An Exploratory Study: Examining Emergency Department Design- Layout and Nursing Physical Fatigue

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Nursing Physical Fatigue

↓

negative impact

↓

Staff Safety + Staff Performance + Staff Retention

↓

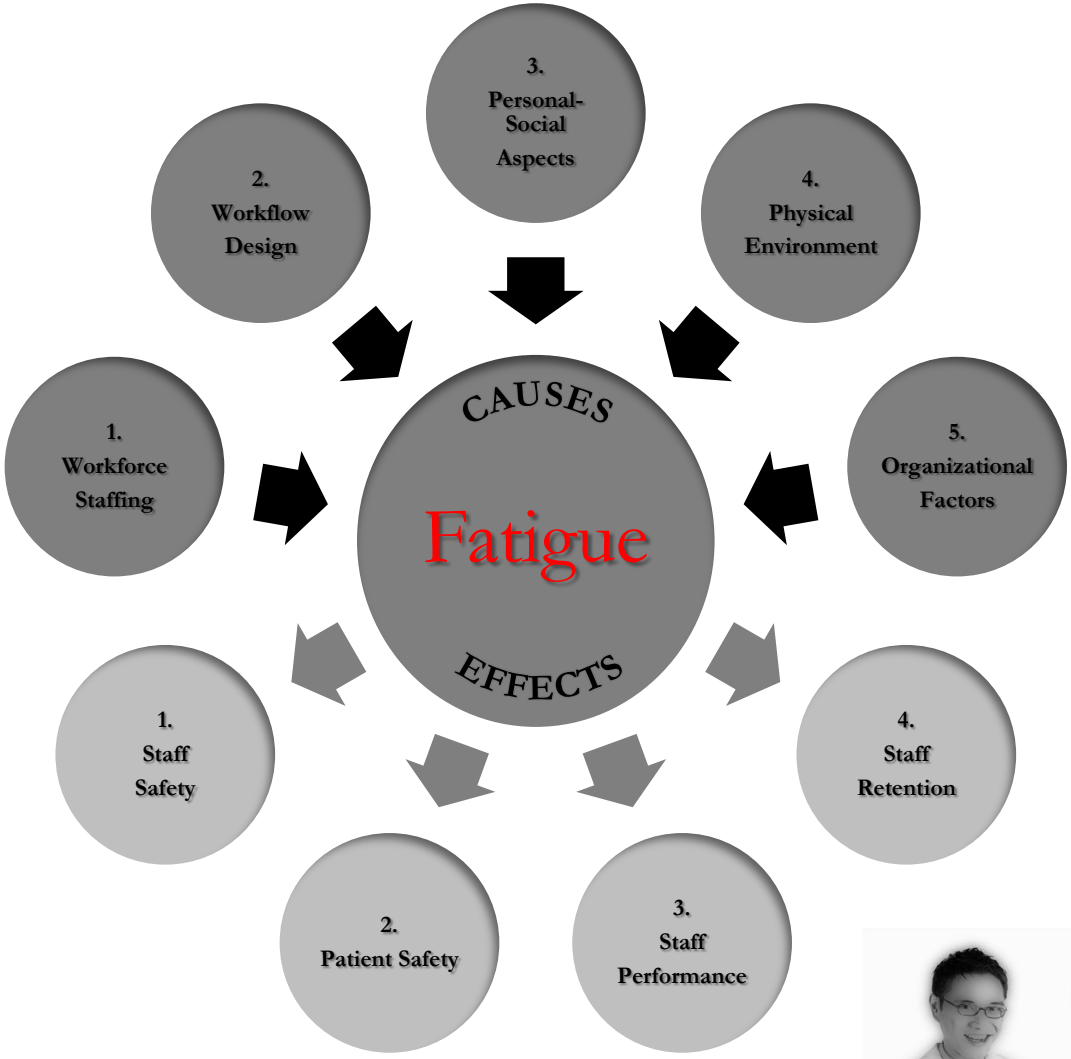
Patient Outcomes
(Patient Safety)

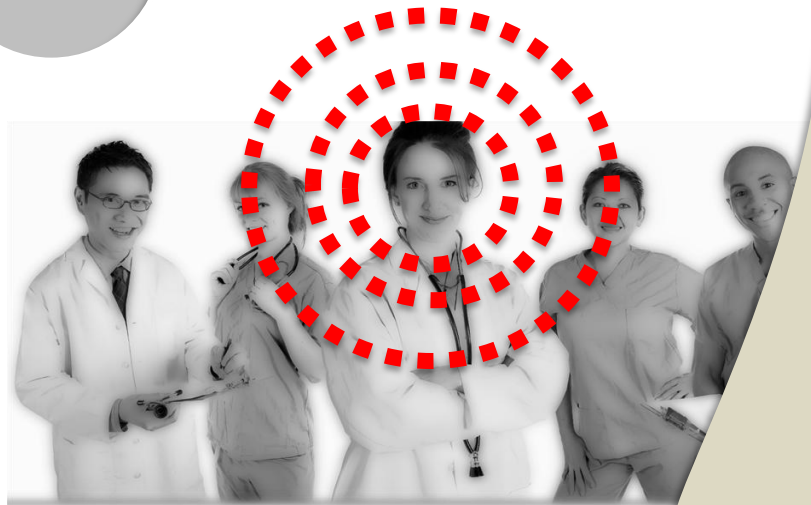
↓

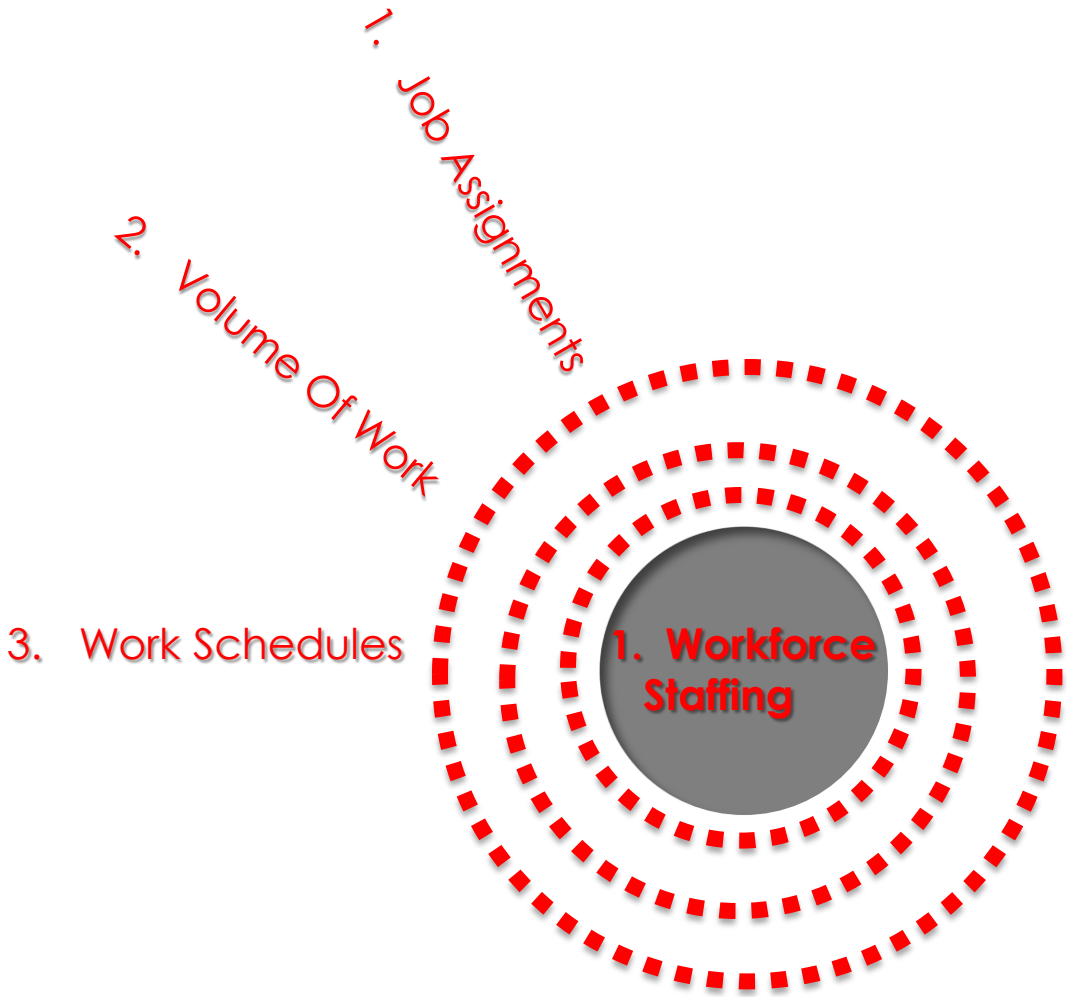
HCO'S Financial Bottom Line

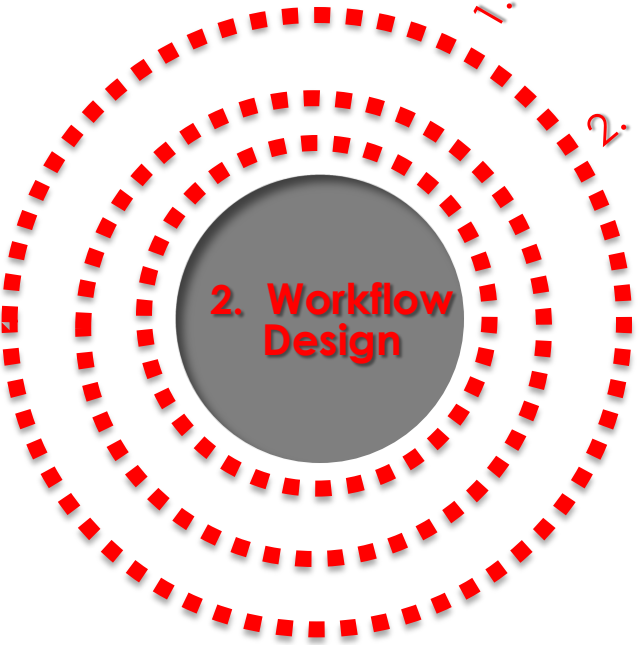
This study proposed to explore the **linkage** between
Emergency Department design-layout and nursing physical fatigue.

It is expected that further understanding on this relationship will support
evidence-based design propositions linking nursing wellness,
job satisfaction, and performance to a higher quality of care and **improved patient safety**.

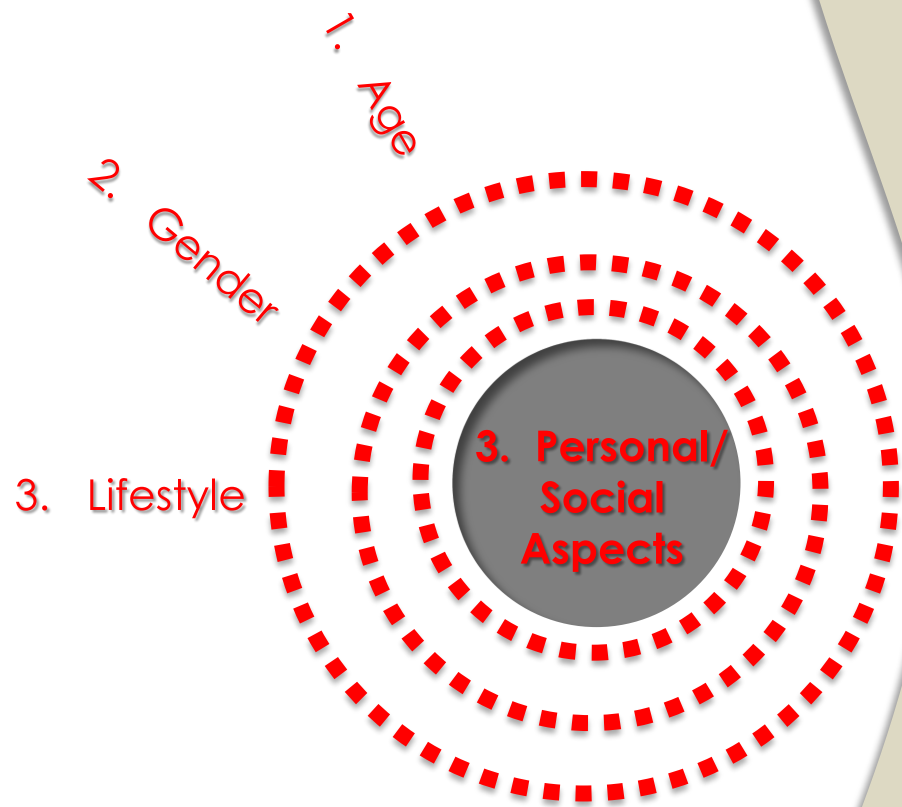

CAUSES
Fatigue
EFFECTS
1. Workforce Staffing
2. Workflow Design
3. Personal-Social Aspects
4. Physical Environment
5. Organizational Factors
1. Staff Safety
2. Patient Safety
3. Staff Performance
4. Staff Retention



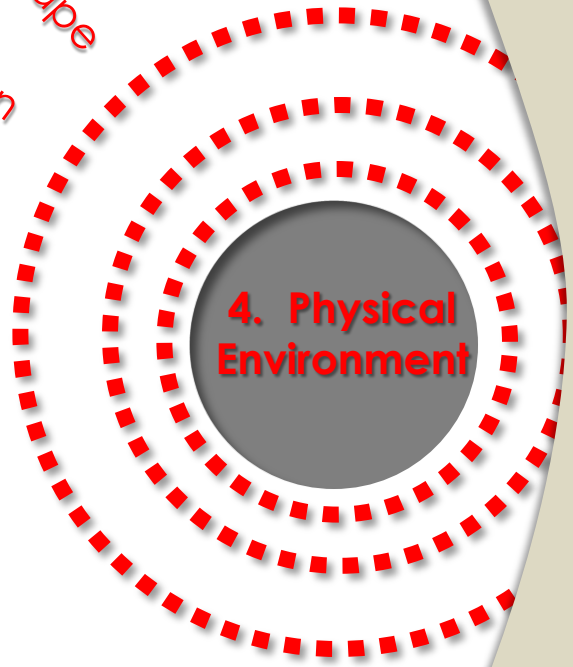

1. Job Assignments
2. Volume Of Work
3. Work Schedules
1. Workforce Staffing

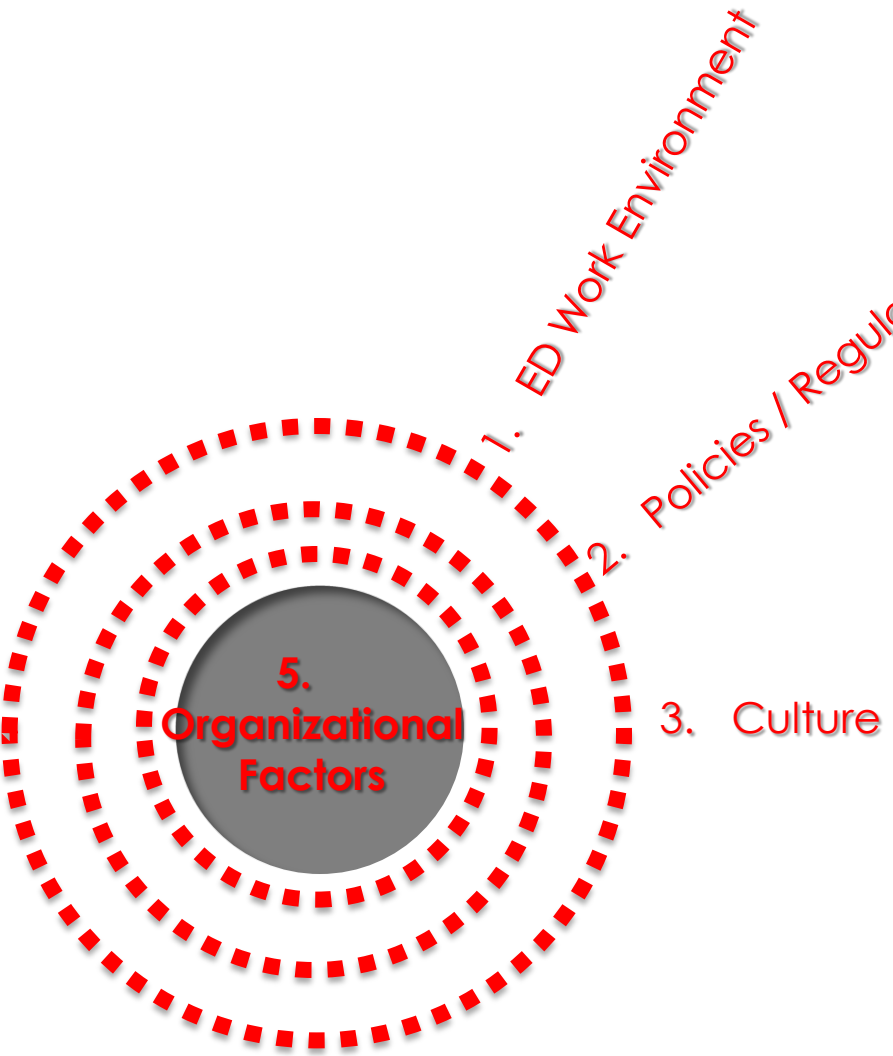


1. Inefficiency
2. A 36-hospital Time and Motion Study
3. Information Technology


1. Age
2. Gender
3. Lifestyle
3. Personal/ Social Aspects

1. Healthcare Landscape
2. Evidence-Based Design
3. Environmental Stressors
4. Ergonomics
5. Layout

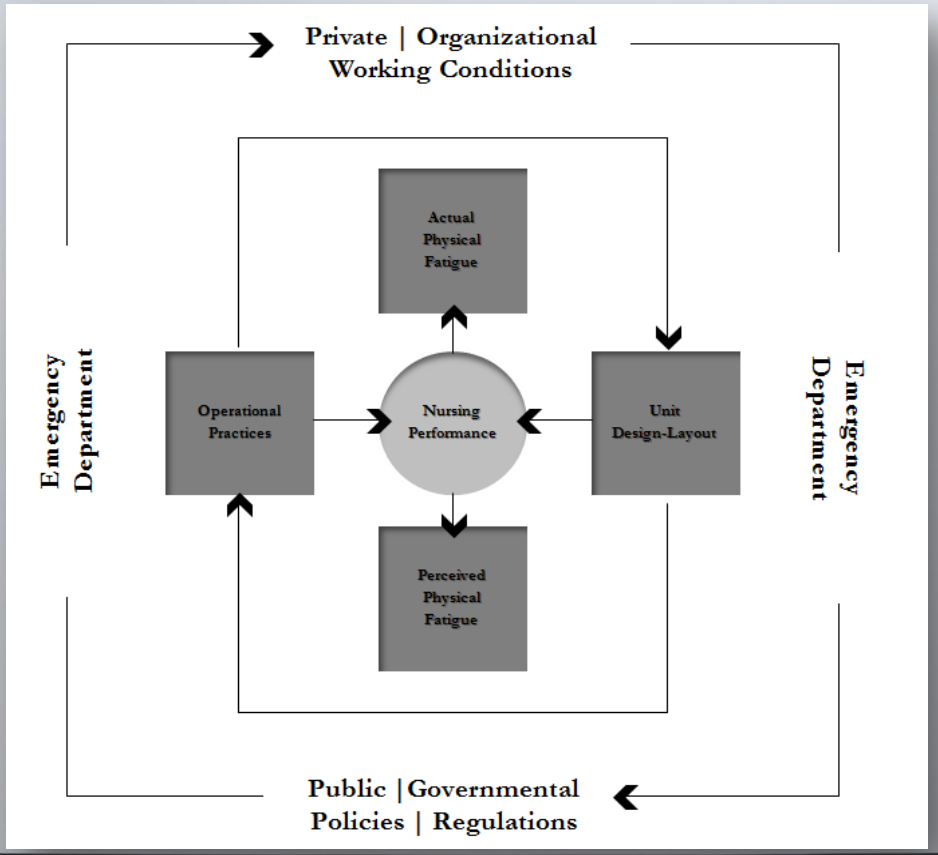



5.
Organizational
Factors
1. ED Work Environment
2. Policies / Regulations
3. Culture

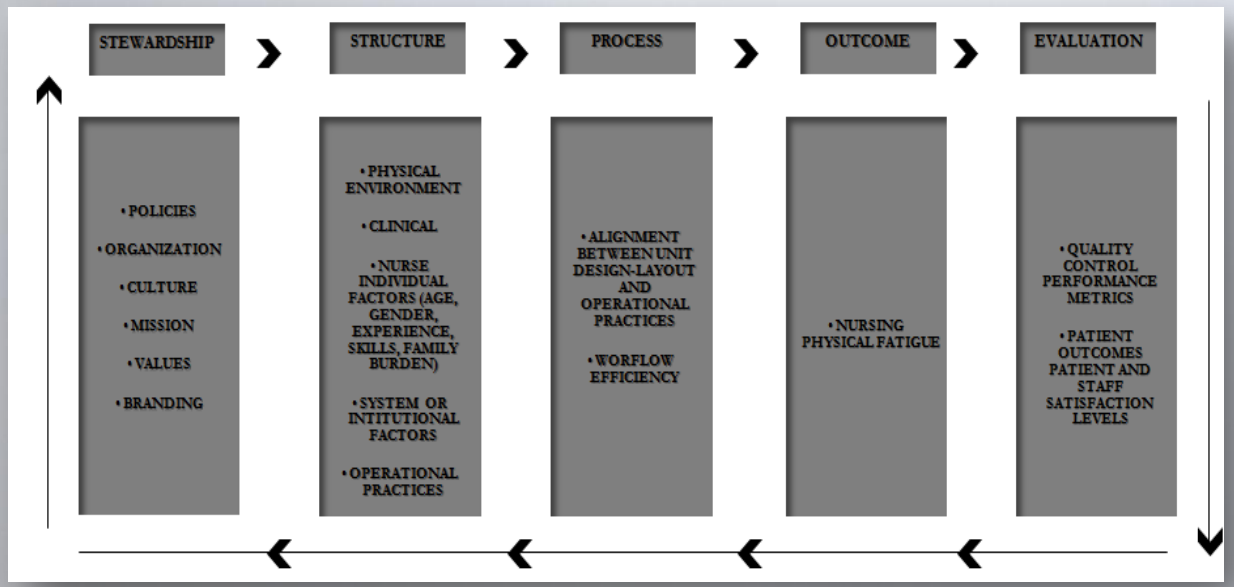
Research Questions

- How do emergency department nurses perceive the impact of the emergency department design-layout attributes on nursing physical fatigue?
- How do emergency department nurses perceive the impact of organizational protocols and operational practices on nursing physical fatigue?
- What are emergency department nurses' actual physical activity levels on an average 12-hour shift?

Conceptual Framework "A" | Relationships



Conceptual Framework "B" | Donobedian Based



3. Research Methodology

Research Design

- Descriptive analysis research methodology.

Study Setting

- This study was conducted in the emergency department of a 136-bed community-based hospital located in a large metropolitan area in the U.S. Southwest region.

Subjects

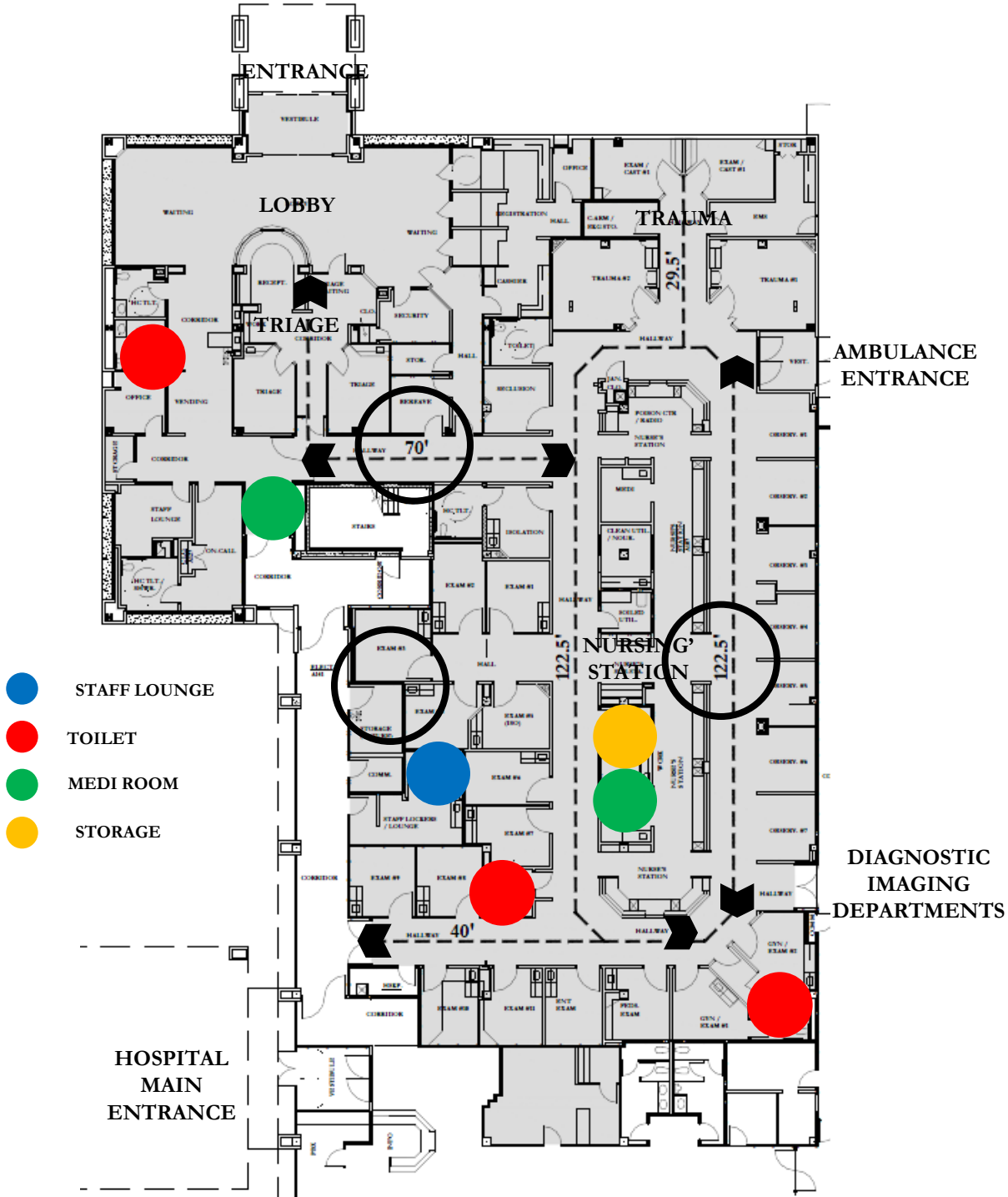
- A non-random, convenience sampling was devised for this study.
- Inclusion criteria consisted of nurses who were (a) registered professionals, (b) full-time employees (defined as working at least 36 hours per week), and (c) those who worked with direct patient care.

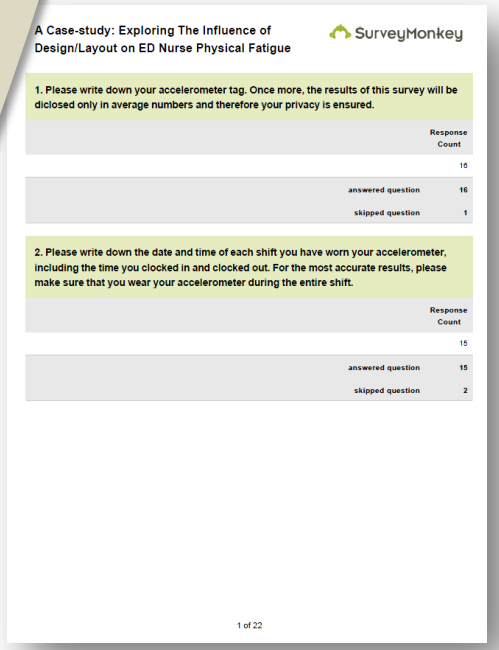
Sample Size

- Although 23 nurses committed to participate from a total of 24, 17 nurses (74%) completed the surveys and eight of the 23 nurses (35%) wore the accelerometers as instructed.

Instrumentation

- Subjective Approach | Self-administered Questionnaire
- Physiological Approach | Direct Monitoring Assessment | Accelerometers


ENTRANCE
LOBBY
TRAUMA
TRIAGE
29.5'
70'
AMBULANCE ENTRANCE
NURSING' STATION
122.5'
122.5'
STAFF LOUNGE
TOILET
MEDI ROOM
STORAGE
DIAGNOSTIC IMAGING DEPARTMENTS
40'
HOSPITAL MAIN ENTRANCE



A Case-study: Exploring The Influence of Design/Layout on ED Nurse Physical Fatigue

SurveyMonkey

1. Please write down your accelerometer tag. Once more, the results of this survey will be diclosed only in average numbers and therefore your privacy is ensured.

	Response Count
	16
answered question	16
skipped question	1

2. Please write down the date and time of each shift you have worn your accelerometer, including the time you clocked in and clocked out. For the most accurate results, please make sure that you wear your accelerometer during the entire shift.

	Response Count
	15
answered question	15
skipped question	2

1 of 22

Subjective Approach

The first goal was to assess, through a subjective approach, nurses' perception of the impact of design-layout on physical fatigue, as compared to organizational protocols and operational practices.

A cross-sectional, self-administered questionnaire was developed by the researcher to address the study's first two research questions.

Section 1 | Categorical Data

Accelerometer' tag number, demographics data and incidence of occupational body discomfort

Section 2 | 5 point Likert Scale from 1 (strongly disagree) to 5 (strongly agree)

Nurses' Perception on The Linkage Between Different Aspects of The Physical Environment and Their Impact on Nursing Physical Fatigue

Section 3 | 5 point Likert Scale from 1 (strongly disagree or Low) to 5 (strongly agree or High)

Nurses' Perception on the impact of various aspects of their current workforce staffing patterns and organizational policies

Physiological Approach

The second goal was to measure, through a physiological approach, nurses' actual physical activity intensity levels.

A direct monitoring assessment design was applied to address the study's research second question. To this end, instrumental data was gathered through the use of accelerometer devices during three consecutive shifts.

The 'gold standard' in physical activity measurement.

Images retrieved from www.actigraph.com

	Variable Description	Mean	SD	Number	Percent
PHYSICAL ASPECTS	Gender Males Females			4 13	23.5% 76.5%
	Age (year)	40.7	11.6		
	BMI* Underweight Normal Overweight Obese	23.42	7.51	1 9 5 1	5.8 52.9% 25% 11.76
LIFE STYLE	Smokes or smoked in the past Yes No			5 12	29.4% 70.6%
	Exercises at least 30 minutes a day Yes No			9 8	52.9% 47.1%
	Sleeps from 6-8 hours a day Yes No			17 0	100% 0%
	Has kids under the age of 16 or an elderly parent at home Yes No			5 12	29.4% 70.6%
	Has another part-time job or regular activity Yes No			10 7	58.8% 41.2%

4. Data Analysis Results | Demographics and Lifestyle Data

	Variable Description	Mean	SD	Number	Percent
WORK RELATED PATTERNS	Number of shifts per week 1-3 4-6			 14 3	 82.4% 17.6%
	Number of hours shifts last on average 12 hours 13 hours			 11 6	 64.7% 35.3%
	Number of consecutive shifts worked per shift week 2 shifts 3 shifts 4 shifts			 5 9 2	 29.4% 52.9% 11.7%
	Years of Experience 0-5 years 5-10 years 11-20 years 21-30 years			 9 3 4 1	 52.9% 17.6% 23.5% 5.9%
	Night | Day Shift Mornings Mid-days Evenings Nights			 4 4 2 7	 23.5% 23.5% 11.8% 41.2%
OCCUP. INJ.	Neck Shoulder Upper back Lower back Upper arm Forearm and elbow Thigh and knee Lower leg Angle and foot	2.12 2.19 2.4 3 2.17 1.94 1.81 2.12 2.31	1.27 1.42 1.30 1.00 2.66 2.11 1.28 2.12 1.40		

4. Data Analysis Results | Work-Related and Occupational Injuries Incidence Data

	#	DESCRIPTION	MEAN	SD
Space Layout	2.2	Inter-department travel distances efficiency	3.98	0.88
	2.3	Intra-department travel distances efficiency	3.61	1.00
	3.3	Patient-care related travel distances efficiency	2.94	1.14
Ergonomic and Functional	2.4	Provision of ergonomic and functional equipment, furniture, accessories and casework	2.23	0.98
Technology Resources	2.5	Provision of technology resources for the reduction of physical fatigue	2.53	0.84

	#	DESCRIPTION	MEAN	SD
Operational Practices	2.1	Alignment between design-layout and operational practices	3.18	1.20
	3.2	Workloads such as patient handling, sitting, standing, transporting, hauling	3.26	1.05
	3.4	Inefficient operational practices	3.57	1.18

	#	DESCRIPTION	MEAN	SD
Organizational Protocols	3.1	Perception of Physical Fatigue According to recovery time patterns and time in the career	3.08	1.04

	3.6	DESCRIPTION	MEAN	SD
Design-Layout Propositions	a.	Unit proximity to staff lounge	2.00	1.00
	b.	Provision of quick break areas	3.41	1.23
	c.	Provision of wellness programs	2.00	1.00
	d.	Provision of exercise and anti-stress spaces	2.35	1.41
	e.	Installation of anti-fatigue performance flooring products and finishes	2.59	1.42
	f.	Reconfiguration of design-layout to reflect and align with patient-care related procedures	4.18	1.13
		WEIGHTED MEAN AND SD	2.75	1.20

ID	Sedentary	Light	Moderate	Vigorous	Total Time
1	0.53	0.44	0.03	0	2163
2	0.57	0.43	0.01	0	2177
3	0.49	0.50	0.01	0	2254
4	0.35	0.62	0.03	0	2160
10	0.59	0.41	0.00	0	2253
13	0.55	0.45	0.00	0	1442
15	0.40	0.57	0.03	0	1492
16	0.45	0.54	0.01	0	1863
TOTAL	0.49	0.49	0.01	0	15804

4. Data Analysis Results | Nurses' Physical Activity Levels During Three Consecutive Shifts

THIS STUDY'S FINDINGS	CRITERIA	LITERATURE REVIEW (C52)	DISCUSSION
76.5% Women	Gender	90.4% Women (Nationally)	• More Sleep problems, occupational injuries, tendency to report fatigue • Usually more family responsibilities • Less ability to engage in physical activity or healthy behaviors
40.7 Years	Age	46 Years	• Deficits in strength and agility (bend, twist, lift, etc…) • Challenges with vision and hearing • Higher incidence of Occupational Injuries
52.9% Normal Weight 25% Overweight 11.76% Obese 5.8% Underweight (23% females and 50% males)	Body Mass Index	33.8% (Females)	• Body Mass Index doesn't indicate physical fitness. • Physical fitness →aerobic power, muscular fitness, flexibility, speed & balance
52.9% Do 47.1% Do not	Exercise Habits	-	• Lack of exercise → predisposing factor for obesity, negative health conditions and work-related injuries and physical fatigue. • Women statistically exercise less than men. Several barriers take place including family burden.
29.5% Does/Did	Smoking Habits (Currently | Past)	15% (RN/ Nationally)	• Leading cause of preventable death and illness in the US. • Directly associated with Physical Fatigue. • Symptoms include difficulty breathing, chronic cough and sleep problems.
100%	Sleeping Habits (6-8 hrs/day)	-	• Will discuss separately
29.4% Does	Family Burden	55% (RN/ Nationally)	• Cause for Nurses leaving the job (68.5%). • Significant contributor of physical fatigue. • Women tend to take on more the family caregiving role than other members.
58.8% Do	Another Part-time Job or Regular Activity	12% (RN/ Nationally)	• The nursing professional is being challenged to limit the hours a nurse can work to mirror other safety-industries such as aviation and nuclear power. • Paradoxically, hospitals are the larger employers of secondary positions.

5. Discussion of Results | Demographics Data

	NUMBER OF SHIFTS PER WEEK		NUMBERS OF HOURS PER SHIFT		NUMBER OF CONSECUTIVE SHIFTS			NIGHT OR DAY SHIFT			ANOTHER PART-TIME JOB/REG. ACTIVITY	
	3	4	12	13	2	3	4	Night	Day	Evening	Yes	No
NUMBER OF PARTICIPANTS	14	3	11	6	5	9	3	7	8	2	10	7
PERCENTAGE OF PARTICIPANTS	82.4%	17.6%	64.7%	35.3%	29.4%	53%	17.6%	41.2%	47%	11.8%	58.80	41.20%

- Data suggests that fatigue and daytime sleepiness may be a result of insufficient sleep, rather than a direct result of stressful working conditions or burnout (C19).

- 17.6% of participant nurses claimed to work 4 shifts/ week and 17.6% 4 consecutive shifts/week
  - Fatigue is exacerbated by working a sequence of shifts without a day off or by having only short durations between shifts (C8).

- 35.2% of participant nurses claimed to 13 hours per shift.
  - Roger (2008) demonstrated that nurses working 12.5 hours or longer in a 24-hour period increased the likelihood of making an error by three times when compared to an eight and a half hour shift. In a similarly designed study, critical care nurses working beyond 12.5 hours had a significantly increased probability of making an error or near error (C5, C7, C8, C11, C19, C20, C30).

- 41.2% of participant nurses claimed to work night shifts
  - Nighttime sleepers (C8, C14, C15) tend to experience more fatigue, sleep disturbances, anxiety and depression (C15).

5. Discussion of Results | Work-Related Patterns Among Participants

	NUMBER OF SHIFTS PER WEEK		NUMBER OF HOURS PER SHIFT		NUMBER OF CONSECUTIVE SHIFTS		NIGHT OR DAY SHIFTS		ANOTHER PART-TIME OR REGULAR ACTIVITY		CHLDREN UNDER 16 OR ELDERLY PARENT	
	3	4	12	13	3	4	D	N	YES	NO	YES	NO
PARTICIPANT 'A'		√		√		√		√	√				
PARTICIPANT 'B'		√	√	√	√	√	√	√	√	√	√	√
PARTICIPANT 'C'		√	√	√	√	√	√	√	√	√	√	√
PARTICIPANT 'D'	√	√	√	√	Na*	√	√	√	√	√	√	√

* No answer

- As illustrated above, participants "A" and "B" claimed to work 13-hour shifts for 4 consecutive shifts a week and, additionally, they claimed to exercise for at least thirty minutes for three times a week.

- Furthermore, participant "A" and "D" claimed to have another part-time activity besides his/her primary nursing position.

- Participants "C" and "D" claimed to have either a child under 16 or an elderly parent at home.

5. Discussion of Results | Work-Related Patterns Among Participants 'A', 'B','C' and 'D'

APPROXIMATE NUMBER OF HOURS	TOTAL HOURS/ DAY PERIOD	REMAINING
ACTIVITY	24	24
1 work shift of 13 hrs	13	11
7 hrs of sleep/day (Average)	7	4
Commuting 1hr/shift	1	3
Hygiene time (1 hr/day to shower, to get dressed, to groom)	1	2
Meals (1 hr/meal, 3 times a day, including time to prepare, or to drive, or order and wait)	3	-1
Relaxation or Personal-social activities (To read, to interact with family members or partners**, to talk on the phone, to watching tv)	2	-3

MINUS

EQUALS

- The final remaining hours expressed in a negative number (-3) demonstrates that a 24-hour period would not be sufficient to allow for time for important daily activities in parallel to work such as preparing meals, exercising, relaxing or performing personal-social activities such as reading, talking on the phone, watching TV.

- Even though some meals may occur during the work shift period shown above, the literature review has shown that meal breaks and rest periods in healthcare settings are likely to be insufficient and fragmented (C20), implying that healthcare providers should allocate a minimum of number of hours per day besides their workshifts for healthy meals.

5. Discussion of Results | Simulation of 4 shifts of 13 hrs on a 24-hour period | 'A', 'B' & 'C'

APPROXIMATE NUMBER OF HOURS	TOTAL HOURS/ WEEK PERIOD	REMAINING
ACTIVITY	168	168
4 work shifts of 13 hrs each	52	116
7 hrs of sleep per day (average)	49	67
30 min. of exercise 3 times per week (with 1 hr of allowance to shower, get dressed, to commute)	4.5	62.5
60 min per shift to commute	4	58.5
1 hr per day for Hygiene (includes to shower, to get dressed, to shave)	7	51.5
1 hr per meal three times a day for main meals (includes time to prepare, to snack, to drive, or to order and wait)	21	30.5
5 hrs per day, three times a week to work on another part-time job or regular activity (includes 1 hr to commute, to get dressed, etc…	15	15.5
1 hr per day for household chores (to buy groceries, to clean, to do the laundry, to put gas, to pay bills, to respond emails)	7	8.5
Relaxation and Personal-social activities (reading, talking on the phone, watching TV)	8.5/7	0

MINUS

EQUALS

- The final remaining hours (8.5/7=1.2) demonstrates that only 1.2 hours per day on a week would not be sufficient to allow for time for important daily activities in parallel to work such as watching TV or reading a book, or for personal-social activities like talking on the phone or responding to emails.

5. Discussion of Results | Simulation of 4 shifts of 13 hrs on a 7-day period | 'A' & 'B'

APPROXIMATE NUMBER OF HOURS	TOTAL HOURS/ WEEK PERIOD	REMAINING
ACTIVITY	168	168
3 work shifts of 13 hrs each	39	129
7 hrs of sleep per day (average)	49	80
60 min per shift to commute	3	77
1 hr per day for Hygiene (includes to shower, to get dressed, to shave)	7	70
1 hr per meal three times a day for main meals (includes time to prepare, to snack, to drive, or to order and wait)	21	49
5 hrs per day, three times a week to work on another part-time job or regular activity (includes 1 hr to commute, to get dressed, etc…	15	34
1 hr per day for household chores (to buy groceries, to clean, to do the laundry, to put gas, to pay bills, to respond emails)	7	27
30 min. of exercise (with 1 hr of allowance to shower, get dressed, to commute)*	7.5	22.5
Time for parenting, relaxation and personal-social activities (reading, talking on the phone, watching TV)	19.5/7	0

MINUS

EQUALS

* This participant has claimed not to exercise; time allocated for exercising was input just for purposes of simulation as it will be shown below. The amount of time was based on the 150 minutes a week of vigorous intensity aerobic physical activity recommended by the 2008 Physical Activity Guidelines for Americans (PAGA, 2008).

5. Discussion of Results | Simulation of 4 shifts of 13 hrs on a 7-day period | 'C'

- Table 5.5 illustrates that participant "C", provided that his/her schedule would allocate time for exercise for at least "thirty minutes a day five days a week" recommended by the 2008 Physical Activity American Guidelines (PAGA, 2008), would have 2.78 hours a day to be shared among parenting or caring for an elderly parent, relaxing and personal-social activities.

- Clearly not sufficient time to perform these remaining activities which usually results in taking the time for exercise to provide for time, which happens to be the case. This participant has claimed not to exercise at least three times for three days a week.

Findings of Participant "D"

- Similarly, participant "D" would potentially have little time for relaxation and personal-social activities as described above.

- Although this participant has claimed not to have another part-time or regular activity besides his/her current nursing position, he or she has claimed to have either a child under 16 or an elderly parent at the house. The average hours spent caring for children or adult relatives is reported to be at least 21 hours per week which is comparable to a part-time job (C21).

- Consistent with the literature review which shows that nurses with family burdens tend to not have time for physical activities, this participant has claimed not to exercise for at least 30 minutes a day three times a week.

QUESTION	RESPONSES 'A'	RESPONSES 'B'	RESPONSES 'C'	RESPONSES 'D'	ALL PARTICIPANTS RESPONSES AVERAGES
1.13. WMSD					
Neck	4	3	-	-	2.12
Shoulder	4	-	4	-	2.19
Upper Back	4	-	-	4	2.40
Lower Back	4	3	4	4	3.00
Upper Arm	-	-	-	-	2.17
Forearm/Elbow/Wrist	-	-	3	-	1.94
Thigh/Knee	-	-	4	-	1.81
Lower Leg	-	-	-	-	2.12
Ankle, foot	4	-	-	-	2.31
3.1.a. Degree of physical fatigue at the beginning of the work shift	2	1	2	1	1.47
3.1.b. Degree of physical fatigue at the end of the work shift	4	5	4	5	4.41
3.1.e. Perception of the physical load demands on the nursing workforce has dramatically changed since the start in the profession	5	5	3	n/a	3.69
3.2.a. Perception of the number of hours of work per shift as potential contributor to physical fatigue	4	2	2	5	4.06
3.2.b. Perception of the number of shifts of work per week as potential contributor to physical fatigue	4	4	2	5	3.18
3.4.c. Duration of Shifts as Potential contribution to fatigue	4	3	2	5	4.18

5. Discussion of Results | Comparison Among Participants 'A','B','C','D' and Remaining

	#	DESCRIPTION	MEAN	SD
Space Layout	3.2.c	# of trips and walking distances during shifts	3.53	0.80
	3.3.a	Travel distances between the unit and other departments	1.76	0.97
Physical Demands	3.2.e	Patient handling (lifting, turning, bathing, etc…)	3.53	1.07
	3.2.g	Standing Time	3.76	1.09
	3.2.h	Sitting Time	1.56	0.81
Provision of ergonomic and Functional furniture, finishes, equipment, accessories and millwork	2.4.a	Provision of lift and transporting equipment readily and in sufficient number	2.24	0.97
	2.4.b	Provision of ergonomic and easy to maintain F,F&E	2.00	0.79
	2.4.c	Provision of chairs and adjustable height seating to reduce standing	2.24	0.97
	2.4.d	Provision of opportunities to rest/lift/stretch the legs when appropriate	2.00	1.06
	2.4.e	Provision of enough work surface to perform tasks proficiently	2.35	1.17
Provision of technology devices and resources*	2.5.a	Provision of telecommunication systems improving efficiency and reducing waste	1.94	0.75

5. Discussion of Results | Nurses' Perceptions of Current Design-Layout Contribution to PF

	#	DESCRIPTION	MEAN	SD
Operational Practices	3.3.d	Amount of efforts interacting with family members	3.76	1.03
	3.4.e	Repetition of tasks and inefficient operational procedures	4.00	1.18

	#	DESCRIPTION	MEAN	SD
Organizational Protocols	3.1.b	The degree of physical fatigue at the end of work shift	4.41	0.87
	3.1.d	The degree of physical fatigue at the end of the work week period	4.20	1.15
	3.1.e	The perception of the physical load level demands on the nursing workforce as dramatically changed since the start in the profession	3.69	1.40
	3.2.a.	Number of hours per shift	4.06	1.12
	3.4.c	Duration of shifts	4.18	1.01

	#	DESCRIPTION	MEAN	SD
Design-Layout Propositions	3.6	DESCRIPTION	MEAN	SD
	a.	Unit proximity to staff lounge	2.00	1.00
	b.	Provision of quick break areas	3.41	1.23
	c.	Provision of wellness programs	2.00	1.00
	d.	Provision of exercise and anti-stress spaces	2.35	1.41
	e.	Installation of anti-fatigue performance flooring products and finishes	2.59	1.42
	f.	Reconfiguration of design-layout to reflect and align with patient-care related procedures	4.18	1.13

- As shown in the tables above, work-related patterns were rated as the greater contributors of physical fatigue with (1) the degree of physical fatigue at the end of the work shift, (2) the number of hours per shift and (3) the duration of shifts averaging 4.20, 4.06 and 4.18 respectively. Second in the ranking were operational inefficiencies with aspects such as (1) amount of efforts interacting with family members and (2) repetition of tasks, with averages of 4.00 and 3.76 respectively.

- Following the pattern, third in the ranking, were design-layout- related attributes with aspects such as standing time, walking distances and patient handling averaging 3.76, 3.53 and 3.53 respectively. Although design-layout related attributes aspects such as (1) the provision of ergonomic and functional F,F &E, accessories and millwork and (2) the provision of technological devices presented outstanding averages, they were just purposeful to illustrate the current conditions of the healthcare setting but were not useful to measure nurses' perception of their impact on nursing physical fatigue.

5. Discussion of Results | Nurses' Rating on Design-Layout Propositions to Reduce PF

ID	Sedentary	Light	Moderate	Vigorous	Total Time
AVERAGES	0.49	0.49	0.01	0%	1975.5m/10.97hrs
PERCENTAGE	49.3%	49.3%	1.4%	0%	

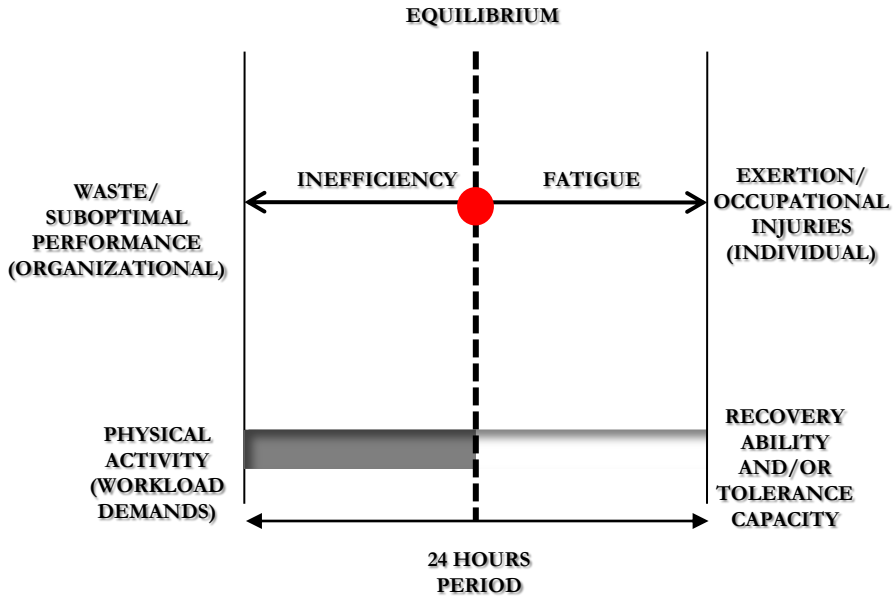
- Paradoxically, while nurses' perceptions of physical fatigue ranked at high rates, their actual physical activity intensity levels averaged between the sedentary and light ranges. These findings suggest that first, although nurses perform several tasks, on average these tasks have been performed in a pace that is considered between light to sedentary intensities.

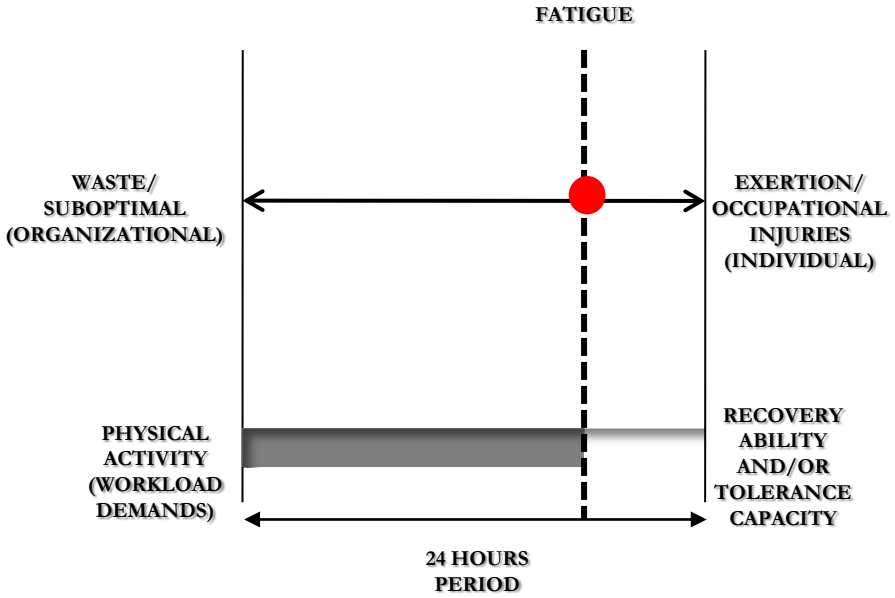
- Consistent with Hedrich et al. (2008) study, which demonstrated that the median nME (normalized met. Equiv.) for nurses on daytime shifts was 1.71 while on night shifts the median was 1.52. These averages also fall into low intensity levels suggesting that even tough nurses walk a lot, they are not meeting the minimum of physical activity levels required by the 2008 PA Guidelines for Americans.

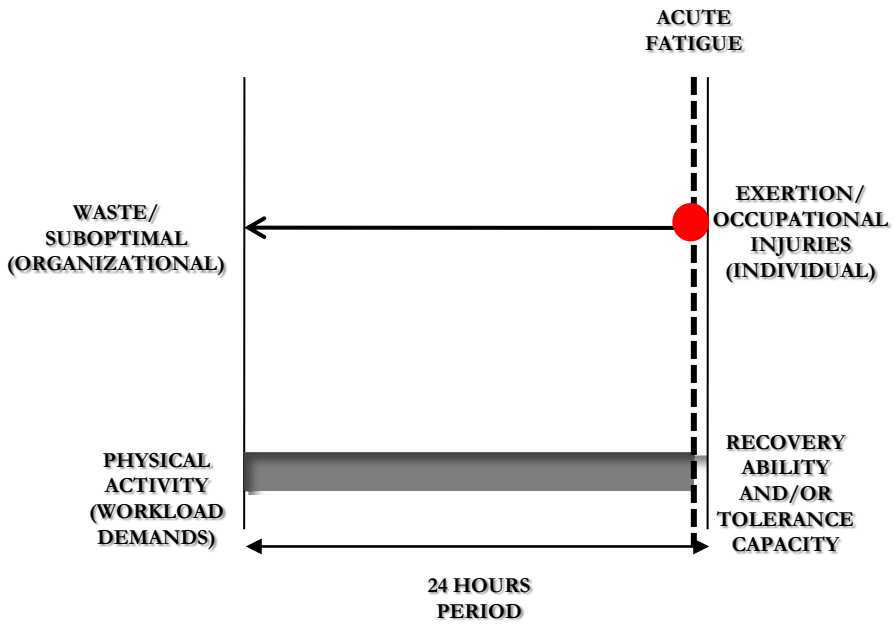
- Consistent with Jen (2009) work, which assessed energy expenditure (EE) of 150 nurses during 12-hour shifts, demonstrated that the average of EE was 323 kcal or .64 METs/hr, also a light workload.

- When these low energy intensity activities are sustained over long hours, they can result in high level energy cost, comparable to short burst of intensity activity. Further investigations are suggested so the real physical activity levels of nurses are assessed and their ability to meet the minimum physical activity levels required can be ensured.

4. Data Analysis Results | Nurses' Physical Activity Levels During Three Consecutive Shifts

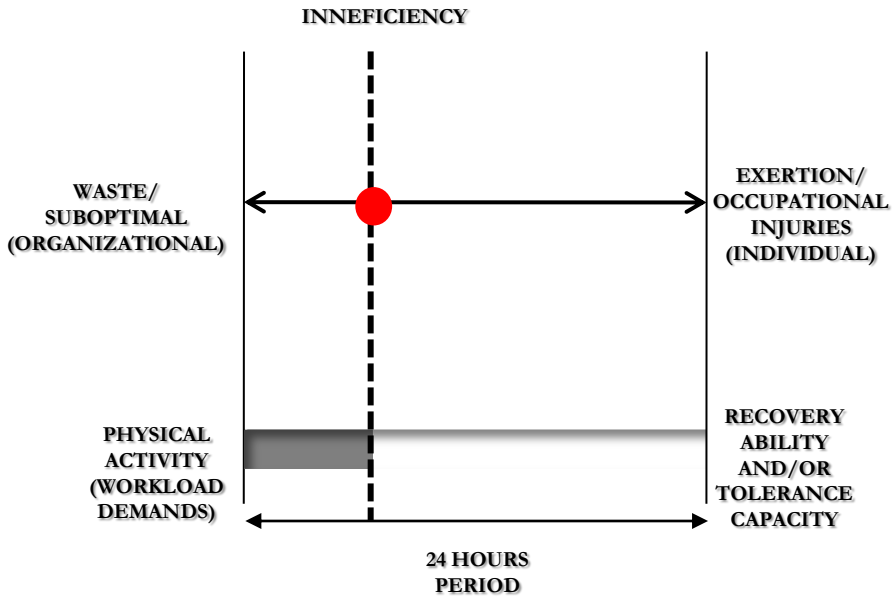

EQUILIBRIUM
WASTE/
SUBOPTIMAL
PERFORMANCE
(ORGANIZATIONAL)
INEFFICIENCY
FATIGUE
EXERTION/
OCCUPATIONAL
INJURIES
(INDIVIDUAL)
PHYSICAL
ACTIVITY
(WORKLOAD
DEMANDS)
RECOVERY
ABILITY
AND/OR
TOLERANCE
CAPACITY
24 HOURS
PERIOD


FATIGUE
WASTE/
SUBOPTIMAL
(ORGANIZATIONAL)
EXERTION/
OCCUPATIONAL
INJURIES
(INDIVIDUAL)
PHYSICAL
ACTIVITY
(WORKLOAD
DEMANDS)
RECOVERY
ABILITY
AND/OR
TOLERANCE
CAPACITY
24 HOURS
PERIOD

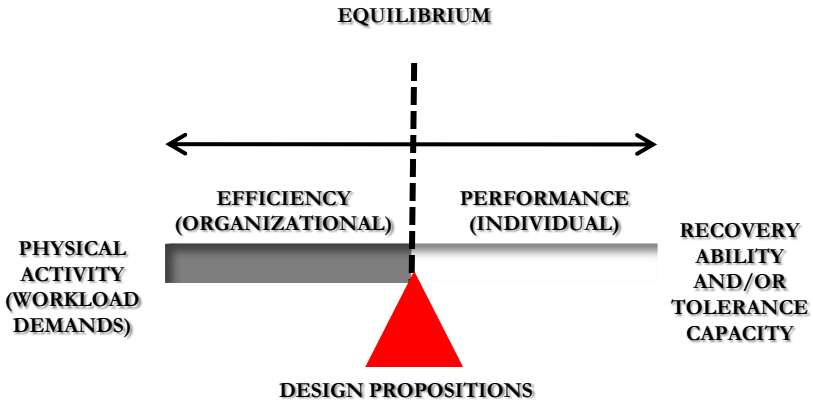


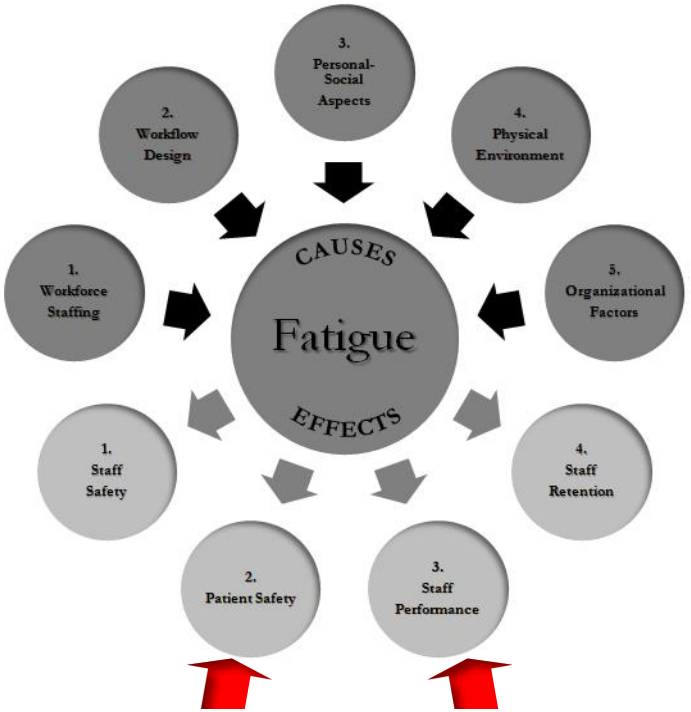
- There is much efficiency that can be achieved before nursing physical exertion.

- Until then, if the imbalance remains persistent or remittent, occupational injuries may develop.



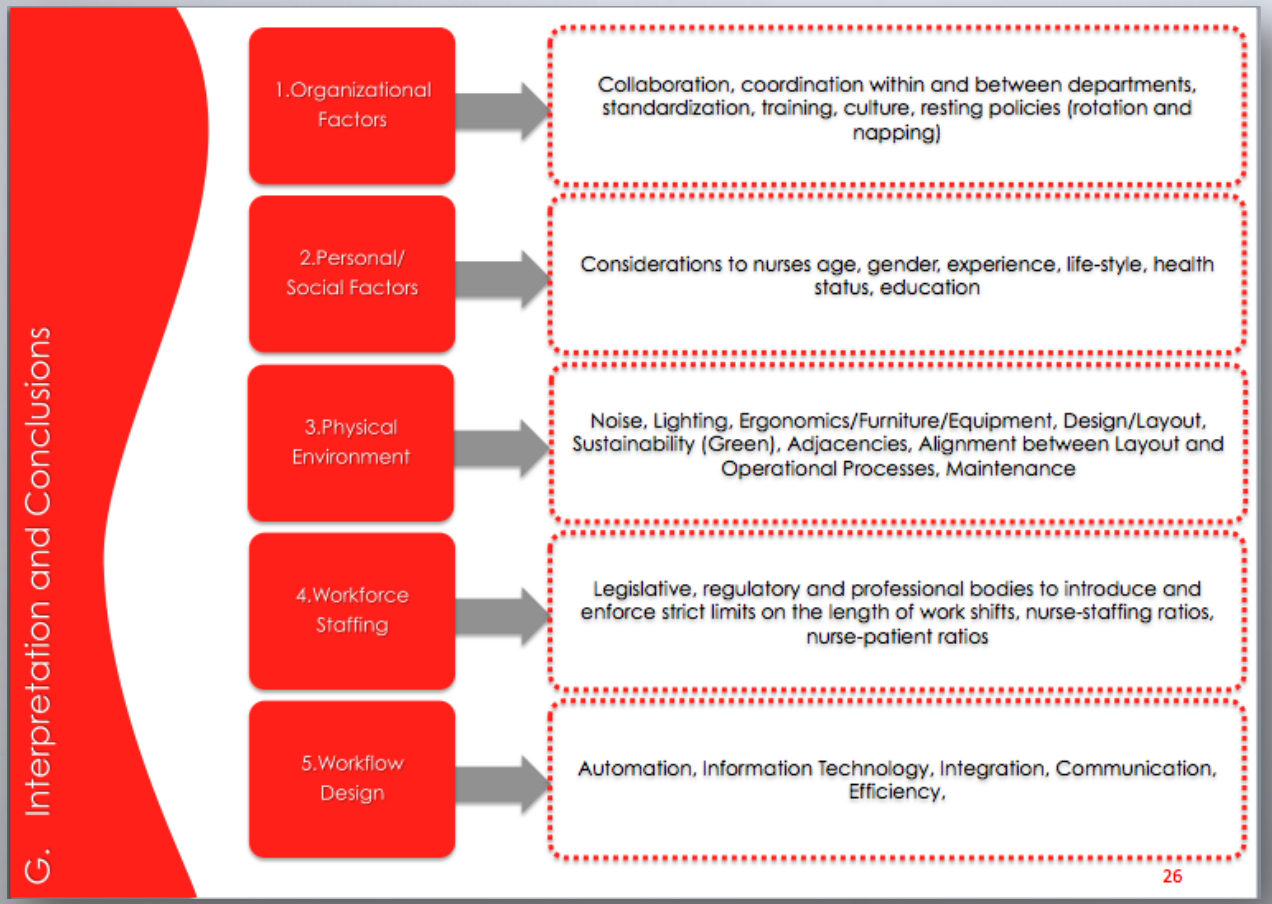
The opposite is true. When recovery ability (time) and tolerance capacity (strength) is underused, the result is inefficiency. The extreme in the inefficiency spectrum is waste

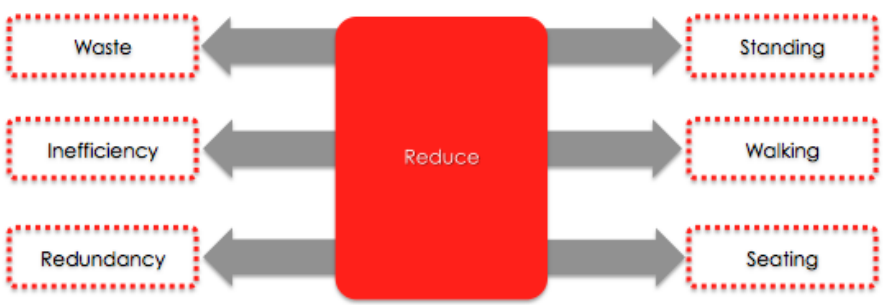

EQUILIBRIUM
EFFICIENCY (ORGANIZATIONAL)
PERFORMANCE (INDIVIDUAL)
PHYSICAL ACTIVITY (WORKLOAD DEMANDS)
RECOVERY ABILITY AND/OR TOLERANCE CAPACITY
DESIGN PROPOSITIONS



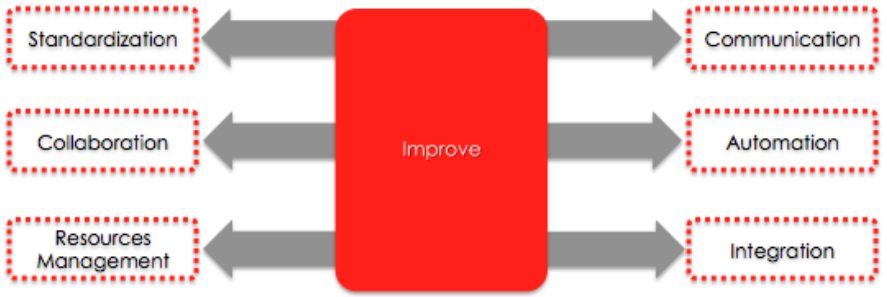
Design Propositions

As illustrated in the "Physical Fatigue Cause and Effect" framework diagram on the left, design propositions aim to eliminate or counterbalance the effects of physical fatigue on staff and patient safety as well as staff performance and retention.

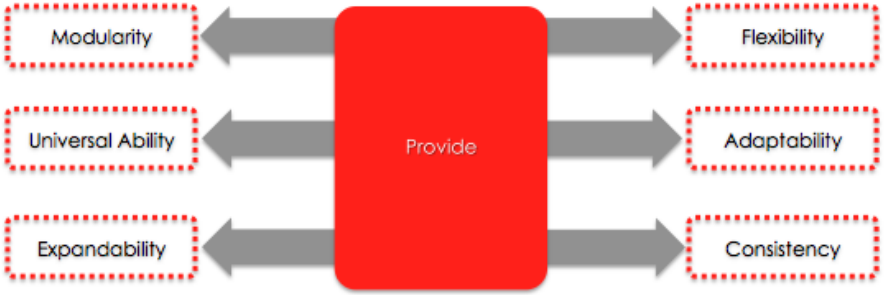

G. Interpretation and Conclusions
1.Organizational Factors
Collaboration, coordination within and between departments, standardization, training, culture, resting policies (rotation and napping)
2.Personal/ Social Factors
Considerations to nurses age, gender, experience, life-style, health status, education
3.Physical Environment
Noise, Lighting, Ergonomics/Furniture/Equipment, Design/Layout, Sustainability (Green), Adjacencies, Alignment between Layout and Operational Processes, Maintenance
4.Workforce Staffing
Legislative, regulatory and professional bodies to introduce and enforce strict limits on the length of work shifts, nurse-staffing ratios, nurse-patient ratios
5.Workflow Design
Automation, Information Technology, Integration, Communication, Efficiency,
26



H. Ideas and format for solutions



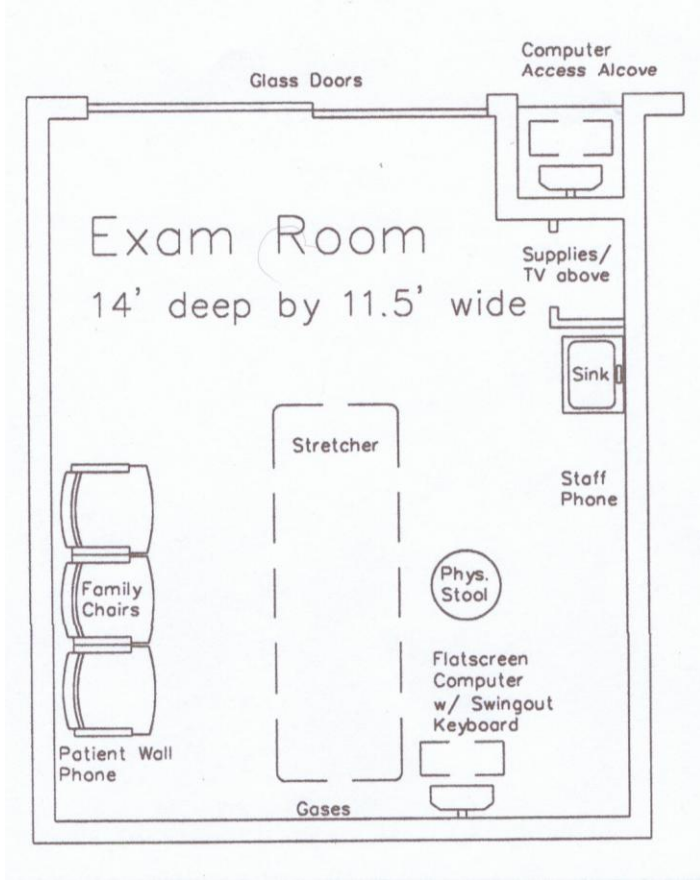
H. Ideas and format for solutions



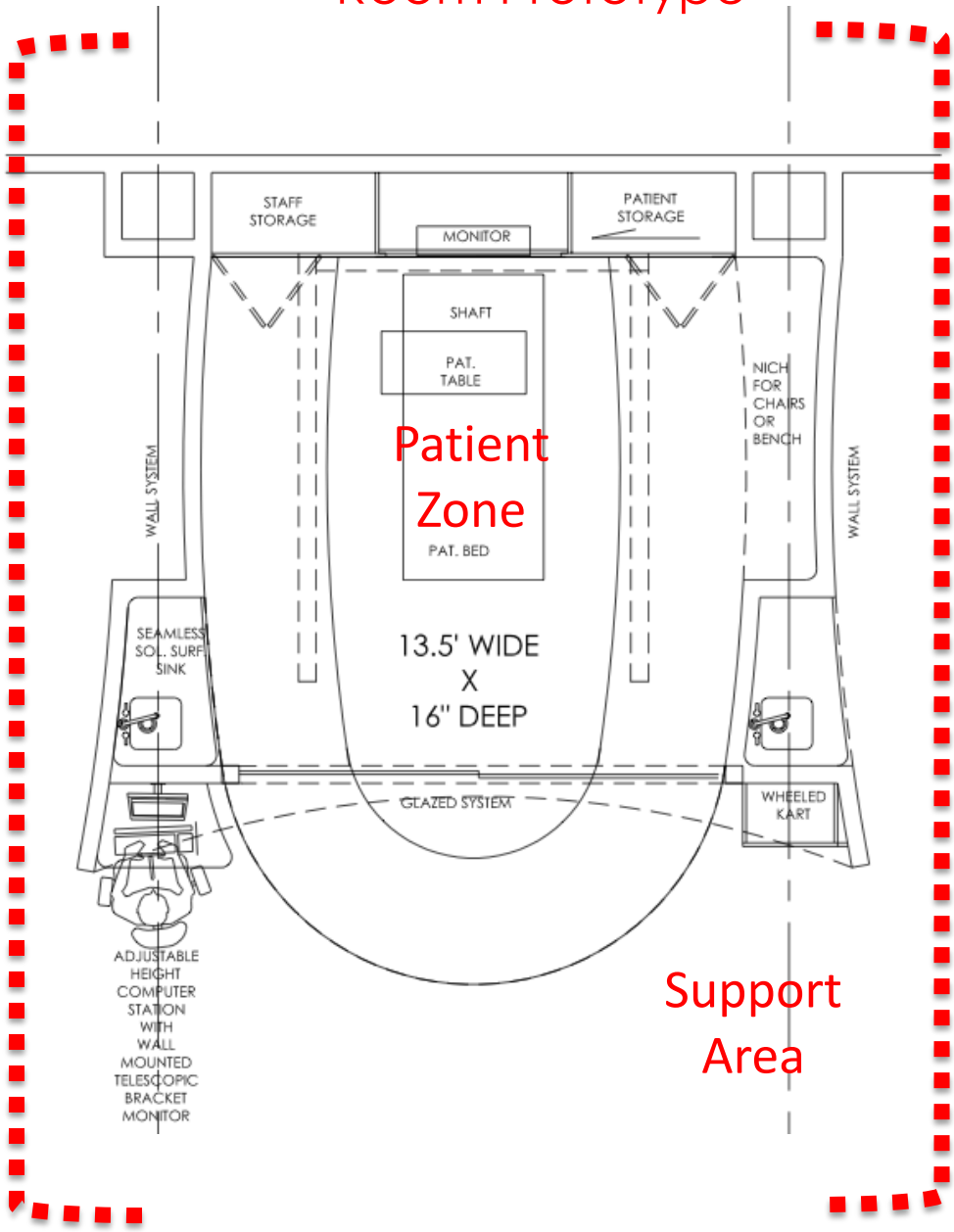
H. Ideas and format for solutions

Acuity-adaptable patient room

"Hands-off Strategy"



Treatment Room Prototype



Universal Design Concepts In the Emergency Department

(C59)

- Spaces change because their usage is typically transitory.
- Administrative and ancillary needs will change.
- Operational practices will change.
- Technology will change.
- "The module must propose a grid that will work efficiently with the overall structural grid of the building" (C59).
- The module must accommodate the maximum predictable number of individual spaces that previously would have been custom tailored.

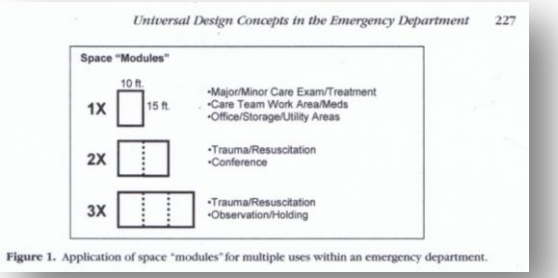


Figure 1. Application of space "modules" for multiple uses within an emergency department.

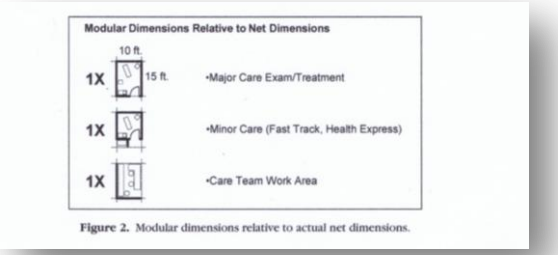


Figure 2. Modular dimensions relative to actual net dimensions.

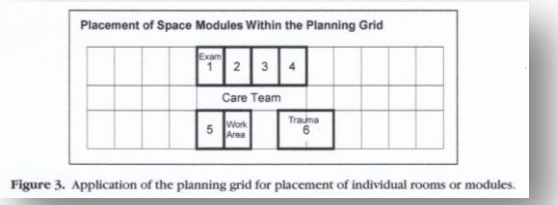


Figure 3. Application of the planning grid for placement of individual rooms or modules.

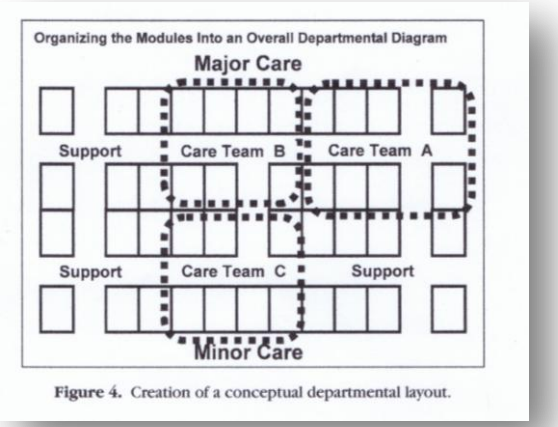
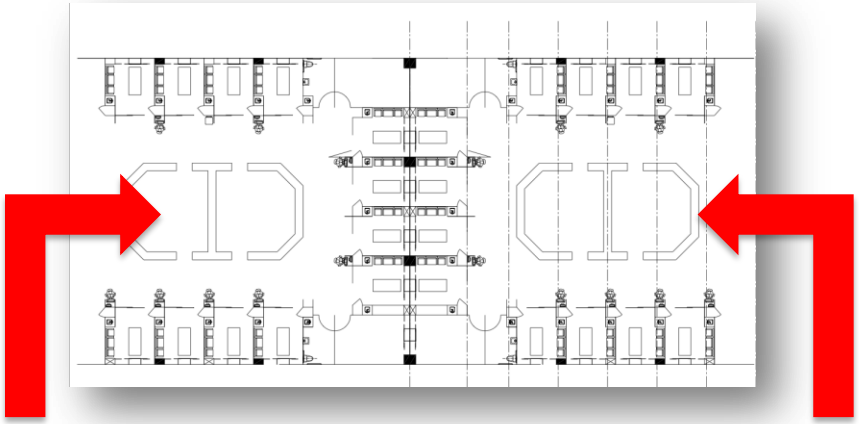
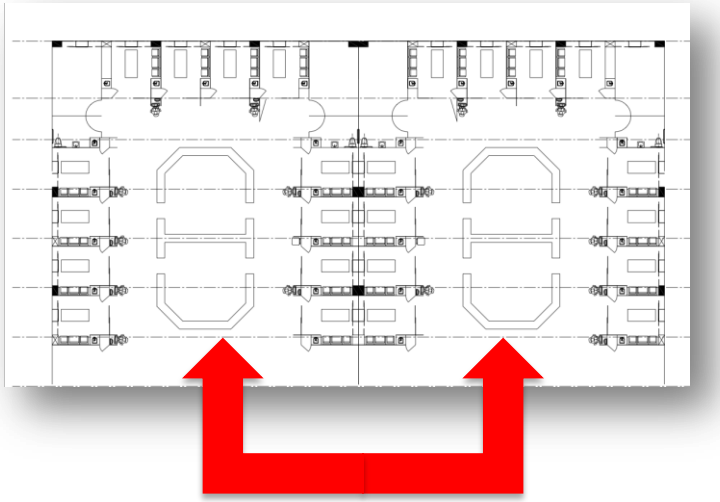
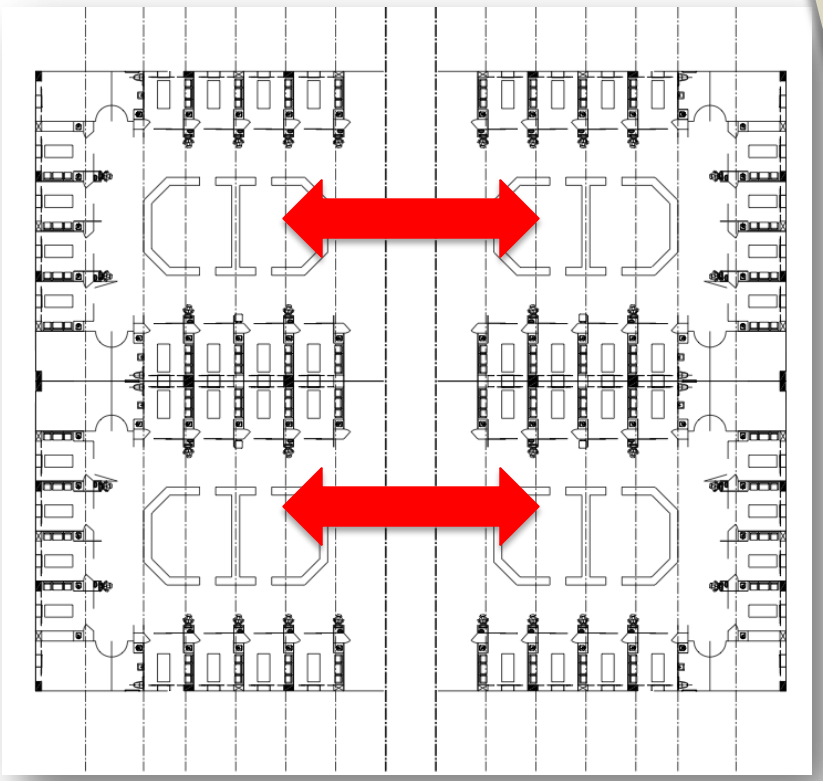


Figure 4. Creation of a conceptual departmental layout.

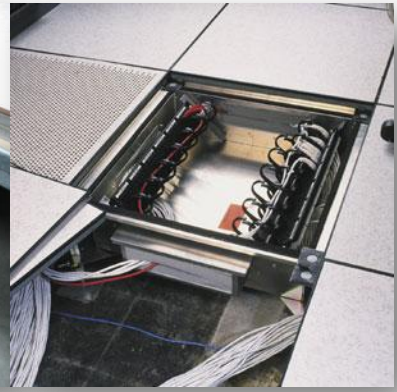
Spatial Relationships



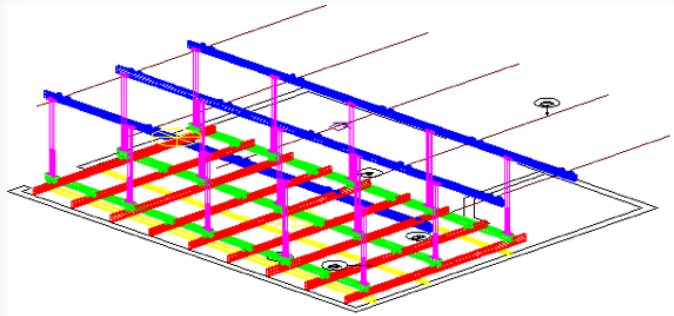




Elevated Flooring System



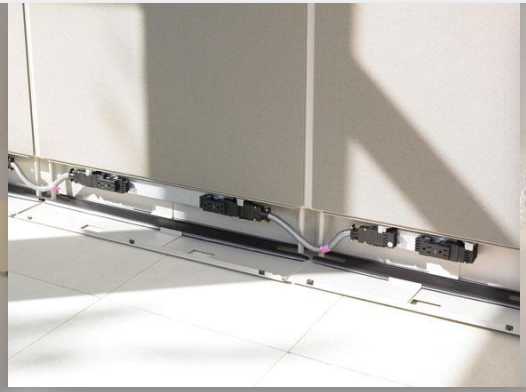
Structural Ceiling Grid System



Demountable Wall Systems








Adjustable Equipment/Furniture/Lighting Systems




Remote Patient Alert Management Systems

Dalcon Alert!

For Remote Patient Monitoring & Alert Management

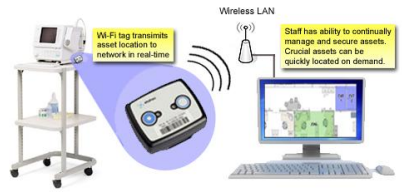
Caregivers acknowledge and respond to many sounds and lights generated by alerts in the patient room each day. These alerts are created by telemetry, monitors, ventilators, infusion pumps, fall alerts and practically anything else.

Although notifications are crucial to administering necessary patient care, throughout the day the increasing number of audible & visual alarms can become overwhelming. Understanding this obstacle in delivering superior patient care, Dalcon has developed *Dalcon Alert!* as a solution.

Remote Alert Monitor (RAM) (Click to Enlarge)

How *Dalcon Alert!* Bed Status Works

Asset Tracking



Hospitals possess a wide variety of valuable mobile equipment. Often, this equipment moves not only from room to room but from building to building and even across campuses. DCM Asset & Patient Tracking gives you the visibility to properly manage and secure your assets, ensuring that they are maintained and available for use when needed.

The DCM solution asset tracking Wi-Fi tags are premium quality. Though small enough for tagging, the tags have a multi-year battery life. An intelligent motion sensor tells the tag to relay location information only when moving—saving battery life and reducing impact on network bandwidth.

Remote Patient Monitoring Systems

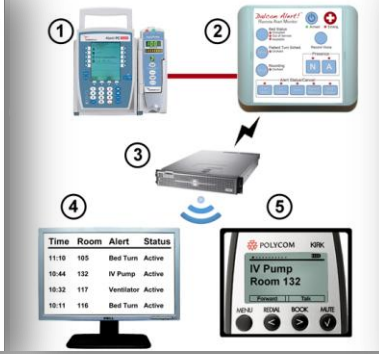
Remote Patient Monitoring

...A Feature of *Dalcon Alert!*

Remote Patient Monitoring allows for healthcare caregivers to constantly stay connected with patients, regardless of their location within the hospital. If blood pressure, heart rate, or other vitals veer above or below set parameters, an alert message is sent to a pre-assigned caregiver's Wireless Telephone so prioritization and appropriate action can be taken.

Healthcare organizations are often challenged with a multitude of systems creating alarm conditions that are essentially "islands of information." Lack of integrated and efficient communication typically results in major gaps in the flow of critical information. *Dalcon Alert!* bridges these disparate systems to provide seamless communication and event-driven connectivity, particularly at the point-of-care.

How It Works



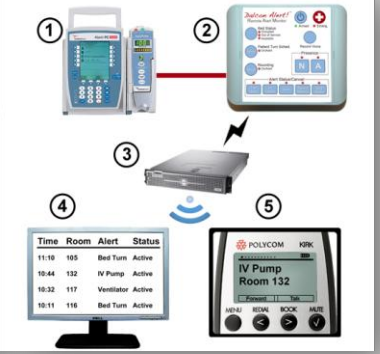
Staff & Patient Tracking

The most valuable assets in any hospital are the members of the staff. Given the nature of healthcare, staff safety is not always guaranteed. However, DCM Asset & Patient tracking enables administration and appropriate staff to know the exact position of vital staff and clinicians. Patient safety drives outcomes; the ability to know the location of patients such as a newborn in L&D, or a long-term care resident out for a walk, facilitates safe and proficient care.

Administration can measure the performance of staff via nonintrusive visual reporting and documentation. Live patient tracking can also be used to update family members on current family patient's status.

Personal asset and patient tracking appliances in the DCM solution include a Wi-Fi wrist tag and a Wi-Fi badge. These two different models allow for trackers to be carried in several different ways—including as an ID badge. As an added safety measure, the Wi-Fi badges incorporate a pull strap alarm that enables the wearer to issue immediate security alerts.

How It Works



Hi-tech Communication Devices and Sources

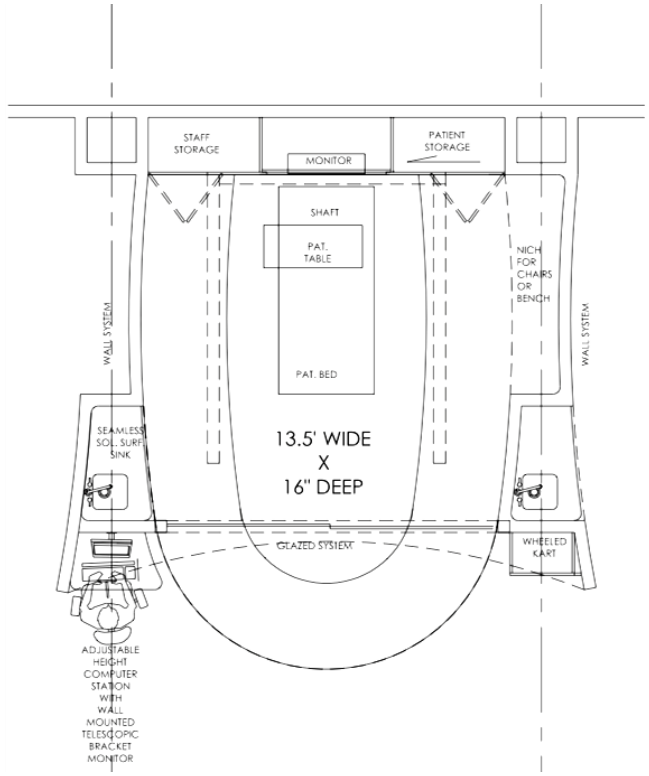
Resting Cocoons and Areas for Collaboration

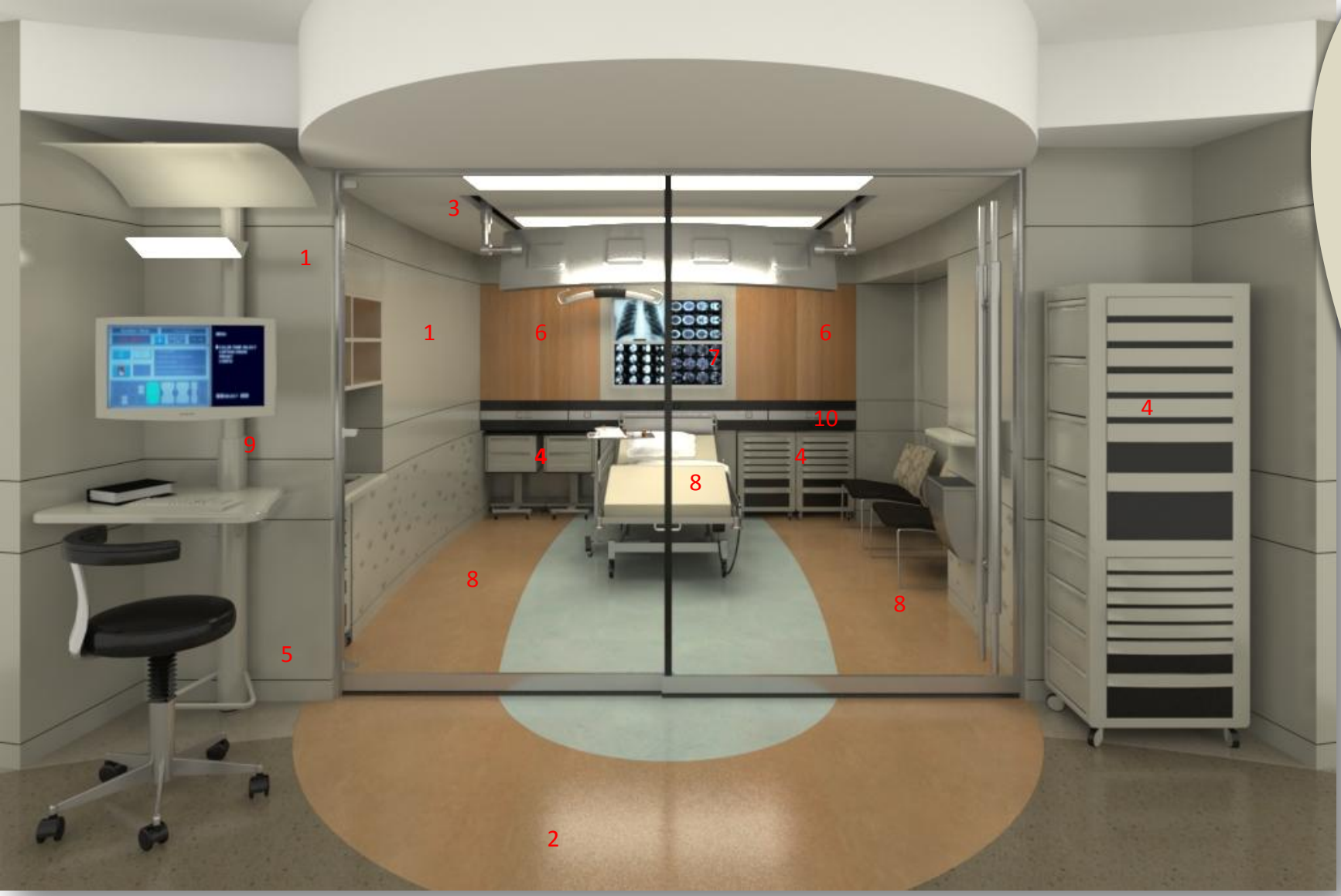
Design Propositions | Space Planning

Privacy Spots

- It is generally accepted in the industry that standardized environments support process and workflow standardization; hence, they improve performance (12).

- Cognitive –Sensitive Design improves familiarity with (and hence the predictability of) the physical environment in which the care is delivered, resulting in less time spent in search-and-located operations, less confusion, and hence, reduced cognitive load.





1. Pre-manufactured and demountable metallic wall and glazed systems
2. Elevated floor system with cushioned floor finish
3. Slots with tracks for ceiling-hung equipment/devices (light fixtures, monitors, lifts, curtains, etc…)
4. Niches for carts, chairs or chart stations
5. Adjustable foot rest
6. Organized storage for staff (left) and patient/family members (right)
7. Information screens with real-time information (Lab , Pharmacy, Diagnostic)
8. Well-defined patient, staff and family Zones
9. Flexible and ergonomic furniture systems
10. Headwall system organizing power/data/gases

1. Pre-manufactured and demountable metallic wall or glazed system
2. Elevated floor system with cushioned floor finish
3. Slots with tracks for ceiling-hung equipment/devices (light fixtures, monitors, lifts, curtains, etc…)
4. Niches for carts, chairs or chart stations
5. Bed Docker
6. Organized storage for staff (left) and patient/family members (right)
7. Information screens with real-time information (Lab , pharmacy, diagnostic)
8. Headwall system organizing power/data/gases
9. Perimeter magnetic band for accessories

1. Multimedia panel (access to home, nurse, doctor, lab, tv)
2. Perimeter magnetic band for accessories support
3. Slots with tracks for ceiling-hung equipment/devices (light fixtures, monitors, lifts, curtains, etc…)
4. Niches for carts, chairs and sink
5. Pre-manufactured acoustical ceiling tile
6. Organized storage for staff (right) and patient/family members (left)
7. Nurse charting station with visual access
8. Flexible and ergonomic furniture systems
9. Elevated floor system with cushioned floor finish
10. Hand-wash station/Hand-sanitizer dispensers

6. Conclusion

Nurses, as ambassadors of health, should portray an image of wellness, which is in concert with healthcare delivery. Healthcare organizations should provide working conditions and supportive environments to promote nurses' performance, health and retention.

Only bundles of strategies in all spheres, from individual to organizational levels, will leverage the knowledge, skills, willingness and resources necessary to achieve these common goals. It is only by addressing these realms of patient care delivery that patient safety will be guaranteed.

The physical environment should be in alignment with these objectives. The findings of this study suggest that nurses are working too many hours and having too little time to avail themselves of healthy lifestyles. Further investigation on how working conditions may hinder nurses' ability to care for themselves should be a priority in a healthcare organization's agenda.

"First things first". "First do no harm", and that includes no harm to nurses

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Thanks

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