Published in final edited form as:

Patient Educ Couns. 2014 January ; 94(1): . doi:10.1016/j.pec.2013.09.021.

Linguistic Markers of Emotion in Mothers of Sickle Cell Carrier Infants: What are They and What do They Mean?

Nadia Y. Ahmad and

Department of Family and Community Medicine, Medical College of Wisconsin, Milwaukee, USA

Michael H. Farrell

Center for Patient Care and Outcomes Research, Medical College of Wisconsin, Milwaukee, USA

Abstract

Objectives—The objectives were to examine emotion-related language in mothers' narratives about newborn screening, and test the correlations between language and self-reported emotion and behavior.

Methods—Transcripts of interviews with mothers of infant sickle cell carriers were analyzed with word count software for the prevalence of emotion-related words in narratives about newborn screening. Word counts were compared to population norms for spoken language using one-sample t-tests. Anxiety-related words were correlated with self-reported anxiety and avoidance of genetic testing.

Results—187 transcripts were analyzed, in which there was a higher percentage of anxiety words ($m = .38\%$) than population norms ($m = .18\%$), $t(186) = 10.59$, $p < .001$, $CI = .16-.23$. Anxiety-related word use was positively correlated with self-reported previous anxiety, $r_s(185) = .24$, $p = .001$. Self-reported previous anxiety, but not word use, was correlated with mothers' avoidance of undergoing genetic testing themselves $r_s(152) = .25$, $p = .002$.

Conclusion—Mothers of sickle cell carrier infants reported anxiety upon learning their child's condition. Anxiety-related words in maternal narratives were correlated with their reports of past, but not present, emotions.

Practice Implications—Researchers and clinicians should use caution in assuming that word choices reflect state emotions. Self-report methods may be preferable for predicting behavioral outcomes.

1. Introduction

Assessing the language that patients or other populations use to describe their experiences has the potential to provide insight into their emotions about the experience. Previous linguistic theory and psychological research (1) suggest that people's emotions and attitudes can be conveyed through their use of evaluative words like *good*, *bad*, *beautiful*, or *ugly* that convey positivity or negativity about a subject (2); words denoting actual specific emotions,

© 2013 Elsevier Ireland Ltd. All rights reserved.

Corresponding author at: Nadia Y. Ahmad, Department of Family and Community Medicine, Medical College of Wisconsin, 8701 Watertown Plank Road, PO Box 26509, Milwaukee, WI 53226, USA. Telephone: +1-414-955-8634. Fax: +1-414-955-6523. nahmad@mcw.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

such as *anger* or *sadness* (3); and other types of *affect markers*, such as adverbs or verbs with emotional connotations, i.e. *relish* or *begrudge* (4, 5).

Emotion-related word choices have been repeatedly examined in the context of individuals' *narratives*. Narratives are defined as spoken or written descriptions of personally experienced events, and are characterized by a sense of meaning ascribed by the narrator to the described events (6). The expression of feelings and/or an evaluation of the described events has been described as a method conveying the meaning that a narrator ascribes to the described events (6). Emotional experience, including emotions specific to a narrative topic, has been found to be associated with linguistic cues – the emotional connotations of the words that people choose (7, 8). Analyzing patients' word choices to make inferences about their emotional experience—that they are experiencing unusually high levels of anxiety or sadness, for example—could be used when direct self-reports are unavailable.

Methods to quantify the emotional content of narratives include manual or automated content analysis, using coding dictionaries that categorize emotion-related words by their general (*positive*, *negative*) and/or specific (e.g., *anxiety*, *sadness*) emotional meaning. Automated analysis of the prevalence of emotion-related words in text files can be conducted with software programs such as Linguistic Inquiry and Word Count (LIWC) (9, 10), whose identification of specified categories of emotion words has been found to correlate with the judgments of human coders (11).

There is experimental, as well as correlational, evidence that the prevalence of emotion-related words, as measured by coders or by LIWC, is a reflection of speakers' or writers' actual emotional experience. For example, inducing specific emotions in participants has been found to result in the participants subsequently using a higher frequency of words consistent with the induced emotion (12). For speakers or writers who describe personally meaningful events in narratives (6), using emotion-related words has been found to have prognostic significance, predicting narrators' subsequent emotion-related (13–15) health outcomes. Treating emotional experience as a factor that can affect health outcomes is supported by findings that positive emotions can influence cardiovascular and endocrine function (14) by buffering reactions to stress, improving cardiovascular recovery, and decreasing exposure to cortisol (13, 16). Conversely, negative emotional experiences have been correlated with an increased risk of negative subsequent health outcomes, including coronary heart disease (17).

Consistent with the idea that word choices can be used as a measure of emotional states, narrators' use of positive emotion words has been negatively correlated with subsequent clinic visits and symptoms of illness (18). Conversely, narrators' usage of negative emotion words has been positively correlated with subsequent clinic visits and symptoms (11), as well as with depression symptoms (19). Emotion-related word use has even been found to predict narrators' longevity (16).

1.2. Clarifying the meaning of emotion-related word use

Despite the evidence that word choices reflect emotional states, assessing emotional outcomes via people's word use is hampered by uncertainty about the *type* of emotional experience expressed by emotion-related word use. One unexpected finding from the literature on emotion-related word choices is that several studies have failed to find a correlation between narrators' use of negative-emotion words when describing traumatic experiences and their self-reported emotional distress (20–22). This could be because the self-report measures of distress were measures of global distress rather than distress specific to the traumatic event that narrators described. In addition, emotional reactions to the traumatic event may have dissipated by the time participants describe the experience and

report their current level of emotional distress. Clarifying the relationship between emotion-related word use and self-reported emotion may help researchers and/or clinicians to understand the type of emotional experience that is being expressed in participant or patient communications about past experiences.

1.3. Present research

The present research addresses the question of whether emotion-related word use reflects emotions specific to a narrative's content, as suggested by linguistic theory (5), rather than the narrators' current, generalized emotional state. The goal of the current study was to test whether the prevalence of emotion-related words in the narratives of mothers of sickle cell carrier infants would reflect the mothers': (a) current emotional states; (b) current emotions specific to the concern elicited by the events in the narratives; or (c) the emotions the mothers remember having felt during the newborn screen and results disclosure. If, as theory suggests (23), people use emotion related language to assign meaning to narrative topics, emotion-related word use should be correlated with self-reported emotion specific to the event discussed, rather than state emotion.

- a. *Prediction 1.* Anxiety-related word use would significantly correlate with topic-specific anxiety: previous anxiety (the anxiety interviewees remember having felt), and/or infant health worries (current levels of anxiety about the precipitating concern described during the interview).
- b. *Prediction 2.* Anxiety-related word use would not correlate with state anxiety (reflecting the interviewees' generalized emotional state at the time of interview), replicating previous findings (20–22).

1.4. Context

The narratives examined for this study focused on the recollections of mothers whose infants were revealed to be sickle cell carriers during routine newborn screening for congenital conditions. Negative emotions, especially anxiety, have been proposed to be potential outcomes of notifying parents that their infant is a carrier of an autosomal recessive disease (24–26). In the United States, as well as in other countries, newborn infants are routinely tested for genetic and other congenital conditions shortly after birth. In addition to identifying infants with actual diseases, screening identifies infants who are heterozygous “carriers” of only one of the two mutations necessary for an autosomal recessive disease. Though carriers will never develop the actual disease, miscommunication or misunderstanding may lead parents to worry unnecessarily about their child's prognosis.

Despite the concerns about potential adverse effects, parents of carrier infants *are* often notified of their child's condition, partly so that parents may make a decision about genetic testing to determine if they are both carriers. If both parents were carriers, subsequent children would be at risk for having the actual disease. Similarly, the infant's carrier status could be of interest for his or her eventual reproductive decision-making.

1.5 Secondary goal

An additional goal of the study was exploratory: to examine the extent to which participants' anxiety-related word choices and self-reported anxiety correlate with a potentially anxiety-related motivation, the avoidance of undergoing genetic testing themselves. Anxiety about medical conditions has been linked to both information-seeking and information-avoiding behaviors (27). Genetic screening avoidance in the current study was assessed via mothers' reports of having undergone screening for being a sickle cell carrier themselves, and, if not, their intention to do so.

2. Method

2.1. Setting

This study was a secondary analysis of telephone interviews with mothers whose infants had been found to be sickle cell carriers through routine newborn screening. These interviews were conducted as part of a statewide observational study of newborn screening disclosure practices, the Wisconsin Project on Improvement of Communication Processes and Outcomes after Newborn Genetic Screening. The purpose of the larger project was to evaluate physicians' disclosure of newborn screening results and parents' reactions to those results, and did not include an interventional component (28). The interviews were conducted between March 2008 and November 2010, three to five months after newborn screenings had taken place. Participants were offered a gratuity in the form of a \$20 US gift certificate.

2.2. Participants

Interviews were eligible for inclusion if the interviewee: was the mother and primary caregiver of an infant sickle cell carrier; conversant in the English language; and had been previously notified of their infants' newborn screening result.

The resulting study sample was comprised of 187 mothers whose ages ranged from 14 to 45 years, $M = 25.46$, $SD = 6.17$. The self-reported ethnic and racial composition of the sample was: 64.2% ($n = 120$) Black; 20.3% ($n = 38$) White; 8% ($n = 15$) reporting more than 1 race; 7.5% ($n = 14$) Hispanic or Latina of any race; 2.1% ($n = 4$) for whom race and ethnicity were not reported; and .5% ($n = 1$) Asian.

2.3. Procedure

Interviews were semi-scripted and conducted over the telephone by a genetic counselor or nurse. There were four components of each interview: (a) an informed consent procedure; (b) a request for the mother to describe her experience with the newborn screening process and the manner in which she learned her child's result; (c) a series of fixed-choice quantitative items; and (d) a debriefing in which the interviewer addressed parental questions and concerns about the study and about the child's condition. Interviews were recorded with participants' consent. The recordings of mothers' narrative descriptions and responses to self-report items were transcribed and proofread for accuracy. All proper names were replaced with common nouns (e.g., "baby's name") to protect participants' privacy.

The resulting transcripts were prepared for LIWC analysis according to published recommendations (29): interviewers' speech and transcriptionist notes were deleted, misspellings were corrected, and filler terms such as *I mean*, *like* (when used as a filler term), and *you know* were manually tagged to avoid misclassification. The text files were then submitted to the LIWC textual analysis program to compute the percentages of emotion-related words used by each mother during her interview (30).

2.4. Measures

2.4.1. LIWC emotion-related word categories—The emotion categories included in the dictionary of the most recent (2007) version of LIWC (30) include: *positive emotion* (406 words with a positive valence); *negative emotion* (499 words with a negative valence); and *anxiety*, *anger*, and *sadness* (three subcategories of negative emotion). The *anxiety* category consisted of 91 anxiety-related words (e.g., *worried*); *anger* consisted of 184 words (e.g., *hate*); and *sadness* consisted of 101 sadness-related words (e.g., *crying*).

2.4.2. Self-report measures—Included in the present analysis were interview questions that addressed mothers' anxiety, genetic testing history, and behavioral intentions to undergo genetic testing. Three different types of anxiety were examined: current state anxiety, past anxiety about the screening results (*previous anxiety*), and current anxiety about the infants' health (*infant health worries*).

State anxiety: Current anxiety was assessed via Marteau and Becker's (1992) State Anxiety Scale (31), a short-form version of the state component of the State-Trait Anxiety Inventory (STAI) (32) that has been found to be highly correlated with STAI in reliability/validity testing conducted in parents of infants with abnormal newborn screens (33). Mothers reported the degree to which they were currently feeling *calm, tense, upset, relaxed, content*, and *worried* on a 4-point Likert-type scale from 1 – *not at all* to 4 – *very much* (29). Responses to *calm, relaxed*, and *content* were reverse scored, and the items averaged to create a state anxiety score for each participant (Cronbach's $\alpha = .76$).

Previous anxiety: Mother's recollection of their level of anxiety upon learning their child's newborn screening result was measured using a single item: "How worried did you feel when you first heard about the screening result?" Parents indicated their responses on a Likert-type scale ranging from 1 – *not worried at all* to 5 – *very anxious*.

Infant health worries: A two-item index comprised of questions from Kerruish and colleagues' 10-item Vulnerable Baby Scale (34) was used to assess parental anxiety specific to their infant's health. Participants indicated their current level of concern about their infants' health ("how concerned are you that [baby's name] is not as healthy as he/she should be?"), and worry about the possibility of infant illness ("how often do you find yourself worrying that your baby may become seriously ill?") on Likert-type response scales ranging from 1 – *not concerned at all* to 5 – *I think of it all the time*. Responses to these items were significantly correlated with one another, $r_s(186) = .25, p = .001$; Cronbach's α of the resulting index = .56.

Avoidance of genetic testing: Mothers were asked if they had undergone, or planned to undergo, sickle cell carrier testing. Responses were coded so that higher numbers reflected greater avoidance of screening: 1 – *mother had already been tested*; 2 – *she planned to be tested*; 3 – *she was unsure about her plans*; or 4 – *she did not plan to be tested*.

2.5. Statistic analyses

Statistical analyses were conducted with IBM PASW® Statistics 18.0. Means, standard deviations, and confidence intervals for the dependent measures were calculated. A series of one-sample t-tests compared narrators' word use to base rates for spoken language. Spearman rho and point biserial correlations assessed the associations between anxiety-related word use, self-reported anxiety, and genetic screening avoidance. All reported probabilities are two-tailed.

3. Results

3.1. Comparison with base rate for spoken language

LIWC was able to categorize from 88.97% to 98.77% of words in each submitted transcript, $M = 95.02\%$, $SD = 1.56$. Table 1 presents descriptive statistics for emotion-related word use, and the results of a series of one-sample t-tests to compare the sample means to population means for spoken language provided by the software publisher, based on studies recording subjects' conversations during the course of their everyday lives, including those occurring in public, with strangers, and between romantic couples discussing relationship issues (35).

The one-sample t-tests revealed that the maternal narratives contained a significantly higher percentage of anxiety words than the population norm for anxiety word usage in spoken language. The narratives contained significantly *lower* percentages of generally negative emotion words, anger words, and sadness words than the norm. There was no difference in the percentages of positive words used in the narratives compared to the norm.

3.2. Meaning of elevated use of anxiety words: self-report correlates

To test potential reasons for the elevated use of anxiety words in the maternal narratives, correlations between anxiety word prevalence and self-reported anxiety were calculated. Mothers' mean levels of self-reported state anxiety and infant health worries were, on average, below the midpoint of the scales provided. Mothers' mean level of self-reported previous anxiety exceeded the midpoint of the provided scale (see Table 2 for descriptive statistics).

Mothers' usage of anxiety words in their narratives about newborn screening was significantly correlated with their self-reported previous anxiety. Anxiety word usage was uncorrelated with the state anxiety measure, and with the child health worries measure. Table 3 displays intercorrelations between anxiety-related word use and self-reported anxiety.

3.3. Association between anxiety-related word use and willingness to undergo genetic testing

Self-reported previous anxiety was significantly correlated with self-reported avoidance of genetic screening, $r_s(152) = .25, p = .002$. Anxiety-related word choices, although significantly correlated with self-reported previous anxiety, were not significantly correlated with screening avoidance, $r_s(152) = .10, p = .23$. Note that only a subset of the sample were asked about their own sickle cell carrier screening ($n = 154$), thus the sample size for this analysis is smaller than the overall sample size.

To address the possibility that some mothers might have been screened during or before their most recent pregnancy, correlational analyses were rerun on the subsample of mothers who reported that they had not yet undergone sickle cell carrier testing. Among the mothers who had not undergone testing, reported screening intentions – not planning to be screened, unsure about being screened, or planning to be screened – were also correlated with the anxiety measures. Correlation coefficients for these analyses are presented in Table 3, and descriptive statistics are presented in Table 4.

Mothers' screening intentions were not significantly correlated with any measure of anxiety. Point biserial correlations revealed a negative correlation between mothers' prior testing and previous anxiety, and a positive correlation between prior testing and infant health worries. Anxiety-related word use was not significantly correlated with prior testing.

4. Discussion and conclusion

4.1. Discussion

The purpose of this study was to examine mothers' use of emotion-related language in their narratives about newborn screening, and to investigate the meaning of emotion-related word use. These analyses revealed that the narratives of mothers whose infants were found to be sickle cell carriers contained a significantly higher percentage of anxiety words than population norms for spoken language.

Unexpectedly, mothers' narratives were also found to contain lower proportions of anger- and sadness-related words than the comparison population norms. We interpret the lower

proportions of sadness- and anger-related words in the maternal narratives to be due to the narrative topic, learning about an abnormal but benign newborn genetic screening result, that might reasonably be expected to produce anxiety, but not necessarily sadness or anger.

The heightened prevalence of anxiety words were significantly correlated with self-reports of only one form of anxiety: previous anxiety, which was the anxiety that mothers reported that they remembered having felt after learning of their infants' test results. These patterns of correlations are consistent with the hypothesis that narrators' emotion-related word choices express emotions that are specific to the episode described, rather than the narrators' current emotional state. In this context, anxiety-related word use reflected the emotions that mothers reported having felt during the events that they described – their infants' newborn screening and the subsequent news that the infant is a sickle cell carrier – rather than the emotions they were experiencing during the interviews.

Theoretical support for our findings can be drawn from Robinson and Clore's Accessibility Model of Emotional Self-Report (36). This model proposes that self-reports of current emotional experience (e.g., state emotion, or current emotion triggered by thinking about a specific topic) rely on the responders' *experiential knowledge*, in contrast to previous self-reports that rely on *episodic memory*. When people access the same source of information (i.e., episodic memory when describing past events) for constructing their narratives and reporting their emotions, it seems likely that their emotion-related word use will be congruent with their self-reported emotions. If a narrator continued to feel the same way about described events (i.e., if previously felt anxiety about the event had not dissipated), one would expect that emotion-related word choices would be correlated with reports of both previous emotion and content-specific current emotion.

The exploratory analysis of correlations between genetic testing avoidance and anxiety found that, despite the significant correlation between self-reported previous anxiety and anxiety-related word use, only self-reported anxiety was correlated with genetic testing avoidance. To the extent that anxiety does decrease motivation to learn about one's genetic information, the pattern of correlations is consistent with the idea that word choices are more imprecise measures of emotional experience than self-reports, which appear to be the most precise method to measure emotions (37). The relationship between anxiety and genetic screening avoidance is equivocal (see Table 4), and is a topic that should be examined in future research.

In addition, there are inherent limitations to the measurement precision that can be achieved by using LIWC or other word-counting methods to assess emotional content. Unlike human coders or more advanced sentiment analysis software, word count methods of text analysis neglect to account for adjoining words that can alter the meaning of emotion-related words, which is likely to reduce its sensitivity in detecting emotional content (20). The lack of precision of word choice measures of emotion also helps to explain the small to medium effect size of the correlation between previous anxiety and anxiety-related word choices.

There are several limitations to consider regarding this study. This was a secondary analysis of a pre-existing dataset that relied on survey questions determined before this analysis was conceived. Thus, it was not possible to include self-report items designed to specifically answer questions about the relationship between emotion-related word use and self-reported emotion. Including more direct questions addressing mothers' ongoing anxiety about their child's genetic carrier status and about newborn screening, for example, could have allowed for additional specificity in the measurement of current topic-specific emotion. Finally, our analysis of genetic screening avoidance yielded equivocal results; follow-up investigations

in which anxiety is examined in relation to subsequent, voluntary genetic screening decisions are warranted.

4.2. Conclusion

These data suggest that mothers of sickle cell carrier infants experience elevated anxiety after they learn of their infants' carrier status. This elevated anxiety appears to have been reflected in the language that they used to describe the screening and disclosure process. These findings also have broader implications for using linguistic cues of emotion to infer narrators' emotional states. They suggest that there is specificity to the relationship between people's use of emotion-related words and their emotional experience; emotion-related words that people use to describe past events may not provide meaningful information about narrators' *current* emotions. In addition, the lack of a correlation between anxiety word prevalence and genetic test avoidance suggests that self-report measures of emotion may be preferable when attempting to predict emotion-related behaviors.

In sum, this study provides preliminary evidence to support the topic-specificity of emotion-related word use in narratives, consistent with the concept of emotion-related word choices as expressions of the personal meaning assigned to narrative topics by narrators. It also supports the idea that caution should be exercised in interpreting emotion-related word use as emotional expression.

4.3. Practice Implications

Though emotion-related word choices are psychologically meaningful, researchers and clinicians should use caution in assuming that word choices reflect state emotions. Self-report methods may be preferable for predicting behavioral outcomes. With that caveat, these data suggest that newborn screens and the disclosure of infants' benign carrier status can be associated with elevated maternal anxiety.

Acknowledgments

This work was supported by the National Institute for Heart, Lung, and Blood [grant numbers R01-HL086691, R01-HL086691-02S1].

The authors thank the interviewers—Hollie Beaudry, Alison La Pean, Jill Paradowski, and especially Jenelle Collins, who also provided insightful analysis advice—as well as Lisa Bradford and two anonymous reviewers for comments on earlier drafts.

References

1. Majid A. Current emotion research in the language sciences. *Emotion Rev.* 2012; 4:432–43.
2. Osgood CE. Studies on the generality of affective meaning systems. *Am Psychol.* 1962; 17:10–28.
3. Johnson-Laird PN, Oatley K. The language of emotions: An analysis of a semantic field. *Cognition Emotion.* 1989; 3:81–123.
4. Biber D, Finegan E. Styles of stance in English: lexical and grammatical marking of evidentiality and affect. *Text.* 1989; 9:93–124.
5. Martin, JR.; White, PRR. The language of evaluation: appraisal in English. Houndmills Basingstoke, UK: Palgrave Macmillian; 2005.
6. Labov W, Waletzky J. Narrative analysis: oral versions of personal experience. *J Narrat Life Hist.* 1967; 7:3–38.
7. Zajonc, RB. Emotions. In: Gilbert, DT.; Fiske, ST.; Lindzey, G., editors. The handbook of social psychology. 4. New York: Oxford University Press; 1998. p. 591–632.
8. Reilly, J.; Seibert, L. Language and Emotion. In: Davidson, R.; Scherer, K.; Goldsmith, H., editors. Handbook of affective sciences. New York: Oxford University Press; 2003. p. 535–59.

9. Pennebaker JW, Booth RE, Francis ME. Linguistic inquiry and word count: LIWC--operator's manual. 2007
10. Tausczik YR, Pennebaker JW. The psychological meaning of words: LIWC and computerized text analysis methods. *J Lang Soc Psychol.* 2010; 29:24–54.
11. Alpers GW, Winzelberg AJ, Classen C, Roberts H, Dev P, Koopman C, et al. Evaluation of computerized text analysis in an internet breast cancer support group. *Comput Hum Behav.* 2005; 21:361–76.
12. Kahn JH, Tobin RM, Massey AE, Anderson JA. Measuring emotional expression with the Linguistic Inquiry and Word Count. *Am J Psychol.* 2007; 120:263–86. [PubMed: 17650921]
13. Fredrickson BL, Levenson RW. Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition Emotion.* 1998; 12:191–220. [PubMed: 21852890]
14. Pressman SD, Cohen S. Does positive affect influence health? *Psychol Bull.* 2005; 131:925–71. [PubMed: 16351329]
15. Tugade MM, Fredrickson BL, Feldman Barrett L. Psychological resilience and positive emotional granularity: examining the benefits of positive emotions on coping and health. *J Pers.* 2004; 72:1161–90. [PubMed: 15509280]
16. Danner DD, Snowdon DA, Friesen WV. Positive emotions in early life and longevity: findings from the nun study. *J Pers Soc Psychol.* 2001; 80:804–13. [PubMed: 11374751]
17. Kubzansky LD, Kawachi I. Going to the heart of the matter: do negative emotions cause coronary heart disease? *J Psychosom Res.* 2000; 48:323–37. [PubMed: 10880655]
18. Pennebaker JW, Francis ME. Cognitive, emotional, and language processes in disclosure. *Cognition Emotion.* 1996; 10:601–26.
19. Rodriguez AJ, Holleran SE, Mehl MR. Reading Between the Lines: The lay assessment of subclinical depression from written self-descriptions. *J Pers.* 2010; 78:575–98. [PubMed: 20433631]
20. O'Carroll Bantum E, Owen JE. Evaluating the validity of computerized content analysis programs for identification of emotional expression in cancer narratives. *Psychol Assessment.* 2009; 1:79–88.
21. Owen JE, Giese-Davis J, Cordova M, Kronenwetter C, Golant M, Spiegel D. Self-report and linguistic indicators of emotional expression in narratives as predictors of adjustment to cancer. *J Behav Med.* 2006; 29:335–45. [PubMed: 16845583]
22. Pennebaker JW, Mayne TJ, Francis ME. Linguistic predictors of adaptive bereavement. *J Pers Soc Psychol.* 1997; 72:863–71. [PubMed: 9108699]
23. Clore GL, Ortony A, Foss MA. The psychological foundations of the affective lexicon. *J Pers Soc Psychol.* 1987; 53:751–66.
24. Kenen RH, Schmidt RM. Stigmatization of carrier status: social implications of heterozygote genetic screening programs. *Am J Public Health.* 1978; 68:1116–20. [PubMed: 152585]
25. Markel H. The stigma of disease: implications of genetic screening. *Am J Med.* 1992; 93:209–15. [PubMed: 1497018]
26. Ross LF, Moon MR. Ethical issues in genetic testing of children. *Arch Pediatr Adolesc Med.* 2000; 154:873–9. [PubMed: 10980789]
27. Case DO, Andrews JE, Johnson JD, Allerd SL. Avoiding versus seeking: the relationship of information seeking to avoidance, blunting, coping, dissonance, and related concepts. *J Med Libr Assoc.* 2005; 93:353–62. [PubMed: 16059425]
28. Farrell MH, Christopher S, Tluczek A, Kennedy-Parker K, La Pean A, Eskra K, et al. Early experience of the Wisconsin project on improvement of communication process and outcomes after newborn screening. *Wisc Med J.* 2011; 110:221–7.
29. Mehl, MR.; Gill, AJ. Automatic text analysis. In: Gosling, SD.; Johnson, JA., editors. *Online behavioral research.* Washington, D. C: American Psychological Association; 2010. p. 109–27.
30. Pennebaker JW, Booth RJ, Francis ME. Linguistic Inquiry and Word Count: LIWC. 2007
31. Marteau Y, Bekker H. The development of a six-item short form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). *Brit J Psychol.* 1992; 31:301–6.
32. Spielberger CD, Gorsuch RL, Lushene RE. 1970

33. Tluczek A, Henriques JB, Brown RL. Support for the reliability and validity of a six-item state anxiety scale derived from the State-Trait Anxiety Inventory. *J Nurs Meas.* 2009; 17:19–28. [PubMed: 19902657]
34. Kerruish NJ, Settle K, Campbell-Stokes P, Taylor BJ. Vulnerable Baby Scale: Development and piloting of a questionnaire to measure maternal perceptions of their baby's vulnerability. *J Paediatr Child Health.* 2005; 41:419–23. [PubMed: 16101975]
35. Pennebaker JW, Chung CK, Ireland M, Gonzales A, Booth RJ. The development and psychometric properties of LIWC2007. 2007
36. Robinson MD, Clore GL. Belief and feeling: Evidence for an accessibility model of emotional self-report. *Psychol Bull.* 2002; 128:934–60. [PubMed: 12405138]
37. Scherer KR. What are emotions? And how can they be measured? *Soc Sci Inf.* 1005; 44:695–729.

Table 1
Emotion-Related Word Usage in Maternal Narratives and Comparison with Population Norms for Spoken Language ($N = 187$)

Word Type	Mothers of SCT Infants		Norm for Speech		
	<i>M</i>	<i>SD</i>	Test	<i>t</i> -value	95% CI
Anxiety	.38	.25	.18	10.59**	[.16, .23]
Anger	.07	.10	.58	-67.25**	[-.53, -.50]
Sadness	.09	.14	.19	-9.19**	[-.12, -.08]
Positive emotion	3.57	1.14	3.42	1.77	[-.02, .31]
Negative emotion	.90	.41	1.49	-19.71**	[-.65, -.53]

** Difference is significant at $p < .001$ (2-tailed).

Table 2Means with Confidence Intervals (CIs) and Standard Deviations of Mother's Self-Reported Anxiety ($N = 187$)

Measure	<i>M</i>	95% CI	<i>SD</i>
State anxiety ^a	1.40	[1.33, 1.47]	.50
Infant health worry ^b	1.85	[1.71, 2.00]	.99
Retrospective anxiety ^a	2.89	[2.67, 3.11]	1.52

^a 4-point scale, with higher numbers indicating more anxiety.

^b 5-point scale with higher numbers indicating more concern/worry.

Table 3
Intercorrelations for Anxiety-Related Word Use, Self-Report Anxiety Measures, Prior Testing, and Test Intentions

Measure	1	2	3	4	5	6
1. LWC-Anxiety ($n = 187$)	—					
2. State anxiety ($n = 187$)	.02 _a	—				
3. Infant health worry ($n = 187$)	-.01 _a	.17 _a *	—			
4. Previous anxiety ($n = 187$)	.24 ^{**} _a	.18 _a *	.21 ^{**} _a	—		
5. Prior testing ($n = 154$)	-.09 _b	-.02 _b	.20 _b *	-.29 ^{**} _b	—	
6. Test intentions ($n = 58$)	-.01 _a	.05 _a	-.01 _a	-.02 _a	—	—

* Correlation is significant at the $p = 0.05$ level (2-tailed).

** Correlation is significant at the $p = 0.01$ level (2-tailed).

^a Spearman's rho correlation

^b Point biserial correlation

Means with Confidence Intervals (CIs) and Standard Deviations of Mother's Self-Reported Anxiety by Mothers Screening for Sickle Cell Carrier Status (N = 187)

Table 4

Mother's sickle cell screen	State anxiety ^a			Infant health worries ^b			Remembered anxiety ^b		
	m (sd)	95% CI		m (sd)	95% CI		m (sd)	95% CI	
Already screened (n = 96)	1.37 (.48)	1.27, 1.47		1.94 (.97)	1.74, 2.13		2.48 (1.45)	2.19, 2.77	
Planned to be screened (n = 21)	1.38 (.52)	1.15, 1.62		1.57 (.93)	1.15, 1.99		3.81 (1.30)	3.22, 4.40	
Unsure about screening plans (n = 12)	1.43 (.50)	1.11, 1.74		1.54 (.72)	1.08, 2.00		3.33 (1.50)	2.38, 4.28	
Did not plan to be screened (n = 25)	1.37 (.42)	1.19, 1.54		1.54 (.85)	1.19, 1.89		3.08 (1.61)	2.42, 3.74	

^a 4-point scale, with higher numbers indicating more anxiety.

^b 5-point scale, with higher numbers indicating more anxiety.