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Perceptions of Safety Climate and Fatigue Related to ACGME Residency Duty Hour Restrictions in Otolaryngology Residents

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Abstract

Objective. To compare otolaryngology residents' perceptions of safety climate with respect to duty hour compliance and self-perceived fatigue.

Study Design. Cross-sectional study.

Setting. Forty-one otolaryngology residencies distributed across the United States.

Methods. A national sample of otolaryngology residents was surveyed electronically in 2019. The survey included demographic details, on-call descriptors, an 18-point Safety Climate Survey (SCS) modified to measure perceptions of program attitudes and practices around resident duty hour compliance, and the 33-point Chalder Fatigue Questionnaire (CFQ).

Results. Of 397 surveyed residents, 205 (51.6%) responded. The mean modified SCS score was 11.29 out of 18 (95% CI, 10.76-11.81). Respondents were most likely to disagree with "Residents are told when they are at risk of working beyond ACGME [Accreditation Council for Graduate Medical Education] duty hour restrictions," where 100 (48.8%) disagreed or strongly disagreed. The mean CFQ score was 15.99 of 33 (95% CI, 15.17-16.81). As the modified SCS score improved, CFQ scores decreased, indicating an inverse relationship between duty hour safety climate and fatigue. Having a protected postcall day off and having the program director, chief resident, or senior resident decide that a resident should take a postcall day off were all associated with higher modified SCS scores.

Conclusion. Otolaryngology residents perceived a safety climate that is suboptimal with regard to duty hour restriction issues. Additionally, an inverse relationship between fatigue and modified SCS scores suggests that fatigue among residents may be lower in programs where residents perceive that ACGME duty hour compliance is more important.

Keywords

residency training, physician fatigue, duty hours, sleep deprivation, fatigue, safety climate, Chalder Fatigue Questionnaire

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The Accreditation Council for Graduate Medical Education (ACGME) imposed resident duty hour reforms in 2003 that included duty hour restrictions (DHRs), which limit continuous on-site duty to 24 hours (with an additional 6 hours permitted for didactic activities, continuity of care, or similar activities).[1] Duty hour rules were intended to improve patient safety by reducing trainee fatigue.[1] These restrictions required time, effort, and money for implementation, but a recent systematic review failed to show evidence of improved patient safety related to these changes.[2] Additional reforms were made by the ACGME in 2011 that added more specific guidance for supervision and placed restrictions on night float frequency, among other changes. A review of the effects of these changes found an unintended negative effect on resident education, as measured by participation in teaching sessions and time with faculty.[2]

One possible contributor to the absence of patient safety improvements after DHR implementation may be that residents do not follow the prescribed DHRs. This has been suggested in several studies. For example, studies have reported no difference in work hours or sleep hours in pediatric residents or internal medicine residents after modifying schedules to accommodate ACGME DHRs.[3,4] In a single-site study, Caulley et al found that 30% of otolaryngology residents who

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met criteria for a postcall day off chose not to take it.[5] Reasons for the residents' decisions were not explored.

In the occupational safety and health literature, conformity with safety-related policies and practices in an organization has been associated with the organization's predominant safety culture. *Safety culture* refers to a set of norms, values, perceptions, and beliefs that regulate behavior and, ultimately, safety outcomes.[6] *Safety climate*[7] is a similar construct, which involves worker perceptions of the safety culture within an organization.[8] Safety climate has been shown to be a critical predictor of observance of safe work practices.[9] Safety climate relating to compliance with ACGME policies in residency is a new area of study. In this study, our goal was to assess safety climate and fatigue in relation to ACGME DHRs in otolaryngology residencies by using a direct contact web-based survey. We examined the contribution of specific program and personal factors to resident fatigue and perception of safety climate with respect to DHRs.

Method

This study was approved by the West Virginia University Institutional Review Board, and a waiver of documentation of informed consent was obtained. All US otolaryngology program directors were contacted by email to obtain the email addresses of otolaryngology residents in their programs. Some program directors provided email addresses for all residents, while others provided email addresses only for residents who had indicated that they were willing to participate. Otolaryngology residents from 41 programs (N = 397) were surveyed by direct email. Incentive for participating was a $10 gift card sent electronically several weeks after survey completion. A maximum of 4 mailings were sent to nonrespondents between May and June 2019 at 10-day intervals.

Study data were collected and managed with REDCap electronic data capture tools hosted at West Virginia University.[10,11] REDCap is a secure web-based platform designed to support data capture for research studies.

The results presented here were part of a larger survey that included demographic information, the Chandler Fatigue Questionnaire (CFQ),[12] a modification of the 6-item Safety Climate Survey (SCS) for measuring workplace safety climate,[13] and a discrete-choice experiment that will be the focus of a future article and is thus not reported here. The CFQ has been applied in clinical and community populations by many research teams; scores range from 0 to 33.[12] The CFQ has a Cronbach α of 0.88 to 0.92, with good discriminant ability; a score of 29 predicts chronic fatigue with 96% accuracy.[12,14]

The SCS has been administered in hospital environments to nurses, technologists, and physicians, with measures of internal consistency ranging from 0.71 to 0.85.[13] Our modified version aimed to measure respondents' perceptions of workplace safety culture with regard to adherence to ACGME DHRs and preservation of resident health and safety in general. As with the original SCS, the modified version assessed safety climate across 4 main dimensions: behavioral norms, supervisory performance feedback, management commitment to safety, and worker involvement. These dimensions of safety climate are common to several other safety climate surveys used in health care.[15] The questions were modified to be more relevant to residents and the DHRs. For example, one of the statements was changed from ''I feel free to report safety violations where I work'' to ''I feel free to report ACGME duty hour violations where I work.'' The modifications were devised by a team of occupational health scientists and academic surgeons. Total scores range from 0 to 18.

Statistical analyses were completed with R,[16] with the addition of the ''tidyverse'' packages.[17] Pearson *r* values were calculated with the ''corrr'' package[18] and Cronbach α with the ''psych'' package.[19]

Results

Email messages were sent to 397 otolaryngology residents; 226 (56.9%) responded. A total of 205 (51.6% of the surveyed group) completed every part of the survey, and these responses were used for analysis. Twenty-one (5.3%) completed only part of the demographic section and SCS and were not included in the analysis. This group had a mean SCS score of 10.0; 52.4% were postgraduate year (PGY) 4 or 5; and 45% were female. However, none of this was statistically significantly different from the respondents who had completed the entire survey ($P > .05$). **Table 1** shows demographic details of the 205 respondents. There was a significant relationship between gender and whether children were present in the home: 7.89% of females had children at home as compared with 31.2% of males ($r = -0.274$, $P < .001$). As training year increased, respondents were more likely to have children ($r = 0.247$, $P < .001$) and were less likely to take primary call ($r = -0.330$, $P < .001$). **Table 1** presents data for who makes decisions about whether a postcall day off is taken. Over a third of respondents indicated that they were the decision makers themselves. Twenty-one (10.2% of the total group) indicated that no other person shared this responsibility in the program, while 56 (27.3%) shared this responsibility. A total of 128 respondents (62.4%) felt that they had no role in deciding postcall days off. When these 3 groups were compared, there was no significant difference in CFQ scores, but there were significant differences in SCS scores, as respondents who shared the decision-making responsibility had higher SCS scores (**Table 2**). There were no differences in gender or PGY among these groups.

Figure 1 shows the results of the modified SCS and questions. Cronbach's α was 0.83, indicating good internal consistency. Mean and median scores are in **Table 2**. Respondents were most likely to disagree with ''Residents are told when they are at risk of working beyond ACGME duty hour restrictions,'' where 100 (48.8%) indicated that they disagreed or strongly disagreed. Eighty-five residents (41.4%) disagreed or strongly disagreed with ''I feel free to report deviations from ACGME duty hour restrictions.'' Sixty-five respondents (31.7%) disagreed or strongly disagreed with ''There are no significant compromises or shortcuts taken when residents' health and safety are at stake.''

CFQ scores appear in **Table 2**. The median score was 15, which is consistent with the response ''no more than usual'' to the CFQ prompts. Total scores are shown in **Figure 2**.

Table 1. Demographics of National Sample of Otolaryngology Residents (N = 205).

Variable	No. (%)
Postgraduate year	
1	51 (24.9)
2	46 (22.4)
3	38 (18.5)
4	39 (19.0)
5	31 (15.1)
Age, y	
≤24	1 (0.5)
25-29	96 (46.8)
30-35	103 (50.2)
≥36	4 (2.4)
Gender	
Male	125 (61.0)
Female	76 (37.0)
Not stated	7 (2.0)
Have children in their home	45 (22.0)
On-call description	
In-house call	49 (23.9)
Night float	15 (7.3)
At-home call	131 (63.9)
Other or not stated	10 (4.9)
Taking primary call this academic year	
Yes	138 (67.3)
No	65 (31.7)
Not stated	2 (1.0)
Has protected postcall days off	
Yes	121 (59.0)
No	84 (41.0)
Who decides if you have a postcall day off?[a]	
Self	77 (37.6)
Senior resident	48 (23.4)
Chief resident	92 (44.9)
Attending faculty	31 (15.1)
Program director	91 (44.4)
Department chair	25 (12.2)
Other	7 (3.4)
Unsure	48 (23.4)

[a]Respondents could choose >1 response. Of the "Self" group, 21 of the 77 included (27.3%) indicated that no other person decided.

Several significant correlations are worth noting among the survey items, as presented in **Table 3** (significance level of $P < .05$). The respondent being able to identify who decides if postcall days are taken (the residents themselves, chief resident, attending faculty, or program director) was associated with higher SCS scores. In contrast, the respondent being unsure of who decides was associated with lower SCS scores. Residents further along in their training reported less fatigue, better perceived safety climate, and less busy calls. PGY, SCS scores, and CFQ scores are shown in **Figure 3**. Those further along in training were also more likely to identify who makes decisions regarding postcall days. Correlations related to age, gender, presence of children in the home, and type of call were not significant.

Discussion

Several findings are notable. First, otolaryngology residents in the present study perceived a safety climate that is suboptimal with regard to DHR issues. Almost half of the otolaryngology respondents felt that their programs did not provide adequate support for residents to comply with DHRs. Four in 10 did not feel safe reporting DHR breaches, and almost a third felt that resident health and safety were being compromised in their programs. As residents became more senior, their perceptions of safety climate improved, as did their knowledge regarding who had the authority to make decisions regarding postcall time off. This suggests that part of the SCS score might be attributed to acculturation to the program. Having a fixed protocol regarding DHR time-off decisions that is specific and accepted throughout the residency program may be a key component of improving how residents view compliance with DHRs. New residents who are informed and reminded routinely about the program's DHR policies and see compliance in action may have more positive perceptions of its safety climate in this area.

We also found that accountability for DHR compliance is a key aspect of safety climate perceptions in this study. Approximately 10% of respondents indicated that they were solely responsible for the decision to take a postcall day off. Given previous research examining the effects of sleep loss on cognition, including judgment, this finding is concerning. For example, can a fatigued person be expected to make a reasonable decision in this situation? Having the fatigued resident as the sole arbiter of whether he or she will comply with DHRs is not associated with perception of a good safety climate. As shown in **Table 2**, residents who share responsibility for decisions about taking a postcall day off perceive better safety climates in their programs than do respondents who feel as though they have no responsibility for these decisions. Furthermore, as **Table 3** shows, a senior resident, faculty member, or program director as a decision sharer may be associated with a better perceived safety climate with respect to DHRs. How these collaborative decisions are made or should be made is beyond the scope of our study; however, our results suggest that on-call residents, as well as potentially other neutral program members, would do well to serve as active participants in decisions about DHR compliance.

In a Canadian study, residents made their own decisions about taking postcall days off based on the Professional Association of Residents of Ontario criteria, which state that if residents worked 1 hour between the hours of midnight and 6 AM, they are eligible for a postcall day off.[5,20] In this study, 46.5% of postcall residents met the criteria for taking the next day off; however, 30% elected not to take that time off.[5] Almost 70% of their postmidnight calls involved nonurgent problems that could be dealt with over the telephone, suggesting that reorganization of the clinical service, specifically saving

Table 2. Association Between Residents' Perceived Role in Decisions About Postcall Days Off and SCS Scores.

Residents' perceived role	No. (%)	Mean score (95% CI)[a]	
		CFQ[b]	SCS[c]
Total	205 (100)	15.99 (15.17-16.81)	11.29 (10.76-11.81)
Solely responsible	21 (10.2)	15.52 (13.36-17.69)	11.38 (9.51-13.25)
Shared responsibility	56 (27.3)	15.39 (13.97-16.81)	12.71 (11.61-13.82)
No responsibility	128 (62.4)	16.33 (15.20-17.45)	10.74 (10.16-11.32)
P value, ANOVA		.581	.004

Abbreviations: ANOVA, analysis of variance; CFQ, Chalder Fatigue Questionnaire; SCS, Safety Climate Survey.
[a]There were no statistically significant differences in postgraduate year or gender among these groups.
[b]Total score of 33 (median, 15).
[c]Total score of 18 (median, 11).

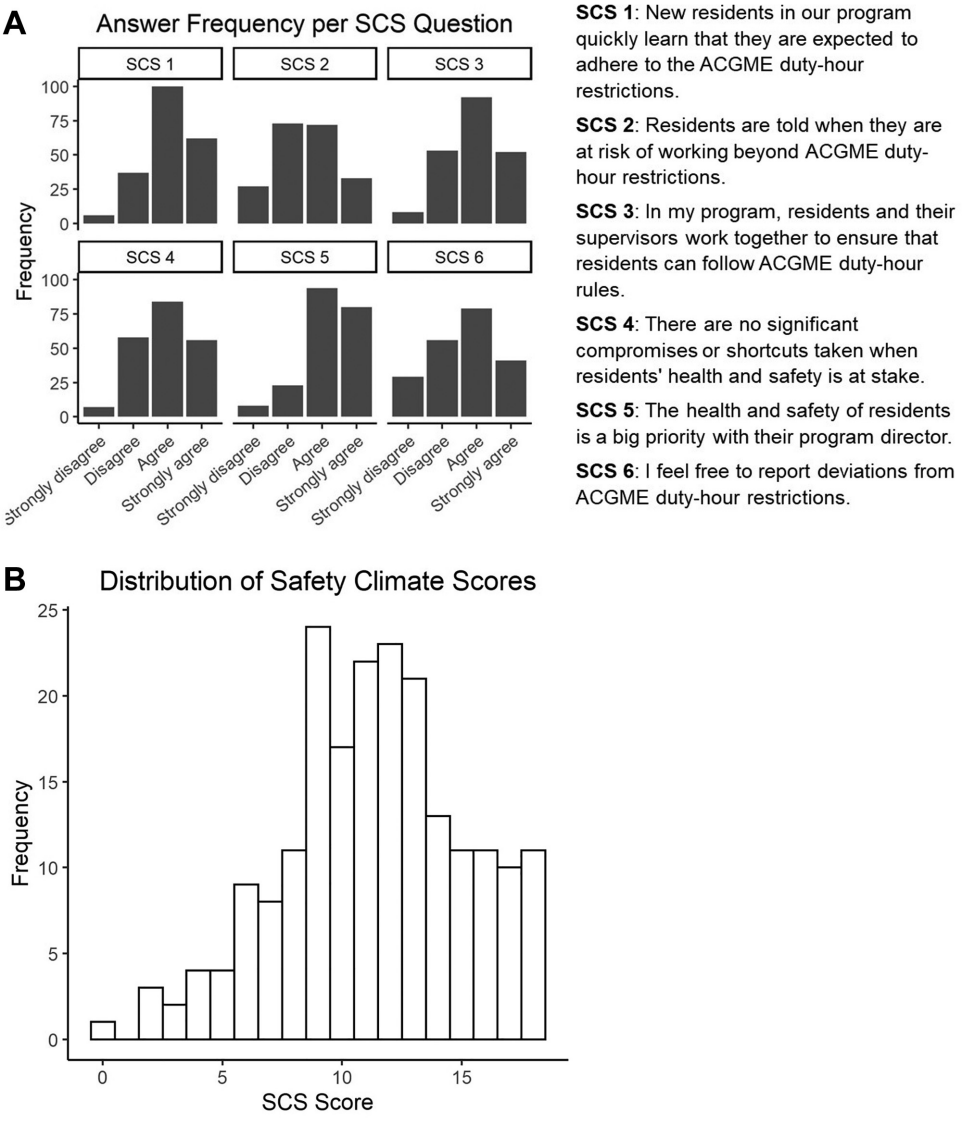

Figure 1. Modified Safety Climate Survey (SCSs) scores for otolaryngology residents. SCS 1 to SCS 6 are questions in the survey.

Table 3. Statistically Significant Correlations of Interest for Otolaryngology Residents.

Comparator	Scale	*r*	Interpretation
Modified SCS score	CFQ score	−0.323	Modified SCS score decreases as CFQ score increases.
Respondents decide if they take a postcall day off	Modified SCS score	0.217	Having the residents decide if they have a postcall day off is associated with increased modified SCS score—perception of a better safety climate with respect to duty hour compliance.
Senior resident decides if someone has a postcall day off	Modified SCS score	0.143	Having a senior resident decide if someone has a postcall day off is associated with increased modified SCS score—perception of a better safety climate with respect to duty hour compliance.
Attending faculty decides if someone has a postcall day off	Modified SCS score	0.172	Having attending faculty decide if someone has a postcall day off is associated with increased modified SCS score—perception of a better safety climate with respect to duty hour compliance.
Program director decides if someone has a postcall day off	Modified SCS score	0.157	Having a program director decide if someone has a postcall day off is associated with increased modified SCS score—perception of a better safety climate with respect to duty hour compliance.
Respondent is unsure who decides if someone has a postcall day off	Modified SCS score	−0.139	Respondents who do not know who decides if someone has a postcall day off have lower modified SCS scores—perception of a worse safety climate.
Year of training	Total CFQ	−0.217	As year of training increases, total fatigue decreases.
Year of training	Modified SCS score	0.216	As year of training increases, perception of safety climate increases.
Year of training	Busy-ness of call	−0.285	As year of training increases, busy-ness on call reduces.
Year of training	Knowing who makes decisions about taking a day off postcall	−0.214	As year of training increases, the respondent is less likely to be unsure about who makes call decisions.

Abbreviations: CFQ, Chalder Fatigue Questionnaire; SCS, Safety Climate Survey.

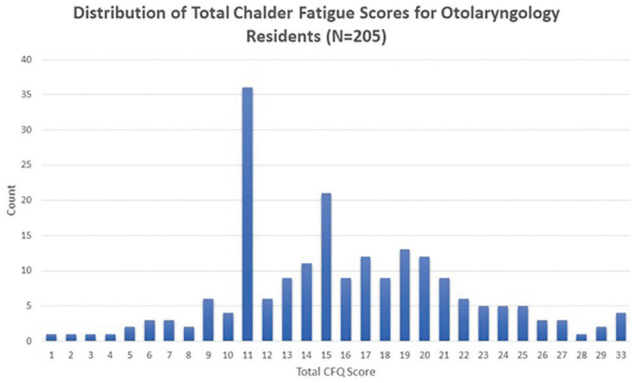

Figure 2. Distribution of Chalder Fatigue Questionnaire (CFQ) scores for otolaryngology residents.

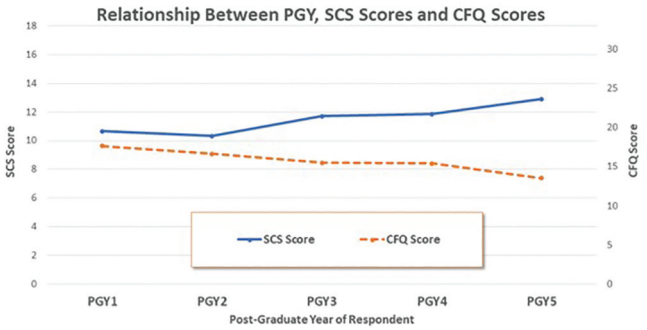

Figure 3. Otolaryngology residents' SCS and CFQ scores vs PGYs 1-5. CFQ, Chalder Fatigue Questionnaire; PGY, postgraduate year; SCS, Safety Climate Survey.

nonurgent calls until normal work hours, could have reduced resident sleep loss and minimized the number of residents meeting criteria for a day off.[5] That study also showed that in 21.4% of these lost workdays, the resident would miss didactic sessions.[5] Therefore, how a program elects to deal with late-night nonurgent calls to residents may be another component of safety climate with respect to DHRs that we did not explore in this study.

When the ACGME instituted DHRs to improve patient safety in 2003, there was concern from the academic surgical community because there was a perception that this would affect resident education and physicians would not be

appropriately prepared for their careers. A decade and a half later, the academic medical community has not been able to demonstrate patient safety effects coincident with DHRs but has shown improvements in resident fatigue and quality of life.[2,21] It may benefit the academic medical community to separate DHRs from patient safety and consider the short- and long-term health and safety of residents, particularly with regard to sleep deprivation.

Chronic sleep deprivation is a contributor to work-related injuries[22] and is associated with a multitude of mental and physical health problems.[23,24] Sleep deprivation has been shown to have effects on performance similar to that of alcohol ingestion.[25,26] Dawson and Reid showed that at 17 hours of wakefulness, performance on a random tracking task was equivalent to that at a blood alcohol concentration (BAC) of 0.05%; at 24 hours of wakefulness, performance was similar to that at a BAC of 0.1%.[25] In New York State at present, a BAC of 0.05% is illegal for drivers, punishable by fines and incarceration,[27] while a BAC of 0.08% is illegal in drivers in all US states.[28] Inadequate sleep is considered to be one of the major factors in motor vehicle crashes, as it affects attention and judgment and slows reaction time.[29] Emergency medicine residents report significantly more motor vehicle accidents after an overnight shift than after other shifts.[30]

Although most faculty of residency programs advocate for their trainees as much as they do for their patients and understand the consequences of chronic sleep deprivation, there are other contingencies, such as staffing shortages, that may affect decisions about postcall days for residents. The ACGME 2020 updates to the common program requirements state that residents at all levels and in all programs must not exceed 24 continuous work hours and must have 14 hours off after a 24-hour shift.[31] This will result in lost academic time and will shorten residency training. Those who advocate for the health of trainees need to consider the fact that residencies may need to be lengthened to accommodate this. The issues surrounding large-scale reform in residency training are beyond the scope of this article, but we acknowledge that they are complex.

Limitations

We relied on a small convenience sample for this study. Most of the otolaryngology program directors contacted by email did not respond to our request for participants. Those who did respond may have been more engaged program directors or may have been different in some other way. Nevertheless, the low response rate is typical of this group.[32,33] Furthermore, many program directors would not provide a list of email addresses for the entire program, allowing residents to volunteer singly for recruitment. This may have resulted in a selection bias and thus a unique group of respondents for our study. These factors limit generalizability.

We measured fatigue via self-report, which may be different from objective measures of impairment that may be related to sleep deprivation. Related to self-report measures, this is the first study in which an adapted SCS was used to measure safety climate with relation to DHRs. Future research could implement the SCS with different resident populations and with other measures of safety climate to assess its generalizability and validity.

This study examined safety climate only with respect to residents' opinions regarding adherence to DHRs. Because this is just 1 aspect of safety climate, the findings should not be interpreted as being representative of or generalizable to otolaryngology residency safety climate as a whole or with respect to other specific issues regarding residents' safety and well-being.

Last, it was not our goal to evaluate the validity of DHRs, and we cannot make any conclusions intended to support or refute their implementation as instituted by the ACGME.

Conclusions

As those in otolaryngology progress through their residencies, safety climate perceptions and fatigue levels improve. It is concerning but not surprising that 4 out of 10 otolaryngology residents do not feel comfortable reporting duty hour violations. It is possible that these values may be higher if social desirability bias factored into the respondents' answers. If DHRs continue to be a critical part of ACGME policy, otolaryngology programs and their administrative teams will need to address this by setting up policies that may control DHRs by upstream reforms, such as careful attention to orienting new residents to DHR expectations. Decisions about DHR compliance may be best put into the hands of clinician supervisors who can work in partnership with residents.

Author Contributions

Michele M. Carr, conception and design of the work; analysis and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; **Jonathan E. Friedel**, conception and design of the work; analysis and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; **Anne M. Foreman**, conception and design of the work; analysis and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; **Daniel C. O'Brien**, conception and design of the work; interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; **Oliver Wirth**, conception and design of the work; analysis and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published.

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