ETHICAL DECISION MAKING IN ACTION: EVALUATING HOSPITAL CARE ATTENDANCE APPROACHES

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ABSTRACT

Patient safety is a priority in the hospital. Hospitals are always considering cost effective ways to keep patients safe and free from harm. Every year an average of 340,000 hospitalized patients are injured due to falls. Providing the best possible care attendance to prevent these incidents is very important. It is demonstrated here that, beyond medical and financial considerations, the proper selection of care attendance is an ethical decision. This decision requires considering the needs of, as well as getting input from, all the parties involved (hospitals, nurses, and patients). Unfortunately, until now, the care attendance discussion has mainly considered the hospital's perspective and rarely that of the patient. Using a stakeholder theoretical approach taken from ethical decision making literature and the Analytic Hierarchy Process which allows the integration of multiple stakeholder perspectives and the inclusion of intangible variables (such as patient's perceived value), we developed an evaluation framework to enable the prioritization and allocation of resources to the different care attendance approaches: care attendant (CA), continuous video monitoring (CVM), normal rounding (NR) and family visitor sitters (FVS). The decision criteria have been identified from the extant medical evidence-based literature, and expert opinions from three decision-makers (each representing a particular stakeholder's perspective) were used to assess the criteria weights and rate the alternatives.

Keywords: ethical care; patient care; care attendance; continuous video monitoring

1. Introduction

Patient safety is the prevention of adverse events and errors in healthcare to patients (Agency for Healthcare Research and Quality, 2018). Nurses play an essential role in patient safety. Patients who are at risk for adverse outcomes including falls, falls with injury, harm to self and others may need increased supervision. An interdisciplinary team including nurses determines the need for increased supervision at the bedside. Bed alarms, chair alarms, low beds, and fall mats are standard interventions to prevent falls and keep patients safe while hospitalized (Cournan, Fusco-Gessick, & Wright, 2018). However, there are circumstances when patients require increased measures such as hourly rounding, care attendants, continuous video monitoring, and family visitor sitters. Determining the best increased measure to provide for each patient in care is circumstantial. The Agency for Healthcare Research and Quality (2018) reports between

700,000 and 1,000,000 people fall in the hospital each year. The number of falls that occur each year is equivalent to the population of Dallas, Texas (U.S. Population City and Town Population, n.d.). More than one-third of in-hospital falls result in injury, including serious injuries such as fractures, head trauma, and even death. Reports estimate 30 - 50% of falls result in injury, costing on average $14,000 per fall (The Joint Commission, 2015). These costs are covered between hospitals, insurance coverage, and patients resulting in serious financial hazard particularly for patients. The Center for Disease Control (CDC) reports "medical costs of fall injuries for U.S. patients ages 65 or older are $34 billion annually, hospital costs account for only two-thirds of the total cost of fall injuries" (CDC, 2016). In summary, fall injuries involve important costs for both hospitals and patients.

While there is no question of the importance of addressing the best way to provide care to patients, it is proposed here that the evaluation of a care attendance approach should be addressed as an ethical decision and a suitable moral decision-making framework should be used for this purpose. In this study, we will first argue that care attendance is an ethical healthcare issue and second, we will use an ethical decision-making approach, rooted in stakeholder theory and using the Analytic Hierarchy Process (AHP) as the methodology for care attendance evaluation (Freeman 1984).

2. Literature review

The literature review comprises two domains. The first domain is the literature discussion that supports the proposal of evaluation as an ethical decision. The second seeks to identify current care attendance approaches, their characteristics, and the elaboration of criteria to evaluate them from different perspectives, more specifically hospital, nurse, and patient's perspectives. The complete literature review is shown in Appendix A.

2.1. Care attendance as an ethical decision

Frameworks for ethical decision making are helpful in examining a clinical situation or action to determine if the situation involves ethical issues. Curtin's 6-step model of ethical decision making recommends the following steps: 1) perception of the problem, 2) identification of ethical components, 3) clarification of persons involved, 4) exploration of options, 5) application of ethical theory, and 6) resolution/evaluation (Curtin, 1979; Stuart & Sundeen, 1987).

2.1.1 Perception of the problem

This step is aimed at identifying if an ethical dilemma exists, and if so the context of the dilemma. Our review of care attendance approaches literature shows the presence of a moral conflict. Hospital management would prefer a solution that reduces cost of the care attendance approach; nurses are more highly concerned with their patient's safety and patients assess care attendance preference based on personal values and perceptions (e.g., a patient may find more value in having a family member providing care than a trained care attendant) (Jeffers et al., 2013; Neville, DiBona, & Mahler, 2016; Tzeng & Yin, 2007).

2.1.2 Identification of the ethical components

The second step in the ethical analysis is to identify ethical components by answering questions like, what is the underlying issue/problem? and who is affected by this dilemma?

These three potentially conflicting perspectives of the hospital, nurse, and patient constitute the key idea for our discussion of care attendance as an ethical decision. Our review of the literature shows the majority of the care attendance approaches discussion has been done from the hospital's perspective, even less from the nurse's perspective and rarely if ever from the patient's perspective (Babine et al., 2018; Torkelson & Dobal, 1999; Laws & Crawford, 2013; Solimine et al., 2018; Neville, DiBona, & Mahler, 2016; Tzeng & Yin, 2007).

2.1.3 Clarification of the people involved

In the third step of the process of ethical analysis, the relevant questions to be asked at this stage are: what are the rights of people/person involved?, who should be included in decision making?, and for whom is the decision being made?

The three parties previously identified (hospitals, nurses, and patients) all have clearly defined rights to participate in care decisions. Hospitals are responsible for providing quality healthcare while maintaining the financial viability of their services. Nurses are professionally committed to the well-being of the patients under their care. Finally, patients will be directly affected by the outcome of the care attendance selection. Therefore, it is felt that all parties should participate in care attendance approaches evaluation decisions. Furthermore, care attendance evaluations should be made to address the needs of all three parties and not only those of the patients.

2.1.4 Exploration of the options

The fourth step in the ethical analysis is the exploration of the options, and at this step the relevant questions to be asked include: what alternatives may exist? and what is the purpose and potential consequences of each alternative.

Based on the extant evidence-based medical literature, the following care attendance approach options have been identified: care attendant (CA), continuous video monitoring (CVM), normal rounding (NR) and family/visitor/friend (FVS). This study will examine the purpose and potential consequences of each of these alternatives and will provide an evaluation framework for this purpose.

2.1.5 Application of ethical theories

Application of ethical theories is the fifth step of the ethical analysis. The application of ethical theories in situational analysis strengthens the final decision. A relevant question at this stage is, which ethical or theoretical framework should we use?

Our previous discussion, in particular the necessity of addressing the needs of the different parties (hospitals, nurses, and patients), suggests the application of stakeholder theory which has become relevant for social responsibility and ethical management in general (Harrison & Freeman, 1999; Freeman et al., 2010). A stakeholder in an organization denotes "any group or individual who can affect the achievement or is

affected by the achievement of the organization's objectives" (Thompson 1967; Freeman 1984). This theory implies that it is a fundamental ethical principle that those who will be affected by a decision will be informed, and will preferably participate in the ultimate decision.

2.1.6 Resolution into action

The sixth and final step is the requirement to decide on a resolution or resolution into action. Relevant questions to be addressed here are the following: what is the goal of one's decision?, how can we ensure the decision is the best for all concerned?, how can the resulting choice be implemented? and how can the resulting ethical choice be evaluated?

The development of this stage is the next step in our paper. Our decision goal is to evaluate the existing care attendance approaches concerning criteria developed from the extant literature and expert opinion, including criteria from the key stakeholders to ensure it is the best for hospitals, nurses, and patients. Suggestions about how to implement the choice(s) and its subsequent evaluation will also be included.

2.2. Care attendance approaches in the evidence-based medical literature

Based on medical evidence-based extant literature (Appendix A) and expert opinions of three decision makers (co-authors), a nursing administrator, a registered nurse in active service, and a layperson with extensive patient experience, we have identified criteria and alternatives for our care attendance approaches evaluation model. Given the nature of the proposed evaluation, a benefit/cost approach was used for the analysis. The benefit criteria include safety and customer value including the sub-criteria patient and hospital perceived value respectively as described in Appendix C. The cost criteria includes fixed costs including two sub-criteria, acquisition and setting up costs, and variable costs (operational) as shown in Appendix D. Alternatives include (nurse-dedicated) care attendants, continuous video monitoring, normal rounding, and family visitor sitters as described in Appendix B.

2.2.1 Care attendance approaches considerations

Patient safety is essential in the acute care setting and healthcare professionals are continually looking for ways to improve patient safety and reduce falls (Votruba, Graham, Wisinski, & Syed, 2016). The Center for Medicare and Medicaid implemented the Inpatient Prospective Payment System that went into effect on October 1st, 2008 resulting in lower reimbursement for hospital-acquired conditions from the Center for Medicare and Medicaid. Many other third-party payers have begun to follow these guidelines regarding reimbursement. One major healthcare acquired condition is a patient fall that could result in fractures, joint dislocation, head injury, and/or crushing injury. Falls can contribute to an increased length of stay, increase in the cost of patient care, patient fear of falling, and emotional distress to the patient (Burtson & Vento, 2015).

Patients are presenting to the acute care setting more and more with delirium, confusion, and other high-risk behaviors that can lead to harm or falls. Hospitals are continually trying to improve the safety of patients. Nursing units are requesting staff that are

beyond budget due to sitter needs. The use of sitters is an uncontrolled and unanticipated dilemma for many hospital managers (Laws & Crawford, 2013).

Implementation of programs, such as sitters, can be expensive for hospital systems. The use of sitters can be a challenge for staffing resources. The average cost for a sitter is $240/sitter/day. Hospitals in the United States have reported spending between $500,000 - $2,000,000 each year on sitter costs. Hospitals are continually looking for ways to improve safety and decrease these costs in the acute care setting (Davis, Kutash, & Whyte IV, 2017).

Patient and staff satisfaction are significant factors in healthcare today. Patient satisfaction includes pain management, response to requests for help (call bell) and the attentiveness of the staff to meet needs during a hospital stay. Staff satisfaction can create a positive work environment, increase morale, and improve staff engagement (Flowers et al., 2016). Patient satisfaction has been associated with adequate staffing of inpatient units and positive environments (Danaf et al., 2017).

The Hospital Consumer Assessment of Healthcare Providers and System (HCAHPS) is a national standardized survey consisting of 32 questions about a hospital stay from the patient's perspective that are reported publically. The HCAHPS survey allows for data to be produced about the perception of patients that allow for objective and meaningful comparisons of hospitals. The survey also provides incentives for hospitals to improve the quality of care provided to patients and enhance accountability by increasing transparency (Centers for Medicaid and Medicare Services, 2017).

The National Quality Nurse Quality Indicators (NDNQI) started in 2000 and 95% of magnet hospitals participate annually. The NQNDI surveys measure nursing quality, improve nurse engagement, strengthen the nurse's work environment, assess nurse staffing levels, and improve reimbursement under the current pay for performance policies. About 300,000 nurses provide insight annually and help create improvements for those who are directly responsible for the patient experience. The results enable hospitals to develop more effective, finely targeted improvements, understand the relationship between nursing-sensitive indicators, staffing, and Registered Nurse survey data (National Database for Nursing Quality Indicators, 2018). A summary of our major findings in the medical evidenced-based extant literature is shown in Appendix A.

2.2.2 Care attendance approaches

Care attendants (CA) are staff fully dedicated to the patient and seem to be an ideal solution although they may have limited capability regarding fall prevention. Improved care attendant training and constant work practices should be considered by hospitals (Jong, Kitchen, & Hill, 2017). Practices should be nurse-led for initiation and discontinuation of patient sitters for management of safety risk behaviors associated with delirium, dementia, and fall risk patients (Colella et al., 2017).

Continuous video monitoring (CMV) can help in the reduction of falls in inpatient rehabilitation settings, especially patients who may be cognitively impaired (Cournan, Fusco-Gessick, & Wright, 2016). One study reported a cost savings of $2.02 million in certified nursing assistants (Jeffers et al., 2013). CVM can be utilized as an additional

component of a fall prevention program (Sand- Jecklin, Johnson, & Tylka, 2016). CMV can be used as a safe alternative for patient companions and does not show an increase in the risk of falling for patients (Votruba, Graham, Winsinski, & Syed, 2016). Nursing culture can shift and trust in the effectiveness of new technology such as video monitoring to address patient safety can increase (Burtson & Vento, 2015).

Normal rounding (NR) is an essential aspect of patient safety and quality of care. Protocols for hourly rounding should be based on individual patient needs and staff preferences (Fabry, 2015). Throughout the implementation of normal hourly rounding education, feedback, use of staff champions and the presence of leaders are needed for success (Kessler, Claude-Gutekunst, Donchez, Dries, & Snyder, 2012). The use of hourly rounding protocols can reduce call light usage, misuse of call lights and improve overall patient satisfaction by increasing the time spent at the bedside. It is essential to keep staff informed and have continued support from leaders for successful implementation of hourly rounding (Dearmon et al., 2013). Normal rounding of patients can improve communication, teamwork and coordination with patients, family members and inter-professional colleagues (Kessler et al., 2012). Normal rounding can increase staff and patient satisfaction through increased visibility of the nurses by the patients (Flowers et al., 2016). Rounding on patients allows the nurse to be present, address the immediate concerns of the patient, and be proactive in their care. Effective use of rounding on patients can impact how patients perceive nursing care, improving overall HCAHPS for patient satisfaction (Neville, Lake, LeMunyon, Paul, & Whitmore, 2012); (Danaf et al., 2017).

Families and friend visitors can act as sitters (FVS) since they like to be actively involved in fall prevention of their loved ones. Patient family members may assist when needed. It is essential to remember that families are informal caregivers and most of the time not professionally trained individuals. Nurses need to assess and evaluate family members understanding and ability to help with fall prevention (Schoberer, Breimaier, Mandl, Halfens, & Lohrmann, 2016). Collaborative relationships built with staff, patients and companions (family members, private aides, and sitters) about a patient's risk for falling are essential in preventing fall-related injuries (Tzeng & Yin, 2007). However, inappropriate delegation to family members for fall prevention can increase the risk of injury to family members. Healthcare team members should not expect families to provide professional care to their loved ones and frequent assessment and reassessment are needed (Tzeng & Yin, 2009). A summary of the care attendance approaches found in the medical extant literature is shown in Appendix B.

3. Objective

The purpose of the proposed current study is to develop an ethical-oriented care attendance approach evaluation framework by taking into consideration the conflicting needs and perspectives of hospitals, nurses and patients.

4. Research design/methodology

According to Curtin's 6-step model and philosophy, a nurse has a unique relationship with a patient which enables him/her to provide close observation and allows them to

identify ethical dilemmas and clinical crises during which the management of these issues requires clinical expertise and moral judgement. The constant change in patient acuity, limited resources, and advanced technology creates ethical dilemmas along the way (Wood, 2001). Not only is it essential to gather adequate relevant data in decision making, it is also important to understand the emotional impact of situations on humans that can offer valuable insight into personal responsibility and accountability (Curtin, 1978). To address these conflicting perspectives, a stakeholder analysis is proposed.

The present study provides an evaluation, using the Analytic Hierarchy Process (AHP) methodology, and Curtin's 6-step model of ethical decision making of four different care attendant approaches identified from the current literature: care attendant (CA), continuous video monitoring (CVM), normal rounding (NR) and family/visitor/friend (FVS) (Saaty, 2001; Curtin, 1978). These approaches constitute the alternatives in our AHP model. The evaluation criteria have been obtained from a review of evidence-based medical literature (shown in Appendix A) as discussed in the literature review section. Their importance is assessed by three decision-makers (study co-authors) which include a nursing hospital administrator, a registered nurse in active patient care service and a layperson with extensive patient experience due to family circumstances. Each of the experts represents the hospital, nursing and patient's point of view respectively when addressing the ethical implications. The pairwise comparisons for the criteria weights were done via group discussion while the ratings of the alternatives were distributed among the stakeholder expert representatives. For example, whenever the comparison question involved a hospital-related criterion (e.g. costs) the team member who is a hospital administrator would perform the assessment; when the comparison question involved a nurse-related criterion (e.g. safety) the active licensed train nurse would intervene; and finally, for the patient-related perspective (e.g. patient's perceived value), the patient stakeholder expert representative would issue the judgment. The team met on different occasions and the intensity judgments were agreed upon through discussion of the different views and negotiating consensus to address this as well as any potential inconsistency. A three-person team makes it much easier than one with a larger number to reach consensus and negotiate inconsistent judgments when they arise. Following standard practice, the consistency ratio, called the inconsistency index in Super Decisions (2018) software, was always kept at less than or equal to .1 for the agreed comparison.

The Analytic Hierarchy Process (AHP) developed by Saaty (2001) is one of the most widely used multi-criteria decision-making frameworks. One of the reasons for its popularity is that it is easy to understand and use by decision-makers. Most often, in selection and evaluation applications, the AHP hierarchy frames a decision as a hierarchical model where the top level captures the goal of the model, the intermediate levels contain the criteria and sub-criteria, and the bottom level consists of the alternatives. In the ratings model approach, the decision-maker can derive a local weight for each of the criteria by pairwise comparison of their relative importance, using Saaty's (2001) intensity scale with ranges from 1 (equally important) to 9 (extremely more important) with respect to the decision goal. These judgments are tabulated in a pairwise comparison matrix (PCM) and the relative weights are calculated by raising the PCM to powers until the limit matrix is obtained. Once the criteria weights are obtained, the alternatives can be evaluated against each of the criterion using a ratings scale (e.g. from "Poor" to "Excellent") and the final rating for each alternative is obtained as a weighted

sum of each criterion rating times its relative weight. While a thorough discussion of AHP is beyond the scope of the present study, the reader is referred to the extensive literature on the topic such as Saaty (2001) and Mu and Pereyra-Rojas (2017).

An AHP Benefit/Cost (B/C) approach and Super Decisions (2018) software for the AHP stakeholder was used following the procedural recommendations of Mu and Pereyra-Rojas (2018) for this type of analysis. One important caveat is that rather than using a traditional financial B/C approach, we took advantage of the AHP methodology to model intangible criteria such as "perceived value" as well as the inclusion of benefit criteria corresponding to the different stakeholders such as hospital's and patient's perceived value and nurse's concern (safety) as seen in Figure 1. A benefit is a gain that can be either financial or intangible. A specific benefit hierarchical model was developed for our study as shown in Figure 1. The cost criteria are more attuned with objective financial considerations as seen in Figure 2.

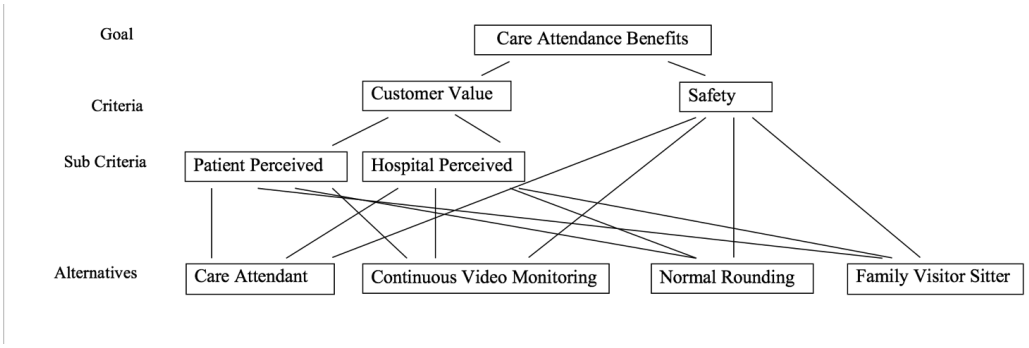

Figure 1 Benefits model

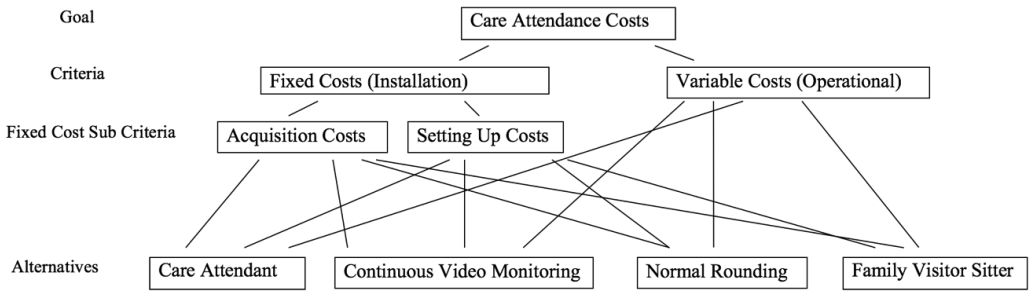

Figure 2 Cost model

5. Benefit and cost analysis criteria/sub-criteria and alternatives

The summary of alternatives for this study is shown in Appendix B. The Benefit Model Criteria/Sub-Criteria are shown in Appendix C. A subjective rating scale was developed for each criterion/sub-criterion and is shown below in Tables 1-3. The alternatives were rated accordingly by the decision-making team as shown in Table 4 and the priorities based on this are shown in Table 5.

Table 1
Benefit model ratings scale explanation of customer value-patient perceived rating scale

Benefit Model Ratings Scale Explanation of Customer Value- Patient Perceived Rating Scale	
Excellent	If patient considers the care attendant approach is the best they have ever received. Extremely high praise for care provided, and met every need of the patient.
Very good	Very professionally attended, to although no moderate degree of empathy.
Good	Professionally well done although no empathy developed between patient and care attendant approach.
Regular	Patient feels that approach covered the very minimum of what was expected by patient expectations.
Deficient	The patient considers that the care attendant approach did not meet his/ her care needs and expectations.

Table 2
Benefit model ratings scale explanation of customer value-hospital perceived rating scale

Benefit Model Ratings Scale Explanation of Customer Value- Hospital Perceived Rating Scale	
Excellent	Patient is very satisfied with care received, gives praise openly and recommends hospital care to all friends and relatives.
Very good	Patient is very satisfied with care and considers it to be above average expectations. Will return to have care and recommend to close friends and family.
Good	The patient is satisfied with care received and considers that needs were met, but could have been provided better overall care. Will return as customer, but will not actively recommend to other customers.
Regular	Patient will consider that needs were barely met. While no complaints will be made, he/ she may not return and will not recommend care attendant approach to other customers.
Deficient	Needs were not met. Care was poor and may issue formal voice complaint or grievance. Unlikely to return if have the opportunity will express negative opinion to family and friends.

Table 3
Benefit model ratings scale explanation of safety rating scale

Benefit Model Ratings Scale Explanation of Safety Rating Scale	
Excellent	Risk of harm and unsafe care to patient based on care approach is very minimal. There is a high degree of a trusting relationship between patient and care providers.
Very good	Risk of harm and unsafe care to patient based on the care attendant approach is minor. Trusting relationships were developed between patient and care providers, but could have been enhanced.
Good	Risk of harm and unsafe care on care attendant approach is moderately possible. Patient may experience unsafe care resulting in no injury.
Regular	Risk of harm and unsafe care on care attendant approach is moderately possible. Patient may experience unsafe care resulting in minor injury. Injury may result in increased length of hospital stay
Deficient	Risk of harm and unsafe care on care attendant approach is moderately possible. Patient may experience unsafe care resulting in major injury. Injury may result in increased length of hospital stay or death.

Table 4
Benefits criteria model with alternatives rating scale

	Benefits Criteria Model with Alternatives Rating Scale					
	B1 Customer Valve (0.167)				**B2** Safety (0.833)	
	B1-1 Patient Perceived Value (0.667)		**B1-2** Hospital Perceived Value (0.333)			
Measurement Type	Subjective		Subjective		Subjective	
Rating Scale						
	1	Excellent	1	Excellent	1	Excellent
	0.403	Very Good	0.403	Very Good	0.403	Very Good
	0.155	Good	0.155	Good	0.155	Good
	0.065	Regular	0.065	Regular	0.065	Regular
		Deficient		Deficient		Deficient
A1 Care Attendants	Very Good		Good		Very Good	
A2 Continuous Video Monitoring	Good		Very Good		Good	
A3 Normal Rounding	Regular		Good		Regular	
A4 Family Visitor Sitter (FVS)	Very Good		Good		Regular	

5.1 Benefit model pairwise comparison

5.1.1 With respect to benefits, what is more important safety or customer value?

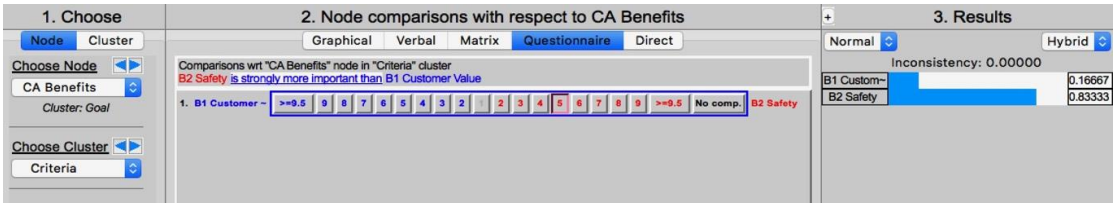

Figure 3 Criteria pairwise comparison with respect to the goal: safety vs customer value

Safety is important because both nurses and hospital administrators want the patient to remain safe during their care. Also, length of stay could increase or injury could result if the patient were to fall or stop receiving care by removing an IV or drain. Patients, nurses and hospital customers also want to feel safe during their hospital stay and they value the attention given to patient safety. Also, customer value is significant because it is a determinant factor in whether the customer will come back to receive care at the facility or choose to go elsewhere. However, patient safety takes priority over where they will choose to receive care in the future. Even if the patient doesn't perceive it to be so, it is vital for the patient to remain safe during their hospital stay. For this reason, safety is considered to be more important than customer value leading to safety (0.833) having a much higher priority than customer value (0.167).

5.1.2 With respect to customer value, what is more important patient perceived value or hospital perceived value?

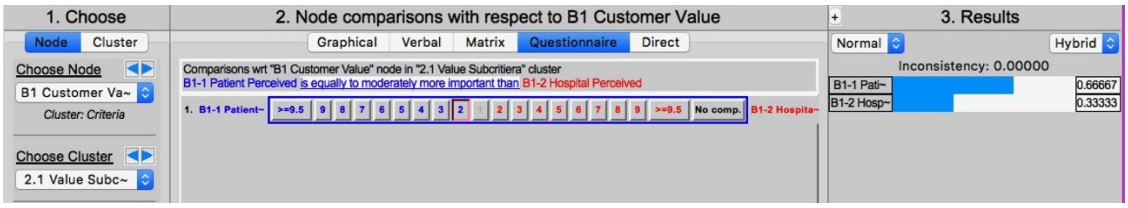

Figure 4 Sub-criteria pairwise comparison with respect to the "customer value" criterion: patient's perceived value vs hospital's perceived value

It is the expected that the patient will come back to receive care, if needed, at the hospital based on the previous care they received and the patient's perceived value of that care. These are subjective perceptions and the hospital and patient may even disagree on their perceptions. Therefore, whose perception should be more important? This is a hot topic for discussion, but it was agreed that while the patient's perception may be independent from the actual safety situation, the patient's satisfaction should still be given greater consideration. For this reason, patient perceived value is from equally to moderately more important (3) than hospital perceived value, and hence their relative priorities are 0.667 and 0.333 respectively.

Table 5
Benefits model results

Benefits Model Ratings

Alternatives	**B1 Customer Value**		**B2 Safety**	**Total**	**Normal**	**Rank**
	0.167		**0.833**			
	B1-1 Patient Perceived		**B1-2 Hospital Perceived**			
Local Weights	0.667	0.333				
Global Weights	**0.111**	**0.056**	**0.833**	1.000		
A1 Care Attendant (CA)	0.403	0.155	0.403	0.383	**0.521**	1
A2 Continuous Video Monitoring (CVM)	0.155	0.403	0.155	0.155	**0.210**	2
A3 Normal Rounding (NR)	0.065	0.155	0.065	0.084	**0.114**	4
A4 Family Visitor Sitter (FVS)	0.403	0.155	0.065	0.108	**0.146**	3
				0.736	1.000	

The above results show that using a care attendant to provide patient care is by far (0.521) the most beneficial approach taking into account the importance given to each of the benefits. This approach addresses the hospital's concern for patient safety as well as the patient's own safety perception.

5.2 Benefit model sensitivity analysis

While the superiority of the care attendant (CA) alternative (0.521) is clear, it is necessary to perform a sensitivity analysis to assess the robustness of this decision. Table 6 shows the results for the case of both criteria (B1-customer value and B2-safety) having the same weight, while Table 7 considers the same scenario but with the caveat of the patient and hospital's perceived value having the same importance.

Table 6
Sensitivity scenario 1: Benefits model with equally important criteria

Benefits Model Ratings						
Alternatives	**B1 Customer Value**		**B2 Safety**	**Total**	**Normal**	**Rank**
	0.500		**0.500**			
	B1-1 Patient Perceived	**B1-2 Hospital Perceived**				
Local Weights	0.667	0.333				
Global Weights	**0.334**	**0.167**	**0.5**	1.000		
A1 Care Attendant (CA)	0.403	0.155	0.403	0.363	**0.494**	1
A2 Continuous Video Monitoring (CVM)	0.155	0.403	0.155	0.155	**0.210**	3
A3 Normal Rounding (NR)	0.065	0.155	0.065	0.121	**0.165**	4
A4 Family Visitor Sitter (FVS)	0.403	0.155	0.065	0.193	**0.262**	2
				0.736	1.000	

Table 7
Sensitivity scenario 2: Benefits model with equally important criteria plus equally important sub-criteria

Benefits Model Ratings						
Alternatives	**B1 Customer Value**		**B2 Safety**	**Total**	**Normal**	**Rank**
			0.500			
	B1-1 Patient Perceived	**B1-2 Hospital Perceived**				
Local Weights	0.5	0.5				
Global Weights	**0.250**	**0.250**	**0.500**	1.000		
A1 Care Attendant (CA)	0.403	0.155	0.403	0.364	**0.495**	1
A2 Continuous Video Monitoring (CVM)	0.155	0.403	0.155	0.155	**0.210**	3
A3 Normal Rounding (NR)	0.065	0.155	0.065	0.149	**0.203**	4
A4 Family Visitor Sitter (FVS)	0.403	0.155	0.065	0.172	**0.234**	2
				0.736	1.000	

As can be concluded from these sensitivity scenarios, the rank of the alternatives remains the same. This means that the original results from Table 2 are quite robust. Indeed, the use of a care attendant (CA) is by far the most beneficial alternative.

5.3 Cost Model Analysis criteria/ sub-criteria

A summary of Cost criteria/sub-criteria is shown in Appendix D. An objective rating scale, based on US dollars, was developed for each cost criteria/sub-criteria and the alternatives were rated accordingly as shown in Table 8. The priority results based on this AHP cost model analysis are shown in Table 9. (See Table 8 on next page)

Table 8
Costs criteria model with alternatives rating scale

	Costs Criteria Model with Alternatives Rating Scale		
	C1 Fixed Costs (0.125)		**C2** Variable Costs (0.875)
	C1-1 Acquisition Costs (0.125)	**C1-2** Setting Up Costs (0.875)	N/A
Measurement Type	Objective	Objective	Objective
Rating Scale	Rating / Amount: 1 / $20,000; 0.75 / $15,000; 0.5 / $10,000; 0.25 / $5,000; 0 / $0	Rating / Amount: 1 / $9,360; 0.75 / $7,500; 0.5 / $5,000; 0.25 / $2,500; 0 / $0	Rating / Amount: 1 / $312.00; 0.75 / $234.00; 0.5 / $156.00; 0.25 / $72.00; 0 / $0
A1 Care Attendants	$0 **(0)**	Average $13 hourly wage per Care Attendant **Total Value for 6 Week Training Period** **$3,210** (Before Benefits and Taxes) In a 24 hour period a patient would have 3 care attendants taking care of them. Therefore, 3 attendants need to be trained. **Total Cost: $9,360** **(1)**	$13 per hour $312/day/patient **(1)**
A2 Continuous Video Monitoring	$20,000/monitor per patient **(1)**	Cost for three care attendants (CA) with training divided by the number of patients that the CA can watch in the hub at one time is eight patients, value for the cost of virtually monitoring the one patient $9,360 /8**Total Cost $1,170** **(0.125)**	$39/day/patient **(0.125)**
A3 Normal Rounding	$0.00 **(0)**	$0.00 **(0)**	$52/day/patient (10 minutes per patient per hour) **(0.166)**
A4 Family Visitor Sitter (FVS)	$0.00 **(0)**	$0.00 **(0)**	$26/day/patient (5 Minutes per patient per day) **(0.083)**

5.4. Pairwise comparison of costs criteria/ sub-criteria

5.4.1. With respect to the CA cost, which is more important fixed costs or variable costs?

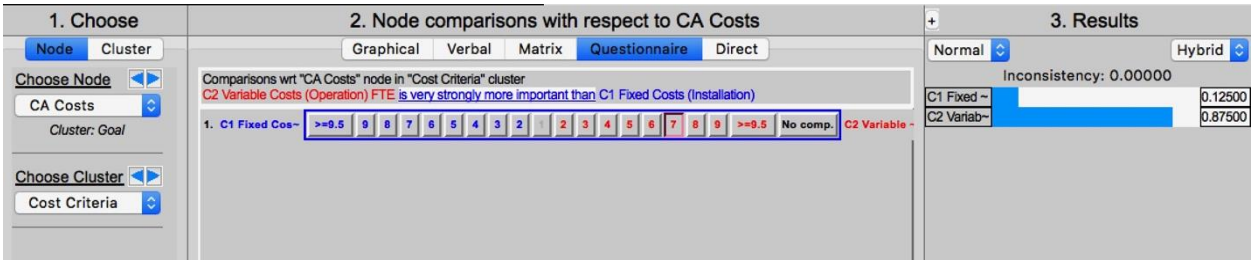

Figure 5 Pairwise comparison with respect to the goal: fixed costs vs variable costs

The variable costs are more important because it is important to be able to operate the solution. In the economic analysis, variable costs are more important than fixed costs, in particular for the breakeven analysis. For this reason, we concluded that the variable costs (0.875) are very strongly more important than fixed costs (0.125). Also, none of the alternatives have expensive fixed costs associated with them or will depreciate over time.

5.4.2. With respect to fixed cost, which is more important acquisition or the setting up costs?

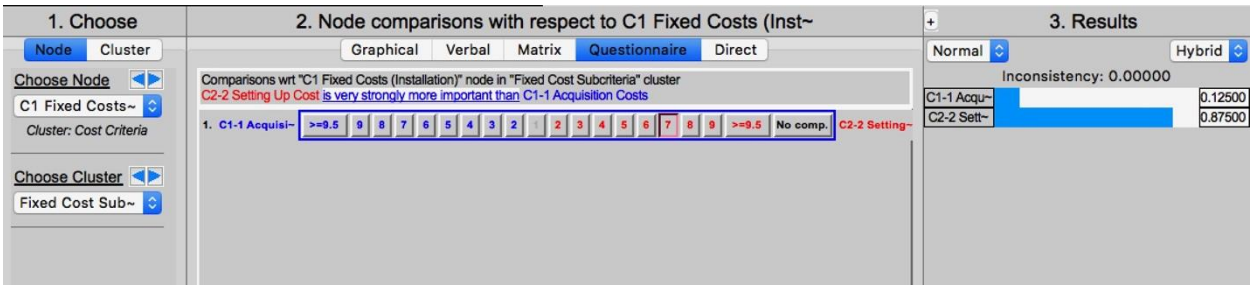

Figure 6 Pairwise comparison of sub-criteria with respect to "fixed costs" criterion: Acquisition costs vs setting up costs

The setting up costs are more important than the acquisition costs because the setting up costs involve multiple interdisciplinary teams and departments as well as initial staff education and buy-in. Setting up costs (0 .875) were estimated to be very strongly more important than the acquisition costs (0.125).

Table 9
Cost model results

Costs Model Ratings						
Alternatives	**C1 Fixed Costs**		**C2 Variable Costs**	**Total**	**Normal**	**Rank**
Criteria Weights	**0.130**		**0.875**			
	C1-1 Acquisition Cost	**C1-2 Setting Up Cost**				
Local Weights	**0.125**	**0.875**				
Global Weights	**0.016**	**0.114**	**0.875**	**1**		
A1 Care Attendant (CA)	0.000	1.000	1.000	0.989	0.631	1
A2 Continuous Video Monitoring (CVM)	1.000	0.125	0.125	0.359	0.229	2
A3 Normal Rounding (NR)	0.000	0.000	0.166	0.145	0.093	3
A4 Family Visitor Sitter (FVS)	0.000	0.000	0.083	0.073	0.046	4
				1.566	1.000	

5.5 Sensitivity analysis for the cost model

Data from Table 9 (normal priorities) shows that the costliest solution to increase patient safety is the use of a care attendant (0.631) followed by the engagement of a family visitor sitter (0.046). To evaluate how much these results are affected by the importance of the criteria a sensitivity analysis was performed. In the first scenario (Table 10), the same weight was given to both fixed and variable costs (although this is not the standard financial practice which generally assigns more importance to the variable costs). Still, the most expensive alternative is care attendant followed by family visitor sitter. When adding the consideration of the sub-criteria acquisition and setting up costs having the same importance, the rank of the alternative costs does not change as shown in Table 11. This sensitivity analysis indicates that the results of Table 9 are pretty robust.

Table 10
Sensitivity scenario 1: Cost model with equally important criteria

Costs Model Ratings

Alternatives	**C1 Fixed Costs**		**C2 Variable Costs**	**Total**	**Normal**	**Rank**
Criteria Weights			**0.500**			
	C1-1 Acquisition Cost		**C1-2 Setting Up Cost**			
Local Weights	**0.125**	**0.875**				
Global Weights	**0.063**	**0.438**	**0.500**	**1.000**		
A1 Care Attendant (CA)	0.000	1.000	1.000	0.938	0.715	1
A2 Continuous Video Monitoring (CVM)	1.000	0.125	0.125	0.250	0.191	2
A3 Normal Rounding (NR)	0.000	0.000	0.166	0.083	0.063	3
A4 Family Visitor Sitter (FVS)	0.000	0.000	0.083	0.042	0.032	4
				1.312	1.000	

Table 11
Sensitivity scenario 2: Same as scenario 1 with equally important sub-criteria

Costs Model Ratings

Alternatives	**C1 Fixed Costs**		**C2 Variable Costs**	**Total**	**Normal**	**Rank**
Criteria Weights			**0.500**			
	C1-1 Acquisition Cost		**C1-2 Setting Up Cost**			
Local Weights	**0.500**	**0.500**				
Global Weights	**0.250**	**0.250**	**0.500**	**1.000**		
A1 Care Attendant (CA)	0.000	1.000	1.000	0.750	0.572	1
A2 Continuous Video Monitoring (CVM)	1.000	0.125	0.125	0.437	0.333	2
A3 Normal Rounding (NR)	0.000	0.000	0.166	0.083	0.063	3
A4 Family Visitor Sitter (FVS)	0.000	0.000	0.083	0.041	0.032	4
				1.312	1.000	

5.6 Benefit cost analysis

In Benefit Cost Analysis, the alternatives are prioritized with respect to Benefits (Table 5) and Costs (Table 9) separately. The priorities from the benefits table reflect how beneficial the care attendance approach alternatives are. The table can be interpreted as the higher the priority the higher the benefit. On the other hand, the priorities from the costs table reflect how costly the alternatives are; that is, the higher the priority the more costly the alternative. For this reason, it is necessary to calculate the B/C ratio for each of

the alternatives. The alternative with the highest B/C ratio will be the most benefit cost effective as shown in Table 12.

Table 12
Benefit Cost B/C Analysis

Benefit Cost Analysis

Alternatives	**Benefit**	**Cost**	**Benefit/Cost Ratio**	**Normal**	**Rank**
A1 Care Attendant (CA)	0.521	0.631	0.826	0.134	3
A2 Continuous Video Monitoring (CVM)	0.21	0.229	0.917	0.149	4
A3 Normal Rounding (NR)	0.114	0.093	1.226	0.200	2
A4 Family Visitor Sitter (FVS)	0.146	0.046	3.174	0.517	1
			6.142	1.000	

From the table above we find that the most benefit cost effective alternative is A4 Family Visitor Sitter (FVS) with a normalized B/C ratio of 0.517, simply because it has the least cost priority (0.046) than any other alternative. However, A1 Care Attendant (CA) is the one with the highest benefit priority (0.521) more than 3 times that of A4 FVS (0.146), but also with the highest cost priority (0.631). This leads us to discuss whether the benefits should weigh more than the costs when making the final decision. This analysis will be made next.

5.6.1 Benefit cost sensitivity analysis using strategic criteria

The consideration of whether the benefits should outweigh costs is related to the strategic criteria for making the overall decision. This is important because the final evaluation priority of the alternatives may be very sensitive to the importance given to either benefits or costs. In our decision analysis, our model criteria are based on the ethical need to incorporate all the stakeholder's considerations; that is, those corresponding to the hospital, nurses and patients as shown in the strategic criteria row in Table 13.

Following best practices, the Benefits and Costs merits were rated according to their importance to address the proposed strategic criteria (Saaty & Ozdemir, 2005). The results are shown in Table 13. As can be seen for our decision, the overarching importance is given to the patient satisfaction (0.731) followed by nurses considerations (0.188) and hospital concerns (0.08) respectively. Based on the importance of these strategic criteria, it is concluded that benefits should have a greater weight (0.642) than costs (0.359). Therefore, the next step would be to re-calculate our benefit cost analysis from Table 12 taking into consideration the greater importance of benefits. The results, using the additive subtractive analysis commonly used for this type of analysis, are shown in Table 13.

Table 13
Strategic Benefit Cost Analysis

Strategic Benefit Cost Analysis								
Strategic Criteria	**Hospital Concerns** (0.080)		**Nursing Considerations** (0.188)		**Patient Satisfaction** (0.731)			
Measurement	Subjective		Subjective		Subjective			
Rating Scale	5	High Importance	5	High Importance	5	High Importance		
	4		4		4			
	3	Medium Importance	3	Medium Importance	3	Medium Importance		
	2		2		2			
	1	Low Importance	1	Low Importance	1	Low Importance		
							Total	**Normalized**
Benefits	3		5		5		4.835	0.642
Costs	4		1		3		2.701	0.359
							7.536	1

Table 14 allows a comparison of the original results (B and C unweighted) with the new ones using strategic criteria. Lines 3 and 4 show the multiplicative (B/C) original results and line 5 shows the rank of the alternatives as taken from Table 9 which we previously discussed.

To perform a weighted benefit cost analysis it is recommended that the additive subtractive synthesis analysis of the form B – C (unweighted) or bB – cC (weighted) as shown in Table 14 be used. In this table, line 7 provides the normalized results for the unweighted case and line 8 provides the rank of the alternatives. Notice that the rank of alternatives is the same whether we use the multiplicative approach (line 5) or the additive synthesis approach (line 7).

Our next step is to use the benefits and costs weight (lines 9 and 10) as factors in the calculation of the weighted synthesis shown in line 13. As can be seen, this drastically changes the order of our preferences (line 15). When using our strategic criteria to weight the benefits and costs, the original worst alternative (A1 Care Attendant) becomes the very best. What used to be the best alternative (A4 Family Visitor Sitter) now becomes the second best alternative. The worst alternative is now A3 Normal Rounding while A2 Continuous Video Monitoring remains as the third best alternative. These results, based on strategic weighting of the merits B and C, as shown in lines 14 (normalized priorities) and 15 (rank), are the ones that must be considered in strategic decision-making concerning care attendance approach evaluation.

Table 14
Strategic benefit cost criteria analysis results

				A1	**A2**	**A3**	**A4**
Line	Description	Formula	Value	**Care Attendance**	**Continuous Video Monitoring**	**Normal Rounding**	**Family Visitor Sitter**
1	Benefits	B		0.521	0.21	0.114	0.146
2	Costs	C		0.631	0.229	0.093	0.046
3	B/C Multiplicative	B/C		0.826	0.917	1.226	3.174
4	B/C Normalized			0.134	0.149	0.200	0.517
5	Rank			4	3	2	1
6	BC Additive Synthesis	B - C		-0.110	-0.019	0.021	0.100
7	Additive Synthesis Normalized			-0.440	-0.076	0.084	0.400
8	Rank			4	3	2	1
9	Benefits Weight	B	0.642				
10	Costs Weight	C	0.359				
11	Weighted Benefits	b*B		0.334	0.135	0.073	0.094
12	Weighted Costs	c*C		0.227	0.082	0.033	0.017
13	BC Weighted Additive Synthesis	b*B - c*C		0.108	0.053	0.040	0.077
14	Weighted Additive Synthesis Normalized			0.389	0.190	0.143	0.278
15	Rank			1	3	4	2

Figures 7a and 7b show in a graphical way how sensitive our BC weighted additive synthesis results (line 13 in Table 15) are with respect to the weights given to the benefits (b) and costs (c) in lines 9 and 10 respectively from Table 15. The addition of b + c must always add to 1.

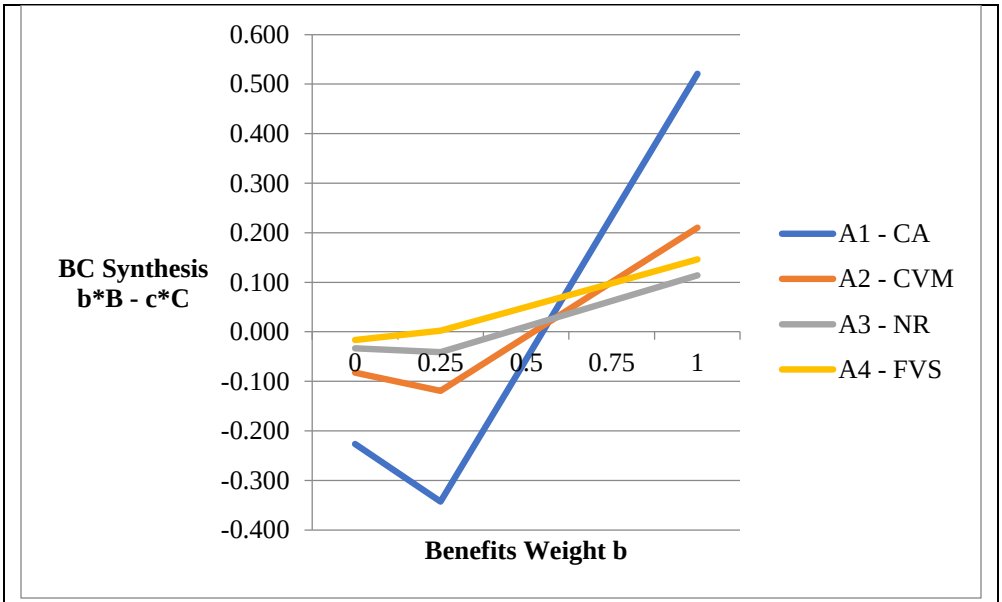

Figure 7a Strategic sensitivity respect to benefits

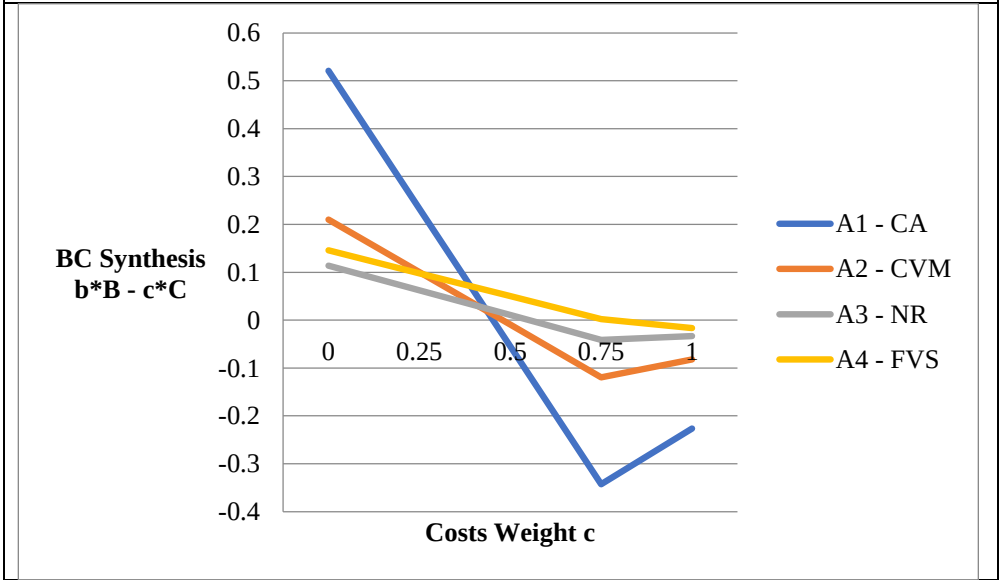

Figure 7b Strategic sensitivity respect to costs

Notice, in Figure 7a, that when benefits are as important as costs (0.5 each), A1 (Care Attendant) is the worst alternative, as found in our original scenario, because it has the lowest priority. However, as the benefits begin having more importance than the costs, A1 starts to quickly outperform the other alternatives. Therefore, since our care attendance approach evaluation is based on the need to provide benefits (0.642) rather than diminish costs (0.359), it is clear that the use of A1 (Care Attendant) constitutes the best alternative.

This conclusion can also be derived from Figure 7b where our BC weighted additive synthesis results show that A1 (Care Attendant) becomes the worse solution as the importance of costs increases while A1 (Care Attendant) constitutes the best solution when costs weights are lower than 0.5 approximately; that is, costs are less important than benefits.

6. Conclusion

In conclusion, this study shows a basic model, derived from the extant medical literature that can be used to prioritize the different care attendance approaches used in the acute care hospital setting. Suitable format for care attendance approaches is an important aspect to keeping patients safe while in the hospital. Furthermore, this study addresses the choice of care attendance as an ethical decision, and for this reason the three different stakeholder opinions are included namely, hospital administration, nurses and patients. Our study shows that the best overall approach is the use of a dedicated care attendant (0.389, Table 14) followed by family/visitor sitters (0.278). This is highly influenced by the fact that the close presence of a person gives the patient a strong sense of security and patient's perception has a large importance as a benefit (0.667, Table 5). Still, most hospitals will need to use mixed patient care approaches to balance both benefits and costs. The findings of this strategic benefit-cost strategic analysis sensitivity allowed us to conclude that in a mixed approach situation, hospitals could distribute resources as suggested by this study prioritization; that is, CA could be allocated 38.9% (Table 14) of the resources to keep patients safe and maximize patient's perception of safety. As each patient's ethical implications and decisions come into play, resources for the other alternatives could be distributed as follows: FVS (27.8%), CVM (19%) and finally NR (14.3%). This model can be used as an evaluation format for hospitals and serve as a reference for care attendance approaches resource allocation acute care settings.

7. Limitations and future research

Expert representation for each stakeholder perspective may be somewhat limited. AHP cannot fully take away the subjectivity of a single participant and for this reason, extending the number of qualified expert judgments in all stakeholder groups may be convenient. This can be done by having focus groups of experts for each stakeholder perspective or surveying a large number of stakeholders. Another area of exploration is to develop different decision hierarchies for each stakeholder perspective, namely, for the hospital, nurse and patient's perspective. In this case, the criteria of each perspective could be specifically tailored in a different hierarchy for each stakeholder. For example, while patients may not think much of the overall costs of each care attendance approach, they may be more mindful of out-of-pocket costs. While there are several possible areas of further development, this study constitutes an important first step toward a quantitative evaluation framework taking into account the essential factors, based on extant literature, to assess current care attendance approaches. Also, this evaluation framework can serve as a practical reference for decision-makers in the acute care setting.

8. Contributions

One of the most important and unique characteristics of the present study is that it shows that care attendance selection is an ethical decision based on Curtin's (1978) ethical model criteria. To address the ethical dilemma of cost-effectiveness (hospital view) versus safety and value (patients and nurse), this study integrates all these different perspectives in a care attendant evaluation framework following a stakeholder's approach (Freeman, 1984). Another important characteristic is that rather than using a traditional financial B/C analysis, we have used the Analytic Hierarchy Process which allows the inclusion of intangible considerations such as "patient's perceived value" (Saaty, 2001). The final priorities obtained for each approach can be used to allocate resources proportionately. Also, this study allows understanding of the key factors, based on current medical literature, involved in the evaluation of the different care attendance approaches. Finally, this report follows recent best practices proposed for this type of study (Mu, Cooper & Peasley, 2018).

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APPENDICES

Appendix A
Review Summary of Extant Literature on Care Attendance

Item	Citation	Topic	Pertinent Findings
1	(Sand-Jecklin, Johnson, & Tylka, 2016)	Hospital, Patient Perceived, Customer Value, Safety, Continuous Video Monitoring	CVM can also aide in reducing cost of sitter hours and reduction in patient falls.
2	(Votruba, Graham, Wisinski, & Syed, 2016)	Customer Value, Hospital Perceived, Patient Perceived, Safety, Fixed Cost-Installation Costs, Variable Costs, Continuous Video Monitoring	CMV can be used for elopement, protect patients from interfering with medical devices, and monitor seizure activity as well.
3	(Kessler, Claude-Gutekunst, Donchez, Dries, & Snyder, 2012)	Normal Rounding, Patient and Hospital Perceived Customer Value, Safety	Increased Press Ganey scores usually in the 80^{th} to 90^{th} percentile in how well patients pain was controlled, promptness in response to call bell, and how well staff cared for patients. Fall rate of patients decreased from 5.46% to 2.19% after implementation of hourly rounding.
4	(Flowers et al., 2016)	Patient and Hospital Perceived, Customer Value, Normal Rounding	Intentional rounding includes common elements of assessing and managing pain, assistance with toileting, repositioning and comfort, and ensuring essential items including call bell, telephone, and bedside table easily accessible to patient. Staff engagement is key for successful implementation.
5	(Solimine et al., 2018)	Care Attendants, Safety, Patient Perceived, Hospital Perceived, Care Attendants	A multi-disciplinary team approach to safety and sitters can be effective. Screening was performed on patients to assess ability to make basic needs known, respond to diversion, and ambulate independently. This approach showed success in prevention of delirium, prevent functional and cognitive decline, and decrease patient falls.
6	(Tzeng & Yin, 2007)	FVS, Customer Value, Patient Perceived	The involvement of family visitor sitters can provide psychological support to patients, but cannot replace RN's in effectively reducing patient falls. This is because family visitor sitters lack professional training.
7	(Neville, Lake, LeMunyon, Paul, & Whitmore, 2012)	Hospital Perceived and Patient Perceived-Customer Value, Normal Rounding	It is important to have staff engagement with the use of hourly rounding. Effective rounding can impact how patients perceive nursing care, improving HCHAPs.
8	(Morgan et al., 2016)	Customer Value, Hospital Perceived, Patient	Intentional rounding can aide in significantly reducing the

		Perceived, Safety, Normal Rounding	number of patient falls.
9	(Tzeng, Yin, & Grunawalt, 2008)	Customer Value, Hospital Perceived, Safety, Care Attendants	The use of a patient attendant assessment tool (PAAT) should be used in the acute care setting related to the provision of constant observation sitters. It may be helpful in the RN assessment of patient needs for sitter to better judge requests for scare nursing resources.
10	(Davis, Kutash, & Whyte IV, 2017)	Care Attendants, Continuous Video Monitoring, Operational Costs, Safety, Customer Value, Patient Perceived, Hospital Perceived	There was no significant difference in patient falls for CVM and in room sitters. The study revealed a decrease in costs per patient sitter day without a significant increase in patient falls or harms when video monitoring was used on a unit for majority of patients who required constant observers.
11	(Boswell, Ramsey, Smith, & Wagers, 2001)	Customer Value, Patient Perceived, Safety, Implementation Costs, Operational Costs- Setting Up, Fixed Costs, Care Attendants	Sitters can have a marginal impact of variables selected in the model (patient falls, dissatisfaction, and quality care). This study showed a better overall understanding of costs associated with a patient sitter program.
12	(Laws & Crawford, 2013)	Safety, Customer Value, Hospital Perceived, Patient Perceived, Variable Costs, Care Attendants	Implementation a program that focused on preventing delirium can aid in decreasing sitter use.
13	(Burtson & Vento, 2015)	Operational Costs- Setting Up Customer Value, Hospital Perceived, Continuous Video Monitoring, Care Attendants, Safety	The implementation of a nursing driven sitter protocol requires that the change agents address widespread nursing beliefs in the effectiveness of sitters through standardized reasons for sitter use.
14	(Cournan, Fusco-Gessick, & Wright, 2018)	Safety, Operational Costs- Setting Up, Continuous Video Monitoring, Fixed Costs- Acquisition Cost	Continuous video monitoring can aide in reduction of costs associated with sitter usage.
15	(Babine et al., 2018)	Safety, Customer Value, Hospital and Patient Perceived, Variable Cost, Setting Up Costs	The study results indicate that improving delirium recognition and treatment through inter-professional education can reduce falls and length of stay.
16	(Neville, DiBona, & Mahler, 2016)	Customer Value- Hospital Perception Safety, Normal Rounding	Nursing leadership is essential for the success of patient rounding. Leaders and nurses should work collaboratively to design optimal tool for patient rounding practices, safety for improved quality care.
17	(Torkelson &	Customer Value, Patient	It is essential to have shared decision making and

	Dobal, 1999)	Perceived & Hospital Perceived, Safety, Care Attendants	collaboration between nurses, physicians, patients, families and case managers to continue or discontinue constant observation of patients.
18	(Rochefort, Buckeridge, & Abrahamowicz, 2015)	Customer Value, Hospital Perceived, Safety, Care Attendants	This study would aide in helping leaders in making the most effective use of scare nursing resources.
19	(Jong, Kitchen, & Hill, 2017)	Customer Value, Hospital Perceived & Hospital Perceived, Safety, Fixed Cost Setting Up Costs, Care Attendants	There is a gap between patient related risk factors and environmental related. Improved training of sitters is needed.
20	(Colella et al., 2017)	Customer Value, Hospital Perceived, Care Attendants	Inter-professional partnerships with a common goal of providing safe quality outcomes is needed.
21	(Goldsack, Bergey, Mascioli, & Cunningham, 2015)	Customer Value, Patient Perceived, Hospital Perceived, Safety, Normal Rounding	Proactive hourly rounding is essential to keep patients safe and reduce number of falls. It is critical that leadership and frontline staff are involved in the program design.
22	(Danaf et al., 2017)	Customer Value, Patient Perceived, Hospital Perceived, Normal Rounding	Proactive rounding helps address hospitalized patients' immediate patient needs. Nursing teams need to be engaged and informed on essential proactive rounding tasks.
23	(Schoberer, Breimaier, Mandl, Halfens, & Lohrmann, 2016)	Customer Value, Patient Perceived, Safety, Family Visitor Sitter	Brochures should be developed regarding information about risk factors, preventative strategies for falls, and additional support to allow family to be involved in patient care.
24	(Tzeng & Yin, 2009)	Customer Value, Patient Perceived, Hospital Perceived, Safety, Family Visitor Sitter, Normal Rounding	Assessment and reassessment of family members understanding and abilities are key to fall prevention and promotion of safety. Family members in Taiwan tend to depend on family members to provide care. However, frequent visits from the bedside nurse are still needed.
25	(Jeffers et al., 2013)	Fixed- Acquisition Costs, Setting Up Costs, Variable Cost Safety, Customer Value, Hospital Perceived, Continuous Video Monitoring	The study showed that CVM had a positive impact on patient falls.

Appendix B
Summary of Care Attendance Alternatives and Literature Source

ID	Definition	Discussion	Source from the Literature Review
A1- Care attendants (CA)	The staff members who help patients who are unable to be on their own due to increased risk factors for injuries or accidents. Care attendants that are monitoring a patient 1:1 can be measured through the use of the use of the nurse's completion of the need for a care attendant form algorithm available in the electronic healthcare record system.	The cost/time of care attendants can be measured to the number of FTE's used, fall injury data, and cost associated. Having a care attendant in the room takes resources away from the unit. It provides the patient with a person that is able to watch for their safety constantly. However, the care attendant must remain attentive at all times or it could still put the patient at risk for safety issues including falling and discontinuing therapies. These issues still occur currently when care attendants are in the room.	(Solimine et al., 2018); (Davis, Kutash, & Whyte IV, 2017); (Boswell, Ramsey, Smith, & Wagers, 2001); (Laws & Crawford, 2013); (Neville, DiBona, & Mahler, 2016); (Torkelson & Dobal, 1999); (Rochefort, Buckeridge, & Abrahamowicz, 2015); (Jong, Kitchen, & Hill, 2017); (Colella et al., 2017)
A2- Continuous Video Monitoring (CMV)	The 24/7 use of video technology to watch multiple at-risk patients to prevent fall injuries and accidents.	Allows the care attendant to be used in resources in other areas of need. (Cross trained as a Patient Care Technicians).	(Sand-Jecklin, Johnson, & Tylka, 2016); (Votruba, Graham, Wisinski, & Syed, 2016); (Davis, Kutash, & Whyte IV, 2017); (Burtson & Vento, 2015); (Cournan, Fusco-Gessick, & Wright, 2018); (Jeffers et al., 2013)
A3- Normal Rounding (NR)	The checking of all patients on each unit by staff for immediate needs including; toileting, pain, positioning, infusion rates and placement, and overall safety of environment should occur hourly.	Normal rounding prevents accidents but can be a brief check on the patient and we only see what is going on in the moment. Patients are often only able to be rounded on every hour, thus putting the patient at an increased risk for falls due to lack of unsafe attempts at toileting, pain, or items not within reach when a staff member may not present in the room	(Kessler, Claude-Gutekunst, Donchez, Dries, & Snyder, 2012); (Flowers et al., 2016); (Neville, Lake, LeMunyon, Paul, & Whitmore, 2012); (Danaf et al., 2017); (Tzeng & Yin, 2009)
A4- Family Visitor Sitter (FVS)	Having a family member or visitor help patients who are unable to be on their own due to increased risk factors for injuries or accidents.		(Tzeng & Yin, 2007); (Schoberer, Breimaier, Mandl, Halfens, & Lohrmann, 2016); (Tzeng & Yin, 2009)

Appendix C
Benefits Criteria/Sub-Criteria Summary and Literature Source

Criteria	Sub-Criteria	Definition	Measurement and Use	Source from Literature Review
B1 - Customer Value		The value convened by the solution, the extent of an environment where high quality care is the overall principle	Measured through patient satisfaction scores (nationally through HCAHPS and Press Ganey. The alternative that provides greater value to the patient, the better.	(Sand-Jecklin, Johnson, & Tylka, 2016); (Votruba, Graham, Wisinski, & Syed, 2016); (Kessler, Claude-Gutekunst, Donchez, Dries, & Snyder, 2012); (Flowers et al., 2016); (Tzeng & Yin, 2007); (Neville, Lake, LeMunyon, Paul, & Whitmore, 2012); (Neville, DiBona, & Mahler, 2016); (Torkelson & Dobal, 1999); (Rochefort, Buckeridge, & Abrahamowicz, 2015); (Jong, Kitchen, & Hill, 2017); (Colella et al., 2017); (Goldsack, Bergey, Mascioli, & Cunningham, 2015); (Schoberer, Breimaier, Mandl, Halfens, & Lohrmann, 2016); (Tzeng & Yin, 2009)
	B1-1 Patient Perceived	Is the value of care attendants approach seen by the patient. The patient's perception of care provided during hospital stay.	Measured subjectively through point of view of each patient from HCHAPS and Press Ganey scores (national measures for satisfaction) The alternative that is perceived higher to the patient, the better the alternative.	(Sand-Jecklin, Johnson, & Tylka, 2016; (Votruba, Graham, Wisinski, & Syed, 2016); (Kessler, Claude-Gutekunst, Donchez, Dries, & Snyder, 2012); (Flowers et al., 2016); (Tzeng & Yin, 2007); (Neville, Lake, LeMunyon, Paul, & Whitmore, 2012); (Boswell, Ramsey, Smith, & Wagers, 2001); (Laws & Crawford, 2013); (Babine et al., 2018); (Neville, DiBona, & Mahler, 2016); (Torkelson & Dobal, 1999); (Jong, Kitchen, & Hill, 2017); (Goldsack, Bergey, Mascioli, & Cunningham, 2015); (Schoberer, Breimaier, Mandl, Halfens, & Lohrmann, 2016); (Tzeng & Yin, 2009)
	B1-2 Hospital Perceived	Is the value of care attendants approach seen by the hospital. The hospital's perception of providing quality care to each particular patient	Measured subjectively through hospital perception of care provided to patients. (NDNQI national safety measures completed by RN every 2 years). The alternative that is perceived higher to the hospital, the better the alternative.	(Sand-Jecklin, Johnson, & Tylka, 2016); (Votruba, Graham, Wisinski, & Syed, 2016); (Kessler, Claude-Gutekunst, Donchez, Dries, & Snyder, 2012); (Solimine et al., 2018); (Neville, Lake, LeMunyon, Paul, & Whitmore, 2012); (Morgan et al., 2016); (Tzeng, Yin, & Grunawalt, 2008); (Laws & Crawford, 2013); (Burtson & Vento, 2015); (Babine et al., 2018); (Neville, DiBona, & Mahler, 2016); (Torkelson & Dobal, 1999); (Rochefort, Buckeridge, & Abrahamowicz, 2015); (Jong, Kitchen, & Hill, 2017); (Colella et al., 2017); (Goldsack, Bergey, Mascioli, & Cunningham, 2015); (Tzeng & Yin, 2009); (Jeffers et al., 2013)
B2 Safety		The extent to which a patient is protected from harm while in the hospital. Harm could include falls, injuries, and other infections.	Monitored and measured subjectively on expert opinion and literature. The higher the safety provided to the patient the better the alternative.	(Sand-Jecklin, Johnson, & Tylka, 2016); (Votruba, Graham, Wisinski, & Syed, 2016); (Kessler, Claude-Gutekunst, Donchez, Dries, & Snyder, 2012); (Solimine et al., 2018); (Morgan et al., 2016); (Tzeng, Yin, & Grunawalt, 2008); (Boswell, Ramsey, Smith, & Wagers, 2001); (Laws & Crawford, 2013); (Burtson & Vento, 2015); (Cournan, Fusco-Gessick, & Wright, 2018); (Cournan, Fusco-Gessick, & Wright, 2018); (Babine et al., 2018); (Neville et al, 2016); (Torkelson & Dobal, 1999); (Jong, Kitchen, & Hill, 2017); (Rochefort, Buckeridge, & Abrahamowicz, 2015); (Schoberer, Breimaier, Mandl, Halfens, & Lohrmann, 2016)

Appendix D
Cost Criteria/ Sub-Criteria Summary and Literature Source

Criteria	Sub-Criteria	Definition	Measurement and Use	Source from Literature Review
C1 Fixed Costs (Installation)		The cost of installing the solution.	Measured as amount of money that is needed to install as specified by vendor and hospital staff The alternative that costs the most, the better the alternative.	(Boswell, Ramsey, Smith, & Wagers, 2001); (Cournan, Fusco-Gessick, & Wright, 2018); (Jong, Kitchen, & Hill, 2017); (Jeffers et al., 2013)
	C1-1 Acquisition Costs	The amount of money it costs to acquire, pay the vendor for each solution.	Measured as the amount of money that needs to be invested for implementation purposes as specified by the vendor and hospital staff**.** The alternative that costs the most, the better the alternative.	(Boswell, Ramsey, Smith, & Wagers, 2001); (Cournan, Fusco-Gessick, & Wright, 2018); (Jong, Kitchen, & Hill, 2017); (Jeffers et al., 2013)
	C1-2 Setting Up Costs	The cost of operating the total solution.	Measured as the amount of money that is needed to upgrade the system such as wireless capability, panels, and sprinkler systems. The alternative that costs the most, the better the alternative.	(Votruba, Graham, Wisinski, & Syed, 2016); (Boswell, Ramsey, Smith, & Wagers, 2001); (Burtson & Vento, 2015); (Cournan, Fusco-Gessick, & Wright, 2018); (Jong, Kitchen, & Hill, 2017); (Jeffers et al., 2013)
C2 Variable Costs (Operational)		The cost of operating the total solution.	Measured as the amount of money that is needed to keep the operation running. Can be measured in terms of FTE ratio/used. The alternative that costs the most, the better the alternative.	(Votruba, Graham, Wisinski, & Syed, 2016); (Davis, Kutash, & Whyte IV, 2017); (Boswell, Ramsey, Smith, & Wagers, 2001); (Laws & Crawford, 2013); (Jong, Kitchen, & Hill, 2017); (Jeffers et al., 2013)