



Examination of explicit and implicit emotions and relationship with the intention to support breastfeeding in public: a descriptive study

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ABSTRACT

Objectives: Current social norms in the United States do not favor breastfeeding in public. This study examined associations between college students' explicit and implicit emotions of breastfeeding in public and their intention to support public breastfeeding.

Methods: Twenty-two student participants viewed images of a breastfeeding woman with a fully-covered, fully-exposed, or partially-exposed breast in a public setting. After viewing each image, participants' explicit emotions (self-reported) of the image were measured using a questionnaire and their implicit emotions (facial expression) were measured using FaceReader technology. We examined if a relationship exists between both emotions [toward images] and intention to support breastfeeding in public using correlation techniques. We determined the relative influence of two emotions on the intention to support breastfeeding in public using regression analyses.

Results: The nursing images depicting a fully-covered breast ($r = 0.425$, $P = 0.049$ vs. $r = 0.271$, $P = 0.222$) and fully-exposed breast ($r = 0.437$, $P = 0.042$ vs. $r = 0.317$, $P = 0.150$) had stronger associations with explicit emotions and intention to support breastfeeding in public compared to implicit emotions and intention. Breastfeeding knowledge was associated with a positive explicit emotion for images with partial- ($\beta = 0.60$, $P = 0.003$) and full-breast exposure ($\beta = 0.65$, $P = 0.002$).

Conclusions: Explicit emotions appear to drive stated intentions to support public breastfeeding. Further research is needed to understand the disconnect between explicit and implicit emotions, the factors that influence these emotions, and whether stated intentions lead to consistent behavior.

KEY WORDS breastfeeding, public support, emotions, FaceReader, social norms

Introduction

Human milk is the ideal food for most infants and provides an immense amount of health benefits for the infant and parent [1]. However, current breastfeeding rates in the United States are suboptimal. The Centers for Disease Control and Prevention (CDC) report a high initiation rate of 4 out of 5 children (83.2%) breastfeeding at birth, but there is a steady decline of infants being exclusively breastfed at 3 and 6 months [2]. Aside from personal and medical reasons, research has shown lack of family support and cultural norms are among the barriers to continued breastfeeding [3, 4].

Receiving societal support is essential to improve breastfeeding rates. For those who exclusively breastfeed for the recommended full 6 months, public breastfeeding can be difficult to avoid. One research study found that the women who were more comfortable breastfeeding in public, tended to breastfeed their children longer [5]. However, current social norms in the United States generally do not support public breastfeeding despite the fact that it is legal in all 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands [6].

Recently, more research has been done to investigate how societal support toward women breastfeeding in public can influence women's comfort levels and overall success rates. A 2017 study used images of women breastfeeding in private and public settings and observed the attitudes men had toward these scenarios. The study found that men viewed breastfeeding in private more positively than breastfeeding in public and that their knowledge and attitudes regarding breastfeeding were factors positively associated with these results [7]. Understanding the emotions these men had could help researchers begin to grasp how to raise awareness to those unfamiliar with public breastfeeding.

Foss & Blake [8] conducted a similar research study where they observed students' attitudes about breastfeeding using entertainment-education, a concept used in an effort to improve attitudes towards breastfeeding. Their research focused on how media influences the knowledge and attitudes of students, by having them view popular television clips that portrayed private versus public breastfeeding. Researchers found that students' attitudes were positive about breastfeeding, but they were uncomfortable seeing it in public [8].

The purpose of this study is to (1) determine students' emotions toward breastfeeding in public with varying levels of breast exposure, (2) analyze the relationship between these emotions and students' intention to support breastfeeding in public, and (3) assess students' psychological processing by observing participants' implicit emotions using face reading technology, Noldus FaceReader. Research has stated that "implicit attitudes are assumed to guide behavior by default, unless they are overridden by controlled processes" [9]. Ajzen & Fishbein [9] also stated that "implicit attitudes predict behaviors that are not consciously monitored" (i.e. facial expressions). To our knowledge, no other research studies have incorporated facial reading technology to analyze participants' implicit emotions toward public breastfeeding.

Methods

Ethics statement

The informed written consent was obtained from each participant. The study protocol was approved by the Institutional review board of Montclair State University (Study number FY18-19-1171).

To understand students' emotions toward women breastfeeding in public, this study aims to differentiate explicit emotion from implicit emotion to see which has a stronger association with intention to support breastfeeding in public. Given that emotions are complex and have been found to be "more predictive of breastfeeding intention than norms" [10], we focused on emotions rather than subjective norms and phrased emotions as explicit and implicit, in an effort to make a comparison to each other later on.

We use “implicit emotion” to refer to an attitude that “manifests as actions or judgements that are under the control of automatically activated evaluation without the performer’s awareness of that causation” [11]. These unconscious emotions could stem from preconceived judgements seen at home or when growing up. Conversely, the term “explicit emotion” is defined as an attitude people think about and deliberately report [12]. Explicit emotions can be measured by self-report and necessarily involve respondents knowing what is being assessed [12].

1. Design

This study used a cross-sectional design to examine students’ implicit and explicit emotions of women breastfeeding in public. Specifically, students were asked to view three images of women breastfeeding, with varying levels of breast exposure, in a public setting. Noldus FaceReader technology was used to analyze students’ facial reactions to the images and their facial expressions were recorded as implicit emotions. A questionnaire was used to determine students’ explicit written reactions to the same images, as well as demographic, knowledge, and intention questions.

Participants were recruited from December 2018 until February 2019 at a public university in northern New Jersey. A total of 26 undergraduate and graduate students were recruited to participate in the study. Recruitment occurred through email, flyers, in-person pleas, and Canvas Learning Management System (Instructure Inc, Salt Lake City, UT, USA) used on campus. Inclusion criteria included undergraduate and graduate students who were at least 18 years of age or older. Lastly, there was an incentive for participants who fully completed the research study; a raffle awarding two participants each a \$25 Amazon gift card at the conclusion of the study.

2. Images viewed by participants

Three images of women breastfeeding on a public park bench were displayed on a Microsoft surface Pro 2 tablet (Windows 10; Pegatron Corporation, Taipei, Taiwan). The images represented were of women breastfeeding with their: nursing breast fully covered (Image 1), nursing breast partially exposed (Image 2), and nursing breast fully exposed (Image 3). The three breastfeeding images were found from Google images (Google LLC, Mountain View, CA, USA), and chosen to fit the following criteria: an outdoor setting, the woman sitting on a bench gazing down at the child, and no other persons visible in the photograph. The woman and child in each of the three images also had similar demographics (age, race, and appearance). This set of criteria was established so that the main difference between the images was breast exposure, to determine if exposure plays a role in public breastfeeding acceptance. Each image was shown for 15 seconds, followed by 20 seconds of a white screen instructing participants to fill out the corresponding page of the questionnaire. Three slideshow variations were made that switched the image viewing order. To try and limit any viewing bias, each participant was randomly assigned a slideshow number that corresponded to one of the three viewing variations.

3. FaceReader to measure participants’ facial expressions of images

Noldus FaceReader technology is a type of facial expression recognition software that analyzes six basic or universal emotions: happy, sad, angry, surprised, scared, and disgusted [13]. This software is used to interpret facial expressions from participants when exposed to different stimuli by video recording them in real time.

This study used an Axis webcam model M1054 network camera (Axis Communications AB, Emdalavägen 14, SE-223 69 Lund, Sweden) mounted on the wall parallel to the tablet and connected to a closed-circuit network to video record participants who provided consent. The FaceReader technology is best utilized and can report an accurate facial reading when participants make direct eye contact with the camera lens. Having the tablet set up parallel to the camera allowed the participants to keep eye contact with the camera as well as view the images as naturally as they could. FaceReader software (version 7; Noldus Information Technology, Wageningen, The Netherlands) was used to analyze the video recordings for implicit facial reactions to each of the three images. The software exports numerical data when a certain emotion is present. Each emotion is expressed

as a value between 0 (not visible) and 1 (fully present), indicating the intensity of the emotion [13]. This study focused on the emotional outputs of happy and disgusted. These terms were used to evaluate implicit positive emotion according to the following equation adapted from previous research, which also utilized FaceReader technology [14]:

$$\text{Implicit positive emotion} = \text{FaceReader happy} - \text{FaceReader disgusted}$$

4. Questionnaire to measure written emotions of images

A short questionnaire asked participants to rate their explicit emotions to each breastfeeding image on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) for each of the following emotions: happy, sad, scared, angry, disgusted, and surprised. These emotions were the same as measured by the FaceReader so that comparisons could be made between implicit facial reactions and explicit stated responses. As with the measure of implicit emotion, explicit emotion was evaluated as the difference between happy and disgusted according to the following equation:

$$\text{Explicit positive emotion} = \text{self-reported happy} - \text{self-reported disgusted}$$

The questionnaire also asked participants about their demographics, breastfeeding knowledge, and intentions about supporting breastfeeding in public. Demographic questions included gender, marital status, race/ethnicity, education, major, parental status (yes/no) and the degree of religiosity. The degree of religiosity was measured by the frequency of attending religious services: more than once a week, once a week, once or twice a month, a few times a year, and never. These categories were later combined into, often (more than once a week; ordinal value of 3), weekly (once a week; ordinal value of 2), and infrequently (less frequently than once a week; ordinal value of 1). Breastfeeding knowledge was measured as the summed response value of five items, adapted from a previous research study [15]. Intention to support public breastfeeding was measured with a 5-point Likert scale: 1 = strongly disagree, 5 = strongly agree.

5. Data Collection

Participants were seated in a booth with proper lighting, room temperature, and noise control. The booth provided an environment conducive to the optimal functioning of FaceReader technology with the Microsoft tablet. Participants were given the following instructions about the FaceReader in order for the camera to properly detect their facial features: remove any hats or glasses, adjust the height of the chair so the camera was eye level, and keep eye contact as best as possible while viewing the images on the tablet. The entire process, from entering the room to leaving, took approximately 10 minutes for each participant.

6. Data Analysis

The relationships between participants' implicit emotion and intention and between explicit emotion and intention were determined by Pearson's correlation coefficients. These relationships were evaluated for the emotion data of each of the three images individually (i.e. implicit emotion for image 1 vs. intention, explicit emotion for image 1 vs. intention, implicit emotion for image 2 vs. intention, etc.), and also for the sum of the emotion data for the three images (i.e. the sum of implicit emotion for all three images vs. intention, and the sum of explicit emotion for all three images vs. intention).

For comparisons of the relative importance of implicit emotions and explicit emotions for the prediction of intention, regression models were produced using implicit emotion and explicit emotion as possible predictors of intention. The internal consistency (Cronbach's α) of the implicit emotion scale across all three images was 0.69. In addition, for comparisons of the underlying factors influencing explicit emotion, regression models were produced using knowledge, religiosity, and parental status as possible predictors of emotion. The internal consistency Cronbach's α of the explicit emotion scale across all three images was 0.75. As with the Pearson correlations described above, tests were performed using emotion response data for each of the three images as well as for the sum of the three images. Regression models were developed using the stepwise method. Standardized coefficients were determined and reported as β values, and these values were compared for determination of

relative magnitudes of effect of the predictors. All statistical analyses were performed with IBM SPSS Statistics for Windows (version 24.0, IBM Corp, Armonk, NY, USA). A statistical significance level was set at 0.05 for all statistical analyses.

Results

Twenty-six eligible participants were recruited and participated in the research study. Three participants were removed because they did not complete the survey correctly, and one who did not provide consent to be video recorded, making the total analytic sample 22 participants. Of the 22 participants, 16 (72.7%) were female and 6 (27.3%) were male. The mean age of the participants was 26 years old (SD = 9.0 years). Fourteen participants (63.6%) were undergraduate students, and 8 (36.4%) were graduate students. Five (22.7%) participants reported they were parents and that they or their partner had breastfed their child/children. Table 1 provides additional demographic information for the sample with regards to marital status, race, ethnicity, religion, education, and academic major. Table 2 presents emotion, knowledge, intention, and religiosity mean scores.

Table 1. Participant demographics

Variables		Total (n = 22)
Age (years)		26 ± 9.02
Gender	Female	16 (72.7)
	Male	6 (27.3)
Marital Status	Single	19 (86.4)
	Married	3 (13.6)
Race	Asian	1 (4.5)
	Black/African American	3 (13.4)
	White	16 (72.7)
	Other	2 (9.1)
Ethnicity	Hispanic	5 (22.7)
	Non-hispanic	17 (77.3)
Aside from weddings and funerals do you attend religious services?	No	11 (50.0)
	Sometimes	5 (22.7)
	Yes	6 (27.3)
Education	High school graduate/ GED	2 (9.1)
	Some college (no degree)	6 (27.3)
	Associate degree	5 (22.7)
	Bachelor's degree	8 (36.4)
	Master's degree	1 (4.5)
Academic standing	Undergraduate	14 (63.6)
	Graduate	8 (36.4)
Major	Nutrition & Food Science	17 (77.3)
	Public health	3 (13.6)
	Other	2 (9.1)
Are you a parent?	No	17 (77.3)
	Yes	5 (22.7)
If you are a parent, did you/your partner breastfeed?	No	0 (0.0)
	Yes	5 (100.0)

Mean ± SD or n (%).

Table 2. Mean scores of explicit and implicit emotions, knowledge, intention, and religiosity

Image	Emotion	Mean	Standard deviation
Nursing breast fully covered (Image 1)	Explicit	2.73	0.94
	Implicit	0.01	0.29
Nursing breast partially exposed (Image 2)	Explicit	2.68	0.95
	Implicit	-0.06	0.19
Nursing breast fully exposed (Image 3)	Explicit	2.45	1.30
	Implicit	-0.03	0.13
Variables		Mean	Standard deviation
Intention		3.55	1.47
Knowledge		7.05	3.21
Religiosity		1.36	0.66

Note: Intention and explicit emotion scores were measured in 1 to 5 levels of intentions. Knowledge score was measured as the summed response value of 5 knowledge questions. Religiosity was measured in 1 to 3 levels of frequency of religious service attendance. Implicit emotions were measured in ranges 0 to 1.0. The implicit emotion score was the difference between the measure of happy and the measure of disgust, according to FaceReader technology during viewing of the images.

Table 3. Correlations between images and overall explicit and implicit emotions

Image	Overall emotion	Coefficient ¹⁾	P-value	95% CI
Nursing breast fully covered (Image 1)	Explicit	0.425	0.049	0.004, 0.718
	Implicit	0.271	0.222	-0.170, 0.622
Nursing breast partially exposed (Image 2)	Explicit	0.370	0.090	-0.061, 0.685
	Implicit	0.094	0.679	-0.342, 0.496
Nursing breast fully exposed (Image 3)	Explicit	0.437	0.042	0.019, 0.725
	Implicit	0.317	0.150	-0.121, 0.652

1) Values are Pearson's correlation coefficients between emotions regarding each image and intention to support breastfeeding in public.

1. Relationships among implicit emotion, explicit emotion, and intention

For all three images, explicit emotion showed stronger association with the intention to support breastfeeding in public compared to implicit emotion. As shown in Table 3, the associations between explicit emotion and intention for image 1 ($r = 0.425$, $P = 0.049$) and image 3 ($r = 0.437$, $P = 0.042$) were statistically significant. The association between implicit emotion and intention for image 1 ($r = 0.271$, $P = 0.222$) and image 3 ($r = 0.317$, $P = 0.150$) were not statistically significant. The association was not significant for either implicit ($r = 0.094$, $P = 0.679$) or explicit ($r = 0.37$, $P = 0.090$) emotion for image 2.

As shown in Table 4, this trend was also true when the emotions of happy and disgusted were separated for each emotion to examine the association with the intention. In addition, the direction of the relationships was positive for happy, and negative for disgusted emotion. This indicated that participants showed a more supportive intention towards public breastfeeding when they felt a higher degree of happiness, whereas a less supportive intention when they felt a higher degree of disgust, reported explicitly.

2. Relative importance of implicit emotion, explicit emotion, and intention

The relative importance of implicit and explicit emotions on predicted intention to support breastfeeding in public was determined by comparing regression coefficients. For images 1 and 3, the explicit emotion was influential on the intention, and the magnitudes of the influence were $\beta = 0.425$ ($P = 0.049$) and $\beta = 0.437$ ($P = 0.042$), respectively. Explicit emotions accounted for 18% ($P = 0.049$) and 19.1% ($P = 0.042$) of the total variance of respective models as shown in Table 5. The regression model was not created for image 2 as both explicit and implicit emotions were eliminated in the model due to insignificant correlations with the intention.

Table 4. Happy and disgusted emotion related to images of women breastfeeding

Image	Emotion	Attitude	Coefficient ¹⁾	P-value	95% CI
Nursing breast fully covered (Image 1)	Happy	Explicit	0.374	0.086	-0.056, 0.687
		Implicit	0.161	0.474	-0.279, 0.546
	Disgusted	Explicit	-0.243	0.276	-0.603, 0.199
		Implicit	-0.286	0.197	-0.631, 0.154
Nursing breast partially exposed (Image 2)	Happy	Explicit	0.333	0.130	-0.103, 0.662
		Implicit	0.227	0.310	-0.216, 0.592
	Disgusted	Explicit	-0.243	0.276	-0.603, 0.199
		Implicit	-0.020	0.929	-0.438, 0.405
Nursing breast fully exposed (Image 3)	Happy	Explicit	0.363	0.097	-0.069, 0.680
		Implicit	0.246	0.283	-0.208, 0.612
	Disgusted	Explicit	-0.371	0.090	-0.685, 0.061
		Implicit	-0.232	0.312	-0.603, 0.222

1) Values are Pearson's correlation coefficients between emotions regarding each image and intention to support breastfeeding in public.

Table 5. Emotions that significantly influence the intention to support breastfeeding in public: for each image and as a whole

Image	Emotions	β	P-value	R ²	P-value
Nursing breast fully covered (Image 1)	Explicit	0.425	0.049	18.0%	0.049
Nursing breast fully exposed (Image 3)	Explicit	0.437	0.042	19.1%	0.042
Images as a whole	Explicit	0.501	0.251	25.1%	0.017

Note: Neither emotion was significant for image 2, nursing breast partially exposed. Images as a whole mean that participants' emotions toward all three images were considered as a single summed term.

When participants' emotions toward all three images were considered as a single summed term, explicit emotion again associated significantly with intention ($\beta = 0.501$, $P = 0.017$), accounting for 25.1% of the total variance.

3. Underlying factors influencing the explicit emotion

In order to examine the roles of underlying factors associated with explicit emotion, we considered additional factors of breastfeeding-related knowledge, religiosity, and parental status. The relationships with implicit emotion were not examined because the implicit emotion did not have a significant role in predicting intention. The relative roles of these factors were compared using regression weights of each variable in predicting the explicit emotion shown in Table 6. For image 1, no regression model was created due to insignificant correlations between the explicit emotion and underlying factors. For image 2, knowledge was the dominant predictor ($\beta = 0.60$, $P = 0.003$) for the explicit emotion, accounting for 36.1% ($P = 0.003$) of the total variance. For image 3, knowledge and religiosity were significant predictors for the explicit emotion, though knowledge was more influential ($\beta = 0.65$, $P = 0.002$) than religiosity ($\beta = -0.53$, $P = 0.008$). The negative direction of the

Table 6. Underlying factors significantly influencing the explicit emotion

Image	Factors	β	P-value	R ²	P-value
Nursing breast partially exposed (Image 2)	Breastfeeding knowledge	0.60	0.003	36.1%	0.007
Nursing breast fully exposed (Image 3)	Breastfeeding knowledge	0.65	0.002	41.7%	0.008
	Religiosity	-0.53	0.008		

Note: Regression model for image 1 [nursing breast fully covered] was unstable. Only explicit emotion was examined because explicit emotion has a stronger relationship with the intention to support breastfeeding in public compared to implicit emotion.

regression weight of religiosity indicates that the more religious one is, the more negative their emotions toward breastfeeding in public while exposed. These underlying factors accounted for 41.7% ($P = 0.008$) of the total variance. The sum of explicit emotion across the three images was also significantly associated with knowledge ($\beta = 0.56$, $P = 0.007$), accounting for 31.3% of the total variance. Parental status was insignificant for all models.

Discussion

Explicit emotions, but not implicit emotions, corresponded with participants' stated intention to support breastfeeding in public. Specifically, the association between participants' explicit emotions and intentions was strongest for the least exposure (image 1) and full exposure (image 3), with no significant results for partial exposure (image 2). In fact, there was no distinction between participants' explicit and implicit emotions for image 2.

The least exposed and fully exposed images had the strongest associations to explicit emotions and intention. This could be because breastfeeding with a cover may be regarded with as much disapproval as without one. A recent study found that the cover which is used to neutralize the act of breastfeeding could actually be drawing more attention due to the fact that the child is breastfeeding underneath, creating disapproval of breastfeeding in public despite the absence of exposure [16]. However, we did find that breastfeeding knowledge is important when there is some level of breast exposure.

Knowledge of breastfeeding played a role in acceptance of breast exposure for participants when considering their explicit emotions, but not for their implicit emotions. However, explicit emotions were not driven by knowledge alone. Our findings showed parental status, which we used as a proxy for breastfeeding experience, was not an underlying predictor of emotion. Religiosity, which was a proxy for conservatism [17], does play a role in predicting explicit emotion, together with breastfeeding knowledge, but only for image 3. The more religious the participant is, the stronger the negative emotion, thus leading to negative intention to support breastfeeding in public, especially when the nursing breast is fully exposed. Breastfeeding in public can evoke emotions, such as disgust and awkward discomfort from bystanders because breastfeeding exposes those to the stigma of women being noticeably sexual [18]. Those who are conservative would support breastfeeding in private.

Overall, in this sample of students, explicit emotions are driving stated intentions. The question that remains is whether those stated intentions lead to behavior. Is it possible that in this case, explicit emotions lead to stated intention, but implicit emotions drive actual behavior? It is not uncommon that we see the disconnection between two emotions. One emotion influences intention yet another emotion influences the behavior.

Several limitations in this study are worth noting. First, the sample size was small and consisted predominantly of white, educated, and single females located in one geographic area of the country. Thus, the results cannot be generalized to other populations. Also, because this study had primarily nutrition and public health students the sample is not representative of all students on campus and their emotions regarding public breastfeeding. Likewise, this sample of students studying the health professions may be more aware of the health benefits to breastfeeding, and therefore have a more positive response toward breastfeeding in public. More research is needed with a larger and more diverse sample that could be representative of the United States.

Furthermore, it is not clear how other settings and survey methods would influence results. Being seated in a booth viewing images on a tablet could influence the results as well. Stated emotions and intentions are usually hypothetical until the real scenario happens, then implicit emotions and judgements surface [19]. Future research should be done to observe emotions of public breastfeeding in a real-life scenario rather than still images of public breastfeeding. Additionally, we chose the FaceReader technology to analyze implicit emotion over the Implicit Association Test, a common survey method to analyze implicit emotions [20]. Using this survey method in combination with the FaceReader could be an interesting technique of implicit emotion research and bring about new findings.

Conclusion

Findings from the current research study demonstrate explicit emotions are associated with stated intentions to support breastfeeding in public when there is breast exposure. Further research to continue to explore the idea of implicit and explicit emotions surrounding breastfeeding in public is needed. Implicit and explicit emotions are complex to comprehend, especially in regard to a controversial topic such as public breastfeeding. A shift in the way society portrays public breastfeeding could be the support women need to continue to breastfeed their children outside their home without judgment.

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Conflict of Interest

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Data Availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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