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A Clinical Dashboard to Reduce Missed Opportunities to Measure Dialysis Adequacy

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Abstract

In the local department, pre-pilot dialysis adequacy data was housed in a spreadsheet with manually entered, month-old data, inaccessible to clinic staff. The inoperability of the local QAPI workbook and EHR as well as data inaccessibility to staff resulted in missed opportunities to measure Kt/V. Based on the synthesis of evidence, dashboards have been utilized in a variety of interdisciplinary clinical settings with positive outcomes in addressing patient care gaps. The purpose of this pilot was to implement the Epic Dashboard that displays automated, real-time quality metric data to reduce missed opportunities to measure Kt/V in the outpatient HD setting. To evaluate dashboard efficacy, the proportion of missed opportunities to measure Kt/V three months pre-implementation was compared to the proportion of missed opportunities three months post-implementation; results did not show a statistically significant difference in missed opportunities to measure Kt/V. Counterbalance surveys to assess perceived impact by local staff yielded themes of sufficient education, dashboard ease of use, and enhanced ability to impact patient outcomes. The results of this QI pilot demonstrated the need for further research to better understand the development, utilization, and associated benefits of data dashboard integration in the clinical setting.

Key Words:

Data dashboard; Nursing; Completeness of care; Outpatient hemodialysis; Dialysis adequacy

Chronic kidney disease (CKD) is a worldwide public health concern, affecting approximately 10% of the global population. This disease is progressive, resulting in subsequent loss of renal function. Hemodialysis (HD) or renal replacement therapy is a life-sustaining treatment often indicated in the late stages of CKD, especially the fifth stage known as End-Stage Renal Disease (ESRD).[1] Unfortunately, the complexity of ESRD and this population's HD dependency has resulted in poor morbidity and mortality outcomes as well as high associated healthcare costs throughout the United States (U.S.).[2]

In response to the Affordable Care Act of 2010,[2] the Centers for Medicare and Medicaid Services (CMS) implemented the ESRD Quality Incentive Program (QIP), introducing a pay-per-performance or value-based payment model.[3] Clinical performance measures (CPMs) are nationally accepted benchmarks adopted by CMS to evaluate an institution's in-center HD care quality for public knowledge and institutional financial reimbursement. Using the pay-per-performance model, a healthcare institution's CMS reimbursement for services rendered is directly related to their CPM outcomes [3]; a retrospective cohort study found that facilities with higher QIP scores exhibited more favorable patient survival outcomes when compared to facilities with lower QIP scores.[4] In an effort to optimize outcomes and revenue, Quality Assurance Performance Improvement (QAPI) is a systematic, all-encompassing, and evidence-based approach for institutions to improve performance and healthcare quality.[5]

Dialysis adequacy is an intermediate ESRD CPM and is defined as the ability to rid the blood of accumulated toxins.[6] To calculate single pool dialysis adequacy using the Daugirdas II Kt/V formula for thrice weekly dialysis sessions, the following data is required: pre- and post-dialysis weight and blood urea nitrogen (BUN), length of the HD treatment, and the amount of volume removed. To calculate standardized Kt/V for patients dialyzing any frequency other than

24 thrice weekly, additional data including 24-hour urine urea nitrogen, creatinine clearance, and

25 urine volume; interdialytic period; age; and sex are required. Kt/V is a numeric value where

26 single pool < 1.2 is inadequate and ≥ 1.2 is adequate for patients dialyzing three times per week,

27 and standardized < 2.0 is inadequate, and ≥ 2.0 is adequate for patients dialyzing any frequency

28 other than three times per week[6]. Research studies show that patients dialyzing three times

29 weekly whose single pool Kt/V is ≥ 1.2 have better survival outcomes as compared to patients

30 whose single pool Kt/V is < 1.2. There is an increased risk of mortality in patients with lower

31 Kt/V.[7]

32   The success of healthcare institutions conforming to the pay-per-performance model has

33 depended heavily on the validity of the defined quality metrics, as well as the infrastructure by

34 which system data is organized, tracked, and reported.[8] The development of the electronic health

35 record (EHR) has afforded healthcare institutions the accessibility of largescale aggregate

36 clinical data. However, despite innovations in the EHR, gaps in the usability and completeness of

37 data remain an issue.[9] Over the years of data collection and review, gaps in care have become

38 evident and presented opportunities for quality improvement (QI) to optimize outcomes and

39 institutional revenue.[8]

40   The local pilot department was a 24-chair, in-center outpatient HD clinic part of a large

41 Midwest-based healthcare enterprise. The clinic was staffed with 14 registered nurses (RNs) and

42 14 certified hemodialysis technicians (CHTs), as well as other interdisciplinary team members

43 including physicians, nurse practitioners, pharmacists, dieticians, social workers, and nursing

44 leadership. Each of the 24 chairs could accommodate two patients per day (one in the morning

45 and one in the afternoon), making the maximum unit census 96 patients per week. However, unit

46 census fluctuated depending on community HD needs, patient travel, hospitalizations, and

47 deaths. The majority of patients underwent HD thrice weekly, on either Monday, Wednesday,

48 Friday, or Tuesday, Thursday, Saturday. However, some patients dialyzed routinely, only twice

49 or four times per week based on individualized needs.

50   The local department interdisciplinary leadership team comprised the medical director,

51 nurse practitioner, pharmacist, nurse manager, dietician, and social worker, engaged in monthly

52 unit-based QAPI review. However, the pre-pilot QAPI workbook was a spreadsheet that housed

53 CPM data, was inaccessible to clinical staff, including the department of nursing, and inoperable

54 with the institution's EHR. Subsequently, hours of retrospective manual data entry were required

55 to record month-old data that was underutilized by nursing, resulting in missed opportunities to

56 measure dialysis adequacy. The inoperability of the pre-pilot QAPI workbook and EHR in

57 conjunction with the workbook's inaccessibility proved to be barriers to use and resulted in

58 patient care gaps.

59 **AVAILABLE KNOWLEDGE**

60   In the setting of local gaps in patient care, a review of research evidence suggested that

61 implementing a data dashboard may mitigate shortcomings of the QAPI workbook and enhance

62 the completeness of care. A data dashboard is an electronic tool that augments the EHR by

63 displaying relevant clinical data to allow end-user analysis and usability.[9] Wilbanks and

64 Langford[10] more specifically define a data dashboard as "a data-driven clinical decision support

65 tool capable of querying multiple databases and providing a visual representation of key

66 performance indicators in a single report." According to the evidence, data dashboards add value

67 to data accessibility, use, and analysis to address gaps in care and inform clinical decision-

68 making.[9]

69   A total of 16 research articles were reviewed and synthesized, including one clinical

70   guideline[11], three systematic reviews,[10,12,13] two quasi-experimental studies,[14,15] and ten

71   descriptive studies.[2,8,9,16-22] Throughout the research literature, dashboards have been utilized in a

72   variety of clinical settings by interdisciplinary healthcare team members with positive outcomes.

73   [2,8-10,12-22] Of those reviewed, one study was conducted in the HD setting[2], and four included

74   nursing participation[2,10,16,22]; these studies consistently echoed positive themes associated with

75   dashboard use in a variety of other settings and user disciplines. Common benefits of

76   implementing a dashboard include enhanced patient safety and quality of care, [2,8-10,12-22]

77   improved efficiency and communication,[8-10,12-22] usability of the data,[8,9,12-19,21,22] and the

78   applicability for interdisciplinary care coordination. [2,9,10, 12,14-19,21] While the existing research

79   evidence surrounding the use of a dashboard in the healthcare setting yielded promising results,

80   knowledge gaps remain.

81   There is limited high-quality evidence surrounding the use of a dashboard; further

82   research is warranted to examine the optimization of dashboard development and its use by an

83   array of interdisciplinary users throughout a variety of specialty clinical settings. There is no

84   standardized guideline for dashboard development therefore, there is variation in dashboard

85   content, design, and display with the same principle conceptual characteristics defined by

86   Wilbanks and Langford.[10] Additionally, setting and participant heterogeneity of the research may

87   point to potential generalizability of findings across specialties and disciplines however, it does

88   impact the reliability of findings. Overall, research evidence supported the use of a dashboard

89   with the need for further investigation to optimize the development, utilization, and associated

90   benefits of dashboard use in the clinical setting.

91   **RATIONALE**

92   The local department was selected by organizational leadership to pilot a data dashboard

93   within the organization's EHR (Epic) as it consists of a larger pool of patients than many other

94   in-center, outpatient HD clinics within the system and the nurse administrator volunteered for the

95   department. Prior to this QI pilot, the dashboard was created by the Epic Systems Corporation

96   information technology and local nursing leadership teams. Therefore, it was out of the scope of

97   this QI pilot to design, develop, or change the Epic Dashboard. The data dashboard will be

98   further referenced as the Epic Dashboard. The leadership team had identified four distinct gaps

99   with the use of the QAPI spreadsheet: (a) inaccessibility of quality data to nursing staff; (b)

100   inability to identify missed bloodwork, crucial for evaluating patient's care plan and dialysis

101   status; (c) inoperability within the current EHR; (d) time spent for manual data entry by the

102   quality specialist. Implementation of the Epic dashboard was assumed to have minimal

103   impedance on clinical workflow, as the dashboard could be quickly accessed, and data

104   interpreted at a glance.

105   The Nursing Role Effectiveness Model (NREM) provided a framework to conceptualize

106   dashboard incorporation into the nursing role and its impact on patient outcomes.[23] NREM

107   delineates relationships between the structure, the nurse's role, and clinical outcomes to improve

108   the quality of nursing care and positively impact patient outcomes. It is based on the Donabedian

109   Model of high-quality care with a strict focus on the role of a nurse. The structure consists of

110   three variables: the nurse's experience, knowledge, and skill set; the organizational environment

111   including staffing patterns, workload, workflow, and assignments; and the patient clinical status,

112   acuity, and morbidity. These multivariable factors impact the nurse's independent, dependent,

113   and interdependent roles. This model guides QI for the multidimensional facets that influence the

114   ability of nurses to function efficiently in their various roles and subsequently impact outcomes.

115   For example, dashboard integration within the department of nursing workflow influenced

116   independent, dependent, and interdependent roles, influencing Kt/V measurement outcomes.

117   In addition to the NREM, the Iowa Model Revised: Evidence-Based Practice to Promote

118   Excellence in Healthcare guided the Epic Dashboard QI initiative.[24] This model outlined seven

119   clearly defined steps for evidence-based practice change implementation.[25] The DNP student

120   authors integrated this stepwise process throughout the Epic Dashboard pilot planning,

121   implementation, and dissemination. Model feedback loops provided opportunities to reassess and

122   improve the process in a methodical manner throughout the project. The model also identified

123   final steps to sustain change and disseminate the results, facilitating effective handoff within the

124   local department and pursuing of professional dissemination opportunities following project

125   completion. The Iowa Model was used with permission from the University of Iowa Hospitals

126   and Clinics, copyright 2015.

127   **SPECIFIC AIMS**

128   The primary aim of this QI pilot was to implement the Epic Dashboard to provide

129   accessible, real-time data for routine integration into the local department of clinical nursing

130   practice to aid decision-making and address gaps in patient care. The clinical question guiding

131   the QI pilot was: In the outpatient HD setting, does the implementation of a data dashboard with

132   automated, real-time data accessible to the department of nursing, reduce the number of missed

133   dialysis adequacy values measured by Kt/V as compared to the current spreadsheet with

134   manually entered, month-old data? In pursuit of advancing the scientific community's

135   knowledge of dashboard intervention, the purpose of this report is to disseminate the

136   background, evidence synthesis, methods, and results of this QI pilot.

137   **METHODS**

138   This QI initiative was deemed exempt from review by the Winona State University and

139   local organization's Institutional Review Boards. The Squire 2.0 guidelines were followed to

140   report the initiatives and findings.[26]

141   **Context**

142   The local department nursing leadership team, comprised of the nurse administrator,

143   quality specialist, and nurse manager, was supportive of the Epic Dashboard and actively

144   involved in discussing its implementation. The implementation of this tool was an organizational

145   initiative and department priority to provide complete care for dialysis patients, thus well-

146   supported by the institution and its leadership team.

147   The project began by completing a broad assessment of the outpatient dialysis system

148   through shadowing interdisciplinary team members throughout their workday. These shadow

149   experiences aimed to enhance understanding of how various roles are integrated into the

150   outpatient dialysis clinical practice and to become familiar with the day-to-day workflow. The

151   shadow experiences also provided insight into key stakeholders that would be integral for

152   implementation. It is important to differentiate that stakeholders who designed the dashboard

153   differed from the stakeholders who were involved with its implementation. This lack of local

154   stakeholder involvement was secondary to the Epic Systems Corporation initiating the dashboard

155   design, and the department for the pilot phase was not yet known, and therefore not engaged.

156   The stakeholders involved in implementing the Epic Dashboard include the nurse administrator,

157   quality specialist, nurse manager, RNs, and CHTs. Through various shadow experiences, it was

158   identified that department of nursing roles desired to be provided with opportunities to voice

159   their concerns and share their expertise. A volunteer unit champion was appointed to represent

160   their peers as it was not feasible to have every individual actively involved in meetings. The

161   champion's first-hand knowledge and clinical expertise ensured the implementation of the Epic

162   Dashboard maintained workflow efficiency and added value to patient care.

163   The benefits and the risks were critically appraised with the nursing leadership team,

164   DNP student authors, and the volunteer champion to ensure the utility of the Epic Dashboard.

165   Identified benefits included providing timely, accessible data for nursing to use as a tool to

166   provide thorough, appropriate care for patients according to a standard guideline. An identified

167   risk was the potential to overwhelm the RNs and CHTs with an additional task. It was identified

168   that appropriate education for the RNs and CHTs, and engagement from a volunteer champion

169   would reduce the risk. Therefore, the benefits of implementing the Epic Dashboard outweighed

170   the identified risks.

171   RNs and CHTs on the unit were engaged in improving patient care with a strong desire to

172   optimize patient outcomes, which supported a pilot of the Epic Dashboard. Per local department

173   of nursing anecdotal feedback (personal communication, October 2021), many RNs and CHTs

174   preferred discussing the Epic Dashboard face-to-face in addition to electronic communications,

175   and the small pool of unit staff makes this style of education feasible. Educating RNs and CHTs

176   was neither time-consuming nor costly. The RNs and CHTs were educated on how to access the

177   dashboard through a multimodal approach including a face-to-face education session, recorded

178   Zoom meeting, one-to-one Epic Dashboard coaching by DNP student authors, in addition to

179   written instructions provided via email, with physical copies placed at each nursing station. This

180   approach to communicating the implementation in various ways ensured individuals received the

181   appropriate information in a format understood best by each individual. Educating RNs and

182   CHTs on using the Epic Dashboard provided no known risks with no foreseeable negative

183   impact on patients.

184   To ensure the Epic Dashboard accurately reflected the data, the local leadership team

185   cross-referenced the values in the manually entered data spreadsheet with the Epic Dashboard.

186   Any identified discrepancies were brought forward to the Epic Systems Corporation information

187   technology (IT) team to troubleshoot and rectify.

188   **Intervention**

189   Incorporating the Epic Dashboard into workflow did not require additional human or

190   physical resources such as extra staff, extended hours, new equipment, or extra space within the

191   clinic. The expectation was for both RNs and CHTs to access the tool every Monday and

192   Tuesday, assessing missed opportunities to measure dialysis adequacy within their respective

193   patient assignments. A missed opportunity was identified as either not obtaining Kt/V for the

194   month if the patient is dialyzed three or four times per week, Kt/V is not obtained once per

195   quarter for patients that are dialyzed twice per week, or the Kt/V for the respective timeframe

196   was inadequate as identified by CMS [6] and was not rechecked a second time during that period.

197   The Dashboard Action Algorithm (Figure 1) was composed by DNP student authors and made

198   available to staff to aid in clinical decision-making. If a missed opportunity to measure Kt/V was

199   identified, the individual would follow unit protocol by notifying the charge nurse and provider

200   team, obtain appropriate orders, fulfill as prescribed, and ensure documentation of steps taken.

201   Once the staff was educated on the intervention, a pilot phase was trialed for one quarter,

202   during April, May, and June 2022. During the first month of implementation, DNP student

203   authors were present on Mondays and Tuesdays as a resource for staff. This presence allowed

204   DNP student authors to spend one-on-one time with RNs and CHTs answering questions,

205   reiterating the importance of the dashboard, and providing individualized discussion of the

206   workflow along with expectations. This also provided the DNP student authors opportunities to

207 implement Plan-Do-Study-Act (PDSA) cycles for rapid improvement changes as needed. During

208 the second month, the DNP student authors were present every other Monday to answer

209 lingering questions and for the third month, they were not physically present on the unit but

210 accessible via phone or email if questions or concerns arose; RNs or CHTs did not contact the

211 DNP students after the second month of the pilot.

212   Initially, the project team, comprised of the nursing leadership team and the DNP student

213 authors, met twice monthly and then monthly to evaluate the Epic Dashboard implementation

214 and review staff feedback. Team discussion aided in the continued use of PDSA cycles. Some

215 PDSA cycles included: printing the dashboard to record actions taken to address missed

216 opportunities to measure Kt/V to prevent duplicate provider communications, clustering

217 dashboard communications to the provider, transitioning from staff assessing missed

218 opportunities to measure Kt/V for their patient assignment to one staff reviewing all cohort data,

219 reducing the frequency of dashboard access from Monday and Tuesday to only Monday.

220 **Study of the Intervention**

221   To identify any potential change in missed opportunities to measure Kt/V, the proportion

222 of missed opportunities pre-implementation was compared to the proportion of missed

223 opportunities post-implementation. First, the number of missed opportunities pre- and post-

224 implementation were compared to the total number of opportunities to assess Kt/V for each

225 respective timeframe, resulting in a proportion for each. This dichotomous, categorical variable

226 was gathered from the reports. Any difference between the proportions pre- and post-

227 implementation was then assessed using Pearson's chi-squared test, assessing statistical

228 significance. This statistical analysis strategy was reviewed with statistician Dr. S. Bergen and

229 his class of student statistician consultants (S. Bergen, personal communication, October 20,

230   2021). It was assumed that any difference between pre- and post-implementation was due to the

231   Epic Dashboard as there were no other significant changes in the department.

232   An anonymous counterbalance survey was administered to stakeholders after three

233   months of dashboard implementation to assess potential unintended negative effects of the Epic

234   Dashboard. This survey was developed in conjunction with the champion and addressed the use

235   of the dashboard, role impact, and perceived ability to impact patient outcomes. An anonymous

236   survey was believed to elicit more accurate feedback; therefore, responses were deidentified. The

237   RNs and CHTs were allotted two weeks to complete the survey, with an email reminder sent to

238   all individuals after one week.

239   **Measures**

240   The proportion of missed opportunities to measure Kt/V three months prior to

241   implementing the Epic Dashboard was statistically compared to the proportion of missed

242   opportunities to measure Kt/V three months post-implementation. Tracking the pre-

243   implementation missed Kt/V values was completed using the QAPI spreadsheet. These missed

244   opportunities were historically tracked for the three months of October, November, and

245   December 2021. Tracking post-intervention missed Kt/V values was completed using the Epic

246   Dashboard for the three months of April, May, and June 2022. The months of January, February,

247   and March 2022 were omitted from data collection to avoid confounding as the RNs and CHTs

248   will be educated on the Epic Dashboard to address missed opportunities to measure Kt/V.

249   To maintain respondent anonymity, the survey was sent out via Microsoft Forms, which

250   was part of Microsoft Office 365, after completion of the pilot phase. The survey consisted of

251   five questions with 5-point Likert scale responses (strongly agree, agree, neither agree nor

252   disagree, disagree, strongly disagree). It also included an area for free-text feedback regarding

253   the Epic Dashboard and its use. This survey aided in gathering additional information regarding

254   aspects of the dashboard that were beneficial or burdensome and solicited constructive feedback.

255   While the counterbalance survey was not validated, it was based on questions posed by Tan et

256   al[22] evaluating usage and satisfaction of a dashboard in nurses working at a hospital in

257   Singapore. For evaluation, the proportion of each response was assessed, including the number

258   of individuals that responded favorably versus the number of individuals who did not respond

259   favorably.

260   **RESULTS**

261   **Missed Opportunities to measure Kt/V**

262   Pre-implementation of the Epic Dashboard, 2.71% of the opportunities to measure Kt/V

263   were missed. Post-implementation of the Epic Dashboard, 4.87% of the opportunities to measure

264   Kt/V were missed. While there were more missed opportunities to measure Kt/V post-dashboard

265   implementation, there is no statistically significant difference ($p < 0.05$) between missed

266   opportunities to measure Kt/V pre-dashboard implementation and post-dashboard

267   implementation ($p = 0.1988$). A review and comparison of the pre- and post-implementation

268   populations revealed that the post-implementation HD population consisted of more new patients

269   and more patient deaths than pre-implementation, which may have led to the findings.

270   **Counterbalance Measures**

271   Of the roughly 18% of staff who responded to the anonymous counterbalance survey,

272   100% agreed that adequate education was provided on Epic Dashboard use (see Figure 2). Forty

273   percent of respondents agreed the dashboard was easy to use and enhanced the user's ability to

274   impact patient outcomes. While only 20% agreed the Epic Dashboard was easy to incorporate

275   into their workflow and enhanced efficiency in their role. One individual provided free-text

276   feedback without suggestions for improvement, but an acknowledgement that the unit was short-

277   staffed and the Epic Dashboard was often forgotten about.

278   **DISCUSSION**

279   The QI pilot demonstrated the complex intricacies of implementing a dashboard to

280   address missed Kt/V values. While post-implementation results showed a trend upwards of

281   missed opportunities, these results were not statistically significant. The counterbalance survey

282   results suggest that staff education was adequate and there were no negative responses for ease

283   of dashboard use. However, the majority of respondents felt the dashboard did not enhance

284   efficiency in their role.

285   While considerable efforts were made to reduce confounding factors, there were several

286   identified challenges for this QI pilot. During the pilot phase, the department spent considerable

287   time short-staffed during post-COVID-19 surges, resulting in insufficient time for RNs and

288   CHTs to access and act upon Epic Dashboard data. Limited free time could have also presented a

289   barrier for the counterbalance survey as RNs or CHTs may not have had extra time during their

290   shift to complete it or did not complete it due to feelings of burnout. There was also nursing

291   turnover amongst the nursing leadership team as three of the four nursing leaders transferred

292   internally to another position within the institution during the QI project. It was also recognized

293   that the HD patient population presented particular challenges. The post-implementation HD

294   patient population experienced frequent hospitalizations and turnover due to deaths.

295   Additionally, patients that dialyzed twice weekly needed to collect a 24-hour urine specimen on

296   the day which monthly labs were drawn to complete the standardized Kt/V calculation, which

297   presented a timing challenge.

298   Identified limitations of the pilot include lack of ability to track who accessed the

299   dashboard and at what frequency it was accessed. During the pilot, it was also identified that the

300   dashboard was not as accurate as initially thought. There were months with duplicated patient

301   data, the Kt/V did not display accurately, manually entered Kt/V data was omitted, and Kt/V

302   calculations for patients who dialyzed any frequency other than three times per week were

303   inaccurate. Dialysis adequacy calculations for patients dialyzing any frequency other than thrice

304   weekly ultimately needed to be calculated, and entered manually, causing a delay in standardized

305   Kt/V results.

306   The strengths of this QI pilot include support from the local department, as well as the

307   healthcare organization. In addition, there was favorable evaluation of dashboard education

308   provided and identified benefit of impacting patient outcomes.

309   Future opportunities for improvement include close collaboration with dashboard

310   developers for accurate use of calculations for single pool versus standardized Kt/V values. Key

311   stakeholders and users of the Epic Dashboard should also be involved in future dashboard

312   updates and modifications. It is also recommended that nursing leadership take an active role in

313   role-modeling the Epic Dashboard, demonstrate presence during education sessions, and

314   reverberate support of the implementation and QI initiative.

315   **CONCLUSION**

316   The implementation of a dashboard to decrease the number of missed opportunities to

317   measure Kt/V in the outpatient HD setting was assessed in this QI pilot. According to the

318   counterbalance survey, the dashboard was reportedly easy to use and enhanced perceived ability

319   to impact patient outcomes. Results indicated a slight upward trend in missed opportunities to

320   measure Kt/V; however, this QI pilot did not show a statistically significant difference in pre-

321   and post-implementation data. Based on these results, opportunities for optimization of the

322   dashboard and QI within the local department were identified. The next steps include close

323   collaboration with dashboard developers to update and optimize the dashboard. Once these

324   limiting factors have been adjusted, another pilot phase may be pursued, but until then,

325   dashboard use is paused. Further research is needed to expand the scientific community's

326   knowledge of the dashboard's development, implementation, optimization, and utility in the

327   clinical setting.

References

1. Melo GAA, Rodrigues AB, Firmeza MA, Grangeiro ASM, Oliveira PP, Caetano,JÁ. Musical intervention on anxiety and vital parameters of chronic renal patients: A randomized clinical trial. *Rev Lat Am Enfermagem.* 2018;26. doi:10.1590/1518-8345.2123.2978.

2. Fischer MJ, Kourany WM, Sover K, et al. Development, implementation and use experience of the Veterans Health Administration (VHA) dialysis dashboard. *BMC Nephrol.* 2020;21(136). doi:10.1186/s12882-020-01798-6.

3. Centers for Medicare & Medicaid Services. ESRD Quality Incentive Program. CMS.gov. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/ESRDQIP. Updated March 3, 2022.

4. Ajmal F, Probst JC, Brooks JM, Hardin JW, Qureshi Z, Jafar TH. Freestanding dialysis facility quality incentive program scores and mortality among incident dialysis patients in the United States. *Am J Kidney Dis.* 2020;75(2):177-186. doi:10.1053/j.ajkd.2019.07.023.

5. Centers for Medicare & Medicaid Services. QAPI Description and Background. CMS.gov. https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/QAPI/qapidefinition. Updated December 1, 2021.

6. Centers for Medicare & Medicaid Services. ESRD Measures Manual for the 2022 Performance Period. CMS.gov. https://www.cms.gov/files/document/esrd-measures-manual-v70.pdf. Updated July 8, 2021.

7. Port FK, Ashby VB, Dhingra RK, Roys EC, Wolfe RA. Dialysis dose and body mass index are strongly associated with survival in hemodialysis patients. *J Am Soc Nephrol.* 2002;13:1061–1066.

8. Runnels P, Coran JJ, Goldman ML, Pronovost P. Utilizing a dashboard to promote system-wide value in behavioral health. *Popul Health Manag.* 2021;24(4):427-429. doi:10.1089/pop.2020.0233.

9. Janssen A, Donnelly C, Kay J, et al. Developing an intranet-based lymphedema dashboard for breast cancer multidisciplinary teams: Design research study. *J Med Internet Res.* 2020;22(4):e13188. doi:10.2196/13188.

10. Wilbanks BA, Langford PA. A review of dashboards for data analytics in nursing. *Comput Inform Nurs.* 2014;32(11):545-549. doi:10.1097/CIN.0000000000000106.

11. National Kidney Foundation. KDOQI clinical practice guideline for hemodialysis adequacy: 2015 update. *Am J Kidney Dis.* 2015;66(5):884–930. doi:10.1053/j.ajkd.2015.07.015.

12. Dowding D, Randell R, Gardner P, et al. Dashboards for improving patient care: Review of the literature. *Int J Med Inform.* 2015;84(2):87-100. doi:10.1016/j.ijmedinf.2014.10.001.

13. Khairat SS, Dukkipati A, Lauria HA, Bice T, Travers D, Carson SS. The impact of visualization dashboards on quality of care and clinician satisfaction: Integrative literature review. *JMIR Hum Factors.* 2018;5(2). doi:10.2196/humanfactors.9328.

14. Clark K W, Whiting E, Rowland J, Thompson LE, Missenden I, Schellein G. Breaking the mould without breaking the system: The development and pilot of a clinical dashboard at the Prince Charles Hospital. *Aust Health Rev.* 2013*;37*(3):304–308. doi:10.1071/AH12018.

15. Patterson Silver Wolf DA, Asher BlackDeer A, Beeler-Stinn S, Zheng K, Stazrad K. Performance-based practice: Clinical dashboards for addiction treatment retention. *Res Soc Work Pract,* 2021;31(2):205-211. doi:10.1177/1049731520972798.

16. Bakos KK, Zimmermann D, Moriconi D. Implementing the clinical dashboard at VCUHS. NI 2012: 11th International Congress on Nursing Informatics (11th: 2012: Montreal, Quebec), 2012. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3799105/. Published June 23, 2012.

17. Bell K, Hartmann C, Baughman AW. A pharmacist-led pilot using a performance dashboard to improve psychotropic medication use in a skilled nursing facility. *BMJ Open Qual.* 2020;9(3):1-6. doi:10.1136/bmjoq-2020-000997.

18. Hensley NB, Grant MC, Cho BC, Suffredini G, Abernathy JA. How do we use dashboards to enhance quality in cardiac anesthesia?. *J Cardiothoracic Vasc Anesth.* 2021;35(10):2969-2976. doi:10.1053/j.jvca.2021.04.034.

19. Laurent G, Moussa MD, Cirenei C, Tavernier B, Marcily R, Lamer A. Development, implementation and preliminary evaluation of clinical dashboards in a department of anesthesia. *J Clin Monit Comput.* 2020;35:617-626. doi:10.1007/s10877-020-00522-x.

20. Leutner LA, Bathelt F, Sedlmayr B, Sedlmayr M, Zoch M. Development of a dashboard for rare disease – A technical case report. *German Medical Data Sciences.* 2021;2021, 283. doi:10.3233/SHTI210544.

21. Sprague AE, Dunn SI, Fell DB, et al. Measuring quality in maternal-newborn care: Developing a clinical dashboard. *J Obstet Gynaecol Can.* 2013;35(1), 29-38.

22. Tan YM, Hi J, Chan K, Sardual R, Mah B. An electronic dashboard to improve nursing care. *MEDINFO 2013.* 2013;192:190-194. doi:10.3233/978-1-61499-289-9-190.

23. Irvine D, Sidani S, McGillis Hall L. Linking outcomes to nurses' roles in health care. *Nursing Economic$.* 1998;16(2):58-64, 87.

24. Iowa Model Collaborative. Iowa model of evidence-based practice: Revisions and validation. *Worldviews Evid Based Nurs.* 2017;14(3):175-182. doi:10.1111/wvn.12223.

25. Melnyk BM, Fineout-Overholt E. *Evidence-based practice in nursing & healthcare: A guide to best practice* (4th ed). Wolters Kluwer Health/Lippincott Williams & Wilkins; 2019.

26. Ogrinc G, Davies L, Goodman D, Batalden P, Davidoff F, Stevens D. Squire 2.0 (Standards for Quality Improvement Reporting Excellence): revised publication guidelines from a detailed consensus process. *J Nurs Care Qual.* 2016;31(1):1-8.
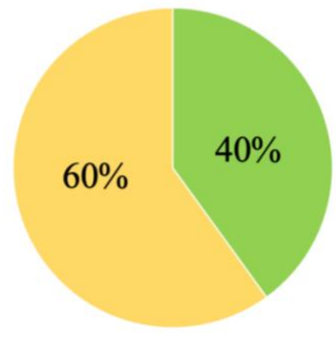
Figure 1

Dashboard Action Algorithm
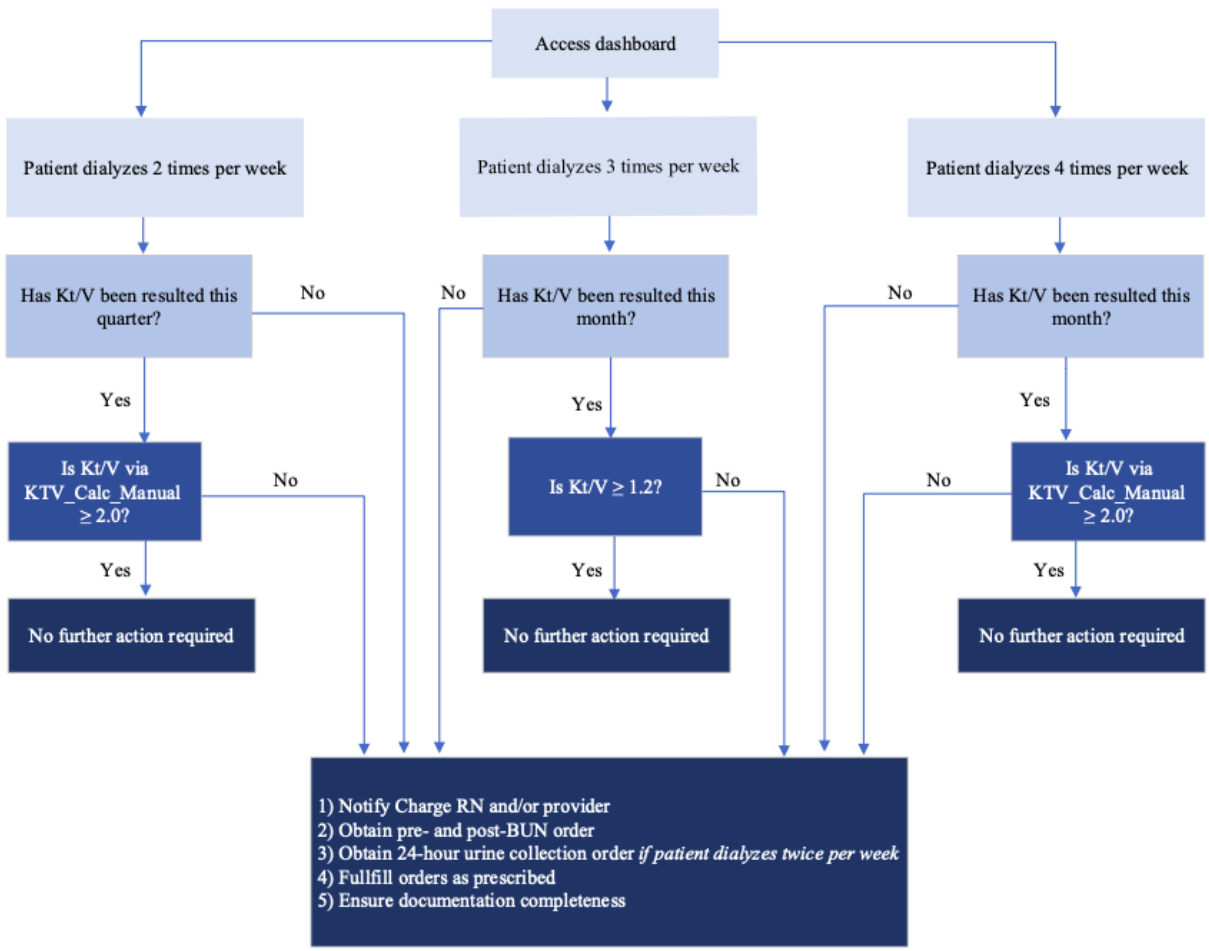
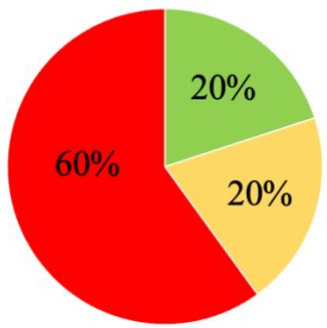**Figure 2**

Counterbalance Survey Results

I felt adequate education was provided on how to use the Epic Dashboard.
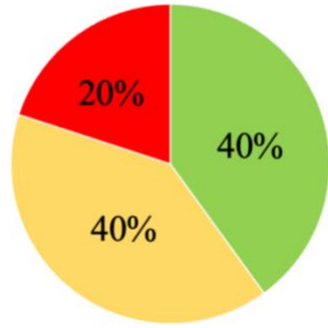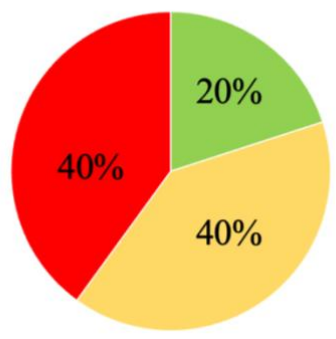
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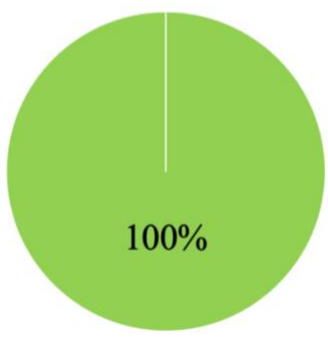
The Epic Dashboard is easy to use.

60% 40%

The Epic Dashboard enhances my efficiency in my role.

20% 20% 60%

The Epic Dashboard has enhanced my ability to impact patient outcomes.

20% 40% 40%

The Epic Dashboard is easy to incorporate into my workflow.

20% 40% 40%

Legend

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree