Determinants of ABCDE Bundle Implementation by Healthcare Providers at Coast General Teaching and Referral Hospital Critical Care Unit, Mombasa County, Kenya

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Abstract

Background: The Awakening, Breathing, Choice of analgesic and sedation, Delirium management and prevention and early Exercise/mobility (ABCDE) is evidenced based protocol associated with improved outcome of the critically ill patients. Fully implementation of this protocol optimizes the outcome of the mechanically ventilated patients. The objectives of the study were: determinants of ABCDE bundle Implementation by healthcare providers Coast general teaching and referral hospital critical care unit.
Methods: The study used descriptive research design. Data collection was done through structured questionnaires in form of Likert scale. Study participants were selected using census sampling method. A total of (N=60) participants were involved in the study. Data was analyzed using statistical package of social sciences (SPSS) version 25.
Results: A total of 60 questionnaires were collected from the participants. The results showed that female were the majority of the participants with 68.3% (n=41) and those between 30-39 age group 38.3% (n=23). The results further revealed that nursing profession contributed the majority of the participants with 75% (n=45). The results also showed that most of the participants had diploma as their level of education with 65% (n=39). Furthermore, the results revealed that majority of the participants had experience of 1-2 years. Additionally, the results revealed that implementation of the bundle varied with 71.7% (n=43) implementing SAT, 66.7% (n=40) SBT, 63.3% (n=38) pain, 75% (n=45) sedation, 75% (n=45) delirium and 76% (n=46) early exercise/mobility. Bivariate analysis of healthcare providers' factors showed that both knowledge and experience had relationship with ABCDE bundle implementation. Similarly bivariate analysis of the healthcare system factors revealed that workload, staffing, protocol availability and training are both significantly related to the implementation of the bundle. Multivariate analysis using logistic regression revealed that knowledge predicts bundle implementation with p=0.009, experience with p=0.049, workload with p=0.021, protocol with p=0.029, training with p=0.035 and staffing with p=0.007.
Conclusion: ABCDE bundle implementation is influenced by both healthcare provider factors and healthcare system factors as revealed by this study.
Key words: *Sedation, Mechanically ventilation, Spontaneous breathing trial, Delirium*

INTRODUCTION

The Awakening, Breathing, Choice of analgesic and sedation, Delirium management and prevention, early Exercise/mobility (ABCDE) bundle is evidenced based protocol which is associated with improved outcome of the critically ill patients (Kram et al., 2015). The ABCDE bundle is composed of the spontaneous awakening trials SATs, spontaneous breathing trials SBTs, pain assessment, sedation assessment, and delirium detection management and prevention early exercise/mobility. Fully implementation of all the components of the ABCDE bundle effectively improves the outcome of the critically ill patients (L. M. Boehm et al., 2016). This

evidence-based protocol integrates the assessment of delirium, discomfort, and readiness to halt sedation, when to begin breathing trials, early mobility or exercise and evasion of the usage of restraints in order to achieve its goal of improving the outcome the critically ill patients (Mart et al., 2019). Performance of the ABCDE bundle reduces mortality, number of ventilator days, readmissions in the critical care unit, delirium, coma and the use of restraints.

.According to a study by Krum et al, (2015) revealed that ABCDE bundle implementation reduces mechanical ventilation days, reduces over sedation and increases mobility of the critically ill patients. A kin to a study by (Ouellette et al., 2017) argues that the bundle is a practice guide that provide guidance of the healthcare providers in their daily management of the critically ill patients. Healthcare providers in the critical care unit play a vital role in the implementation of the ABCDE bundle with the aim of ensuring better outcome of the critically ill patients.

There was a reduction in the incidence of patients experiencing deep sedation from 47% to 29% and the duration of sedation reduced from 2.2 days to 1.8 days (Ice et al., 2017). There was a significant drop in the number of days patients spent in coma and a reduction in delirium among the mechanically ventilated patients(L. M. Boehm et al., 2016) (Ice et al., 2017) as a result of ABCDE bundle implementation.

In a study by Costa, (2017) showed that despite the effectiveness of the ABCDE bundle implementation among the critically ill patients, healthcare providers face challenges in implementation of the bundle. Adoption and implementation of ABCDE bundle is the only way to provide quality care and improve the outcome of the critically ill patients.

The ABCDE bundle represent one method of treating critically ill patients which is well-rounded path that optimizes resource utilization resulting in better pain control (Marra et al., 2018).

Multidisciplinary rounds has shown to facilitate and enhance sustainability of ABCDE bundle implementation by the healthcare providers in the critical care unit and overall improvement of patients outcome (Stollings et al., 2020). According to Pinto & Biancofiore, (2016) revealed that 48% of the study participants did not implement ABCDE bundle. Despite the benefits of ABCDE bundle implementation to the critically ill patients, its utilization by the critical care healthcare providers is limited (Sneyers et al., 2017). Patients still spend more days in coma, delirium, and in mechanical ventilation. This problem could be effectively avoided through performance of the ABCDE bundle among the critical care unit healthcare providers.

Failure to implement the ABCDE bundle by the critical care unit healthcare providers rises the prevalence and poor patient outcomes among the critically ill patients (Bounds et al., 2016). This study explored the determinants of ABCDE bundle implementation by healthcare providers Coast general teaching and referral hospital in (CGTRH) critical care unit, Mombasa County Kenya.

The specific objectives of the study were: To evaluate the ABCDE bundle implementation, to assess healthcare provider factors influencing implementation of ABCDE bundle , to determine the healthcare system factors influencing implementation of ABCDE bundle and to determine the predictors of ABCDE bundle implementation among healthcare providers at the CGTRH CCU, Mombasa County Kenya.

METHODOLOGY

A descriptive approach was used to explore determinants of ABCDE bundle implementation among healthcare providers at the CGTRH CCU, Mombasa County, Kenya.

The primary field site was a 700-bed level 5 (tertiary) government hospital located in the second largest city in Kenya. It is within this facility where the 18-bed capacity is located CCU is situated in the first floor bordering main theatre and renal unit. This CCU provides care at affordable cost, making it the preferred by the majority of patients who cannot afford care in the private facilities. The CCU serves both surgical and medical patients and all referrals from across the coastal region which is made up of 6 counties.

A total of 60 healthcare providers working in the critical care unit providing direct care to critically ill patients were targeted for this study. Census sampling was used to recruit healthcare providers as study subjects. The researcher approached the unit manager with a letter of approval for data collection which was obtained from the hospital ethics board. Healthcare providers in the CCU were informed of the study. A total of 60 healthcare providers participated in this study. Inclusion criteria required healthcare providers who had worked in the unit for at least 6 months providing direct care for critically ill patients.

The self-administered structured questionnaires were used. The questionnaire content and face validity were established through expert opinion and pretesting. On the other hand, Cronbach's alpha test was used to determine the questionnaire's reliability which generated a reliable score of 0.8.

Independent study variable included healthcare provider related factors such as knowledge, experience and attitude and healthcare system related factors that included workload, staffing, training, equipment availability and clear protocol. The dependent variable was implementation of the ABCDE bundle by healthcare providers. Self-administered structured questionnaires in the form of Likert scale were used to collect data from the 60 study participants.

Data analysis was conducted after verification of the questionnaires for completeness and then coded. Statistical analysis and management were done using the statistical package of social science (SPSS), version 25. Descriptive and inferential statistics were used. Frequency tables and percentages for demographic data, chi-square for association of the independent and dependent variables. Logistic regression was used to predict the outcome variable.

Approval was obtained from both Kenyatta University ethics review committee and Coast General Teaching and Referral Hospital (CGTRH) research ethics board before data collection. Study participants filled informed consent form and confidentiality was assured through coding.

RESULTS

Study participants from the critical care unit

The total sample (n=60; *Table 1*) included nurses, physicians, medical officers, anesthesiologist, physiotherapist, pharmacist, nutritionist and biomedical.

Table 1: Study participants from the critical care unit

Variable	n=60	n (%)
Nurses	45	75
Physicians	3	5.07
Medical officer	5	15
Anesthesiologist	1	1.7
Physiotherapist	1	1.7
Pharmacist	1	1.7
Nutritionist	1	1.7
Biomedical	3	5.07
Total	60	100

Participants' demographics are illustrated in *table 2*

Table 2: Participants demographics

Variable	Category	Percentage (n)
Gender	Male	31.7%(n=19)
	Female	68.3%(n=41)
Age	20-29	30%(n=18)
	30-39	38.3%(n=23)
	40-49	21.7%(n=13)
	50 and above	10%(n=6)
Profession	Nursing	75%(n=45)
	Pharmacy	1.7%(n=1)
	Physiotherapy	1.7%(n=1)
	Biomedical engineering	5.07%(n=3)
	Nutrition	1.7% (1)
	Medicine	15%(n=9)
Education level	Diploma	65%(n=39)
	Degree	33.35(n=20)
	Masters	1.7%(n=1)
Experience	1-2 years	60%(n=36)
	3-5 years	21.7%(n=13)
	5-10 years	6.7%(n=4)
	Above 10 years	11.7%(n=7)
Specialty	Critical care	21.7%(n=13)
	General medical officer	8.3%(n=6)
	Physiotherapist	1.7%(n=1)
	Physician	5.0%(n=3)
	Anesthesiologist	1.7%(n=1)
	General nurse	53.3%(n=32)
	General nutritionist	1.7%(n=1)
	Biomedical	5.0%(n=3)
	Clinical pharmacist	1.7%(n=1)

ABCDE bundle implementation

Participants were asked to rate how they implemented ABCDE bundle in the critical care unit. The options were; none response, never, occasionally, frequently and routinely. The results showed variation in the implementation of the ABCDE bundle as demonstrated in table 3

Table 3: ABCDE bundle implementation among healthcare providers

Implementation of;	None response, % (n)	Never, % (n)	Occasionally, % (n)	Frequently, % (n)	Routinely, % (n)
SATs	6.7(4)	18.3(11)	55(33)	10(6)	10(6)
SBTs	6.7(4)	18.3(11)	40(24)	28.3(17)	6.7(4)
Pain assessment	0.0(0)	6.7(4)	26.7(16)	56.7(34)	10(6)
Sedation assessment	0.0(0)	15(9)	50(30)	25(15)	10(6)
Delirium assessment	3.3(2)	23.3(14)	60(36)	5(3)	8.3(5)
Early exercise assessment	0(0)	11.7(7)	50(30)	30(18)	8.3(5)

The study further categorized healthcare providers who implemented ABCDE and those who did not implement the bundle. To achieve that, none response and never were grouped as not implemented whereas occasionally, frequently and routinely as implemented. The results revealed variation in implementation of the ABCDE bundle across the components as shown in *table 4*

Table 4: Category of ABCDE bundle implementation by healthcare providers

Bundle component	Implemented	Not implemented.
SAT	71.7% (n=43)	28.3% (n=17)
SBT	66.7% (n=40)	33.3% (n=20)
Pain	63.3% (n=38)	36.7% (n=22)
Sedation	75% (n=45)	25% (n=25)
Delirium assessment	75% (n=45)	25% (n=25)
Early exercise	76% (n=46)	23.3% (n=14)

Healthcare provider factors influencing ABCDE bundle implementation

Participants were asked whether knowledge, attitude and experience of the healthcare provider influenced ABCDE bundle implementation in the critical care unit. Majority of the participants strongly agreed that knowledge and experience had direct influence on ABCDE bundle implementation.

The study further explored the relationship between healthcare provider factors and ABCDE bundle implementation. This was done by grouping the responses as either agreed or disagreed. Strongly agree and agree were grouped as agreed while neither agree nor disagree, disagree and strongly

disagree were combined as disagreed and a Chi-square test was conducted to determine the association. The results were as shown in *table 5*.

Healthcare system factors influencing ABCDE bundle implementation

Participants were asked whether workload, staffing, training, protocol and equipment influenced ABCDE bundle implementation. The results demonstrated that majority of the participants strongly agreed that healthcare system factor influenced the implementation of ABCDE bundle as shown in *table 6*.

Association of healthcare system factors and ABCDE bundle implementation

To get more insight, the study further categorized responses as either agreed or disagreed and Chi-square test was conducted to establish the association of healthcare system factors and ABCDE bundle implementation. The results were as shown in *table7*.

Predictors of ABCDE bundle implementation

Both healthcare provider factors and healthcare system factors that were statistically significant were further analyzed to predict the relationship of those factors and ABCDE bundle implementation. The results showed that both healthcare provider factors and healthcare system factors predicted ABCDE bundle implementation at the CGTRH CCU, Mombasa County Kenya as shown in *table 8*

Table 5: Healthcare provider factors influencing ABCDE bundle implementation

Variable		SAT implementation		X^2	Df	Pvalue
		Implemented	Not implemented			
Knowledge	Agree	37	9	7.464	1	0.006
	Disagree	8	6			
Attitude	Agree	36	13	0.428	1	0.513
	Disagree	7	4			
Experience	Agree	34	10	2.554	1	0.110
	Disagree	9	7			
		SBT implementation				
Knowledge	Agree	32	14	0.745	1	0.388
	Disagree	8	6			
Attitude	Agree	35	14	2.727	1	0.099
	Disagree	6	5			
Experience	Agree	32	12	2.727	1	0.099
	Disagree	8	8			
		Pain assessment				
Knowledge	Agree	26	20	3.939	1	0.047
	Disagree	12	2			
Attitude	Agree	31	18	0.001	1	0.982
	Disagree	7	4			
Experience	Agree	27	17	0.276	1	0.600
	Disagree	11	5			
		Sedation assessment				
Experience	Agree	36	8	4.091	1	0.043
	Disagree	9	7			
		Delirium assessment				
knowledge	Agree	32	14	3.106	1	0.078
	Disagree	13	1			
Attitude	Agree	37	12	0.037	1	0.847
	Disagree	8	3			
Experience	Agree	32	12	0.455	1	0.500
	Disagree	13	3			
		Early exercise				
Knowledge	Agree	42	4	1.689	1	0.194
	Disagree	11	3			
Attitude	Agree	45	4	3.183	1	0.074
	Disagree	8	3			
Experience	Agree	38	6	0.621	1	0.431
	Disagree	15	1			

Table 6: Healthcare system factors influencing ABCDE bundle

| Variable	Strongly agree %(n)	Agree % (n)	Neither agree nor disagree	Disagree %(n)	Strongly disagree % (n)
Workload influences ABCDE bundle implementation	60 (36)	31.7(19)	5 (3)	1.7(1)	1.7 (1)
Staffing determines ABCDE bundle implementation	67.8(40)	30.5 (18)	0.0 (0)	1.7 (1)	0.0 (0)
Availability of protocol influence ABCDE bundle implementation	58.3 (35)	40 (24)	1.7 (1)	0.0(0)	0.0(0)
Availability of equipment influence ABCDE bundle implementation	56.7 (34)	43.3 (26)	0.0 (0)	0.0 (0)	0.0(0)
Training of healthcare provider influence ABCDE bundle implementation	76.7 (46)	23.3 (14)	0.0 (0)	0.0 (0)	0.0 (0)
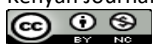
Table 7: Association of healthcare system factors and ABCDE bundle implementation

Variable		SAT implementation		X²	Df	Pvalue
		Implemented	Not implemented			
Workload	Agree	36	14	0.016	1	0.898
	Disagree	7	3			
Staffing	Agree	34	10	2.554	1	0.110
	Disagree	9	7			
Protocol	Agree	30	10			
	Disagree	13	7	0.657	1	0.418
Equipment	Agree	32	11	0.566	1	0.452
	Disagree	11	6			
Training	Agree	28	11	0.001	1	0.976
	Disagree	15	6			
		SBT implementation				
Workload	Agree	37	13			
	Disagree	7	3	7.260	1	0.007
Staffing	Agree	27	9			
	Disagree	13	11	2.813	1	0.094
Protocol	Agree	33	11			
	Disagree	9	7	5.156	1	0.023
Equipment	Agree	30	13			
	Disagree	10	7	0.657	1	0.418
Training	Agree	28	11			
	Disagree	12	9	1.319	1	0.251
		Pain assessment				
Workload	Agree	29	18			
	Disagree	9	4	0.249	1	0.618
Staffing	Agree	25	11			
	Disagree	13	11	1.447	1	0.229
Protocol	Agree	38	6			
	Disagree	12	4	21.039	1	0.000
Equipment	Agree	27	16			
	Disagree	11	6	0.019	1	0.890
Training	Agree	32	13			
	Disagree	9	6	4.689	1	0.030
		Sedation assessment				
Workload	Agree	37	8			
	Disagree	10	5	1.604	1	0.205
Staffing	Agree	27	18			
	Disagree	9	6	0.000	1	1.000
Protocol	Agree	34	11			
	Disagree	10	5	0.455	1	0.500
Equipment	Agree	32	13			
	Disagree	11	4	0.027	1	0.869
Training	Agree	38	7			
	Disagree	7	8	8.563	1	0.003
		Delirium assessment				
Workload	Agree	36	14			
	Disagree	9	1	1.440	1	0.230
Staffing	Agree	33	3			
	Disagree	12	12	13.333	1	<0.001
Protocol	Agree	38	6			
	Disagree	7	9	11.364	1	0.001
Equipment	Agree	34	9			
	Disagree	13	1	1.341	1	0.247
Training	Agree	35	10			
	Disagree	10	5	0.741	1	0.389
		Early exercise				
Workload	Agree	40	7			
	Disagree	6	7	8.637	1	0.003
Staffing	Agree	32	4			
	Disagree	13	11	7.500	1	0.006
Protocol	Agree	40	4			
	Disagree	13	3	1.062	1	0.303
Equipment	Agree	35	11			
	Disagree	8	6	1.897	1	0.168
Training	Agree	39	5			
	Disagree	9	7	0.027	1	0.870

Table 8: Predictors of ABCDE bundle implementation

Variable	B	S.E	Wald	Df	Pvalue	AdjustedOR
Knowledge & SAT	1.701	0.656	7.735	1	0.009	5.481
Knowledge & pain	-1.529	0.820	3.482	1	0.062	0.217
Experience & sedation	1.253	0.638	3.858	1	0.049	3.500
Workload & SBT	1.616	0.697	5.369	1	0.021	5.033
Protocol & SBT	1.425	0.651	4.793	1	0.029	4.159
rotocol & pain	0.053	0.629	0.007	1	0.933	1.054
Training & pain	1.306	0.621	4.421	1	0.035	3.693
Protocol &delirium	1.632	0.734	4.937	1	0.026	5.112
Staffing & Delirium	2.046	0.764	7.166	1	0.007	7.733
Training & sedation	1.825	0.661	7.623	1	0.006	6.204
Staffing & sedation	2.281	0.850	7.208	1	0.007	9.791
Staffing &Exercise	2.484	0.884	7.897	1	0.005	11.991

DISCUSSION

The study findings showed that the number female respondents were greater than the male respondents. This findings complements previous studies by (Dietrich et al., 2017a) on perceptions of workload burden and adherence to ABCDE bundle among intensive care providers reported similar findings. A kin to studies by B.L.M.Boehm et al,(2017) Tool & Bardwell,(2020) who had majority of study participants being female and all these findings agree with the findings of this study. A cross-sectional survey conducted in southwest China on implementation of ABCDE bundle revealed that majority of the study respondents were women(Huang et al., 2021). These findings might explain the fact that females are the majority in nursing profession and therefore contributed majority of the study participants.

Nursing as a profession had majority of the participants compared to other professions that were involved in the study supporting a study by (B. L. M. Boehm et al., 2017). This findings however, negate a study Huang et al., (2021) which showed nursing as the minority among the professions involved in the study. The study findings point out experience of the healthcare provider as important determinant and predictor of ABCDE bundle implementation. Transfer of healthcare providers from critical care unit to other departments is responsible for the limited experience among healthcare providers. This is a new development as majority of the previous studies revealed that experience had no statistical significance in ABCDE bundle implementation.

The results revealed variations in the implementation of ABCDE bundle among healthcare providers. Worth to note was the low implementation especially on the pain component of the ABCDE bundle but high implementation on early exercise/mobility. As Kelly et al. (2017), suggest, healthcare providers face various in implementation of ABCDE bundle in the critical care unit such as lack of knowledge and increased workload. A kin to a study by Kram et

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al.,(2015) showed that knowledge deficit impedes ABCDE bundle implementation by healthcare providers. These findings may explain the importance of having ABCDE bundle education periodically for example twice in every month to ensure that healthcare providers have the knowledge to implementation of the ABCDE bundle in the mechanically ventilated patients leading to improved patients' outcome in the critical care unit. Additionally, the study findings showed that experience of the healthcare provider is a determinant of sedation assessment. Patients in the critical care unit sometimes get restlessness and agitated, severe pain which sometimes go unnoticed and untreated or even sometimes over sedated. The role of the healthcare provider is to assess and determine the right analgesic and sedation to reduce anxiety (Mnsc, 2020). 60% (36) of the study participants in the current study agreed that experience plays a big in ABCDE bundle implementation. Experienced healthcare providers in the critical care unit should do on job training of junior healthcare providers on sedation assessment to help them get the necessary skills and experience to assess sedated critically ill patients. This will prevent over sedation and promote SATs and SBTs and timely extubation.

Participants in this study identified workload as a determinant of ABCDE bundle implementation and that increase in workload would make healthcare providers not to implement the bundle. This finding was consistent with previous studies by Govindan et al., (2018) who found that an increase in workload lead to a drop in the implementation of the ABCDE bundle. This

may explain the reason of low implementation of the bundle as participants reported to have more than three patients with competing task to handle making it difficult to implement the ABCDE bundle. A kin to a study by Dietrich et al.,(2017b) who reported that increased workload resulted to a drop in ABCDE bundle implementation. The workload concerns should be looked into by the management to identify critical care unit needs such as additional staffing to ensure fully implementation of the ABCDE bundle.

The study findings further showed that clear protocol availability influences implementation of the bundle. The protocol would guide them on how and when to implement the ABCDE bundle. Lack of the protocol resulted to confusion among the healthcare providers leading to low implementation. This findings is in agreement with studies by L. M. Boehm et al., (2016) who reported lack of protocol as barrier to ABCDE bundle implementation. This may explain the underutilization of the ABCDE bundle. This may be addressed by developing ABCDE protocol guide by the unit management to guide the implementation of the bundle by the healthcare providers.

The study findings revealed that assessment of SBTs was implemented by 66.3% (40) of the study participants. Despite this percentage, it is worth to note that a total of 33.3% (20) of the participants did not implement SBTs and this may be the reason for long stay in mechanical ventilation, over sedation among others. The findings are consistent with a study by Ouellette et al.,

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(2017) who reported a lower percentage of SBT assessment by healthcare providers. Mechanical ventilated patients require close monitoring to avoid over sedation. Potential solution to SBT monitoring is to have experienced and knowledgeable healthcare provider demonstrate to other healthcare providers how to assess and when to assess the ABCDE bundle.

Analysis of the study results revealed that not all participants routinely assessed pain among the critically ill patients. This finding require improvement since patients in the critical care unit suffer severe pain which sometimes go unnoticed and therefore not treated. In a study by Kotfis, Roberson, Wilson, & Pun,(2020) showed that insufficient pain assessment resulted to delirium development. The results demonstrate the need for further education in regards to routine assessment of pain by the healthcare providers. Additionally, the study results revealed that three quarters of the participants assessed sedation and delirium respectively.

The findings indicate improvement from previous studies which reported a lower assessment on the same. This explains the reasons behind reduction in delirium development, over sedation of the critically ill patients and reduction in the length of mechanical ventilation. Further analysis of the study results revealed that 76% of the study participants implemented early exercise/mobility and this indicated an improvement in the assessment on early exercise/mobility of the critically ill patients. A kin to study by Huang et al.,(2021) reported that only 38.5% of the study participants implemented early exercise/mobility. This has led to timely extubation of and weaning off patients from mechanical ventilation and consequently reduction in the development of ventilator acquired pneumonia among the critically ill patients.

Healthcare provider factors influencing ABCDE bundle implementation

Analysis of the results revealed key healthcare factors influencing ABCDE bundle implementation that require improvement. Participants agreed that knowledge of ABCDE bundle facilitate its implementation by healthcare providers and lack of it impedes implementation. This was clear from the study findings which showed 85% of the participants strongly agreed. This finding is consistent with a study by Gulseren et al, (2021) which revealed similar finding. Therefore, implementing ABCDE bundle remains difficulty without the knowledge of the healthcare providers

The potential solution to this concern is continuous education on ABCDE bundle implementation the healthcare providers in building capacity to enable them implement this evidenced based care bundle.Further analysis of the results revealed that healthcare providers' attitude was not associated with ABCDE bundle implementation study. These findings indicate that attitude of the healthcare provider does not determine ABCDE bundle implementation by healthcare providers. This study results is inconsistent with previous studies by B. L. M. Boehm et al., (2017) who reported attitude as a

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determinant of ABCDE bundle implementation by healthcare providers.

Experience of the healthcare providers affect the implementation of the ABCDE bundle.

Another key healthcare provider factor revealed by the study was experience of the healthcare provider to be a determinant of ABCDE bundle implementation. Study participants reported that experienced healthcare providers have an upper hand of implementing the ABCDE bundle. This study showed that majority of the study participants had 1-2 years of experience and this finding may explain the low implementation of the ABCDE bundle by the healthcare providers. This phenomenon could be explained by the frequent changeover which impedes implementation of the ABCDE bundle. Possible solution to this concern through specialization and retention of healthcare providers in the unit.

Healthcare system factors influencing ABCDE bundle implementation

Approximately more than half of the study participants in this study agreed that workload influence ABCDE bundle implementation in the critical care unit. The findings are consistent with the study by Dietrich et al, (2017) which revealed that rise in workload dropped the implementation of ABCDE bundle by 53%. This demonstrate the need to have a workload which is appropriate for the staffs and any increase in the patients' number should follow an increase in the healthcare providers in the critical care unit so as to fully implement the ABCDE bundle.

The study findings further indicate that staffing influences implementation of the ABCDE bundle as participants strongly agreed. This finding is similar to previous reports by L.B.M. Boehm et al, (2018) which showed that healthcare providers always have more than 2 patients requiring assessment and close monitoring making it hard to manage resulting to difficulty in implementation of ABCDE bundle. This shows understaffing affects the implementation of the care bundle and there adequate staffing is necessary for fully implementation of ABCDE bundle.

Deena Kelly Costa et al, (2017), reported training of healthcare providers to be key determinant of ABCDE bundle implementation. This current study is consistent with the findings by Deena Kelly Costa and colleagues as majority of the study participants strongly agreed. It is necessary therefore to ensure proper and regular trainings of the critical care healthcare providers, implementation of the various component of the ABCDE bundle will be easier. In a study by Hermes et al., (2018), a clear protocol guide is a good step enroute for implementation of ABCDE bundle by healthcare providers. The management of the hospital should develop and provide clear protocol guidelines on how to implement or assess the various components of the ABCDE bundle and thus reduce confusion. Overall, participants agreed that healthcare system factors influence implementation of ABCDE bundle in the critical care unit.

Association of healthcare system factors and ABCDE bundle implementation

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The results revealed an association between workload and SATs, SBTs and this shows how workload is an important factor in implementation of the ABCDE bundle by healthcare providers in the critical care unit. Similar finding were reported by Hanson, (2019) demonstrated that workload has an impact in bundle implementation. This finding may explain the reason behind low implementation of ABCDE bundle among the healthcare providers. Participants agreed that having more than two critically patients make it difficult to offer quality services. The study further revealed statistical significance between protocol and SBTs assessment as it is confusing. Healthcare providers are sometimes left confused on who to implement what component of the ABCDE bundle due to lack of clear protocol guideline. The result is a drop in implementation of the ABCDE bundle.

Availability of clear protocol will provide guideline on implementation of the ABCDE bundle and reduce confusion among healthcare providers. A large of the participants agreed training of healthcare providers influences pain assessment and the study finding showed statistically significant between training and pain assessment. This finding adds deeper understanding of the significance of training in detection and management of pain among the critically ill patients as reported by(Marra et al., 2018). Participants agreed that adequate staffing and regular training will ensure fully implementation of ABCDE bundle and improve the outcome of the critically ill patients. This was similarly reported by (Weiss, 2017)(Hermes et al., 2018) and (Hanson, 2019).

These findings were both statistically significant and predict the likelihood of ABCDE bundle implementation. It is therefore important to have enough staffs who are well trained and experienced, clear protocol guidelines to avoid role confusion among the healthcare providers. Lack of clear protocol result scheduling conflicts like patient taken to dialysis during time of ABCDE bundle implementation reported by Costa et al, 2017. Rise in workload result to a drop in implementation of the ABCDE bundle in the critical care unit, for improved patients' outcome. Dietrich et al, 2017 reported a drop of 53% of ABCDE bundle implementation. This will lead to reduction in delirium, over sedation and reduced length of patients in mechanical ventilation and also reduce the cost of ICU admission.

Predictors of ABCDE bundle implementation

The findings from binary logistic regression revealed a relationship in both healthcare provider factors and healthcare system factors in the implementation of the ABCDE bundle and predicted predict likelihood of ABCDE bundle implementation. This observation further adds deeper insight of the determinants of ABCDE bundle implementation in the critical care unit. This study finding is consistent with previous studies by Boehm et al, (2017), who reported that knowledge and experience of the healthcare provider affect the implementation of ABCDE bundle. While a strong relationship between both healthcare provider factors and healthcare system factors and ABCDE bundle implementation,

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no relationship was found between knowledge and assessment of pain.

Limitations

This study used 60 study participants only and was carried out in a single hospital and therefore the result represents healthcare providers in that hospital. This was the limitation of this study. The other limitation was resources specifically finances to support the study.

CONCLUSION

The ABCDE bundle is an evidence-based protocol that can improve the outcome of critically ill patients in the critical care unit. This study was conducted in a single government hospital in Kenya, and therefore most applicable in similar settings. The study identified factors that influenced ABCDE bundle implementation among healthcare providers can apply overall to all public hospitals in Kenya and to developing countries with limited resources. For example, implementation of ABCDE bundle was low in some of the components of the bundle whereas others were high. Knowledge and experience were the identified healthcare provider factors influencing ABCDE bundle implementation. This concern requires continuous education on ABCDE bundle and training among the healthcare providers to solve the problem. Workload, staffing, training and protocol availability were the healthcare system factors that influenced ABCDE bundle implementation and thus require a solution. Evaluating staffing needs of the CGTRH CCU and recruiting more staffs is paramount to fill the gap. This will cure not only the staffing problem but also workload. Regularly training and provision of validated tools will change the perspective of ABCDE bundle implementation among the healthcare providers for better patient outcome.

RECOMMENDATIONS

The study recommends formation of ABCDE bundle implementation team comprising of critical care nurse with wealth of knowledge and experience of ABCDE bundle, critical care physician, anesthesiologist, critical care pharmacist, physiotherapist to provide continuous education to ensure fully implementation. Re-evaluation of staffing needs and recruitment of more staffs, regular training of healthcare providers and provision of validated tools to guide implementation of ABCDE bundle.

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