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# The Duchenne Marker is *Not* a Universal Signal of Smile Authenticity – But it Can Be Learned!

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**Abstract.** The Duchenne marker has been proposed as a universal marker of smile authenticity. However, Elfenbein, Beaupré, Levesque, and Hess (2007) found that, whereas Canadians typically show the Duchenne marker when posing happiness, Gabonese do not. We therefore investigated whether the Duchenne marker is perceived as a marker of smile authenticity by Gabonese and by Mainland Chinese living in Quebec, Canada. The results show that Gabonese do not use the Duchenne marker to assess smile authenticity at all. Mainland Chinese immigrants to Quebec showed sensitivity to the Duchenne marker only when judging smiles by French-Canadian encoders, suggesting learning of the use of this cultural dialect through cultural exposure. In sum, the use of Duchenne marker is not universal, but rather limited to certain cultures.

**Keywords:** emotion, cultural dialects, facial expressions, authenticity, Duchenne smile

Inferring what others feel is an important aspect of everyday social interaction. Much research has focused on the processes underlying the ability to correctly label emotional facial expressions and it is general held that at least a subset of emotions (happiness, anger, fear, sadness, disgust and surprise) are universally recognizable (see Adolphs, 2002; Ekman et al., 1987; Elfenbein & Ambady, 2002; Hess & Thibault, 2009). Yet, it is not only important to know what emotion a face expresses, but also whether this expression is authentic, that is, whether the expression corresponds to the person's internal emotional state or not.

Of all the facial expressions of affect, the smile is the most ubiquitous and the most confusing (Bugental, 1986; Niedenthal, Mermillod, Maringer, & Hess, 2010). Importantly, people smile not only when they are happy, but also as an indication of politeness or shyness, or to signal affiliation in public situations, and these smiles tend to differ in appearance (Hess, Beaupré, & Cheung, 2002; Niedenthal et al., 2010). The morphology of smiles can vary along two dimensions, the intensity of the activity of the *Zygomaticus major* muscle that pulls the corner of the mouth up and the presence of activity of other muscles. Smiles also vary with regard to their asymmetry and their temporal dynamics.

In Western cultures the so-called Duchenne smile, which combines action of the *Zygomaticus major* muscle and action of the *Orbicularis oculi* muscle (which pro-

duces crow feet's wrinkles around the corners of the eyes), has been consistently found to be perceived as more joyful or "felt" than other smiles (Duchenne, 1862/1990; Ekman, Davidson, & Friesen, 1990; Ekman & Friesen, 1982; Frank & Ekman, 1993). In fact, the presence of crow's feet wrinkles – the so-called Duchenne-marker – has been suggested to be a "hardwired" and hence universal marker of smile authenticity (Williams, Senior, David, Loughland, & Gordon, 2001). This distinction between genuine and polite smiles is so profoundly anchored in psychology and other sciences that both types of smiles are commonly used as stimulus material without questioning the authenticity assumption (see for example Del Giudice & Colle, 2007; Shore & Heerey, 2011), even though the underlying assumption – that the Duchenne marker cannot be feigned – has been criticized (Krumhuber & Manstead, 2009).

In contrast to the assumption of the universality of the Duchenne marker, Elfenbein, Beaupré, Levesque, and Hess (2007), who studied cultural dialects of emotion expression (Elfenbein & Ambady, 2003; Marsh, Elfenbein, & Ambady, 2003), found that individuals from Quebec and Gabon expressed felt happiness differently. Specifically, Elfenbein et al. (2007) found that, whereas 53% of the Quebecois participants spontaneously showed a Duchenne smile when asked to pose a clearly recognizable state of happiness, only 23% of the Gabonese did so. It is important to note that both types of smiles were well

recognized. That is, despite the presence of a clear expressive cultural dialect, both types of smiles were considered by members of both cultures to signal happiness. However, the question that these researchers did not address is whether both types of smiles were also perceived as equally authentic across the two cultures. In fact, if the Duchenne marker is universally employed as a marker of happiness, the prototypical Gabonese smile – which does not contain this marker – should be perceived as nonauthentic by both Gabonese and Quebecois judges. However, if the Duchenne marker is not a universal sign of smile authenticity, then Gabonese judges would consider two smiles that differ only with regard to the presence of the Duchenne marker as equally authentic.

The goal of the present study was therefore to investigate the possibility that the Duchenne marker may constitute a cultural dialect of smile authenticity. That is, it should serve as a differential diagnostic of genuine enjoyment for individuals from different cultures. For this, we showed static expressions varying in both intensity and the presence and absence of the Duchenne marker, posed by Gabonese, Chinese, and French-Canadian individuals, to participants from Gabon and Quebec. Mainland Chinese immigrants to Quebec participants were included to increase the generalizability of the findings and to investigate whether the use of a cultural dialect like the Duchenne marker can be learned through acculturation into a host culture.

Specifically, we first investigated whether the members of the three groups use the Duchenne marker as a sign of authenticity when judging smiles shown by members of their own ethnic group. A second analysis focused on the question of whether Mainland Chinese immigrants use the Duchenne marker to assess smiles of members of the host culture and whether this use depends on their length of stay in Quebec. Also of interest was the use of the Duchenne marker by Mainland Chinese when judging smiles by Gabonese encoders.

## Method

### Participants

A total of 152 French-Canadian, 139 Gabonese, and 126 Mainland Chinese individuals participated. The French-Canadian and Mainland Chinese participants were recruited in the city of Montreal, whereas the Gabonese participants were recruited in Libreville, Gabon. The Mainland Chinese participants were first generation immigrants who had lived in Quebec on average 30 months (range: 0 to 144 months). The mean age of the participants of Gabonese, French-Canadian, and Mainland Chinese origin was 24.7 ( $SD = 2.4$ ), 27.9 ( $SD = 10.0$ ) and 33.1 ( $SD = 5.5$ ) years, respectively. All participants could read and speak either French or English fluently.

### Material

Printed color pictures (2¾ inches × 3½ inches) served as the stimulus material. The stimuli were taken from Beaupré and Hess (2003). Encoders were French-Canadian, Mainland Chinese, and Sub-Saharan African men and women. The expressions varied with regard to both the intensity of the *Zygomaticus major* activity and the presence of *Orbicularis oculi* activity (Duchenne marker). Not all of the theoretically possible combinations of these two muscles are ecologically valid, and some are in fact impossible to achieve. For example, intense smiles are always accompanied by wrinkles around the eye as the cheeks are pushed up. Conversely, it is extremely difficult to combine a weak smile with wrinkles around the eye. Based on these considerations, the expressions retained for the present experiment were ecologically valid smiles of different intensities with and without Duchenne marker:

1. an intense smile with wrinkles around the eyes,
2. a medium intensity Duchenne smile,

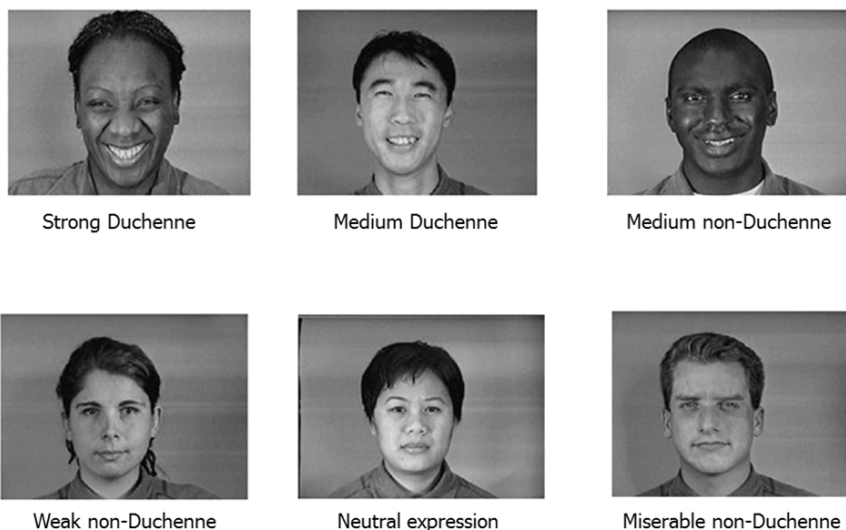


Figure 1. Examples of the stimulus material.

3. a medium intensity smile without presence of wrinkles (non-Duchenne smile),
4. a weak smile without presence of wrinkles.

The medium non-Duchenne smile was created by replacing the upper face of the medium Duchenne smile with the upper face from the neutral expression to assure that no activity of the *Orbicularis oculi* is present at all. In addition we included a neutral face and a miserable smile (smile with a frown) in order to fill the cells of the Latin square design. A second purpose was that this helped to not fixate the raters' attention solely on the presence/absence of the Duchenne marker by adding other differences between the consecutively rated smiles. These two expressions will not be discussed in the present context. The expressions were shown by two male and two female encoders from each ethnic group, resulting in a total of 72 stimuli (6 expressions  $\times$  2 genders  $\times$  3 ethnic groups  $\times$  2 encoders). Figure 1 shows an example for each type of expression. A modified Latin-square design was used to completely counter-balance encoder sex, encoder group, and type of expression such that each participant saw one exemplar for each of the six expressions, shown by a male and a female encoder from each of the three groups. The use of the modified Latin-square design allowed us to treat the data using between subjects' analyses.

## Individual Difference Measures

Identification with culture was operationalized as the degree to which the Quebec culture and their own culture are included in the self of the participants, using the Inclusion of Other in the Self Scale (IOS; Aron, Aron, & Smollan, 1992). This scale consists of a series of seven increasingly overlapping pairs of circles representing the participant and the target object (in our case the relevant culture). The validity of the scale for group identification has been established by Tropp and Wright (2001). This scale has been

widely used to measure identification with a variety of targets, including ethnic in-group identification (e.g., Bratt, 2005).

## Procedure and Dependent Measure

The experimenter first explained the notion of authenticity by giving an example of a situation typical for an authentic smile (you meet a friend you have not seen in a long time) and another situation typical for a non authentic smile (your grandmother gives you an unattractive present). Participants then rated the level of authenticity of the facial expressions by placing a cross on a continuous 24 cm scale with the anchors 0 (= *not at all authentic*) to 24 (= *totally authentic*).

## Results

In order to investigate the use of the Duchenne marker by the three groups for the assessment of smile authenticity, we conducted two focused analyses. The first investigated whether members of the three groups use the Duchenne marker as a sign of authenticity when judging expressions shown by members of their own ethnic group. The second assessed whether Chinese raters do so when judging smiles shown by French-Canadians and Gabonese.

*Is the Duchenne marker used by all three participant groups to assess the authenticity of expressions by members of their own group?*

For this, we conducted a 2 (Encoder sex)  $\times$  3 (Ethnic group)  $\times$  4 (Expression type) analysis of variance on the authenticity ratings for the weak smile, the two medium smiles, and the intense smile by each decoder group for members of their own in-group (see Figure 2). Initial analyses did not reveal an effect of sex of participant; this factor was

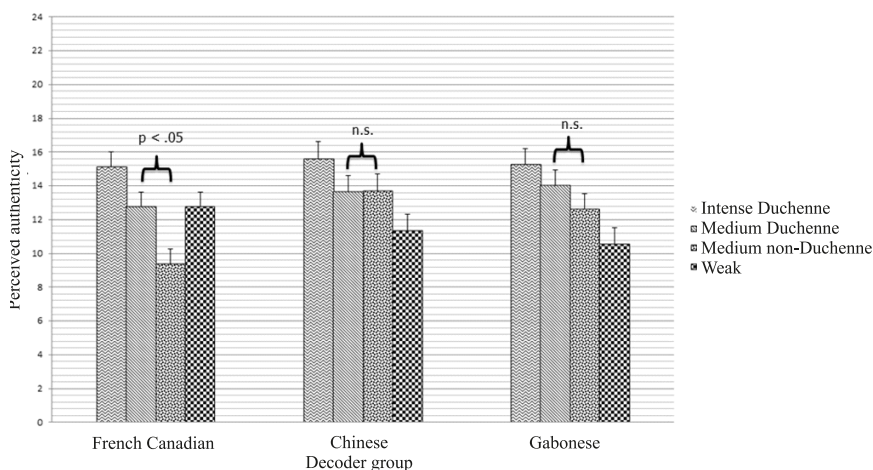


Figure 2. Mean authenticity ratings for the smile shown by the participants' ethnic ingroup as a function of smile type and participant ethnic group.

Table 1. Means of all smiles types for each encoder and decoder

| Encoder         | Decoder         | Smile type          |      |                     |      |                      |      |                       |      |
|-----------------|-----------------|---------------------|------|---------------------|------|----------------------|------|-----------------------|------|
|                 |                 | Intense Duchenne    |      | Medium Duchenne     |      | Medium non-Duchenne  |      | Weak non-Duchenne     |      |
|                 |                 | Mean                | SD   | Mean                | SD   | Mean                 | SD   | Mean                  | SD   |
| French-Canadian | French-Canadian | 15.13 <sup>a</sup>  | 6.64 | 12.77 <sup>c</sup>  | 6.50 | 9.39 <sup>ab c</sup> | 6.11 | 12.77 <sup>a b</sup>  | 5.79 |
|                 | Chinese         | 12.00               | 7.57 | 14.73 <sup>ab</sup> | 7.78 | 11.31 <sup>b</sup>   | 7.16 | 9.28 <sup>a</sup>     | 6.50 |
|                 | Gabonese        | 12.09 <sup>a</sup>  | 6.87 | 11.60               | 5.99 | 11.83                | 5.88 | 10.39                 | 5.72 |
| Chinese         | French-Canadian | 17.17 <sup>a</sup>  | 5.72 | 15.40 <sup>b</sup>  | 6.03 | 14.87 <sup>c</sup>   | 6.02 | 11.60 <sup>ab c</sup> | 5.77 |
|                 | Chinese         | 15.60 <sup>a</sup>  | 6.42 | 13.63               | 6.58 | 13.69                | 6.55 | 11.35 <sup>a</sup>    | 6.46 |
|                 | Gabonese        | 14.56               | 5.87 | 12.78               | 5.77 | 12.28                | 5.40 | 12.30                 | 5.89 |
| Gabonese        | French-Canadian | 17.03 <sup>a</sup>  | 6.19 | 16.65 <sup>b</sup>  | 4.89 | 15.45                | 6.21 | 13.51 <sup>ab</sup>   | 7.00 |
|                 | Chinese         | 16.53 <sup>ac</sup> | 7.54 | 14.02 <sup>b</sup>  | 7.66 | 13.16 <sup>c</sup>   | 7.09 | 10.68 <sup>ab</sup>   | 5.55 |
|                 | Gabonese        | 15.27 <sup>ab</sup> | 6.41 | 14.00 <sup>c</sup>  | 5.89 | 12.63 <sup>b</sup>   | 6.26 | 10.56 <sup>ac</sup>   | 5.89 |

Note. Means that share a superscript differ significantly ( $p < .05$ ).

therefore dropped from the analyses. An Encoder sex  $\times$  Ethnic group interaction,  $F(2, 534) = 2.98$ ,  $p = .051$ , emerged, such that French-Canadian and Chinese but not Gabonese participants overall rated smiles by women as more authentic than smiles shown by men.

A main effect of Expression type,  $F(3, 534) = 10.20$ ,  $p < .001$ , was qualified by the predicted Ethnic group by Expression type interaction,  $F(6, 534) = 2.35$ ,  $p = .030$ . No other significant effects emerged. Simple effects analyses showed that, as suggested by previous studies on the perception of Duchenne smiles by Westerners, the French-Canadian participants rated medium non-Duchenne smiles as significantly less authentic than any of the other smiles.

By contrast, neither the Gabonese nor the Chinese participants rated the medium Duchenne smile as more authentic than the medium non-Duchenne smile. Yet both groups rated the intense smile as significantly more authentic than the weak smile with the two medium smiles rated as intermittent in authenticity, suggesting the use of smile intensity as a relevant marker for smile authenticity. Table

1 shows the means and standard deviations for all smiles types as well as significant pairwise comparisons.

In sum, the data showed no evidence that the two non-Western participant groups used the Duchenne markers when rating the authenticity of smiles shown by other members of their cultural group. To assess whether the Duchenne marker may be used by Chinese raters when rating smiles shown by members of other groups – specifically by members of the French-Canadian host community, which uses the Duchenne smile, we conducted a second analysis comparing the ratings by Chinese participants of smiles shown by French-Canadians and Gabonese.

*Is the Duchenne marker differently used by Chinese participants to assess the authenticity of smiles shown by the three encoder groups?*

To answer this question, we analyzed the relevant contrasts for the ratings by Chinese raters of the expressions by French-Canadians,  $F(3, 164) = 3.97$ ,  $p = .009$ , Chinese,  $F(3, 161) = 2.63$ ,  $p = .05$ , and Sub-Saharan,  $F(3, 163) =$

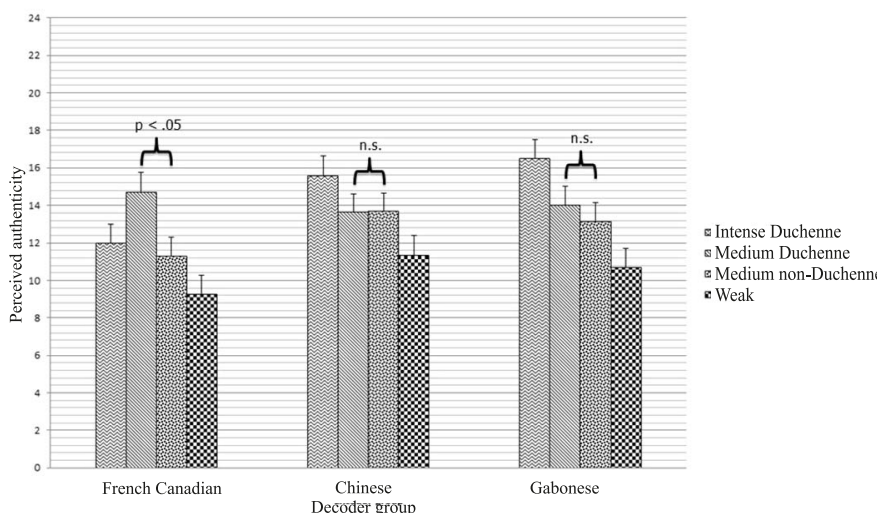


Figure 3. Mean authenticity ratings of Chinese decoders as a function of smile type and encoder group.

5.17,  $p = .002$ . The pattern of results showed that Chinese participants rated the smiles in Gabonese and Chinese faces identically, using smile intensity as the relevant marker for smile authenticity and not differentiating between the two medium intensity smiles. When rating the French-Canadian expressions, however, the Chinese immigrant raters rated the medium Duchenne smile as more authentic than both the weak and the medium non-Duchenne smile. That is, even though they did not use this marker for ratings of authenticity of smiles shown by Chinese or Gabonese encoders, they did use it to assess the authenticity for smiles shown by French-Canadians, suggesting cultural learning.

Interestingly, however, the pattern of ascribed authenticity was reversed when compared to ratings by French-Canadian decoders. Specifically, whereas French-Canadians rated non-Duchenne smiles as *less* authentic than either Duchenne smiles or weak smiles (see Figure 2), Chinese participants rated Duchenne smiles as *more* authentic than either weak and non-Duchenne smiles (see Figure 3). This pattern of results suggests that the Chinese participants learned the rule that “wrinkles around the eyes signify authenticity” – which is how the Duchenne marker effect is usually described. A further indicator that Duchenne marker use is learned is that the level of authenticity attributed to this smile correlates significantly with the length of stay in the French-Canadian host culture ( $r = .42$ ,  $p = .022$ ).

## Discussion

The present study assessed whether the Duchenne marker is universally used as a sign of smile authenticity. For this, we compared judgments of smile authenticity made by participants from three ethnic groups with differential experience with Western smiles. The results provide clear evidence that only French-Canadians used the Duchenne marker to assess the authenticity of smiles by members their own group – neither the Mainland Chinese nor the Gabonese decoders used the Duchenne marker as a cue to authenticity when judging smiles by members of their own ethnic groups.

Mainland Chinese decoders were sensitive only to the Duchenne marker when shown by French-Canadians. However, they did so in a pattern reversed to that shown by French-Canadians. Specifically, French-Canadians perceived the medium intensity smile *without* Duchenne marker as least authentic, whereas Mainland Chinese decoders rated medium Duchenne smiles as most authentic. This use of the Duchenne marker is closer to how this marker is usually referred to when people talk about the twinkle in the eyes or laughing eyes as signs of true enjoyment, and it is suggestive of the application of a culturally transmitted rule. The significant positive correlation between the number of months that a decoder had lived in Quebec and the level of perceived authenticity of the medium Duchenne smile further supports the notion that increased exposure to

the host culture led participants to consider the presence of the Duchenne marker as an indicator of authenticity. In fact, Mainland Chinese showed significantly higher levels of identification with the French-Canadian culture ( $M = 3.36$ ,  $SD = 1.33$ ) than did Gabonese who lived in Gabon ( $M = 1.80$ ,  $SD = 1.15$ ,  $t[258] = 10.18$ ,  $p < .001$ ). These results are concordant with cultural dialect theory (e.g., Elfenbein et al., 2007). In fact, Elfenbein and Ambady (2002) reported that individuals from different cultures who live in close geographical proximity show less evidence for misunderstandings of the meaning of each other’s emotion expressions.

Interestingly, French-Canadian decoders rated weak non-Duchenne smiles by their ingroup as similarly authentic than medium Duchenne smiles. This is not unexpected, considering that the participants’ task was to judge the authenticity – not the intensity – of happiness. If one is a little bit happy, then a weak smile is quite authentic – if indeed there is another specific marker of authenticity – which is the case for the French Canadian decoders. This was not the case for the Chinese and Gabonese decoders, who seem to use intensity as the sole marker and for whom consequently weak smiles must appear less authentic.

The finding that the Duchenne marker is not used as a marker of smile authenticity by all ethnic groups is discordant with the notion that the activation of the *Orbicularis oculi* is a necessary feature for a real smile of enjoyment or that humans possess a hard-wired response to Duchenne smiles (Williams et al., 2001). Rather, the present study supports the notion that, instead of representing a universal display of authenticity, the Duchenne smile may in fact be recognized in this way specifically in our Western culture. The results of the present study are in line with the recent work of Maringer, Krumhuber, Fischer, and Niedenthal (2011), who suggested that the processes underlying judgments of smile authenticity go beyond the face of the sender to include elements from the mind of the perceiver. Although this finding does not in any way invalidate the copious literature on the validity of the Duchenne marker in Western cultures, it suggests that caution has to be applied when generalizing Western standards for smile authenticity to members of other cultural groups. This finding has important implications for our increasingly multicultural world, where such generalizations can easily lead to misunderstandings.

This raises the question of what other markers of authenticity are used by Gabonese and Chinese individuals. Inspection of Figure 2 suggests that Chinese participants use intensity as a possible index of authenticity when judging Chinese faces, and inspection of Figure 3 suggests that Chinese participants also use intensity in a similar fashion when judging Gabonese faces. The Gabonese participants also perceived the weak smile as least authentic, again suggesting a larger reliance on intensity as a cue. Yet, as mentioned earlier, authentic and nonauthentic smiles also differ with regard to asymmetry (Chartrand & Gosselin, 1995; Ekman, Hager, & Friesen, 1981), presence of additional

facial actions other than *Orbicularis oculi* activation (Gosselin, Beaupré, & Boissonneault, 2002) as well as temporal dynamics (Hess, Kappas, McHugo, Kleck, & Lanzetta, 1989; Hess & Kleck, 1990; Krumhuber & Kappas, 2005; Krumhuber, Manstead, & Kappas, 2007). Hence, we would predict that, for individuals from China and Gabon, these other characteristics of the smile are more important determinants of perceptions of smile authenticity than the Duchenne marker.

The smiles used in this study were highly controlled across encoder groups with regard to both action units shown and their intensity, thus minimizing as much as possible expressive differences between encoders. In addition, the observed effects replicate across stimulus exemplars as well as across gender and in some cases ethnic group, making it hence implausible that they are dependent on the specific characteristics of any individual stimulus face.

In sum, the present findings extend cultural dialect theory from the study of emotion recognition accuracy to the study of perceptions of authenticity. Specifically, the results from the present study suggest that a well-established marker of smile authenticity, the activation of the *Orbicularis oculi* muscle, does not seem to function as such in some non-Western contexts but rather represents a nonverbal cultural dialect that can be learned through cultural exposure.

## Acknowledgments

This research was supported by a grant from the Fonds Québécois de Recherche sur la Société et la Culture to Pascal Thibault, as well as by a grant from the Fonds de Formation des Chercheurs et Aide à la Recherche to Pierre Gosselin and Ursula Hess. The preparation of this manuscript was facilitated by Grant LX0990031 from the Australian Research Council to Ursula Hess.

The authors wish to thank Faye Duhamel, Audrey Chaïken, Danika Michaud, Nathalie Lanctôt, and Grâce Nyavaba for their help in collecting the data.

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Received June 23, 2011

Final revision received April 5, 2012

Accepted April 13, 2012

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