherence of GPs to the latter. To the best of our knowledge, no audits have been performed in the primary care setting in the United Kingdom, to assess the degree of uptake of the new guidelines. The results of the first audit round suggest that prior to our interventions, a high proportion of patients presenting to this general practice partnership with clinically suspected new HF were not investigated for diabetes mellitus status, with either method. This represents an area requiring significant improvement in the standard of care of this patient population. The low proportion of patients having their plasma HbA1c level measured at the first audit round (less than a third) was somewhat expected, since the specific record search took place only 2 months after the updated guidelines were released by NICE. Despite this, it was decided to undertake the audit, feedback, and education approach, which was shown to be effective in improving the uptake of guidelines in different settings,^[19] while a re-audit was planned for 4 months later to complete the cycle and assess for intervention effectiveness.

During the practice meeting, which all GPs working at the partnership attended, their attention was brought to the NICE guideline update, and reasons for noncompliance to the new guidelines were identified. These included lack of awareness among GPs regarding the changes proposed by the new guideline. Furthermore, as described earlier in the Materials and Methods section, as the regional pathology laboratory did not update their software in time for the updated NICE guidelines release,

GPs were misled into automatically choosing to order an FPG measurement. Only a small number of GPs were aware that the pathology laboratory's preselected investigation list, linked to ordering a plasma NT pro-BNP test, could be manually customized. Reasons for not performing any investigation for diabetes mellitus status, despite FPG measurements being suggested by NICE guidelines prior to the 2018 update, were not identified. Following this meeting and the preparation of our illustrated guide for customizing the plasma NT pro-BNP-related blood tests request [Figure 1], an attempt was made to liaise with the regional pathology laboratory and ensure that a software update is achieved. Unfortunately, despite our efforts, this wasn't achieved prior to the second audit round.

The results of the second audit round suggest that our interventions were effective in improving adherence to the recommendation of investigating diabetes mellitus status in patients with suspected HF in primary care, with 80% of patients now having one or both tests done. Furthermore, the proportion of patients having the recommended investigation (plasma HbA1c level) ordered reached almost 60%, at 4 months after our interventions. Our results therefore reinforce the importance of a complete audit cycle, with at least two rounds, in assessing and improving adherence to clinical guidelines. Unfortunately, previous research suggests that although a plethora of audits is undertaken by clinicians, in over three quarters of them the loop was not closed by re-auditing, thus undermining their effectiveness and wasting resources.^[20] Having shown with this audit that simple interventions such as GP information and re-education are effective, we recommend regular auditing and re-auditing of new guideline updates, to achieve even higher adherence rates. In particular, our results demonstrate that a complete audit cycle is a good way of helping primary care clinicians, who tend to work more in isolation than other specialists, to stay up to date and adhere to new guidelines. Theoretically, a 100% adherence rate to the specific NICE HF guidelines could be achieved, with an updated preselected list of blood investigations, replacing FPG with plasma HbA1c, to accompany all plasma NT pro-BNP orders. Although in practice this was not achieved prior to the second round of our audit, we recommend that pathology laboratories that use electronic investigation systems, such as "SystemOne," should keep their software up to date and in line with new guidelines. A further re-audit of the specific guidelines is also recommended, after such software updates are implemented, in conjunction with frequent reminders to GPs. Our audit therefore emphasizes the point that primary care can play a fundamental role in helping other organizations they work with keep up to date with guidelines and raising the standard of care of their patients. In addition to that, we have showcased that primary care technology can sometimes be amended in-house to help improve adherence to new guidelines.

Concluding, our audit acts as a reminder to GPs and primary care physicians about the importance of diabetes mellitus in the prognosis of HF and in emphasizing that plasma HbA1c is now

test of choice to check for diabetes mellitus status, including in patients with HF. Finally, we are hopeful that our results will prompt the National UK Heart Failure Audit to consider auditing the use of plasma HbA1c testing, in inpatients newly diagnosed or being investigated for new HF during that admission, and whose diabetes mellitus status is unknown, and the effect of that on patient outcomes.

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Conflicts of interest

There are no conflicts of interest.

References

- Kemp CD, Conte JV. The pathophysiology of heart failure. *Cardiovasc Pathol* 2012;21:365-71.
- Ponikowski P, Anker SD, AlHabib KF, Cowie MR, Force TL, Hu S, *et al.* Heart failure: Preventing disease and death worldwide. *ESC Heart Fail* 2014;1:4-25.
- Lehrke M, Marx N. Diabetes mellitus and heart failure. *Am J Cardiol* 2017;120:S37-47.
- Bergsten TM, Donnino R, Wang B, Nicholson A, Fang Y, Natarajan S. Predicting adults likely to develop heart failure using readily available clinical information. *Prev Med* 2019;130:105878.
- Hakuno D, Fukae T, Takahashi M, Takiguchi S, Li HC, Nishizawa K, *et al.* Combinations of cardiac and non-cardiac predictors for prognoses in patients with acute heart failure. *Eur Heart J Qual Care Clin Outcomes* 2019;1093. doi: 10.1093/ehjqcco/qcz059.
- Matsue Y, Suzuki M, Nakamura R, Abe M, Ono M, Yoshida S, *et al.* Prevalence and prognostic implications of pre-diabetic state in patients with heart failure. *Circ J* 2011;75:2833-9.
- Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, *et al.* 2016 ESC 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 J Heart Fail* 2016;18:891-975.
- National Institute for Health and Care Excellence (2018) Chronic heart failure in adults: Diagnosis and management (NICE Guideline 106). Available from: <https://www.nice.org.uk/guidance/ng106/chapter/Recommendations#diagnosing-heart-failure>. [Last accessed on 2019 Sep 08].
- Healthcare Quality Improvement Partnership NATIONAL HEART FAILURE AUDIT 2019 Summary Report (2017/18 data). Available from: <https://www.hqip.org.uk/wp-content/uploads/2019/09/Ref-129-Cardiac-Heart-Failure-Summary-Report-2019-FINAL.pdf>. [Last accessed on 2019 Sep 16].
- Kmietowicz Z. More patients are surviving heart failure, audit finds. *BMJ* 2017;358:j3860.
- Emdin CA, Conrad N, Kiran A, Salimi-Khorshidi G, Woodward M, Anderson SG, *et al.* Variation in hospital performance for heart failure management in the National Heart Failure Audit for England and Wales. *Heart* 2017;103:55-62.
- Khalil V, Danninger M, Wang W, Khalil H. An audit of adherence to heart failure guidelines in an Australian hospital: A pharmacist perspective. *J Eval Clin Pract* 2017;23:1195-202.
- Kristensen SL, Preiss D, Jhund PS, Squire I, Cardoso JS, Merkely B, *et al.* Risk Related to pre-diabetes mellitus and diabetes mellitus in heart failure with reduced ejection fraction: Insights from prospective comparison of ARNI with ACEI to determine impact on global mortality and morbidity in heart failure trial. *Circ Heart Fail* 2016;9:e002560.
- Dauriz M, Targher G, Temporelli PL, Lucci D, Gonzini L, Nicolosi GL, *et al.* Prognostic impact of diabetes and prediabetes on survival outcomes in patients with chronic heart failure: A post-hoc analysis of the GISSI-HF (Gruppo Italiano per lo Studio della Sopravvivenza nella Insufficienza Cardiaca-Heart Failure) trial. *J Am Heart Assoc* 2017;6:e005156.
- Echouffo-Tcheugui JB, Sheng S, DeVore AD, Matsouaka RA, Hernandez AF, Yancy CW, *et al.* Glycated hemoglobin and outcomes of heart failure (from Get With the Guidelines-Heart Failure). *Am J Cardiol* 2019;123:618-26.
- Ho-Pham LT, Nguyen UDT, Tran TX, Nguyen TV. Discordance in the diagnosis of diabetes: Comparison between HbA1c and fasting plasma glucose. *PLoS One* 2017;12:e0182192.
- Rosella LC, Lebenbaum M, Fitzpatrick T, Zuk A, Booth GL. Prevalence of prediabetes and undiagnosed diabetes in Canada (2007-2011) according to fasting plasma glucose and HbA1c screening criteria. *Diabetes Care* 2015;38:1299-305.
- Kim CH, Kim HK, Kim EH, Bae SJ, Choe J, Park JY. Risk of progression to diabetes from prediabetes defined by HbA1c or fasting plasma glucose criteria in Koreans. *Diabetes Res Clin Pract* 2016;118:105-11.
- Vratsistas-Curto A, McCluskey A, Schurr K Use of audit, feedback and education increased guideline implementation in a multidisciplinary stroke unit. *BMJ Open Qual* 2017;6:e000212.
- Gnanalingham J, Gnanalingham MG, Gnanalingham KK. An audit of audits: Are we completing the cycle? *J R Soc Med* 2001;94:288-9.