Associations between low back pain and depression and somatization in a Canadian emerging adult population

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Introduction: *The association between depression, somatization and low back pain has been minimally investigated in a Canadian emerging adult population.*

Methods: *1013 first year Canadian university students completed the Modified Zung Depression Index, the Modified Somatic Perception Questionnaire, and a survey about low back pain frequency and intensity. Multinomial logistic regression was used to measure associations between low back pain and depression and somatization, both independently and co-occurring.*

Results: *Over 50% of subjects reported low back pain across grades, and both depression and somatization were significantly positively associated with low back*

Introduction : *L'association entre la dépression, la conversion et la lombalgie a fait l'objet de très peu d'études au sein d'une population adulte émergente canadienne.*

Méthodologie : *Au total, 1 013 étudiants universitaires canadiens de première année ont rempli l'indice de dépression de Zung modifié, le questionnaire de perception somatique modifié et un sondage sur la fréquence et l'intensité de la lombalgie. On a utilisé la régression logistique multinominale pour mesurer les associations entre la lombalgie, la dépression et la conversion, tant de façon indépendante que cooccurrente.*

Résultats : *Plus de 50 % des sujets ont déclaré de la lombalgie sur plusieurs stades et tant la dépression que la conversion étaient associées de manière positive*

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pain. Several positive associations between the co-occurrence of somatization and depression with various grades of low back pain were observed.

Discussion: *These results suggest that low back pain, depression and somatization are relatively common at the onset of adulthood, and should be considered an important focus of public health.*

et étroite à la lombalgie. On a observé plusieurs associations positives entre la cooccurrence de la conversion et de la dépression et divers stades de lombalgie.

Discussion : *Ces résultats laissent entendre que la lombalgie, la dépression et la conversion sont relativement communes au début de l'âge adulte et doivent représenter un facteur important en santé publique.*

Introduction

Low back pain is one of the most common musculoskeletal conditions worldwide, with a lifetime prevalence of 84.1%[1]. LBP is the leading cause of years lived with disability[2] and is associated with worse health-related quality of life[3]. This prevalence has been widely investigated in studies across a variety of populations, including adolescents and adults. However, fewer studies have specifically investigated the prevalence of back pain during "emerging adulthood", particularly in a Canadian population, which is typically defined as ages 18 to 26.[4] It is during this time when individuals experience an increased amount of responsibility and independence with respect to their lifestyle choices, and begin to establish long-lasting behaviours that are associated with long-term health risks.[5] Importantly, while behaviours during this period may be linked to chronic disease later in life, they may be amenable to change.[5] For this reason, evaluation of low back pain and associated risk factors during the emerging adult period is warranted, and may highlight viable targets of behavioural and clinical interventions.

Consideration of psychological factors may be particularly relevant in the emerging adult population, who experience high rates of depression.[6,7] Depression has been shown quite consistently to be associated with back pain in the general adult population[8,9], although research looking specifically at the association between back pain and depression in emerging adults is limited and equivocal, and to our knowledge, this association has not been in-vestigated in a Canadian context. For example, in a study of 973 male and female college students in the United States by Kennedy *et al*.[10], psychological factors like feeling sad, exhausted, and overwhelmed were directly associated with the prevalence of low back pain. Similarly, Unalan *et al*.[11] found that scores on the Zung Depression Index were associated with back pain in their study of 250 Turkish vocational students. In contrast, a study of 170 female nursing students in Australia by Mitchell *et al*.[12] found that there were no differences in depression scores between low back pain and control students. While it seems likely that back pain would be similarly associated with depression in the emerging adult population, the definitiveness of this conclusion is limited by the small number of research studies in this area.

Heightened somatic awareness, also known as somatization, is associated with depression[13], which makes it logical to explore these psychological factors concurrently. Somatization is defined as a "complex array of behaviors characterized by an abundant usage of body expressions and language to convey feelings of personal complaint and social distress, amplifying or distorting sometimes subtle physiological changes"[14], and somatization can be clinically diagnosed as a somatoform disorder when physical symptoms suggestive of illness or injury are unexplainable by a known medical condition[15]. Clinical co-occurrence of depressive and somatoform disorders is quite common.[16] As with depression, somatization symptoms have been positively associated with

low back pain in a general adult population[17], although a recent study found that patients with chronic low back pain were no more likely to be diagnosed with somatoform disorders than patients without back pain[18]. Both depression and somatization have been found to co-occur in adult patients with non-specific chronic low back pain.[19] Somatoform disorders are known to occur in adolescents and young adults[20,21], although the association between somatization and low back pain, and the co-occurrence of depressive and somatization symptoms with low back pain, have been minimally investigated in an emerging adult population in general and in Canada specifically.

Given the lack of literature regarding the association between low back pain and depressive and somatization symptoms in an emerging Canadian adult population, the purpose of the present study was to investigate these associations in a sample of first year students at a Canadian university. It was hypothesized that as in the general adult population, depressive and somatization symptoms would be positively associated with low back pain in an emerging adult population. The results of this study will provide novel insight into the potential co-occurrence of these conditions within an emerging adult population and inform future research in the therapeutic management and prevention of low back pain.

Methods

Participants
Subjects were undergraduate students enrolled in a first-year biology course at the University of Guelph in Fall 2011, Winter 2012, Fall 2012, and Winter 2013. As part of the course, students completed health questionnaires and surveys that were incorporated in the laboratory portion of the course curriculum. Students received 0.5% for completion of each survey. The questionnaires and surveys were linked to the topics that were covered in the course, including back pain and mental health. The purpose of completing the questionnaires and surveys was to provide students with feedback regarding their personal experiences with these health issues. Students were encouraged to seek medical help for health problems identified through the course of survey and questionnaire completion, and were directed to Student Health Services for assistance. During the final week of the semester, the researchers presented the purpose of the study to the stu-

dents and requested their informed consent to analyze the data previously collected. A total of 1013 students (781 female and 205 male students) provided consent to have their survey data analyzed, which represents 31% of all students enrolled in the course. This study was approved by the Research Ethics Board at the University of Guelph. All students in each course were invited to participate in the study, and consenting subjects gave written consent to have collected data analyzed. Because students completed the surveys as part of the course, no inclusion or exclusion criteria were applied to aggregate course data collection. The exclusion criteria applied for participation in the research study was that students must have completed the three surveys in their entirety, although personal data regarding subject gender and age could be missing. Due to the nature of data collection in this study, information on confounding variables was not collected.

Surveys
The questionnaires completed by students included the Modified Zung Depression Index, the Modified Somatic Perception Questionnaire, and questions about low back pain frequency and intensity.

The Modified Zung Depression Index is a validated, self-administered rating scale that has been used to identify depression.[22] The modified version of Zung's original scale was developed by Main *et al*.[23] as part of the Distress and Risk Assessment Method that is used as a psychological assessment screening tool for those with chronic pain and back pain. The Distress and Risk Assessment Method also assists in the classification of patients into those showing no psychological distress, those at risk and those distressed.[23] It helps guide the clinician to whether a more comprehensive psychological or psycho-physical assessment is warranted. The Modified Zung Depression Index is scored using an adjectival scale with 4 response categories, ranging from "not at all all/little of the time" (score 0) to "most of the time" (score 3). The total score (sum score for all 23 items) ranges from 0 to 69 points. Those scores less than 16 are considered "normal", those between 17 and 33 are considered "at-risk" and those above 34 are considered "depressive". Several studies have investigated the validity and reliability of the Zung index with good outcomes, as reviewed in Mariush (2009).[24]

The Modified Somatic Perception Questionnaire is a

13 item self-report scale for patients with chronic pain or disabilities.[2]. It can help identify somatic complaints that may be associated with psychological responses such as anxiety or depression.[26] The scale was developed by Main as a clinical screening instrument to measure somatic and autonomic perception in patients with low back pain and other chronic pain problems.[25] The questionnaire was designed to identify psychological distress in patients with low back pain and provide information to facilitate the distinction between physical pathology and illness behaviour.[25] The questionnaire includes questions about the occurrence in the last week of various symptoms such as nausea, sweating or feeling faint. The Modified Somatic Perception Questionnaire is scored using an adjectival scale with 4 response categories ranging from "not at all" (0 points) to "could not have been worse" (3 points) for each item. The 13 items that are scored are denoted with an asterisk in Table 3. The total score (sum score of all 13 items) ranges from 0 to 39. Those total scores below 12 are considered "at-risk" and those scores above 12 are considered "distressed". It is important to note that the "at-risk" category includes very low somatization scores, and therefore, for the purposes of the present analysis, this category will be considered as "non-distressed". The Modified Somatic Perception Questionnaire has an internal consistency of alpha = 0.78, and it is significantly correlated with the Zung Depression Index.[26]

Students were also asked to identify the frequency of past or present low back pain, using a four point scale of never, once, intermittent, or chronic. They were also asked to identify the intensity of past or present low back pain, using a four-point scale of none, mild, moderate or severe. Frequency and intensity of low back pain were combined and divided into four graded categories to make a single dependent variable for data analysis. Four levels

Table 1.
Grade of low back pain.

Grade	Description (Frequency + Intensity)
0	None or a single episode with mild intensity
1	Intermittent or chronic episodes with mild intensity
2	Single episode of moderate to severe intensity
3	Intermittent or chronic episodes with moderate to severe intensity

of grade of low back pain were determined as illustrated in Table 1. No clinimetric values are available for the low back pain survey.

Statistical Analysis
All statistical analyses in this study were conducted in consultation with a statistician at the University of Guelph. All tests were done with SPSS version 20. Using logistic regression, a full model was constructed which included somatization and depression as main effects along with somatization by depression as an interaction term. The interaction term was found to be non-significant (p=0.575) and was not included in the model. For both models, the Likelihood Ratio Chi-Square test and Pseudo-R squared test (p<0.05) indicates the full model statistically predicts the dependent variable better than the intercept-only model alone. For the investigation of low back pain and somatization, the "non-distressed" category was used as the reference, while for low back pain and depression, the "normal" category was the reference group. Using Pearson Chi-Square test, the association between somatization and depression was found to be significant (p<0.05). Therefore, to investigate the specific associations between the co-occurrence of depression and somatization with LBP, the categories of depression and somatization were combined as follows: Non-distressed/At-risk Depression, Non-distressed/Depressed, Distressed/Normal Depression, Distressed/At-Risk Depressed, and Distressed/Depressed. The combination of the Non-Distressed and Normal Depression categories was used as the reference. This statistical approach is consistent with methods used to analyze categorical data[27], and determines the odds ratio (OR), which represents an index of effect, or effect size. Confidence intervals (CI) were also determined. Significance was accepted at p < 0.05. Descriptive statistics models were also used to determine the prevalence of low back pain within the study.

Results

Subject Characteristics and Prevalence of Low Back Pain
Subject characteristics including gender, age, prevalence of LBP by grade, and scores on the Zung Depression Index and Modified Somatic Perception Questionnaire are reported in Table 2. The grade of low back pain as a

Table 2.
*Subject Characteristics and Prevalence of
Low Back Pain*

Descriptive Statistics	n	%
Sex		
Male	205	20.8
Female	781	79.2
TOTAL	**986**	
Age (years)		
<17	4	0.4
17	56	5.7
18	653	66.3
19	197	20.0
20	30	3.0
21	15	1.5
22	12	1.2
>22	18	1.8
TOTAL	**985**	
Modified Zung Depression Index		
Normal	434	42.8
At-Risk	484	47.8
Depressive	95	9.4
TOTAL	**1,013**	
Modified Somatic Perception Questionnaire		
At-Risk	899	88.7
Distressed	114	11.3
TOTAL	1,013	
Low Back Pain Grade		
0	496	49.0
1	252	24.9
2	55	5.4
3	210	20.7
TOTAL	1,013	

Table 3.
Grade of Low Back Pain by Gender

Grade			Male	Female	Total
0	Count		118	368	468
	% within grade		24.3%	75.7%	100%
	% within gender		57.6%	47.1%	49.3%
1	Count		46	200	246
	% within grade		18.7%	81.3%	100%
	% within gender		22.4%	25.6%	24.9%
2	Count		10	41	51
	% within grade		19.6%	80.4%	100%
	% within gender		4.9%	5.2%	5.2%
3	Count		31	172	203
	% within grade		15.3%	84.7%	100%
	% within gender		15.1%	22.0%	20.6%
Total	Count		205	781	986
	% of Total		20.8%	79.2%	100%

Table 4.
Low Back Pain and Somatization

Grade	Somatic Category	Sig	Odds Ratio	95% CI
1	Distressed	0.001*	2.594	1.505 to 4.471
2	Distressed	0.305	1.672	0.626 to 4.465
3	Distressed	0.000*	3.219	1.873 to 5.533

Legend: *$p < 0.05$

function of gender is illustrated in Table 3. It should be noted that 27 subjects (2.6%) elected to not disclose their gender and were excluded from the analysis of low back pain and gender. Similarly, 28 subjects (2.7%) elected to not to disclose their age. Notably, a total of 49% of the population were classified as grade 0, 24.9% of the population were classified as Grade 1, 5.4% of the population were classified as Grade 2, and 20.7% of the population were classified as Grade 3. There were more females than males in the subject sample, resulting in more females in each category of low back pain grade. The percentage of each grade within genders was quite comparable,

although there were 10.5% more males in the grade 0 category, and 6.9% more females in the grade 3 category. Ninety five percent of subjects were between the ages of 17 and 20.

Low Back Pain and Somatization

Table 4 presents the unadjusted OR and 95% CI for the association between low back pain and somatization symptoms. The mean ± SD score for the Modified Somatic Perception Questionnaire was 6.52 ± 4.168. The analyses demonstrate that those in the emerging adult population falling within the distressed category of somatic percep-

Table 5.
Low Back Pain and Depression

LBP Grade	Depression Category	Sig	Odds Ratio	95% CI
1	Depressive	0.810	1.077	0.589 to 1.968
2	Depressive	0.468	1.510	0.496 to 4.598
3	Depressive	0.116	1.642	0.884 to 3.049
1	At-Risk	0.132	1.282	0.928 to 1.771
2	At-Risk	0.026*	2.002	1.088 to 3.684
3	At-Risk	0.001*	1.874	1.310 to 2.681

Legend: *p<0.05

tion are more likely than people in the non-distressed category to have low back pain. Individuals in the distressed somatic perception category were 2.594 times more likely to report grade 1 low back pain and 3.219 times more likely to report grade 3 low back pain than those in the non-distressed category. A non-significant direct association was seen between grade 2 low back pain and somatization.

Low Back Pain and Depression

Table 5 presents the unadjusted OR and 95% CI for the association between low back pain and depressive symptoms. The mean ± SD score for the Modified Zung Depression Index was 19.14 ± 9.796. The analyses demonstrate that people in the at-risk category of depression were more likely than people in the normal depression category to be classified as having low back pain. Significant associations were observed for the at-risk depression category and grades 2 and 3 low back pain, whereby individuals in the at-risk depression category were 2.002 times more likely classified with grade 2 and 1.874 time more likely to be classified with grade 3 low back pain than those in the normal depression category. Non-significant direct associations were seen between the depressive category of depression and grade 2 and 3 low back pain, and the at-risk depression category and grade 1 low back pain.

Low back pain, Depression and Somatization Co-occurrence

Table 6 presents the unadjusted OR and CI for the association between low back pain and the co-occurrence of depressive and somatization symptoms. The analy-

Table 6.
Low Back Pain Grade and Co-Occurrence of Symptoms

LBP Grade	Combined Category	Sig	Odds Ratio	95% CI
1	Distressed/Depressed	0.143	1.837	0.815 to 4.141
1	Distressed/At-Risk Depression	0.000*	3.966	1.855 to 8.482
1	Distressed/Normal Depression	0.012*	5.845	1.481 to 23.069
1	Non-distressed/Depressed	0.241	1.525	0.754 to 3.086
1	Non-distressed/At-risk Depression	0.121	1.303	0.933 to 1.819
2	Distressed/Depressed	0.416	1.906	0.402 to 9.026
2	Distressed/At-Risk Depression	0.066	3.574	0.920 to 13.886
2	Distressed/Normal Depression	0.186	4.765	0.470 to 48.289
2	Non-distressed/Depressed	0.348	1.864	0.508 to 6.839
2	Non-distressed/At-risk Depression	0.023*	2.073	1.107 to 3.881
3	Distressed/Depressed	0.001*	3.857	1.790 to 8.309
3	Distressed/At-Risk Depression	0.000*	7.393	3.489 to 15.666
3	Distressed/Normal Depression	0.103	3.857	0.760 to 19.571
3	Non-distressed/Depressed	0.068	2.012	0.950 to 4.264
3	Non-distressed/At-risk Depression	0.002*	1.813	1.252 to 2.624

Legend: *p<0.05

ses demonstrate that there was a significant association between the co-occurrence of the distressed category of somatization and the category of at-risk depression with grade 1 and 3 LBP. This association was strongest for subjects in the grade 3 category of low back pain. Subjects in the grade 3 category of low back pain also showed a strong association with the co-occurrence of the distressed category of somatization and the depressed category of depression.

Discussion

The objective of this study was to investigate the associations between low back pain, depression and somatization, both independently and co-occurring, in an emerging adult population. Our findings demonstrate that both depression and somatization are positively associated with low back pain, both independently and co-occurring. These results are consistent with the literature regarding low back pain, somatization, and depression in a general adult population and suggest that these conditions are relatively common at the onset of adulthood.

The results of this study support the evidence that low back pain is quite prevalent in an emerging adult population, with over half of the participants reporting current or past low back pain across grades. Subjects in this study most commonly reported experiencing back pain in the lowest grade category, with nearly 25% reporting intermittent or chronic episodes of mild intensity. Another nearly 21% reported intermittent or chronic episodes with moderate to severe intensity while only 5% experienced a single episode of moderate to severe intensity. These results are comparable to those previously reported by Cakmak *et al.*[28] who examined the prevalence and risk factors associated with low back pain in an emerging adult population in Turkey. The authors surveyed 1,552 university-aged students between 17 and 26 years of age and reported a low back pain prevalence of 40.9% within this population and the prevalence increased with age.[28] A similar study by Falavigna *et al.*[29] evaluated the association between physiotherapy and medical students with a mean age of approximately 22 years, and reported an even higher lifetime prevalence of low back pain at nearly 80%. While differences in study outcomes exist within the in the emerging adult population, there are a variety of factors to which these differences may be attributed including questionnaires, subject characteristics, study

design and cultural differences. Despite these differences, existing studies demonstrate that low back pain is a common occurrence during early adulthood years.

One relevant consideration regarding low back pain prevalence in the present study is the younger age of this population (17-22 years, with 95% between ages 17 and 20) which falls on the lower end of the emerging adult range and spans the later years of adolescence. A recent meta-analysis of low back pain in children and adolescents found that the lifetime prevalence of low back pain was approximately 40%, further showing a positive association with age.[30] In addition to previously described Cakmak *et al.*[28], an association of age with low back pain was similarly observed in a study by Taspinar *et al.*[31], who found that University students under 19 years of age experienced less severe back pain than those over 19 years. Similarly, the prevalence of back pain in a general adult population is higher than in children and/or adolescents, with prevalence rates approaching 80%.[1,32,33] To this extent, the results of the present study are consistent with prior literature demonstrating that low back pain prevalence increases with age, placing the emerging adult population on a continuum including childhood, adolescence, and later adulthood.

Low back pain has also consistently been shown to be associated with depression in adults across observational studies, with research suggesting that people experiencing depression are approximately 60% more likely to develop back pain in their lifetime versus non-depressed people.[8] This has important implications on the potential impact of low back pain to society, since the presence of depression has been shown to have a negative effect on the course of recovery of low back.[34] Persistent low back pain also increases the risk of developing depressive symptoms.[35] In the present study, the odds of participants in the at-risk categories of depression reporting low back pain were increased, with significant associations observed at the higher grades of low back pain. This observation suggests that, in a young emerging adult population, depression is a risk factor for low back pain and is consistent with the findings across later adulthood. These findings align with previous research by Kennedy *et al.*[10] and Unalan *et al.*[11], who reported similar associations between low back pain and depressive symptoms. Only one study did not observe a difference in depression scores between low back pain and control students[12], however, this study was limited

by small sample size of subjects reporting depression. Despite this, the collective literature in this area strongly supports an association between low back pain and depression in both emerging and general adult populations.

As with depression, somatization has also been associated with low back pain in adults[17], with strong associations also observed with low back pain severity and disability[19]. In contrast to depression, the association between low back pain and somatization in both the emerging and general adult populations is poorly understood owing to the limited research attention it has received. Only one recent study in adults failed to show any relationship between somatization and low back pain outcomes.[18]

The results of the present study provide evidence for an association between somatization and low back pain in a young emerging adult population. Participants in the distressed category of somatization were more likely to experience low back pain than those in the non-distressed category and this association was particularly robust for the highest grade of low back pain defined as intermittent or chronic episodes with moderate to severe intensity. The similarities in findings between low back pain, somatization and depression are unsurprising given the established relationship between these psychological factors in the literature.[13] Furthermore, the observed relationship between low back pain and the co-occurrence of low back pain with depressive and somatization symptoms are consistent with the literature that somatic perception and depression are risk factors for low back pain in general adulthood[36], and the co-occurrence of depression and somatization in adults with low back pain[19].

Consideration of psychological factors in relation to low back pain is highly relevant. It has been suggested that negative psychological attributes such as pain catastrophizing and pain-related fear avoidance behaviour, heightened somatic awareness and depression are all associated with greater perceptions of pain and disability.[37] Gatchel *et al*.[38] proposed that there are clear differences in the role of emotional distress in high-risk acute back pain vs. high-risk chronic back pain, as patients with chronic low back pain have shown to have worsened psychosocial sequelae relative to acute low back pain patients. This suggests that these maladaptive psychosocial symptoms may be related to the development of the chronicity of pain.[38] In a 2002 systematic review of psychological

factors associated in the development of back pain chronicity, Pincus *et al*.[39] found evidence for the role of somatization, distress and depression in the transition from acute to chronic low back pain. Although the present study suggests that depression and somatization is a risk factor for low back pain in emerging adults, it does not resolve the mechanism(s) that may be responsible for the association between these variables. Crombie *et al*.[40] have suggested that pain is a manifestation of the interaction of cognitive, emotional, motivational, behavioural and physical components, while Carroll *et al*.[41] suggest that the influence of depression and somatic perception can influence low back pain in a number of ways such as passive coping. Further investigation is needed to elucidate the pathways and chronology between low back pain and somatic perception.

There are several limitations that should be considered in the interpretation of the results of this study, the most significant of which being our inability to control for confounding variables that are known to influence back pain. For example, several factors have been shown to influence back pain in University students, including smoking, class attendance, using a computer and using lumbar support.[31] Other factors such as age, sex, inactivity, obesity and race have also been identified as risk factors for the development of back pain in children, adolescents and adults.[42-44] Although these variables were not collected as part of the present study, the strength of the observed associations and the consistency of our findings with previous literature supports the validity of our observations. As well, this study is limited to University students enrolled in one class at a single Canadian institution, which may not be representative of the diversity of the emerging adult population. It should also be noted that a minority of students enrolled in the classes under investigation consented to participate in the research study, and that not all subjects provided data for all outcomes, such as gender and age. However, by recruiting subjects across four classes, our total sample size was quite large, and the number of subjects without all data points represents only a small fraction of the total subject sample. It should also be acknowledged that the early mean age of our sample does not capture the demographics of the broad emerging adulthood population. In spite of this, low back pain has been shown to be a significant issue throughout the world[45], and the collective geographically

specific studies has not shown large differences between populations. Low back pain has been studied specifically in Canadian adults[1] and adolescents[46], and low back pain has been shown to be the strongest predictor of major depression in a Canadian adult population[47]. As well, subjects' assessment of low back pain may also be subject to recall bias and subject bias, and there is a slight risk of bias due to the provision of grades for completion of the health surveys. A final limitation of the present study is that the clinical significance of the odds ratios calculated in this study are unclear, although it should be noted that Deyo *et al*.[26] found that the Modified Somatic Perception Questionnaire was only weakly associated with pain outcomes.

In conclusion, the results of this study demonstrate a high prevalence of low back pain in an emerging adult population and that low back pain is directly associated with depression and somatization. These findings are consistent with previous research in adult, emerging adult and adolescent populations. Future studies should examine whether there is an increasing incidence of low back pain and depression and somatization across the full age range spanning the emerging adult population, and aim to elucidate potential mechanisms underlying the association of these variables. The significant burden of musculoskeletal pain and psychological suffering highlights an urgent need for development of preventive interventions targeting this population. We suggest that interventions could be directly integrated into academic curriculums at Universities and colleges given their broad inclusion of the emerging adult population, and should be considered an important target of public health and prevention initiatives.

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