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Are intelligent peers liked more? Assessing peer-reported liking through the network analysis

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ABSTRACT

The current study examines whether intelligent adolescents are liked more by their peers, does this likeability assessment remains constant over time, and do intelligent adolescents like certain people or everyone? For this purpose, we recruited seven classes of adolescents at the beginning of the first school year. We administered an intelligence test and gathered peer-reported information regarding the liking relations. To examine the dynamics of such associations, we repeated the measurement three months and one year later. The results of the Temporal Exponential Random Graph Model revealed that intelligent adolescents are liked more. However, these highly intelligent adolescents did not reciprocate such relations, as they liked fewer people than those who were less intelligent. This finding was stable both across short- and long-term and could be explained by the fact that those who are intelligent, tend to only like other intelligent peers, representing a fewer number of individuals. Our results suggest that intelligence is important in the explanation of the relation of liking.

1. Introduction

Everyday people fulfil their social needs and encounter a wide range of relationships, which can be defined in different manners such as friendships, acquaintances, collaborators (Tooby & Cosmides, 1996). Different laws of attraction and liking, such as the similarity effect (Byrne, 1961; Gouldner, 1960), guide individuals in forming social relationships (Cuddy et al., 2008). This study investigates whether adolescents within a classroom setting reciprocate the relation of liking. Moreover, we scrutinize whether this interpersonal process is different for those scoring higher in intelligence.

Although there is substantial empirical evidence indicating that actual and perceived similarity in attitudes, values, and opinions foster attraction (Montoya et al., 2008), there is scant research exploring the role of intelligence in liking others. According to Byrne's (1961) cognitive dissonance perspective, people generally favor information that validate their logic and ideas. In this case, individuals matching in intelligence may be seen as more attractive since the history of liaisons with them is associated with more positive, reassuring feelings. However, some research suggests that intelligence does not play a role in the similarity effect as higher intelligence is universally seen as an advantageous feature of individuals. For example, more intelligent individuals are seen as more compelling companions because of their prosocial and cooperative behaviors, empathy, civic engagement (Guo et al., 2019), and ability to produce witty ideas (Christensen et al., 2018). For profoundly gifted adolescents, many achieve extraordinary accomplishments by the age of 40, such as earning doctorates, being awarded academic tenure, and becoming leaders of major organizations (Makel et al., 2016), accomplishments which may result in respect from their peers. Indeed, Czeschlik and Rost (1995) and Inglés et al. (2017) observed that being intelligent increases the chance of being liked by peers regarding elementary school students.

On the other hand, finding a way through the complex maze of interpersonal relationships can be especially challenging for secondary school students. In this group, establishing a stable peer network is of crucial importance and influences further development (Meijs et al., 2010). Peer regard may take distinct forms such as popularity or acceptance. While the former is an indicator of likability and general

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positive acclaim from peers, the latter denotes prestige and visibility in a social network (Gorman et al., 2011). Although both popularity and acceptance are fundamental for a student's well-being, self-esteem, and social adjustment (Gorman et al., 2011; Meijs et al., 2010), acceptance seems to be particularly critical. For example, research has shown that social exclusion can be an important factor by preventing students from manifesting their full potential, especially in cases when an individual is forced to hide their abilities to fit in and avoid being labelled as "weirdo" (Clasen & Clasen, 1995).

This issue is especially important in the case of students with gifts and talents (SWGT) who often perform better in a school setting, and therefore, are unlike the majority of their peers by definition (Cross et al., 2019). Researchers have documented a variety of negative attitudes towards SWGT, which are a source of difficulties in establishing gratifying relationships with their peers, especially negative labeling such as being called a "nerd" or a "geek" (Cross et al., 2019; Händel et al., 2013). Hence, even if they are in fact highly regarded by their peers, highly intelligent adolescents may be less trustful towards others (Oh et al., 2019).

Despite the fact that reflection on peer perception of intelligence is present in psychological and educational research, there has been little attention paid to examining actual social networks in context of the intelligence level of the teenage students. Given the fact that previous research (Czeschlik & Rost, 1995; Inglés et al., 2017) explored this phenomenon among elementary school students, the aim of our study is to explore it among older students and to verify if the association between liking and intelligence is stable over time.

2. Method

2.1. Participants and procedure

The study involved adolescents from six classes from the general high school from Poland. The results presented in this manuscript are part of a larger data collection effort (more detail in Kowalski et al., 2018; Rogoza, Danieluk, Kowalski, Kwiatkowska, & Kwiatkowska, 2020). The current study reports novel analyses and results. Participants completed measures three times: 1) during the first month of school when the level of acquaintance was low, 2) after three months (short-term acquaintance); and 3) after one year from the first measurement point (long-term acquaintance). At the start of their high school education, students completed the Raven's Progressive Matrices (Standard version; Raven, 1981). When completing the test, they followed standard recommendations included within the Polish manual (Jaworowska & Szustrowa, 2010). After that, each student was asked to nominate the peer or peers that they liked the most from a list of all their classmates. No limit was given on the number of nominees such that participants could select no one from the list or even nominate all of the students if they desired. At the first measurement point, we include results from 128 students ($M_{age} = 16.89$, $SD_{age} = 0.31$; 28.1% of the sample were boys). However, due to the longitudinal nature of the study, we included only students who completed the social network questionnaire three times ($N = 113$; 69.9% of the sample were girls). The participants reached scores in the Raven test between 31 and 57 ($M = 48.61$, $SD = 4.77$).

2.2. Statistical analyses

Network analysis was conducted using Temporal Exponential Random Graph Models algorithm (TERGM). TERGM is an extension of a broader family of Exponential Random Graph Models (ERGM) for fitting, simulating, and diagnosing dynamic social network models. Simple ERGM enables to simulate a pattern of dependencies between a set of covariates and participant's relations within a social network (similar to Generalized Linear Model (GLM) regression analysis). The main difference between GLM and ERGM (or TERGM) lies in the basic independence assumption. In GLM, the scores of each individual participant must be independent from the scores of other participants. When investigating the liking relationships within a bounded group (i.e., a school class), such assumption cannot be met. For example, the liking relation between Mary and John depends on Mary's and John's relations with the other members of the group (if they like or dislike the same or different peers). Unlike GLM, ERGMs model the whole matrices of relations ($n \times n$ matrix), not individual scores, so the GLM's basic assumption of independency is superseded by the assumption of dependency between the cases. The basic ERGM treats a network as a single multivariate observation (one $n \times n$ matrix), but TERGM is its temporal or multigroup extension, when single model is fitted to more than one network (Hanneke et al., 2010; Krivitsky & Handcock, 2014). It could be that one group is investigated in subsequent time points, but it is also possible to investigate a couple of groups in a cross-sectional pattern. In our study, we joined these two options in a longitudinal multi-group (mixed) pattern.

In ERGM (and TERGM), the modelling is of relations within a group depending on internal (endogenous) and external (exogenous) covariates. Individual characteristics (such as personality traits or intelligence) are external ones because they are external from the relation that created the network. It is possible to include them into the model both in ego and alter perspective, to verify if, for example, intelligence influences nominating (ego – sender) or being nominated (alter – receiver).

In the current study, as main variables, we entered the intelligence (Raven score) in ego and alter perspective as well as its interaction with time factor. We have analyzed a short-term change (wave 1–2) and long-term change (wave 1–3) in separate analyses. We also included an 'absdiff' term for intelligence that is equal to the absolute difference between Raven scores of every pair of participants (every relation within a group). Significant estimate for this term means that absolute differences between the intelligence scores of two participants influences the probability of a liking relationship between them (Morris et al., 2008).

Because we were modelling relations within a network, there was a necessity to consider some universal network dependencies based on a general network theory (Scott, 2000; Wasserman & Faust, 1994). Within a network, there is a common tendency to reciprocate relation ('mutual' term) and to create triads ('GWESP' term). Ignoring these trends might lead to an overestimate of the effects of external covariates (Steglich et al., 2010). We also include a term that covers the tendency to like "almost everyone" ('GWODEG' term) to control for the phenomenon that some people have lower thresholds of liking others and calling them "friends" than other people. Because of the specific character of the studied group of adolescents, we also controlled for the tendency to prefer relationships with peers of the same gender identity ('Sex: node match' term).

To examine the quality of the TERGM model fit, one hundred new networks were simulated based on the model parameters and covariates and compared with the observed networks (Hunter et al., 2008). The frequency distribution of the six basic network parameters were computed: dyad-wise shared partners, edge-wise shared partners, geodesic distances, in-degree and out-degree relations, and triad census. The TERGM formula was estimated using Markov Chain Monte Carlo Maximum Likelihood Estimation (MCMC-MLE), implemented in the *xergm* package for the R statistical environment (Leifeld et al., 2018; R Core Team, 2015).

3. Results

Both of the analyzed TERGM models reached convergence and the goodness-of-fit checking procedure demonstrated that the estimated models were well fitted to the observed data (see OSF project site: https://tinyurl.com/peersint). The estimates, as well as their equivalents in the form of odds-ratios, are presented in Table 1. Intelligence proved to be a significant factor, determining both liking and being liked among the classmates, however, it did so in the opposite direction. Being

Table 1
Estimates of the Temporal Exponential Random Graph Model (TERGM) for short- and long-term change of liking.

	TERGM (*SE*)	*OR*	95% CI
Main effects			
Intelligence: receiver	0.06 (0.03)*|0.05 (0.03)*	1.06| 1.06	[1.01, 1.12]| [1.00, 1.11]
Intelligence: sender	−0.09 (0.03)***|−0.08 (0.03)**	0.91| 0.92	[0.87, 0.96]| [0.88, 0.97]
Abs. difference for intelligence	−0.01 (0.01)†|−0.01 (0.01)†	0.98| 0.99	[0.97, 1.00]| [0.97, 1.00]
Intelligence: receiver × time	−0.03 (0.02)†|−0.02 (0.02)	0.97| 0.97	[0.94, 1.00]| [0.94, 1.00]
Intelligence: sender × time	0.04 (0.02)**| 0.03 (0.02)†	1.05| 1.03	[1.01, 1.08]| [1.00, 1.06]
Exogenous control variables			
Time period	−0.60 (0.63)|−0.32 (0.63)	0.55| 0.73	[0.16, 1.88]| [0.21, 2.48]
Sex: node match	0.28 (0.05)***|0.34 (0.06)***	1.32| 1.40	[1.19, 1.47]| [1.26, 1.57]
GWODegree	0.30 (0.34)|0.21 (0.29)	1.36| 1.23	[0.69, 2.66]| [0.70, 2.16]
Endogenous network dependencies			
Edges	−2.55 (1.03)*|−2.42 (1.03)*		
Mutual	2.23 (0.12)***|2.24 (0.12)***	9.35| 9.40	[7.42, 11.79]| [7.36, 11.99]
GWESP	1.38 (0.13)***|1.22 (0.11)***	3.88| 3.37	[3.04, 4.98]| [2.72, 4.18]

Note: Estimates for the long-term effects are after the vertical bar (|).
† $p < .100$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

intelligent increased the probability of being liked by other peers but also decreased the probability of liking other people. The absolute difference term for intelligence was also significant, suggesting that within examined classes, pupils liked other adolescents who were similarly intelligent. These main effects were significant in both short- and long-term dynamics.

Interaction terms tests the main effects of intelligence (alter and ego perspective) in relation to time. In the short-term (3 months), there was a statistical trend to attenuate the tendency to like intelligent classmates (alter perspective, see: Fig. 1). Similarly, there was a significant effect of decreasing selectiveness in nominating others based on their intelligence (ego perspective, see: Fig. 2). With time, intelligence predicted less liking of others. For the long term (one year later), the effect of decreasing selectiveness in nominating others becomes less significant (ego perspective: Fig. 3) and the interaction of intelligence in alter perspective and time was nonsignificant.

Finally, in the analyzed social networks, we observed a typical and highly significant network dependency: the tendency to reciprocate relation ('mutual') and to create triads ('GWESP'), supporting the reliability of the procedure. We also observed a preference to nominate same sex classmates as friends, which is characteristic of adolescents. Fortunately, a trend to like "almost everyone" ('GWODeg') did not occur among our participants.

4. Discussion

Intelligence constitutes an advantage in life as demonstrated in longitudinal studies (see Clynes, 2016; Lubinski et al., 2014). It seems, however, that while high intelligence may facilitate professional success, unlike the case for emotional intelligence, higher intelligence may also hinder the development of successful relationships (Czarna et al., 2016). The results of our study revealed that while students generally tend to like intelligent classmates, intelligent students only like those

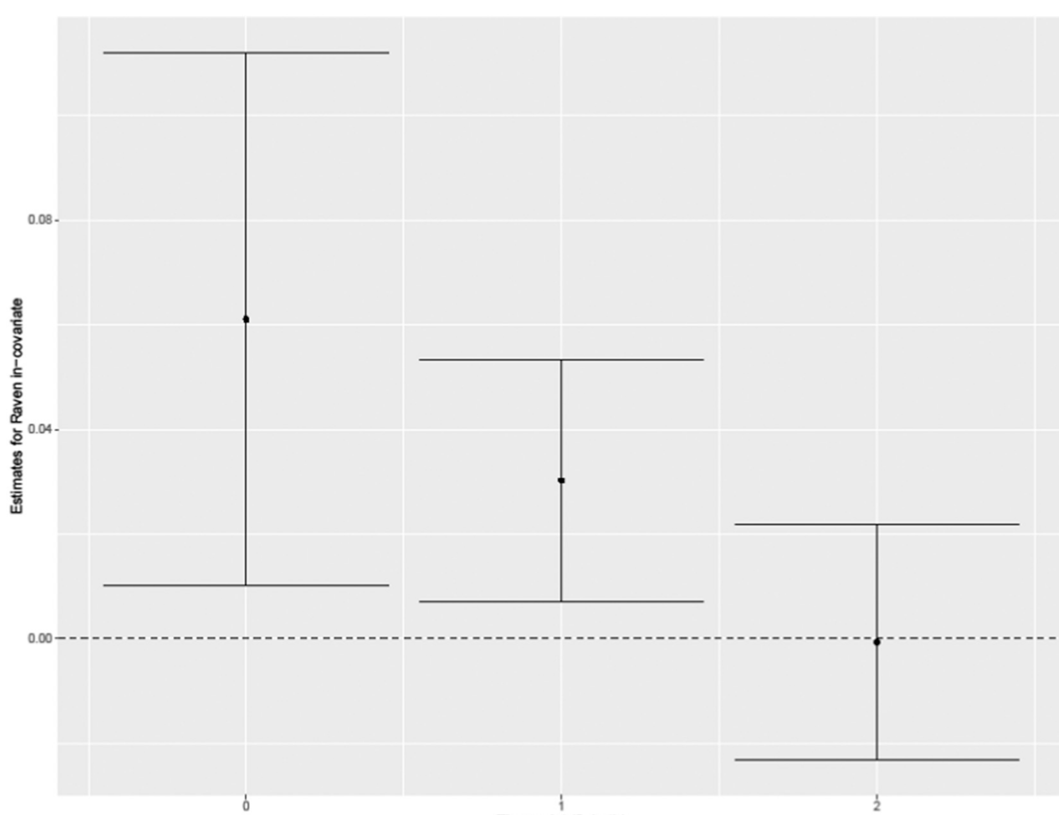

Fig. 1. Estimates for intelligence effect in alter-perspective (receiving nominations) for short-term (three months later).

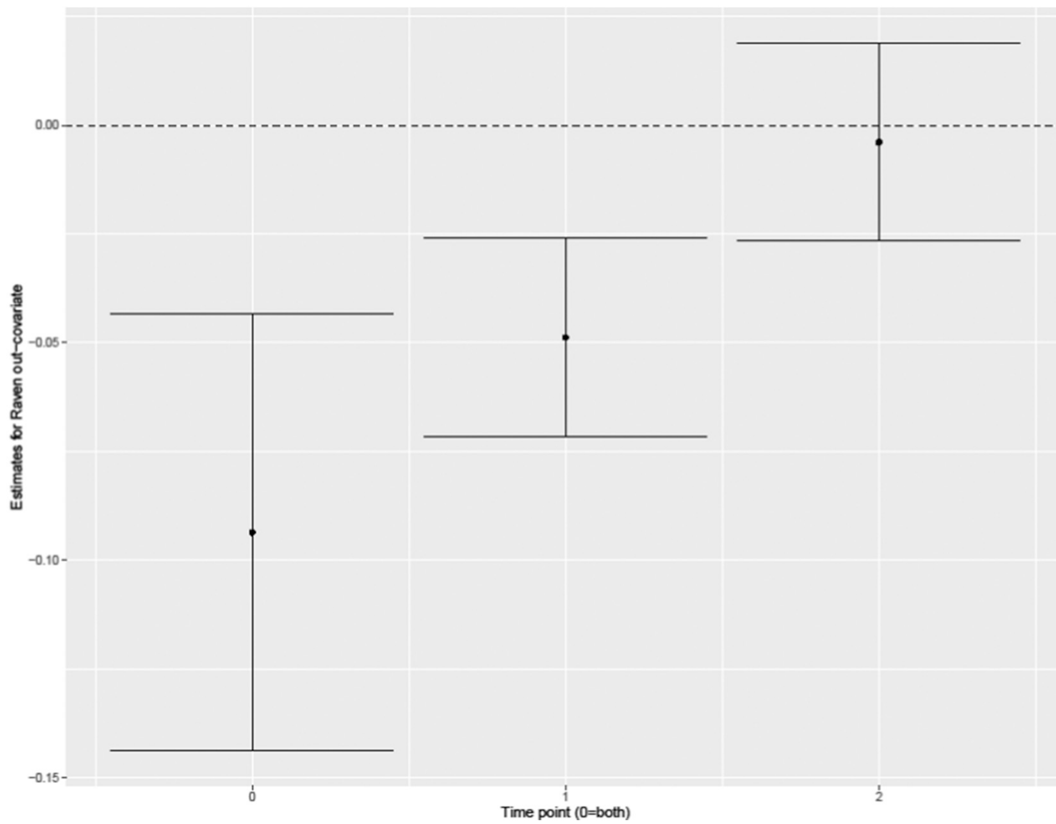

Fig. 2. Estimates for intelligence effect in ego-perspective (giving nominations) for short-term (three months later).

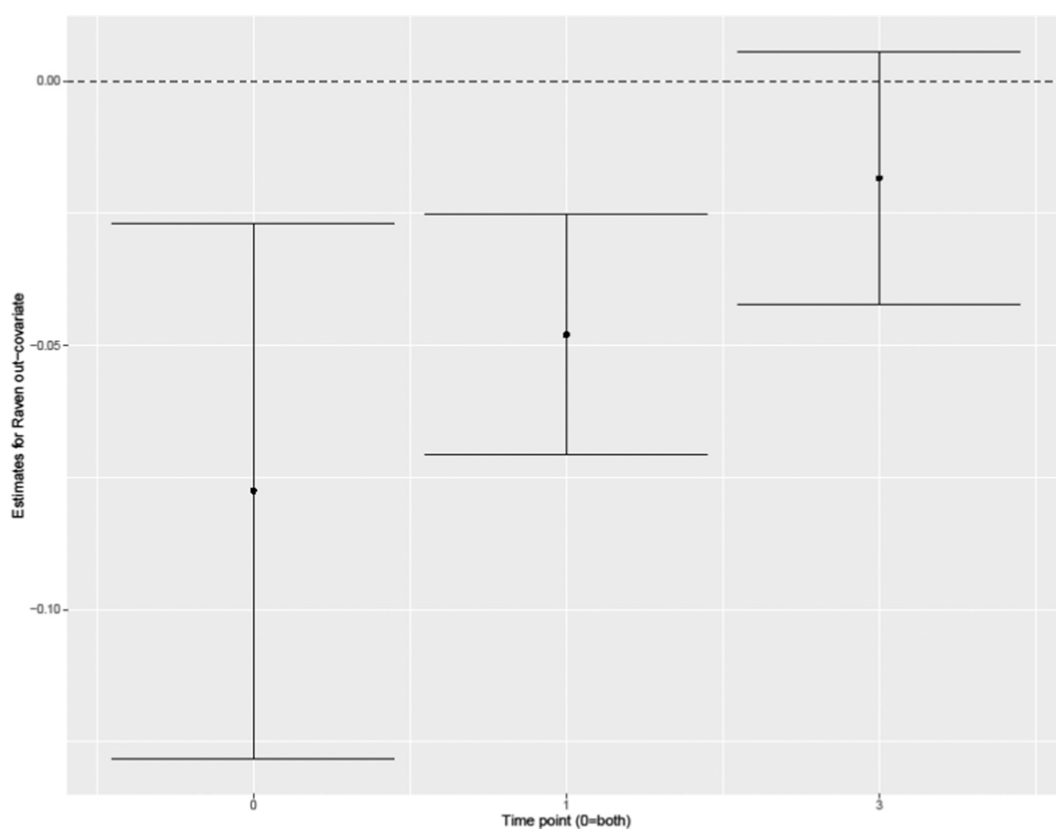

Fig. 3. Estimates for intelligence effect in ego-perspective (giving nominations) for long-term (one year later).

who are as intelligent as they are. These two tendencies seem to lead to the opposite effects, by which being intelligent increases the chance of being liked by others and, at the same time, reduces the chance of liking others due to the limited number of equally intelligent people. This finding suggests that, similar to younger students (Czeschlik & Rost, 1995; Inglés et al., 2017), being intelligent increases the chance of being liked by other teenagers. The combination of these elements may be of particular importance for the school experiences of students belonging to the group of less liked and less intelligent, who, as research of children up to 16 years of age show in some educational areas, achieve lower results and drop out more often than people from the more liked and higher intelligence group despite holding similar attitudes towards school and learning (Zettergren, 2003). The fact that more intelligent students may like fewer people due to the limited number of students with a similar level of intelligence can, on the other hand, lead to being perceived by others as isolated (Van Rossem & Vermande, 2004), and may result in social disregard from others (Sisto et al., 1999).

Another important finding of the present study was that over time, the importance of intelligence in forming relationships diminishes and in the case of being liked by others, becomes non-significant. A possible explanation for this result might be that in the first stage of group formation, when students are getting acquainted, indicators of intelligence play an important role because they are easily accessible (e.g., performance on school tasks) and provide information about the position of individuals in the classroom. However, when group norms emerge and knowledge of shared interests increases, these variables may have a greater impact on position and acceptance among classmates than the individual's level of intelligence (see Leenders et al., 2016; Tuckman, 1965). For example, previous research indicates that intelligence is more important in choosing a partner for learning than for entertainment (Almack, 1922) and that both desired and ignored to play with students had high cognitive abilities, which indicates that preferring or excluding them by classmates had to resulted from other factors (Sisto et al., 1999).

It is also possible that, over time, intelligence becomes an element which determines the acceptance related to prestige in the classroom (for example, due to the student's resources), rather than popularity related to liking (Gorman et al., 2011). The tendency to like similar classmates and the decreasing tendency to like and be liked based on intelligence level, may, in combination, lead to the formation of subgroups or friendships based on other individual differences (e.g. personality traits). Future research is needed to further determine how intelligence impacts group development in various social settings.

Some limitations need to be noted regarding the present study. First, our findings cannot be extrapolated to students other than those attending high school. Ideally future studies will aim to replicate our results at other levels of education. Second, we did not measure the subjective sense of being liked, which means that our interpretations are based only on students' declarations concerning others. Third, we did not control for the GPA scores of the students, therefore we assume that those with high Raven's Progressive Matrices scores are perceived by others as intelligent. Finally, because Raven's Progressive Matrices is a non-verbal test, our conclusions are limited to the non-verbal aspects of intelligence. Nevertheless, the limitation of having the Raven test as a measure of intelligence is, to some extent, an advantage of the current study. The literature on how non-verbal intelligence may be related to being liked by others is an under-researched area, and our work is among the first to shed some light on how non-verbal intelligence shapes the social relations over time.

In conclusion, we aimed to analyze the relationship between students' intelligence and liking in actual social networks. The results indicate that among high school students, being intelligent increases the probability of being liked by others, and decreases the probability of liking many other students, but both of those tendencies become less significant with time.

CRediT authorship contribution statement

Maria Flakus: Conceptualization, Writing – original draft, Writing – review & editing, Supervision. **Barnaba Danieluk:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **Lidia Baran:** Conceptualization, Writing – original draft, Writing – review & editing. **Katarzyna Kwiatkowska:** Conceptualization, Writing – original draft, Writing – review & editing. **Radosław Rogoza:** Conceptualization, Writing – original draft, Writing – review & editing, Methodology, Supervision. **Julie Aitken Schermer:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision.

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