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Recognition of patient pain cues among staff nurses working in the intensive care unit: A mixed-method study

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ABSTRACT

Interpretation of pain messages from patients is an important communicative action in the intensive care unit (ICU). This study explored how *"pain"* is recognized in pain assessment through (a) clinical knowledge, (b) neurocognitive perception, and (c) communicative actions among ICU staff nurses. A 2-phase explanatory sequential mixed-method design was applied. Data are collected from May 14 to 22, 2017 in different government ICUs. Forty female expatriate nurses mostly with baccalaureate degree (82.5%), mean age of 33 years, and mean work experience of 6 years have participated. Five themes were isolated: pain is physical, emotional, or mixed; pain assessment is facial and behavioral/physiological; barriers to pain assessment are related to healthcare team and system; pain assessment functions between task and diagnostic; and pain assessment is valued as task and diagnostic. Pain assessment is usually done at the beginning of the shift (75%) or as needed (25%). Emotional intelligence scores were at average and high levels. Nurses scored pain more often (51.04%) than no pain (48.96%) and had more neutral facial expression (0.6498 msec) when deciphering pain. The communicative meaning of pain assessment is *"knowing patient's feeling"*. Neurocognitive perception of nurses to pain in nonvocal patients is connected to their clinical knowledge and learned practices within the ICU. Clinical training on facial expressions of pain in nonvocal patients should be included.

1. Introduction

The communicative meaning of pain assessment among Intensive Care Unit (ICU) nurses can be thought bifurcated between bureaucracy and autonomy (Touati et al., 2015). The former is framed as mechanistic under an evidence-based practice paradigm by regulatory organizations who supply practitioners with scientific data to favor a change in practices and aims for conformity (Touati et al., 2015).

The latter operates under an organic paradigm that promotes knowledge development within communities of practice (CoP) and aims for empowerment (Touati et al., 2015).

This study considers the aforementioned dilemma as privileging to explain the variations in pain assessment technically. Pain is a shared phenomenon between the observer and subject. Its definition overlaps two realms: part emotion (negative sensation) and part physiological response, and acute and chronic (Nippert, 2015). It demands attention and produces a number of effects in the observer: spontaneous neurophysiological reactions reflexive distress, reflective appraisal, and potential for empathy and clinical judgment among healthcare providers but the dispositions to attend, recognize, and understand the pain experience of others are influenced by observer's previous experience with pain, professional histories, and personal characteristics that include biases (Craig, 2015).

Pain communication is a transactional process (Prkachin and Craig, 1995). Further, it provokes empathy (Nippert, 2015) that is essential in the caring behavior of nurses. Preston and de Waal's perception-action model (PAM) of empathy proposes that the capacity to feel the internal state of an individual activates the corresponding representations in an observer (Wieser et al., 2014). This phenomenon has been studied by various researchers (Wieser et al., 2014). However, there is a lack of consensus for a universal *"pain face"* (Nippert, 2015). Pain is identified relevant to the observer and

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its perception relies on facial cues that *"signal the aversiveness of pain"* (Roy et al., 2015). Facial expressions give important clues about emotions.

Human emotions are classified into universal emotions, as surprise, fear, disgust, anger, happiness, sadness (Busso et al., 2004), and contempt (Matsumoto and Hwang, 2011). Detecting facial expressions can be grouped into two: macroexpressions occurring from 0.5 to 4 seconds, involving the entire face; and microexpressions occurring 1/30 seconds, reflecting concealed emotions and involuntarily manifested as in a subtle facial expression but provides more information about the true emotional state of a person. Facial expressions feedback to modulate emotional experiences (Price and Harmon-Jones, 2015). Different emotions, attitudes, and intentions can be communicated with the slight changes in facial expressions such as in eyebrow position, head tilt, onset dynamic, or lip press.

In spite of practice group recommendations, gaps in clinical pain assessment can be traced from ICU nurses' knowledge and practice. Significant findings of Rose et al. (2012) in a survey of Canadian nurses (n=802) have shown that 33% (n=267) are less likely to use a pain assessment tool for patients who are unable to communicate as compared with 89% (n=712) of respondents caring for patients who are able to verbalize pain and they perceive pain in ICU patients with respiratory therapy, positioning of nasogastric tube, venous and arterial catheters, and lack of mobilization (Severgnini et al., 2016).

A prospective cross-sectional study on behavioral pain assessment knowledge among ICU nurses by Souza et al. (2013) revealed gaps in educational techniques and content rather than a lack of training. Nascimento and Kreling (2011) found that pain assessment barriers includes *"lack of time"* and *"Pain cannot be measured…"* among hospital staff (N=188) working in a large teaching hospital in Londrina, Brazil. On the other hand, Batiha (2014) conducted a qualitative study on pain management among critical care nurses in Jordan. Barriers on the nursing side includes *"patient sedation," "limited communication," "inadequate staff knowledge," "inconsistent practices,"* and *"time limitations"* while barriers on the hospital side includes *"nursing shortages"* and *"interruptions of activities"*.

Nurses' clinical knowledge development of pain assessment was elucidated by Mattsson (2012) in a qualitative study among Swedish pediatric ICU nurses (N=30) comprised largely of females. Knowledge development among nurses is closely connected to the workplace culture. Communication in clinical nursing practice transcends the exchange of information on the routines of care. It creates and reproduces *"caring"* in nursing through a nurturing environment to heal sick individuals in a therapeutic relationship over the course of illness.

However, verbal communication of patients in the intensive care unit or ICU is compromised by intubation, tracheostomy, impaired consciousness, or neurological dysfunction so nurses need to decode the nonverbal reactions of patients to pain and physical discomfort. Interpretation of pain messages from patients is pivotal to a series of communicative actions (i.e., reporting and referral) for pain management.

In another study, Kizza et al. (2016) found that knowledge about pain assessment principles among nurses (N=170) in Uganda was significantly associated with their understanding of the need to assess for pain and pre-emptive analgesia for physical procedures that includes patient repositioning, drain removal, and invasive line placement. Knowledge gaps were on key concepts in pain assessment.

This study has been contemplated by the Researchers to add evidence on the gaps that were reported by Souza et al. (2013), Nascimento and Kreling (2011), Batiha (2014), and Mattsson (2012) but exploring further on the reality of pain assessment in terms of its contextuality (meaning of pain), neurocognition (decoding of pain from facial expression), and clinical practice (pain assessment routines) among ICU nurses.

1.1. Objectives of the study

Quantitatively, this study aims to determine the demographical profile of female expatriate nurses in the ICU in terms of age, years of experience, level of education, and emotional intelligence score; determine the pattern of pain assessment; and determine the pattern of neurocognitive perception in terms of facial recognition of pain and facial expressions among female expatriate nurses with simulated pain recognition.

Qualitatively, this study aims to piece together the insights among ICU nurses. First, by uncovering what constitutes the clinical knowledge on pain assessment, knowledge and practice barriers, and communicative actions that reproduce knowledge and practice of pain assessment. Second, by inferring on the culture of pain assessment in the ICU.

Moreover, this study is committed to utilize the results for improving pain assessment of ICU nurses from knowledge development to clinical practice.

2. Methods

2.1. Design

Mixed-method, specifically an explanatory sequential design (QUAN→qual) was applied to meet the study objectives. Research design by Varndell et al. (2017) was used to layout the construction of a 2-phase data collection: first, data collection with quantitative (numerical) phase and second, qualitative (textual) phase. As described by Subedi (2016), quantitative data and results give a general picture of the research problem while qualitative data supports the former.

Participants are met individually in the intensive care units of two government hospitals to collect

data from May 14 to 22, 2017. Inclusion criteria are as follows: education is baccalaureate degree or diploma; minimum of 1 year experience; have previous training on pain assessment tools; can communicate in English clearly; and available to give insights during the researchers' visit to ICU.

2.2. Data gathering

2.2.1. Quantitative phase

Age, years of experience, level of education, and pattern of pain assessment per patient and per shift were collected using the researchers' questionnaire. Sample means and facial expression test reliability were calculated and analyzed in IBM SPSS Statistics 21. Emotional intelligence score of each respondent was measured online using TalentSmart (www.talentsmart.com) between 5 to 7 minutes which is composed of 28 items assessing four core skills based on Goleman's (Stys and Brown, 2004) emotional intelligence model with coefficient alphas ranging from 0.79 to 0.92: self-awareness (6 items), self-management (9 items), social awareness (5 items), and relationship management (8 items) by a 6-point Likert-type scale (1 = Never to 6 = Always).

The pattern of pain perception was assessed using fifty-nine human facial expressions illustrated and clustered by Medlej (2014) into 5 domains: 'Happy'-15 (Amused, Ecstatic, Excited, Grin, Hopeful, Innocent, Laughing 1, Laughing 2, Pleased, Proud, Real Smile, Seductive, Smile, Surprised, and Tender); Surprised-4 (Curious, Impressed, Puzzled, and Shocked); 'Relaxed'-11 (Blank, Bored, Drained, Groggy, Lazy, Peaceful, Refreshed, Relaxed, Savoring, Sleepy, and Tired); 'Disgusted'-13 (Angry, Arrogant, Disgusted, Enraged, Frown, Furious, Grumpy, Haughty, Pout, Skeptical, Sneering, Upset, and Vindictive); and 'Sad'-16 (Blue, Crying, Depressed, Disappointed, Distressed, Embarrassed, Frustrated, Guilty, Pain, Sad, Scared, Shy, So-So, Stressed, Terrified, and Worried). Cronbach's alpha was .91.

A facial test grid was constructed over 4-column by 62-row in Microsoft Excel 2010 sheet and were replicated for each respondent. The last column was used by respondents for scoring the facial expressions: 1-PAIN; and 0-NO PAIN. The pattern of facial expressions (Happy, Surprised, Neutral, Disgusted, Sad) among respondents was assessed in millisecond changes frame by frame while performing the pain assessment test using a laptop (HP Probook 450 G2) with a built-in high resolution camera (HP HD WebCam), YouCam 7 Deluxe video recording software, and open source, non-commercial research software for facial recognition IntraFace on 64-bit Windows 7 Enterprise.

The facial recognition software that was used approximates facial landmarks (Fig. 1) with 49 superimposed dots: right eyebrow-5; left eyebrow-5; right eye-6; left eyebrow-6; nose-9; and upper lip-9; and lower lip-9 in the output image per captured frame. Facial expressions are measured from 12 coordinate movements: #1 (outer corner) to #2 (inner corner) right eyebrow; # 3 (inner corner) to #4 (outer corner) left eyebrow; #7 (outer corner) to #8 (inner corner) right eye; #9 (inner corner) to #10 (outer corner) left eye; #5 (between eyes) to #6 (nose tip) nasal bridge; and #11 (right corner) to #12 (left corner) lips.19 Analyses are exported to Microsoft Excel in csv format. Data are displayed in columns as follows: #frame; confidence in the result; 49 facial landmarks; 12 facial landmarks; pitch angle; yaw angle; roll angle; happy; surprised; neutral; disgusted; sad; main mood; main mood value; statistical mode mood; frames ratio of mode mood to main mood; left-eye gaze; left-eye gaze; right-eye gaze; right-eye gaze; and eye pupils positions. Performance evaluation in emotion expression and action unit detection was reported *"state-of-the-art"* (De la Torre et al., 2015).

Fig. 1: Facial expression analysis (courtesy of the respondent)

2.2.2. Qualitative phase

The respondents' clinical knowledge on pain assessment, knowledge and practice barriers, and communicative actions were assessed in the following: (1) *"What is pain?"* (2) *"How do you assess pain in the patient?"* (3) *"What affects your pain assessment?"* (4) *"What have you learned from others about pain assessment?"* and (5) *"Why you need to do pain assessment every shift?"*

Content analysis and theme construction were used to determine the factors of pain assessment viewed by respondents. With content analysis, meaning is drawn from perception of nurses thus allowing *"…replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use"*. The methodology of Mattsson (2012) and Bengtsson (2016) served as a guide in context analysis, where the manifest content in the analysis refers to visible, countable components (i. e. words) in the entire text while latent content refers to the meaning of the former.

Textexture, a non-linear, [natural language] processing tool developed by Nodus Labs in 2012 was used in order to: (a) decontextualize texts (i.e., removing stop words and extra characters, converting words into their morphemes, and syntax parsing) to extract the most influential keywords and contexts as scaffolding for the manifest content; (b) automatically reconstruct/translate the texts' realm into a visually dynamic (i.e., moving freely in space-time) textual network, first in Gephi version 0.9.2 open graph platform to determine the *"modularity"* (density of keyword clusters) and *"betweenness centrality"* (number of shortest paths/proximity) between keywords (nodes) and co-occurrences [conceptually] with contexts (edges), and finally in a JavaScript library running Sigma.Js version 1.2.0 to make the textual network more visually readable in a Force Atlas layout; and (c) decipher meanings from syntactic *"patterns of association"* since text network analysis is related to meaning-making (Paranyushkin, 2011).

On the other hand, latent content is generated by searching for syntaxes of the manifest content across original textual responses in QDA Miner Lite version 2.0.2 coding software and then naming categories for the themes. In order to infer on the greater meaning of pain assessment, the study phenomenon is re-contextualized by interpreting the *"universe"* (reality of latent content) against the culture of practice using abductive approach. This allows the researcher to inquire on the observed phenomenon within the framework of Müller (Meissner, 2005) and to yield understanding of the web of meanings from a new perspective of communication in the research setting. It also involves theory matching to data by moving back and forth from theoretical to empirical explanations to arrive at [holistic] conclusions (Kovács and Spens, 2005).

2.3. Ethical considerations

Standard procedures for seeking approval and data collection are employed for the protection of respondents' information following the guidelines of the Standing Committee for Research Ethics on Living Creatures corresponding to approval number H-2016-029. Voluntariness to participate in the study, withdrawal at any time for any reason, and anonymity of the respondents are ensured. All respondents accepted those conditions as explicitly stated in the Informed Consent. Facial capture was not stored electronically to protect the identity of respondents. Real-time facial expression analyses were exported in Excel sheets. Online data collected from respondents on TalentSmart was protected by website access over 1 month subscription. On the other hand, information provided by respondents on paper was stored in the office safe.

3. Results and discussion

Table 1 contains the demographic profile, pain assessment frequency and time, emotional intelligence scores, and pain assessment test scores of the respondents. Based on inclusion criteria, a total of 40 participants were recruited who are female nurse expatriates, namely Filipino (57.5%), Indian (37.5%), and Indonesian (5%) mostly with baccalaureate degree (82.5%). The mean age is 33; mean work experience in ICU is 6. Pain assessments were performed as needed (25%) and in the beginning of the shift (75%) as per routine. Majority of nurses (67.5%) had high emotional intelligence. Pain test scores out of 2359 items revealed pain were more often perceived (51.04%) than no pain (48.96%).

Table 1: Profile of nurse participants

Characteristics *(N=40)*	*N (%)*
Age	
≤33	27 (67.5)
>33	13 (32.5)
Gender	
Female	40 (100)
Male	0 (0)
Nationality	
Filipino	23 (57.5)
Indian	15 (37.5)
Indonesian	2 (5)
Nursing Education	
Baccalaureate	33 (82.5)
Diploma	7 (17.5)
ICU Work Experience	
≤6	25 (62.5)
>6	15 (37.5)
Frequency of Pain Assessment Per Patient	
Once	9 (22.5)
Two Times	6 (15)
Three Times	0 (0)
As Needed	25 (62.5)
Never	0 (0)
Usual Time of Pain Assessment Per Shift	
Beginning of shift	30 (75)
Any time (during)	10 (25)
End of shift	0 (0)
Beginning of shift and end of shift	0 (0)
Emotional Intelligence Score	
Very High (90-100)	5 (12.5)
High (80-89)	27 (67.5)
Average (70-79)	6 (15)
Low (60-69)	0 (0)
Very Low (≥59)	0 (0)

Majority of nurses have considered pain assessment *"As needed"* (62%). This contends the knowledge of pain as 5th vital sign and as routine practice based on clinical guidelines. As reported by Georgiou et al. (2015), pain assessment of critically-ill patients (with or without appropriate tools) have been reported from 1.6% to 28% which is low and around 63% of pain episodes are not reassessed according to Ayasrah et al. (2014). The statistics can be used to inquire more about the attitudes of nurses and their workload. The predilection to action is influenced by beliefs (Souza et al., 2013). However, how beliefs were ingrained in the research setting can be explained through symbolic interactionism by Blumer in 1969 in the process of negotiation, taking-in (adopting) other's views and behavior, and making interpretations (Hussain, 2015).

Pain assessment is usually performed *"Beginning of shift"* after hand-offs (nurses verbal and written

communication of care). This reflected the nurses' inclination to a bureaucratic culture as described by Touati et al. (2015). On the other hand, autonomy occurs when nurses can decide to restructure the pain assessment routine according to locally shared clinical knowledge and empirically validated nursing practices. The routine itself is a way to ensure norms and culture of practice are imposed.

EI scores conferred with the study of Greaves (2010) for healthcare professionals although ICU nurses had achieved a high to very high levels. It can be inferred that EI have developed from maturation and working experience.

Table 2 shows the facial caricature with highest scores on pain assessment test. The following were perceived as "PAIN": amused (100%), excited (100%), grin (100%), laughing 1 (100%), ecstatic (97.50%), real smile (97.50%), and pain (95%). For "NO PAIN", scores were high with crying (100%), stressed (100%), sad (95%), and terrified (95%) of the time.

Table 2: Facial assessment showing most of the significant results

Item	Facial Expression	Domain	Pain (%)	No Pain (%)
1	Amused	Happy	100*	0
5	Blue	Sad	5	95*
7	Crying	Sad	0	100*
14	Ecstatic	Happy	97.5*	2.5
17	Excited	Happy	100*	0
21	Grin	Happy	100*	0
29	Laughing 1	Happy	100*	0
32	Pain	Sad	95*	5
38	Real Smile	Happy	97.5*	2.5
49	Smile	Happy	95*	5
52	Stressed	Sad	0	100*
55	Terrified	Sad	5.0	95*
	Total Items		2359 (100)	
	Pain		1204 (51.04)	
	No Pain		1155 (48.96)	

*: Highest percentage

Pain assessment results validated the study findings by Roy et al. (2015) that sadness; disgust; happiness; and surprise can be mistaken for pain. These can be attributed on the reported knowledge barriers of the respondents that includes *"The knowledge of the staff regarding the use of pain scale…;" "…knowledge of the assessing person;" "…knowledge of the one who assess…;" "…knowledge regarding pain and its management;" "…knowledge of the who is assessing person;" "knowledge of the assessor…;" "…level of knowledge…;" "…nurse's knowledge…;" "…knowledge of nurse…;" and "…knowledge of staff in pain assessment"* which are also unveiled by Souza et al. (2013), Batiha (2014), and Kizza et al. (2016). Specifically, the findings of Souza et al. (2013) can be inquired against the practical knowledge of nurses. The level of knowledge can explain how nurses perceive and experience difficulties with their patients.

Table 3 shows the respondents' neurocognitive processing time according to 5 human facial expressions from high to low: relaxed (pain, 53.64% versus no pain, 46.36%) at 0.6498 msec; happy (pain, 88.83% versus no pain 11.17%) at 0.1550 msec; sad (pain, 29.22% versus no pain, 70.78%) at 0.1063 msec; surprised (pain, 52.50% versus no pain, 47.50%) at 0.0337 msec; and disgusted (pain, 31.54% versus no pain, 68.46%) at .0262 msec.

Table 3: Neurocognitive processing time *"pain"* versus *"no pain"* per expression domain

Total Sub-items (N=40)	Domain	Pain (%)	No Pain (%)	Ave. (msec)
11	Relaxed	53.6*	46.4	.6498*
15	Happy	88.8*	11.8	.1550
16	Sad	29.2	70.8*	.1063
4	Surprised	52.5*	47.5	.0337
13	Disgusted	31.5	68.5*	.0262
2360	5	51.6	48.9	.1942

*: Highest percentage

Results of neurocognitive perception analysis among ICU nurses can be explained by Prkachin and Craig (1995) that mental image of pain is subjective in the observer. With IntraFace GUI 1.0.0, NO RESPONSE=0 and STRONG EMOTION=1. 'Neutral' facial expression had the longest time which may indicate a gap in visual processing or discrimination of other cues against those that signify pain that can simulate the "*unpleasant*" state contextualized from clinical knowledge. More often, perceptions of facial expression were limited with grimacing, i.e. wrinkles between the eyes and the mouth (Kunz and Lautenbacher, 2014). Pain on the affective component was shown more with 'happy' and 'sad' emotional responses. Cognitive biases also responsible for recognition errors due to underestimation but the study results fit in the pain perception models discussed by Prkachin and Craig (1995). Table 4 displays the responses on the meaning of *"pain"* which has a total of 587 words. After running textual network analysis in Textexture, 100 word clusters and 545 co-occurrences have produced 4 influential keywords and 17 associated contexts (Fig. 2).

Table 5 displays the responses to how pain is assessed which has a total of 749 words. After running textual network analysis in Textexture, 100 word clusters and 635 co-occurrences have produced 4 influential keywords and 16 associated contexts (Fig. 3).

Table 6 displays the barriers of pain assessment which has a total of 587 words. After running textual network analysis in Textexture, 100 word clusters and 523 co-occurrences have produced 4 influential keywords and 18 associated contexts (Fig. 4).

Table 7 displays the responses to pain assessment practices which have a total of 251 words. After running textual network analysis in Textexture, 61 word clusters and 269 co-occurrences have produced 4 influential keywords and 16 associated contexts (Fig. 5).

Table 8 displays the responses to importance of pain assessment which has a total of 199 words. After running textual network analysis in Textexture, 55 word clusters and 215 co-occurrences have produced 4 influential keywords and 18 associated contexts (Fig. 6).

Table 4: Perception of pain

Most influential keywords	Most influential local contexts	Actual context-based meanings	Category	Sources of Knowledge (Kumar and Elavarasi, 2016)
feeling	feeling, person, uncomfortable, state	Pain is a feeling of the person in uncomfortable state.	Emotional	*"state"* and *"uncomfortable"* - North American Nursing Diagnosis Association *"feeling"* - The Free Dictionary by Farlex *"sensory"* - Task force on taxonomy of the International Association for the Study of Pain
pain	pain, discomfort, sensation, change	Pain is having a sensation of discomfort or change.	Physical	*"sensation"* – (Okeson, 2005)
physical	physical, unpleasant, suffering, emotional	Pain is physical and emotional unpleasant suffering.	Mixed	*"discomfort"* -North American Nursing Diagnosis Association *"unpleasant"* and *"emotional"* - Task force on taxonomy of the International Association for the Study of Pain- (Okeson, 2005)
subjective	subjective, stubbing, objective, damaging, stimulus	Pain is subjective as stubbing and objective as a damaging stimulus.	Physical	*"unpleasant"* - The Free Dictionary by Farlex;- (Okeson, 2005) *"stubbing"* - (Okeson, 2005)

Table 5: Perception of pain in the assessment

Most influential keywords	Most influential local contexts	Actual context-based meanings	Category	Description of Pain Assessment Tool
patient	patient, pain, conscious, behavioral	Assessment of pain in patient: conscious [state] and behavioral.	Behavioral/ Physiological	Behavioral pain assessment tools (Gregory , 2012; Kawagoe et al., 2017)
pain	expression, facial, grimace, verbal	Assessment by expression, facial, grimace, and verbal.	Facial	Facial coding system (Roy et al., 2015; Kunz and Lautenbacher, 2014)
expression	vital, sign, crying, behavior	Assessment by vital [sign] and [observation of] crying and behavior.	Behavioral/ Physiological	Behavioral pain assessment tools (Gregory , 2012; Kawagoe et al., 2017)
vital	body, feeling, nurse, person	Assessment by the nurse of [other] person body and feeling.	Behavioral/ Physiological	Behavioral pain assessment tools (Gregory , 2012; Kawagoe et al., 2017)

Table 6: Perceived barriers to pain assessment

Most influential keywords	Most influential local contexts	Actual context-based meanings	Category	Description of Barriers
pain	pain, staff, knowledge, nurse	Assessment of pain is affected by staff nurse knowledge.	Healthcare team-related factor	Barriers related to nurses: *"inadequate staff knowledge"* (Batiha, 2014) knowledge gaps on key concepts in pain assessment (Kizza et al., 2016) knowledge and beliefs (Souza et al., 2013) [acquired] educational techniques and content (Souza et al., 2013)
patient	patient, consciousness, level, narcotic	Assessment of patient is affected by level of consciousness with narcotic [sedation].	Healthcare team-related factor	Barriers related to nurses: *"patient sedation"* (Batiha, 2014) *"limited communication"* (Batiha, 2014)
environment	environment, health, care, sex, positioning	Assessment is affected by healthcare [practices] in the [physical] environment, sex and positioning of patient.	Healthcare team-related factor	Barriers related to nurses: *"inconsistent practices," "time limitations"* (Batiha, 2014) *"lack of time," "Pain cannot be measured"* (Nascimento and Kreling, 2011)
assess	assess, attitude, patient, communication, work	Assessment is affected by work[load] and [staff] attitude to assess patient [pain] communication	System related-factors	Barriers related to hospital policies: *"nursing shortages"* [causing] *"interruptions of activities"* (Batiha, 2014)

On the qualitative results, the researchers established four themes based on the responses of the ICU nurses, these are theme 1: Pain is physical, emotional, or mixed; theme 2: Pain assessment is facial and behavioral/physiological; theme 3: Barriers to pain assessment are related to healthcare team and system, and theme 4: Pain assessment functions between task and diagnostic.

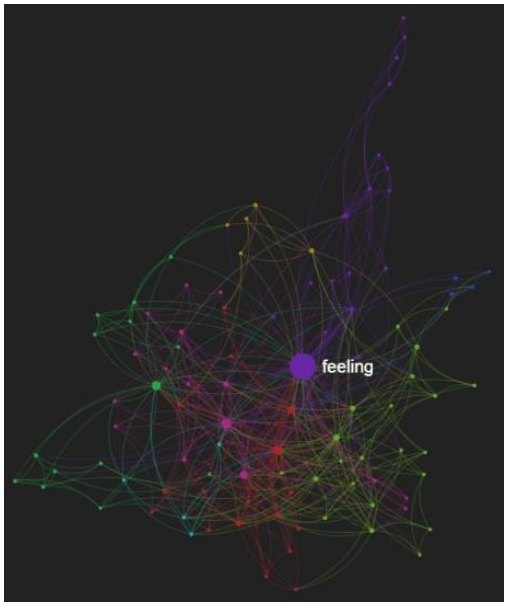

Fig. 2: The meaning of pain

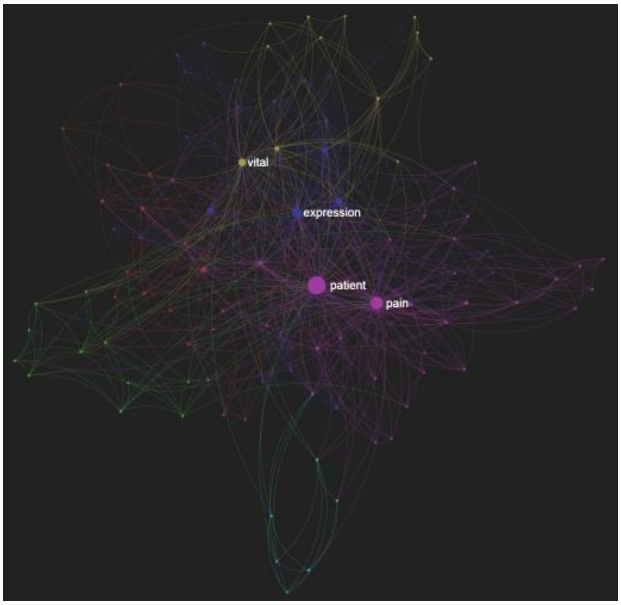

Fig. 3: Pain assessment indicators

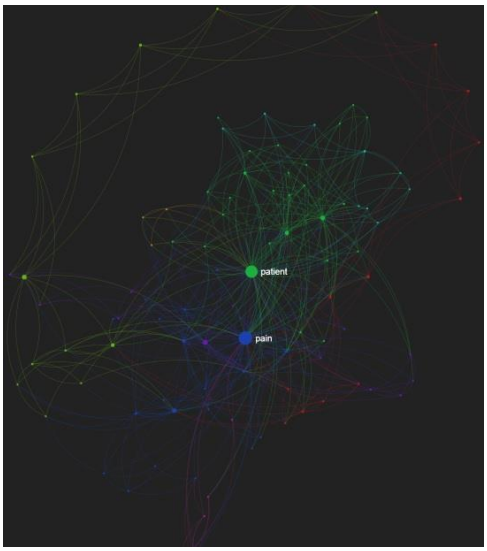

Fig. 4: Barriers of pain assessment

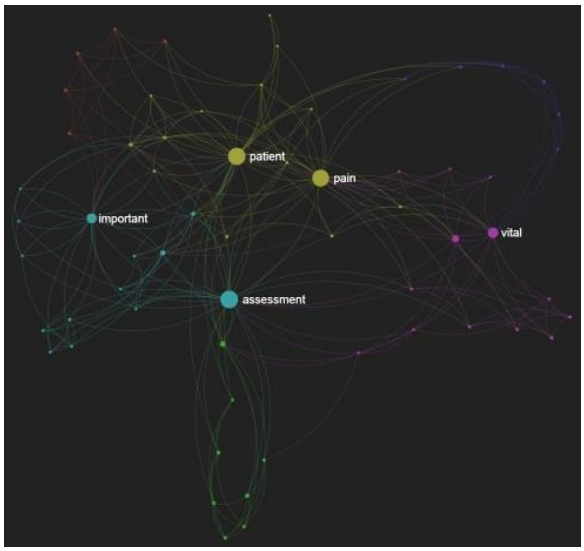

Fig. 5: Practices of pain assessment

Table 7: Pain assessment practices

Most influential keywords	Most influential local contexts	Actual context-based meanings	Category	Description of the Goals of Care (Nascimento and Kreling, 2011)
assessment	assessment, important, nurse, identify	Important nurs(ing) assessment to identify [pain]	Task	*"Patient's well-being"*
patient	patient, tool, assess	Assess(ment) patient using tools	Diagnostic	*"Works as a parameter of the patient's progress"* *"Serves to measure pain"*
vital	vital, sign, duration, location	[Signified by] vital sign, and [pain] duration and location	Diagnostic	*"Pain changes the other vital signs"*
pain	objective, sensation, expression, distress, face	Objective sensation is [by means of] face expression of distress	Diagnostic	*"Helps with the diagnosis"*

Table 8: Perceived importance of pain assessment

Most influential keywords	Most influential local contexts	Actual context-based meanings	Category	Description of the Goals of Care (Nascimento and Kreling, 2011)
pain	pain, patient, assess, responsibility	To assess patient pain is a responsibility	Task	*"Patient's well-being"*
patient	patient, sign, reduce, symptoms, manifest	To reduce sign/symptoms/ patient manifest [of pain]	Diagnostic	*"Patient should not feel pain in the hospital"*
assessment	assessment, tool, level, pain	Pain level by assessment tool	Diagnostic	*"Serves to measure pain"*
nursing	nursing, onset, intensity, aggravating, part	Part of nursing [process] is [to assess pain] onset, intensity, aggravating [factors]	Diagnostic	*"Works as a parameter of the patient's progress"*

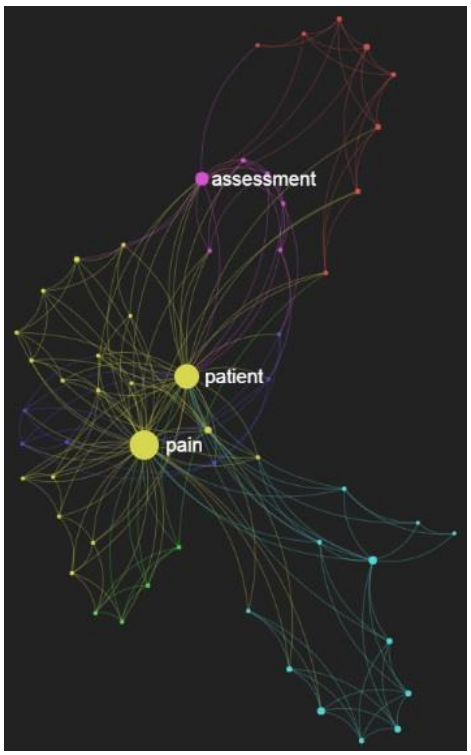

Fig. 6: Importance of pain assessment

Theme 1: Pain is physical, emotional, or mixed. Pain is mostly a semantic of feeling [and its morphemes: feel; felt] and the subjective emotional state. Nurses' definitions are re-contextualized from medical dictionary and North American Nursing Diagnosis Association which are primary sources of lexical knowledge (Kumar and Elavarasi, 2016).

When asked about the meaning of pain, nurses responded that:

"Pain is a subjective feeling… in uncomfortable state…;"
"…a physiological state of feeling like stress and emotion;" and
"…feeling of discomfort, uneasiness and feeling of unwell".

Over the span of the meeting with the respondents, there manners to uncover the importance of pain are impacted by observer's past involvement with pain, and their individual attributes that incorporate predispositions. Major theories of pain (specificity theory, pattern theory, gate control theory, and psychological/behavioral theory) underscore that pain involves a physiological stimulus (Cheng et al., 2003). Nurses process the concept of pain as what patients might feel with 'physical' and 'invasive' procedures (Kizza et al., 2016). Thus, they reproduce the pain with procedures as "painful" or *"hurtful"*. In addition, the words associated with the phenomenon are learned by early life experience which ICU nurses may bring into clinical practice.

Theme 2: Pain assessment is facial and behavioral/physiological. Pain is assessed by a combination of facial, physiological (vital signs), and behavioral indicators from evidence-based practice literature (Roy et al., 2015; Kunz and Lautenbacher, 2014). Responses captured the essential contexts as follows:

"In cases of patients are not able to talk, objective data can be use, patient's gestures, vital signs and other criteria...;"
"For comatose patient, through vital signs (tachycardia) and respiratory rate and sometimes high blood pressure;"
"…according to his or her facial expression and body movements;" and "Facial grimacing; tense body language; from verbal clue; sleeping all the time; elevated respirations".

The study of Ayasrah et al. (2014) can be used to validate the responses of participants from a Middle East nursing practice. Body movements, muscular rigidity/spastic body, grimacing, and increased blood pressure have been reported as pain indicators.

Theme 3: Barriers to pain assessment is related to healthcare team and system. Barriers to pain assessment is mostly nurse-related similarly found by Souza et al. (2013), Nascimento and Kreling (2011), Batiha (2014), and Kizza et al., (2016) on knowledge, communication techniques for sedated/unconscious patients, routines, and time. Patient assessment attributed to patient's PAIN (threshold, tolerance, severity, intensity, quality), CONDITION (status, medical, diagnosis, anxiety disorder, diseases, unstable vital signs, mood, sleep disturbances, disability, psychiatric, degenerative), LEVEL OF CONSCIOUSNESS (unconsciousness, subconscious, not responsive, vegetative, deteriorating, decreased), SEDATION (narcotic, analgesic, pain reliever), COMMUNICATION (verbal, intubated), and EQUIPMENT/CONTRAPTIONS (gadgets) were the most important constraints. The above are captured as follows:

"…patient threshold of pain, the severity, intensity and quality of pain;"
"Physical and psychological factors of the patient… pain threshold of each individual…;" and
"Pain tolerance of the patient… intensity of pain;"
"Patient's level of consciousness…"

Theme 4: Pain assessment functions between task and diagnostic. The dilemma encountered with pain assessment reflected the findings by Nascimento and Kreling (2011) either task-oriented (imposed and becomes embedded in routines) or patient-oriented. Participants mostly conveyed pain assessment for PATIENT(S) diagnosis. Noteworthy responses include:

"It is important tool for assessing patients need;"
"Helpful tool for assessing patient needs," and

"Pain assessment is very important to me as a nurse for me to know the proper intervention that I will render to the patient".

When ICU nurses asked about the need to do the pain assessment, the researchers generated conclusion as, that, pain assessment is valued as task and diagnostic. The *"communicative"* value of pain assessment is contextualized as *"task"* and *"diagnostic"* (Nascimento and Kreling, 2011). Perceived importance of pain assessment evokes much *"care"* to patient who is focused on ASSESS[ING], KNOWING/FINDING, MEASURING, and NURSING (MANAGEMENT, QUALITY) to ALLEVIATE/RELIEVE/PREVENT/HELP the level of PAIN (FEELINGS) as follows:

"To assess patients' condition;"
"Part of assessment tools;"
"To know the level of pain;"
"Patient need to be relieved from pain, promote health;" and
"To free patient from pain since they are human."

4. Conclusion

The worldview of participants are entangled with knowledge development about *"pain"* both formally (education and training) and informally (personal experience). Its concept among the participants seems to define the cognitions contributed by social interactions and then reified by their work experiences.

Patterns of responses highlight pieces of information that were exchanged through socialization. The uniqueness of responses based on syntactical variations may signify the proximity and depth of personal encounter with another, who for instance, has been enriched by synchronous negotiations of the meaning of *"pain assessment"*. How pain indicators were described validates the understanding of pain as congruent to medical literature and clinical guidelines. The communicative meaning of pain assessment follows a bureaucratic workflow.

Abductively, it can be articulated that profound meanings about pain assessment are constituted through nurses' actions. The voices emerging within the greater culture of practice is not inert to uncertainty. Thus, utterances and texts reflect normative structures and prescriptive elements (guidelines) from primary sources, regulatory committees, and nursing administration. Since the model aforementioned is interactive, impositions of meanings are nonlinear. Voices can shift on the implications of behavioral actions. It means ICU nurses can configure their practices better through mentorship, administrative support, and linkages to other *"communities of practice"*. The communicative meaning of *"pain assessment"* knows the patient's feeling. However, the nurses' neurocognitive perception of "pain" in nonvocal patients was derived from their clinical knowledge and learned practices within the ICU.

This study recommends in-depth exploration of textual network and facial expression analyses for nursing research on communication and their reliability should be investigated. A multicenter study of ICU culture on pain assessment and neurocognitive modeling on pain perception may be useful for developing a grounded theory or a future research expansion.

Clinical training on facial expressions of pain in nonvocal patients should have a greater consideration in order to bolster critical care knowledge and to institutionalize evidence-based teaching-learning strategies in the use of pain assessment tools.

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References

Ayasrah SM, O'Neill TM, Abdalrahim MS, Sutary MM, and Kharabsheh MS (2014). Pain assessment and management in critically ill intubated patients in Jordan: A prospective study. International Journal of Health Sciences, 8(3): 287-298.

Batiha AM (2014). Pain management barriers in critical care units: A qualitative study. International Journal of Advanced Nursing Studies, 3(1): 1-5.

Bengtsson M (2016). How to plan and perform a qualitative study using content analysis. NursingPlus Open, 2: 8-14.

Busso C, Deng Z, Yildirim S, Bulut M, Lee CM, Kazemzadeh A, and Narayanan S (2004). Analysis of emotion recognition using facial expressions, speech and multimodal information. In the 6th International Conference on Multimodal Interfaces, ACM, Pennsylvania, USA: 205-211.

Cheng S, Foster RL, and Huang C (2003). Concept analysis of pain. Tzu Chi Nursing Journal, 2(3): 20-30.

Craig KD (2015). Social communication model of pain. Pain, 156(7): 1198-1199.

De la Torre F, Chu WS, Xiong X, Vicente F, Ding X, and Cohn J (2015). IntraFace. In the IEEE International Conference on Automatic Face and Gesture Recognition, Ljubljana, Slovenia: 1-8.

Georgiou E, Hadjibalassi M, Lambrinou E, Andreou P, and Papathanassoglou ED (2015). The impact of pain assessment on critically ill patients' outcomes: A systematic review. BioMed Research International, 2015: Article ID 503830, 18 pages. https://doi.org/10.1155/2015/503830

Greaves J (2010). How do you stack up? EQ trends by industry. TalentSmart: 1-5. Available online at: http://www.talentsmart.com/articles/How-Do-You-Stack-Up--EQ-Trends-by-Industry-41897549-p-1.html

Gregory J (2012). How can we assess pain in people who have difficulty communicating? A practice development project identifying a pain assessment tool for acute care. International Practice Development Journal, 2(2): 1-22.

Hussain M (2015). Acute pain for postoperative patients in Kuwait: A study of how surgical nurses assess postoperative pain. Ph.D. Dissertation, University of Salford, Manchester, UK.

Kawagoe CK, Matuoka JY, and Salvetti MDG (2017). Pain assessment tools in critical patients with oral communication difficulties: A scope review. Revista Dor, 18(2): 161-165.

Kizza IB, Muliira JK, Kohi TW, and Nabirye RC (2016). Nurses' knowledge of the principles of acute pain assessment in critically ill adult patients who are able to self-report. International Journal of Africa Nursing Sciences, 4: 20-27.

Kovács G and Spens KM (2005). Abductive reasoning in logistics research. International Journal of Physical Distribution and Logistics Management, 35(2): 132-144.

Kumar KH and Elavarasi P (2016). Definition of pain and classification of pain disorders. Journal of Advanced Clinical and Research Insights, 3: 87-90.

Kunz M and Lautenbacher S (2014). The faces of pain: a cluster analysis of individual differences in facial activity patterns of pain. European Journal of Pain, 18(6): 813-823.

Matsumoto D and Hwang HS (2011). Reading facial expressions of emotion: Basic research leads to training programs that improve people's ability to detect emotions. Psychological Science Agenda. American Psychological Association, 25(5). Available online at: http://www.apa.org/science/about/psa/2011/05/facial-expressions.aspx

Mattsson JY (2012). A qualitative national study of nurses' clinical knowledge development of pain in pediatric intensive care. Journal of Nursing Education and Practice, 2(2): 107-118.

Medlej J (2014). Human anatomy fundamentals: Mastering facial expressions. Available online at: https://design.tutsplus.com/tutorials/human-anatomy-fundamentals-mastering-facial-expressions--cms-21140

Meissner JO (2005). Relationship quality in the context of computer-mediated communication-a social constructionist approach. WWZ Discussion Paper (No. 05/01), Universität Basel, Switzerland.

Nascimento LAD and Kreling MCGD (2011). Assessment of pain as the fifth vital sign: Opinion of nurses. Acta Paulista de Enfermagem, 24(1): 50-54.

Nippert AR (2015). The expression of chronic pain: A multimodal analysis of chronic pain patients. Bachelors Thesis, University of Arizona, Tucson, Arizona, USA.

Okeson JP (2005). Bell's orofacial pains: the clinical management of orofacial pain. Quintessence Publishing Company, Chicago, USA.

Paranyushkin D (2011). Identifying the pathways for meaning circulation using text network analysis. Nodus Labs, Berlin, Germany. Available online at: http://noduslabs.com/research/pathways-meaning-circulation-text-network-analysis

Price TF and Harmon-Jones E (2015). Embodied emotion: the influence of manipulated facial and bodily states on emotive responses. Wiley Interdisciplinary Reviews: Cognitive Science, 6(6): 461-473.

Prkachin KM and Craig KD (1995). Expressing pain: The communication and interpretation of facial pain signals. Journal of Nonverbal Behavior, 19(4): 191-205.

Rose L, Smith O, Gélinas C, Haslam L, Dale C, Luk E, Burry L, McGillion M, Mehta S, Watt-Watson J (2012). Critical care nurses' pain assessment and management practices: a survey in Canada. American Journal of Critical Care, 21(4): 251-259.

Roy C, Blais C, Fiset D, Rainville P, and Gosselin F (2015). Efficient information for recognizing pain in facial expressions. European Journal of Pain, 19(6): 852-860.

Severgnini P, Pelosi P, Contino E, Serafinelli E, Novario R, and Chiaranda M (2016). Accuracy of critical care pain observation tool and behavioral pain scale to assess pain in critically-ill conscious and unconscious patients: Prospective, observational study. Journal of Intensive Care, 4(1): 68. https://doi.org/10.1186/s40560-016-0192-x

Souza RCS, Garcia DM, Sanches MB, Gallo AMA, Martins CPB, and Siqueira ILCP (2013). Nursing team knowledge on behavioral assessment of pain in critical care patients. Revista Gaucha De Enfermagem, 34(3): 55-63.

Stys Y and Brown SL (2004). A review of the emotional intelligence literature and implications for corrections. Research Report N R-150, Research Branch Correctional Service of Canada, Ottawa, Canada.

Subedi D (2016). Explanatory sequential mixed method design as the third research community of knowledge claim. American Educational Research Journal, 4(7): 570-577.

Touati N, Denis JL, Roberge D, and Brabant B (2015). Learning in health care organizations and systems: An alternative approach to knowledge management. Administration and Society, 47(7): 767-801.

Varndell W, Fry M, and Elliott D (2017). Exploring how nurses assess, monitor and manage acute pain for adult critically ill patients in the emergency department: protocol for a mixed methods study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 25(1): 75-84.

Wieser MJ, Gerdes A, Reicherts P, and Pauli P (2014). Mutual influences of pain and emotional face processing. Frontiers in Psychology, 5(1160): 1-6.