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ORIGINAL PAPER

The bare necessities: a necessary condition analysis of the dual role of basic psychological need satisfaction and frustration on wellbeing at work

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Abstract
The purpose of the current study was to test the necessity of basic psychological needs within self-determination theory (SDT) for employee wellbeing. Utilizing necessary condition analysis across three samples (two cross-sectional and one longitudinal), we evaluate whether need satisfaction and need frustration of the basic psychological needs for autonomy, competence, and relatedness are essential for various indicators of well-being and ill-being among employees. The results, although varied across samples and outcomes, generally indicated that autonomy and competence constitute necessities for employee wellbeing. Specifically, both satisfaction and low frustration of autonomy were necessary for promoting well-being and avoiding ill-being, while low frustration of competence emerged as a consistent necessity across a broad spectrum of well-being indicators. In contrast, the need for relatedness did not consistently emerge as necessary across the studied outcomes but was identified as necessary for certain ones. Together these findings validate the necessity assumption of the basic psychological needs posited by SDT and illuminates the dual role of satisfaction and frustration for employee wellbeing.

Keywords Necessary condition analysis · Basic psychological needs · Occupational health · Well-being · Ill-being · Self-determination theory

Introduction

The quest for a fulfilling work life has led scholars to probe deeply into the elements that underpin employee wellbeing and optimal functioning. A prominent theory for this exploration is self-determination theory (SDT; Ryan & Deci, 2017), which posits the fundamental role of basic psychological needs in fostering human flourishing and wellness by defining them as *psychological nutrients that are essential for individuals' adjustment*, *integrity*, *and growth* (Ryan, 1995). Furthermore, SDT contrasts the satisfaction of basic needs with need frustration, which represents a stronger and more threatening experience than the mere absence of need fulfillment (Vansteenkiste et al., 2020). Together these two mechanisms shed light on both the bright and dark paths of human motivation.

Within the organizational literature, abundant research has alluded to the importance of basic psychological needs in relation to employees' wellbeing. The significance of satisfying these needs is particularly well-documented and summarized meta-analytically (Slemp et al., 2018; Van den Broeck et al., 2016), highlighting a path that leads to enhanced motivation, positive attitudes and behaviors, and wellness at work. Conversely, a more recent stream of research has documented the effects of need frustration, showing how active undermining of these needs paves the way for diminished well-being and engagement (Niemiec et al., 2022; Olafsen et al., 2017, 2021; Trépanier et al., 2016)[1].

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[1] Recently, need dissatisfaction has been recognized in the literature as a distinct third need state, differing from need frustration in that it involves indifferent external influences rather than active undermining, along with the experience of unmet needs (Huyghebaert-Zouaghi et al., 2021).

Despite this burgeoning literature on the importance of basic psychological needs in the workplace, past research has not directly examined the necessity claim found within their very definition. Recent methodological advancements offer the opportunity to evaluate whether the basic psychological needs for autonomy, competence, and relatedness are indeed *necessary requirements* for psychological well-being at work. Necessary condition analysis (NCA; Dul, 2016) can be utilized to elucidate the indispensable role these needs play in achieving desired work outcomes. Specifically, NCA allows for the analysis of the necessary conditions for various human experiences that are well in line with the definition of basic psychological needs lying at the heart of SDT.

Accordingly, the current study aims to utilize NCA to dissect the necessity of both the satisfaction and frustration of basic psychological needs for explaining both positive and negative wellbeing outcomes, thereby illuminating the dual paths within the SDT model in the workplace (Deci et al., 2017; Forest et al., 2023). Herein, we define wellbeing as the overall state of wellness and make a distinction between well-being (positive outcomes) and ill-being (negative outcomes) as the bright and dark sides of employee wellness, respectively. With this, the current study contributes to the SDT literature in the realm of work by providing a nuanced understanding of the conditions under which basic psychological needs exert a significant impact on work-related wellbeing. Specifically, by integrating NCA, our aims in this research are to validate the foundational premises of basic needs within SDT, as well as to expand our understanding of the assumed bright and dark paths of employee motivation in predicting positive and negative outcomes, respectively.

The necessity of basic psychological needs for employees wellbeing

As mentioned, a core assumption within SDT is that individuals have a set of basic psychological needs, the satisfaction of which is essential for their flourishing and wellbeing (Ryan & Deci, 2017). Although various needs have been proposed (e.g., Sheldon et al., 2001), the current list of needs that meet SDT's strict criteria for being considered a basic psychological need includes autonomy, competence, and relatedness (Vansteenkiste et al., 2020). These needs have been identified through both inductive and deductive bases, demonstrating the role of experienced autonomy, competence, and relatedness in developing and maintaining optimal motivation and well-being (Ryan & Deci, 2017).

Autonomy refers to the need to feel volition, willingness, and choice in the things we undertake. When satisfied, an employee feels a desire to engage in activities out of genuine interest and willingness, whereas when frustrated, feelings of pressure or coercion appear. *Competence* refers to the need to feel effective in one's interactions with the environment and to experience a sense of mastery and achievement in undertaking and completing tasks. When satisfied, an employee feels capable of undertaking one's work tasks and experiences opportunities to use and extend their skills, but when frustrated, feelings of failure and ineffectiveness arise. *Relatedness* refers to the need to feel that one belongs and is part of a group or community. At work, this need is satisfied when an employee feels cared for and connected with others, while it becomes frustrated when left feeling alienated, excluded, and lonely. Conceptually, experiences of need satisfaction and need frustration have an asymmetrical relationship: while the lack of need satisfaction does not automatically mean need frustration, the presence of need frustration indicates that need satisfaction is absent. Based on this distinction, the basic psychological needs operate through two pathways—a bright path where need satisfaction leads to well-being, and a dark path where need frustration leads to ill-being (Vansteenkiste & Ryan, 2013).

According to SDT, the satisfaction of these psychological needs as well as the lack of their frustration, are necessary conditions for positive outcomes to arise (Vansteenkiste et al., 2020). However, existing research has rarely directly tested this necessity assumption, rather established an association and provided evidence for them being sufficient conditions (e.g., autonomy satisfaction increases work engagement). Abundant research has shown that satisfaction of the three basic needs is related to indicators of well-being such as increased vigor (Olafsen et al., 2021; Van den Broeck et al., 2008), happiness (Gillet et al., 2012), mindfulness (Olafsen, 2017), and overall work engagement (Trépanier et al., 2015), as well as decreased exhaustion (Olafsen et al., 2021; Van den Broeck et al., 2008), anxiety (Deci et al., 2001), and psychosomatic complaints (Trépanier et al., 2016). Conversely, need frustration has been associated with adverse ill-being outcomes, such as increased work stress, exhaustion, sleep disturbances, anxiety, depressive symptoms, and psychosomatic complaints (Niemiec et al., 2022; Olafsen et al., 2017, 2021; Trépanier et al., 2016), as well as decreased vigor (Olafsen et al., 2021; Vander Elst et al., 2012), happiness (Gillet et al., 2012), and life satisfaction (Trépanier et al., 2016). In fact, in a meta-analysis of 99 studies based on 119 distinct employee samples (Van den Broeck et al., 2016), satisfaction of each need consistently showed positive associations with indicators of well-being and negative associations with indicators of ill-being, with relative weight analysis indicating that each need accounted for incremental variance in these indicators (with the exception of competence satisfaction not predicting incremental work engagement beyond the other two needs). However, as

Dul (2016) explains, a sufficient condition is not the same as a necessary condition (i.e., the outcome (engagement) can only occur if the predictor (autonomy satisfaction) is present). Thus, it is time to shed new light on how basic psychological needs may function as necessary conditions for wellbeing at work.

NCA (Dul, 2016) is a general methodology for testing necessary conditions, and is therefore pertinent to studying the SDT postulate that the three basic psychological needs are essential for human thriving, functioning, and wellness. In short, NCA allows for investigating whether the basic psychological needs for autonomy, competence, and relatedness are necessary conditions for employee well-being by establishing threshold levels beyond which well-being can or cannot be sustained. Within the logic of necessity, having basic psychological needs as necessary conditions for employee well-being means that if employees experience well-being, then their basic psychological needs are necessarily satisfied (the presence of the outcome infers the presence of the necessary antecedent). Conversely, if employees' basic psychological needs are not satisfied, then they are unlikely to experience well-being (the absence of the necessary antecedent infers the absence of the outcome). By contrast, NCA cannot make any inference on whether employees having their needs satisfied means they experience well-being (the presence of the antecedent does not infer the presence of the outcome) or whether employees not experiencing well-being do not have their needs satisfied (the absence of the outcome does not infer the absence of the antecedent). In other words, it can demonstrate the probability of basic psychological needs being necessary for employee well-being, but not the probability of basic psychological needs being sufficient for employee well-being. Thus, NCA does not provide the full picture of the relationship between employee needs and well-being, but it paints some parts of that picture in a new light.

Within the scope of this research, we focus on the distinct influence of each need as a potential necessary condition independent from the other. Thus, our work complements to prior research on the interaction between needs and the synergistic effects of needs on employee wellbeing (Dysvik et al., 2013; Sheldon & Niemiec, 2006). Although NCA does not capture the interplay between needs, such as how an imbalance among them affects wellbeing (e.g., Sheldon & Niemiec, 2006) need compensation between life domains, or how their shared and unique contributions are parsed (e.g., Sánchez-Oliva et al., 2017), it excels at isolating which specific needs are essential for wellbeing and identifying the minimum levels required for employees to flourish. With this, NCA provides a unique quantitative assessment that differs from traditional regression analyses.

Despite the potential of NCA to uncover the underlying assumptions of SDT, the approach has so far been hardly used. A few exceptions exist in publications that aim to introduce NCA as a relevant analytic technique in organizational psychology and use SDT as an example to demonstrate its procedures and benefits. For instance, in their paper aimed at introducing NCA into managerial psychology, Ding and Kuvaas (2023) use the basic psychological needs within SDT to demonstrate its value and application, finding that satisfaction of the three needs is a necessary condition for work engagement. Building on this, the current study seeks to provide a comprehensive test of the necessity of basic psychological needs for employee well-being. In doing so, we include an examination of both need satisfaction and frustration and cover a range of indicators of well-being and ill-being. Finally, while past NCA studies have relied solely on cross-sectional data, we investigate the necessity assumption underlying the satisfaction and frustration of SDT's basic psychological needs for employees across a wide range of wellbeing outcomes over time.

Hypotheses

Given past research showing the role of satisfaction of the needs for autonomy, competence, and relatedness in various wellbeing-related outcomes among employees (Van den Broeck et al., 2016), coupled with the definition of basic psychological needs as necessary nutriments for wellness (Ryan, 1995), we propose the following:

H1a: Satisfaction of the need for autonomy is necessary for employee well-being.

H1b: Satisfaction of the need for competence is necessary for employee well-being.

H1c: Satisfaction of the need for relatedness is necessary for employee well-being.

By contrast, given the adverse effects associated with frustration of the needs for autonomy, competence, and relatedness in past research (Niemiec et al., 2022; Olafsen et al., 2017, 2021; Trépanier et al., 2016), coupled with the underlying criteria of need frustration being predictive of ill-being (Vansteenkiste et al., 2020), we propose the following:

H2a: Frustration of the need for autonomy is necessary for employee ill-being.

H2b: Frustration of the need for competence is necessary for employee ill-being.

H2c: Frustration of the need for relatedness is necessary for employee ill-being.

Moreover, given the assumed asymmetrical relation between need satisfaction and frustration, where the absence of need satisfaction does not imply the presence of need frustration, but the presence of need frustration denotes the absence of need satisfaction (Vansteenkiste & Ryan, 2013), we propose the following:

H3a: Absence of frustration of the need for autonomy is necessary for employee well-being.

H3b: Absence of frustration of the need for competence is necessary for employee well-being.

H3c: Absence of frustration of the need for relatedness is necessary for employee well-being.

While it is postulated that the presence of need frustration denotes the absence of need satisfaction—meaning that if high need frustration is a necessary condition for ill-being, low satisfaction is a corollary condition—we nevertheless consider the possible impact of need satisfaction on ill-being. Indeed, recent research has demonstrated that having a high level of positive personal perceptions, such as a sense of power or self-efficacy, can be a necessary condition for maintaining a low level of ill-being (Korman et al., 2022). A similar necessity may be found with experiences of need satisfaction. Indeed, as long as employees feel that the course of their job is strongly aligned with their own choices and interests (autonomy satisfaction), that they are enabled to use and improve their skillset to the fullest (competence satisfaction), and that they are part of a meaningful and caring community at work where they belong (relatedness satisfaction), they may encounter challenges and adverse experiences in their job, but not be affected by them in a way that creates ill-being. We thus posit that need satisfaction may have a beneficial capacity to prevent the development of ill-being outcomes, and highly satisfied employees may thus maintain a low level of ill-being. We propose the following:

H4a: Satisfaction of the need for autonomy is necessary for low levels of employee ill-being.

H4b: Satisfaction of the need for competence is necessary for low levels of employee ill-being.

H4c: Satisfaction of the need for relatedness is necessary for low levels of employee ill-being.

General method

Necessary condition analysis

Across the three following studies, we used the NCA package developed by Dul (2022) for the statistical software R. This enabled us to investigate satisfaction and frustration of the three basic psychological needs as necessary conditions for the occurrence of employee well-being and ill-being. The identification of necessary factors is done through analyzing the scatter plot of the two variables tested (the hypothesized condition and its outcome) and searching for empty areas to distinguish them from areas full of data points. Empty areas in the scatter plot indicate that, for a specific hypothesized condition variable across a specific range, the outcome variable can have no value that falls within that specific area, which is likewise delineated across a specific range of possible outcome values. By contrast, full data areas in the scatter plot indicate that, for the condition variable across that specific range, the outcome variable can have values that fall within that specific area all the way to the boundaries of the full data area (i.e., where the empty area begins).

For instance, we can have an autonomy satisfaction scale rating from 1 to 7 and a work engagement scale rating from 1 to 7, and we can hypothesize that autonomy is a necessary condition for work engagement. If the empty area in the scatter plot of the two variables has a section ranging from 1 (the lowest possible value) to 3 for autonomy satisfaction and 4 to 7 (the highest possible value) for work engagement, we can say that for job satisfaction rated below 3, work engagement cannot go above 4, since there is no data point above the value of 4 in that section of the empty area. When looking at the corresponding section of the full data area, for autonomy satisfaction values of 1–3, all work engagement values range from 1 to 4.

Furthermore, if the next section of empty area ranges from 3 to 5 for autonomy satisfaction and 6 to 7 for work engagement in the same scatter plot, we can say that for autonomy satisfaction rated below 5, work engagement cannot go above 6. In combination with our analysis of the first empty section, we can then say that work engagement can only go above 4 if autonomy satisfaction goes above 3, since the second range of autonomy satisfaction values includes data points with work engagement values above 4 (the limit being at 6, above which the area is empty). In other words, having autonomy satisfaction above 3 is a *necessary condition* for having work engagement above 4.

When looking at the corresponding section of the full data area, for autonomy satisfaction values of 3–5, all work engagement values range from 1 to 6. This way, by looking at the line that distinguishs the full data area from the empty area in the scatter plot, called a *ceiling line* (Dul,

2016), and gradually following the evolution of that line across the range of the necessary condition variable values, we can establish what the highest possible outcome values are at any point in that range, and whether the highest possible outcome value increases or decreases as we progress through the range of condition values.

The ceiling line that separates the empty area from the full data area can be drawn using either of two techniques: ceiling envelopment with free disposal hull (CE-FDH) and ceiling regression with free disposal hull (CR-FDH). The CE-FDH technique generates a linear envelope by producing a line that scales up or down, following the evolution of the highest data points in the scatter plot in a stepwise manner, depending on whether the data points are expected to increase or decrease across the range of the condition variable. The CR-FDH technique produces a smooth regression line based on the ceiling line of the CE (Dul, 2016). These ceiling lines enable the calculation of the overall area of the empty space.

In the present study, we will consider that the empty area is located in either of the two upper corners of the scatter plot, depending on our hypotheses. Hypotheses positing that a high level of a condition variable is necessary for a high level of the outcome variable (H1a to H1c; H2a to H2c) will therefore assume that the ceiling line increases across the range of condition values in the scatter plot, so the empty area will be located in the left upper corner of the scatter plot (see Fig. 1): an empty left upper corner means that there can be no high outcome values for low condition values. Hypotheses positing either that a low level of the condition variable is necessary for a high level of the outcome variable (H3a to H3c), or that a high level of the condition variable is necessary for a low level of the outcome variable (H4a to H4c), will assume that the ceiling line decreases across the range of condition values in the scatter plot, so the empty area will be located in the right upper corner of the scatter plot (see Fig. 2): an empty right upper corner means that there can be no high outcome values for high condition values.

In NCA, two crucial parameters are effect size (d) and significance level (p). The effect size (d) measures the relative magnitude of the empty space, with a larger empty zone indicating a stronger necessity effect. The significance level (p) assesses the likelihood that the effect size d occurred by chance. An effect size above the 0.1 threshold is considered meaningful enough to not reject the necessary conditions hypothesis, and a low p value, ($p<0.05$) signifies that the results are statistically significant (Dul, 2016). Furthermore, the aforementioned CR and CE are indicators of the robustness of our analysis. Only results where both CR and CE are meaningful ($d>0.1$) and significant ($p<0.05$) can indicate a necessary condition. If only one of either CR or CE is significant or meaningful, the results will not be consistent enough to indicate a necessary condition.

Bottleneck tables are presented in the Supplementary Material and show what values of the condition variable are necessary for the outcome variable to reach certain levels, thus describing what level of each basic need satisfaction and frustration is necessary to achieve specific levels of well-being and ill-being outcomes. The bottleneck tables are based on CE values, as the raw data points may not necessarily follow a linear pattern and there may be stark decreases or increases in the outcome value from one section of condition values to the next, which is best captured when following the ceiling line of the CE rather than the CR. In the Results section, we only report the bottleneck tables for outcomes that have at least three meaningful conditions out of the six need states (three satisfaction states and three frustration states), as these would warrant describing the combination of various necessary condition levels for a single outcome. The remaining bottleneck tables can be found in the Supplementary Material.

Study 1

Participants and procedures

Data were collected through a survey delivered on an online platform, where 494 English-speaking members of the general working population in the United States and the United Kingdom responded. The sample consisted of a heterogeneous group of employees working full time across a variety of organizations and industries. The sample comprised an equal number of men and women (247 for both), with a mean age of 37 years and a mean tenure of 6.8 years in their current job.

Measures

Basic psychological need satisfaction and frustration Need-based experiences at work were assessed with the Work-related Need Satisfaction and Frustration Scale (Olafsen et al., 2021). Participants rated their level of satisfaction on four items for *autonomy satisfaction* (e.g., "I have a feeling of choice and freedom in what I do at work"), *competence satisfaction* (e.g., "I feel capable in doing what I do at work"), and *relatedness satisfaction* (e.g., "I feel closely connected to other people who are important to me at work"). Similarly, four items assessed their level of *autonomy frustration* (e.g., "I feel pressured to do many of the things I have done at work"), *competence frustration* (e.g., "I feel insecure about my abilities at work"), and *relatedness frustration* (e.g., "At work I feel excluded from the group

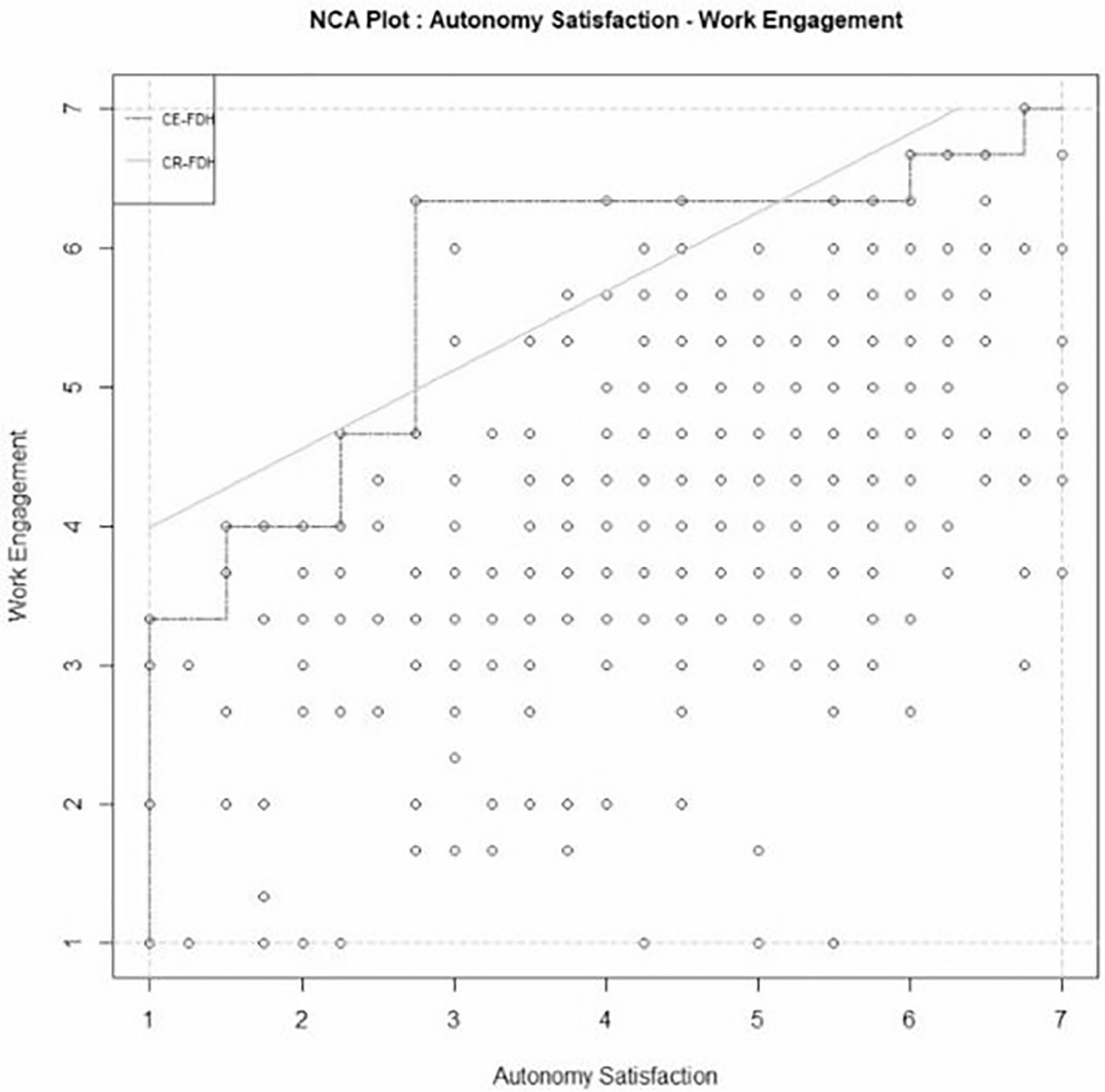

Fig. 1 Necessity relationship between autonomy satisfaction and work engagement

that I want to be a part of"). All items were reported on a scale ranging from 1 (completely disagree) to 7 (completely agree). A confirmatory factor analysis (CFA) showed a good fit ($\chi^2 = 826$; df = 237; CFI = .94; RMSEA = .07; SRMR = .04) for the measurement model across the six dimensions of need satisfaction and frustration according to established standards in the literature (Hu & Bentler, 1999).

Well-being outcomes Work engagement was assessed with the three-item version of the Utrecht Work Engagement Scale (Schaufeli et al., 2017). The measurement scale asks respondents to report on their vigor (e.g., "At my work, I feel bursting with energy"), dedication (e.g., "I am enthusiastic about my job"), and absorption (e.g., "I am immersed in my work") on a scale ranging from 1 (never) to 7 (daily). Eudaimonic work well-being was assessed using the four items in the intrapersonal dimension of the Eudaimonic Workplace Well-being Scale by Bartels et al. (2019). Respondents rated the four items (e.g., "I have felt that I have a purpose at my work") on a scale ranging from 1 (strongly disagree) to 5 (strongly agree).

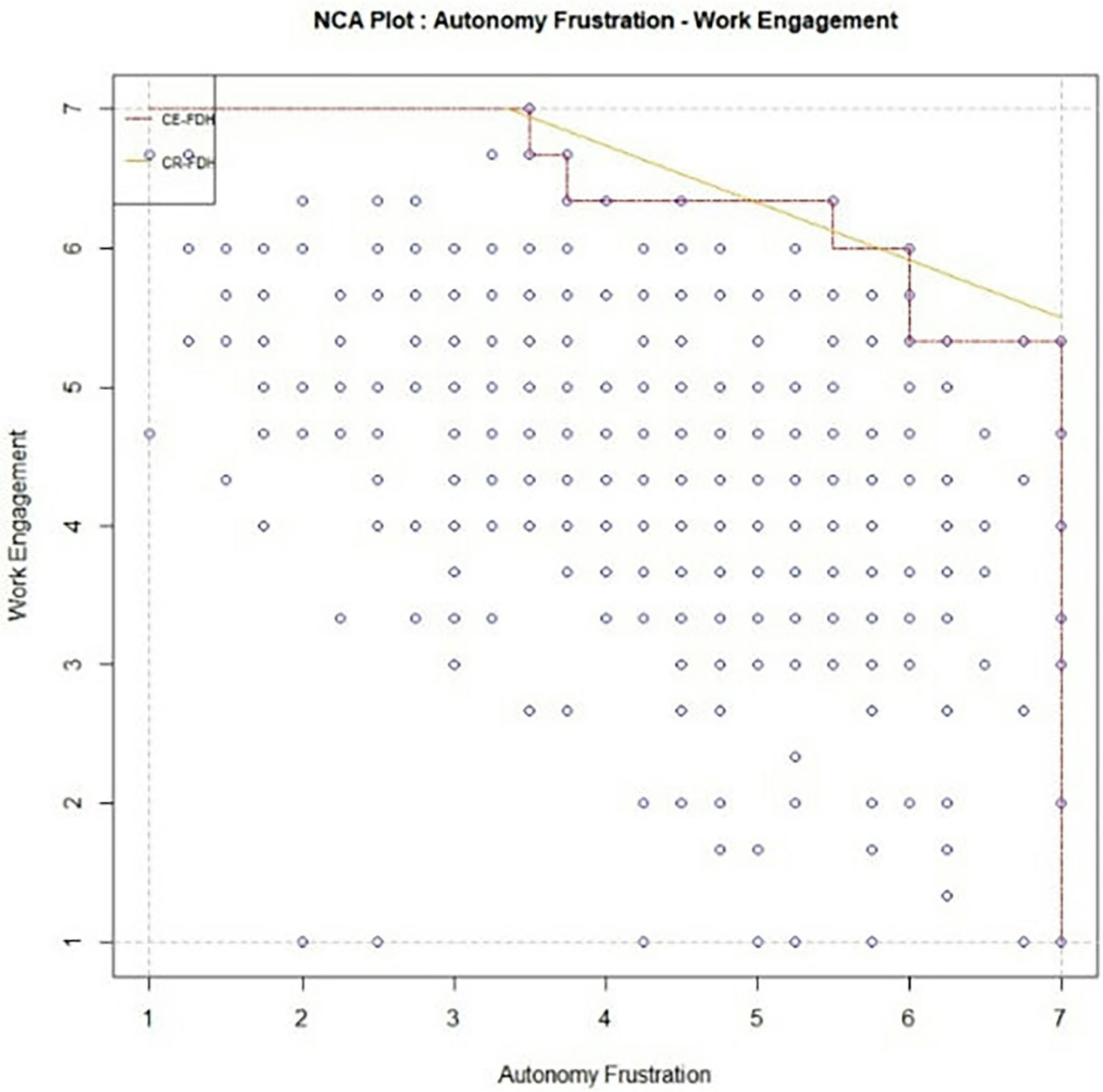

Fig. 2 Necessity relationship between autonomy frustration and work engagement

Ill-being outcomes Participants were asked to report on their level of experienced *work stress* on a scale ranging from 1 (no stress) to 10 (extreme stress) based on the measure by Stanton et al. (2001). Participants rated their level of *emotional exhaustion* (five items; e.g., "I feel used up at the end of the workday") based on the Maslach Burnout Inventory (Maslach et al., 1996) on a scale ranging from 1 (never) to 7 (daily).

Results

Descriptive statistics, reliabilities, and correlations for Study 1 are shown in Table 1. An overall look at the correlations shows that the sufficiency condition seems to be met for the relationships between the ensemble of the need states and the ensemble of outcomes: need satisfaction states significantly positively correlate with well-being outcomes and negatively with ill-being outcomes, while need frustration

Table 1 Descriptive statistics, alphas and intercorrelations for the Study 1 variables

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Autonomy satisfaction	**.89**									
2. Competence satisfaction	.41**	**.94**								
3. Relatedness satisfaction	.46**	.39**	**.95**							
4. Autonomy frustration	−.45**	−.18**	−.33**	**.87**						
5. Competence frustration	−.25**	−.65**	−.26**	.39**	**.91**					
6. Relatedness frustration	−.27**	−.39**	−.53**	.46**	.60**	**.88**				
7. Work engagement	.61**	.44**	.49**	−.44**	−.38**	−.38**	**.87**			
8. Eudaimonic well-being	.63**	.44**	.56**	−.47**	−.37**	−.44**	.80**	**.88**		
9. Emotional exhaustion	−.33**	−.33**	−.26**	.52**	.43**	.39**	−.43**	−.40**	**.95**	
10. Work stress	−.21**	−.31**	−.19**	.37**	.41**	.37**	−.23**	−.24**	.61**	–
Mean	4.66	5.79	5.11	4.41	2.65	2.51	4.27	3.37	4.00	4.98
Standard deviation	1.36	1.08	1.39	1.37	1.46	1.34	1.16	0.91	1.71	2.20
Skewness	– 0.60	– 1.40	– 0.92	– 0.19	0.80	0.74	– 0.64	– 0.74	0.07	0.06
Kurtosis	– 0.13	2.82	0.76	– 0.59	– 0.23	– 0.22	0.64	0.12	– 1.05	–0.95

Alphas on the diagonal. *p<.05, **p<.001

Table 2 Necessary condition analysis (NCA) results for Study 1

Analyzed parameters	Work engagement		Eudaimonic well-being		Emotional exaustion		Work stress	
	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH
Need satisfaction								
Autonomy	**.222*****	**.213*****	**.129*****	**.138*****	.015**	.021*	.043**	.051*
Competence	**.313*****	**.308*****	.135	.193***	0	0	0	0
Relatedness	.048	.072	.090***	.120**	.006***	.012***	.009	.019
Total	**.360*****	**.391*****	**.208*****	**.253*****	.010*	.014*	.042***	.043**
Need frustration								
Autonomy	.090**	.090***	.016	.023	.074***	.112***	**.142*****	**.148*****
Competence	**.250*****	**.213*****	**.170*****	**.133*****	0	0	.007	.014
Relatedness	**.176****	**.199****	.087	.107	0	0	.028***	.056***
Total	**.222****	**.223*****	**.145****	**.145***	.111*	.129	.111***	.095***

Bolded: Results which are significant (p<.05) and meaningful (d>.1) across the two CE and CR measurements

CE-FDH piecewise linear ceiling line, *CR-FDH* continuous ceiling line

*p<.05. **p<.01. ***p<.001

states significantly positively correlate with ill-being outcomes and negatively with well-being outcomes.

Regarding necessary conditions for the well-being outcomes, the results of the NCA showed that satisfaction of the need for autonomy and the need for competence are both necessary conditions for employees to have a high level of work engagement. In other words, employees can only reach high levels of work engagement when these two needs are satisfied. The effect size reaches above the.1 level (CR: d=.222, p<.001; CE: d=.213, p<.001) for autonomy satisfaction and above the.3 level (CR: d=.313, p<.001; CE: d=.308, p<.001) for competence satisfaction, which indicates a medium and a large effect, respectively. Satisfaction of the need for relatedness was not found to have a similar significant meaningful effect.

In addition to need satisfaction, the results also showed the necessity of low need frustration for work engagement. In particular, frustration of the need for competence (CR: d=.250, p<.001; CE: d=.213, p<.001) and the need for relatedness (CR: d=.176, p<.01; CE: d=.199, p<.01) are factors that must be low for employees to have a high level of work engagement, whereas autonomy frustration has no significant impact. In other words, employees can only reach high levels of work engagement when these two needs are not frustrated (Table 2).

To illustrate the interpretation of the bottleneck tables presented in the Supplemental Material, Table 8 shows the bottleneck table for these results. It is shown that a low level of competence satisfaction (1.5 out of 7) is necessary to reach a level of engagement above 1. Moreover, a low level of both autonomy satisfaction and competence satisfaction is necessary to reach a medium level (4) of engagement. Regarding frustration, both competence frustration and relatedness frustration must be below the average level (4) to reach higher levels of engagement (6). Finally, a high level of autonomy satisfaction (6.75), the highest level of competence satisfaction (7), the lowest level of competence frustration (1), and a low level of relatedness frustration

(1.25) are necessary to reach the highest level of engagement (7) (Table 3).

As for eudaimonic work well-being, the results from the NCA showed that only autonomy satisfaction (CR: d=.129, p<.001; CE: d=.138, p<.001) and low competence frustration (CR: d=.170, p<.001; CE: d=.133, p<.001) are necessary conditions for employees to reach a high level of well-being, whereas no other need states are necessary. In other words, employees can only reach high levels of eudaimonic work well-being when their need for autonomy is satisfied and their need for competence is not frustrated.

Regarding ill-being outcomes, results from the NCA showed that only frustration of the need for autonomy (CR: d=.142, p<.001; CE: d=.148, p<.001) is a necessary condition for employees to have high levels of work stress, whereas no other need states are necessary. In other words, employees can only experience high levels of stress at work when their need for autonomy is frustrated. No necessary conditions of needs were found for emotional exhaustion.

Post hoc analyses

We conducted additional analyses on the potential role of total need satisfaction and total need frustration as necessary conditions for well-being and ill-being on top of the role of each separate need. To this end, we computed the three needs together into a single average variable for total need satisfaction and one for total need frustration. We then tested these two satisfaction and frustration averages as necessary conditions for well-being and ill-being outcomes in the same manner as we did for separate needs.

For well-being outcomes, high total need satisfaction (CR: d=.360, p<.001; CE: d=.391, p<.001) and low total need frustration (CR: d=.222, p<.01; CE: d=.223, p<.001) were both necessary conditions for work engagement. High total need satisfaction (CR: d=.208, p<.001; CE: d=.253, p<.001) and low total need frustration (CR: d=.145, p<.01; CE: d=.145, p<.05) were also both necessary conditions for work eudaimonic well-being. Regarding ill-being outcomes, neither total need satisfaction nor total need frustration was a necessary condition for any of the outcomes.

Study 2

Participants and procedures

Data were collected through an online questionnaire sent to 3580 employees in two Norwegian organizations of which 604 responses were obtained (response rate of 16.9%). The research project was approved by the Norwegian Agency for Shared Services in Education and Research. The sample comprised 393 women, 196 men, and 15 participants who identified as "other" or did not indicate their gender. The mean age of the sample was 43.7 years (SD = 11.8). Of the participants, 477 were full-time workers, 124 were part-time workers, and 3 did not indicate whether they were working full- or part-time.

Measures

Basic psychological need satisfaction and frustration Need-based experiences at work were assessed with the Work-related Need Satisfaction and Frustration Scale (Olafsen et al., 2021), as in the first study. A CFA showed a decent fit (χ^2 = 999; df = 237; CFI = .89; RMSEA = .07; SRMR = .05) for the measurement model across the six dimensions of need satisfaction and frustration according to established standards in the literature (Hu & Bentler, 1999).

Table 3 Bottleneck table for the necessity relationship between basic psychological needs and work engagement in Study 1

Work engagement	Need satisfaction			Need frustration		
	Autonomy	Competence	Relatedness	Autonomy	Competence	Relatedness
1	NN	NN	NN	7	7	7
1.5	NN	1.5	NN	7	6.75	7
2	NN	1.5	NN	7	6.75	7
2.5	NN	1.5	NN	7	6.75	7
3	NN	1.5	NN	7	6.75	7
3.5	1.5	1.5	NN	7	6.75	6.25
4	1.5	2.25	NN	7	6.75	6.25
4.5	2.25	3	NN	7	6.75	6.25
5	2.75	3	NN	7	6.75	6.25
5.5	2.75	3	NN	6	5.75	5.75
6	2.75	3	NN	6	4	4
6.5	6	6	3.75	3.75	2	3.5
7	6.75	7	6	3.5	1	1.25

"NN" means "not necessary." Work engagement was measured on a 7-point Likert scale, and three basic needs were measured on a 7-point Likert scale

Well-being outcomes Work engagement was assessed with the nine-item version of the Utrecht Work Engagement Scale (Schaufeli et al., 2006), tapping into respondents' vigor, dedication, and absorption as in the first study. Positive affect was assessed with the short form of the Positive and Negative Affect Scale (Thompson, 2007). Respondents were asked to rate how they usually feel, with the five items (e.g., "Inspired") being rated on a scale ranging from 1 (never) to 5 (always). Life satisfaction was assessed with the Satisfaction with Life Scale (Diener et al., 1985) where the five items (e.g., "I am satisfied with my life") were rated on a scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Ill-being outcomes Participants rated their level of emotional exhaustion based on the Maslach Burnout Inventory (Maslach et al., 1996) as in the first study. Negative affect was assessed with the short form of the Positive and Negative Affect Scale (Thompson, 2007). Respondents were asked to rate how they usually feel, with the five items (e.g., "Nervous") being rated on a scale ranging from 1 (never) to 5 (always).

Results

Descriptive statistics, reliabilities, and correlations for Study 2 are shown in Table 4. As in Study 1, an overall look at the correlations shows that the sufficiency condition seems to be met for the relationships between the ensemble of the need states and the ensemble of outcomes.

Regarding necessary conditions for the well-being outcomes, the results of the NCA showed that low frustration of the need for competence is a necessary condition for employees to reach a high level of work engagement (CR: d=.153, p<.01; CE: d=.170, p<.01) and a high level of positive affect (CR: d=.213, p<.001; CE: d=.261, p<.01) at work, whereas no other need states are necessary. In other words, employees can only reach high levels of work engagement and positive affect when their need for competence is not frustrated. Furthermore, the results showed that satisfaction of the need for autonomy (CR: d=.118, p<.01; CE: d=.146, p<.001) and the need for relatedness (CR: d=.110, p<.05; CE: d=.122, p<.01), as well as low frustration of the need for competence (CR: d=.137, p<.05; CE: d=.191, p<.05), are necessary conditions for employees to have a high level of life satisfaction. No other need states are necessary conditions for life satisfaction. In other words, employees can only reach high levels of life satisfaction when their autonomy satisfaction and relatedness satisfaction are high, and their competence frustration is low.

Regarding ill-being outcomes in this sample (i.e., negative affect and emotional exhaustion), the results of the NCA showed that only low satisfaction of the need for autonomy (CR: d=.117, p<.001; CE: d=.133, p<.001) is a necessary condition for employees to have a high level of negative affect, whereas the other need states are not. In other words, employees cannot reach a high level of negative affect if their autonomy is satisfied. There were no consistently significant and meaningful results for emotional exhaustion.

Post hoc analyses

Similar to Study 1, we conducted additional analyses on the potential role of total need satisfaction and total need frustration as necessary conditions for well-being and ill-being outcomes (Table 5).

Regarding well-being outcomes, neither total need satisfaction nor total need frustration was a necessary condition for any of the outcomes. Regarding ill-being outcomes, high total need frustration was a necessary condition for emotional exhaustion (CR: d=.181, p<.001; CE: d=.208,

Table 4 Descriptive statistics, alphas and intercorrelations for the Study 2 variables

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Autonomy satisfaction	**.80**										
2. Competence satisfaction	.35**	**.83**									
3. Relatedness satisfaction	.44**	.24**	**.85**								
4. Autonomy frustration	−.46**	−.16**	−.30**	**.82**							
5. Competence frustration	−.33**	−.55**	−.22**	.42**	**.83**						
6. Relatedness frustration	−.38**	−.14**	−.55**	.46**	.44**	**.88**					
7. Work engagement	.47**	.30**	.38**	−.32**	−.28**	−.29**	**.93**				
8. Life satisfaction	.35**	.20**	.25**	−.27**	−.25**	−.30**	.42**	**.89**			
9. Positive affect	.28**	.33**	.17**	−.16**	−.34**	−.15**	.57**	.38**	**.78**		
10. Negative affect	−.24**	−.19**	−.11**	.25**	.40**	.29**	−.22**	−.27**	−.22**	**.74**	
11. Emotional exhaustion	−.29**	−.13**	−.13**	.39**	.28**	.27**	−.27**	−.28**	−.17**	.41**	**.89**
Mean	5.37	6.07	5.55	3.15	1.99	2.02	5.66	5.02	3.88	1.99	2.93
Standard deviation	0.95	0.65	0.97	1.22	0.91	1.10	1.11	1.15	0.49	0.51	1.37
Skewness	− 0.85	− 1.03	− 0.80	0.34	1.42	1.34	− 1.13	− 0.79	− 0.09	0.64	0.81
Kurtosis	0.68	2.61	0.69	− 0.37	2.83	1.37	1.18	0.39	0.34	1.01	0.16

Alphas on the diagonal. * p<.05, ** p<.001

Table 5 Necessary condition analysis (NCA) results for Study 2

Analyzed parameters	Work engagement		Emotional exhaustion		Positive affect		Negative affect		Life satisfaction	
	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH
Need satisfaction										
Autonomy	.080**	.107***	.038*	.057**	.049	.075	**.117*** **	**.133*** **	**.118****	**.146*** **
Competence	.043	.086*	0	0	.054	.107	.004	.008	.088	.125*
Relatedness	.097**	.125***	.027*	.040**	.103	.119	.030	.060	**.110***	**.122****
Total	.005	.009	.058**	.072**	.017	.033	.091**	.108**	.074	.098
Need frustration										
Autonomy	0	0	.079***	.099***	0	0	.095*	.119**	.006	.012
Competence	**.153****	**.170****	0	0	**.213*** **	**.261****	.016	.032	**.137***	**.191***
Relatedness	0	0	.003*	.006*	.014	.028	.021	.029	.107	.126
Total	.056*	.081**	**.181*** **	**.208*** **	.070	.105	**.216*** **	**.236*** **	.089*	.095*

Bolded: Results which are significant ($p<.05$) and meaningful (d>.1) across the two CE and CR measurements

CE-FDH piecewise linear ceiling line, *CR-FDH* continuous ceiling line

*$p<.05$. **$p<.01$. ***$p<.001$

$p<.001$). It must be noted that high frustration of any specific need was not a necessary condition for emotional exhaustion., High total need frustration was also a necessary condition for negative affect (CR: $d=.216$, $p<.001$; CE: $d=.236$, $p<.001$). It must be noted that, again, high frustration of any specific need was not a necessary condition for negative affect.

Study 3

Participants and procedures

Data were collected through an online questionnaire sent to employees in the Norwegian Dental Hygienist Association across two timepoints separated by 6 months. All members at the time ($N=999$ T1 and 989 at T2) received an invitation to participate. At Time 1, 299 participants (29.9%) responded, and 167 of these also responded at Time 2. Because only 167 of the 299 enrolled participants completed the second timepoint, differences in the study variables, age, and gender between groups (completers = 0; dropouts = 1) at Time 1 were assessed. Results from a logistic regression analysis showed that completion status was not associated with any study variables at Time 1 except for competence frustration (OR = 1.75, SE = 0.26, $p=.03$) and cynicism (OR = 0.52, SE = 0.22, $p=.004$). Of the participants at Time 1, the majority were women (96%), and the mean age was 42.7 years (SD = 12.6). In addition, 220 participants were full-time workers, 74 were part-time workers, and 5 participants did not indicate whether they were working full- or part-time.

Measures

Basic psychological need satisfaction and frustration Need-based experiences at work were assessed with the Work-related Need Satisfaction and Frustration Scale (Olafsen et al., 2021), as in Studies 1 and 2. A CFA showed a decent fit ($\chi^2=679$; df = 237; CFI = .90; RMSEA = .07; SRMR = .06) for the measurement model across the six dimensions of need satisfaction and frustration according to established standards in the literature (Hu & Bentler, 1999).

Well-being outcomes Work engagement was assessed with the nine-item version of the Utrecht Work Engagement Scale (Schaufeli et al., 2006), as in Study 2.

Ill-being outcomes Participants rated their level of emotional exhaustion with the five items from the Maslach Burnout Inventory (Maslach et al., 1996) on a scale ranging from 1 (never) to 7 (daily) as in Studies 1 and 2. In addition, the same instrument and response scale were used to capture respondents' level of cynicism (five items; e.g., "I doubt the significance of my work") and sense of personal accomplishment (six items; e.g., "I have accomplished many worthwhile things in this job"; reversed coded). Participants also rated their experience of *somatic symptoms* using the Somatic Symptom Scale-8 (Gierk et al., 2014). They were asked to rate their experiences of the symptoms (e.g., headache, dizziness, trouble sleeping) over the past four weeks on a scale ranging from 0 (not at all) to 4 (very much).

Results

Descriptive statistics, reliabilities, and correlations for Study 3 are shown in Table 6. As in Studies 1 and 2, an overall look at the correlations shows that the sufficiency condition seems to be met for the relationships between the ensemble of the need states and the ensemble of outcomes.

Considering the cross-sectional level of NCA, the results showed that for the well-being outcomes, only low frustration of the needs for autonomy (CR: $d=.105$, $p<.01$; CE: $d=.127$, $p<.01$) and competence (CR: $d=.223$, $p<.01$; CE: $d=.314$, $p<.01$) are necessary conditions for high levels of

work engagement, whereas the other need states are not. Regarding ill-being outcomes, only autonomy frustration has a small effect as a condition for cynicism (CR: d=.196, p<.001; CE: d=.177, p<.001). For somatic health complaints, autonomy frustration (CR: d=.159, p<.001; CE: d=.204, p<.001) as well as low autonomy satisfaction (CR: d=.103, p<.05; CE: d=.130, p<.05) are both necessary conditions, whereas no other needs are necessary. There were no consistently significant and meaningful results for exhaustion and personal accomplishment (Table 7).

Considering the longitudinal level of analysis, the results showed that for the well-being outcome, only competence satisfaction (CR: d=.111, p<.05; CE: d=.111, p<.05) and low autonomy frustration (CR: d=.103, p<.05; CE: d=.126, p<.05) at Time 1 are necessary conditions for reaching higher levels of work engagement at Time 2, whereas no other need states are necessary. In other words, employees could only reach higher levels of work engagement at Time 2 if they had high competence satisfaction and low autonomy frustration at Time 1.

Regarding ill-being outcomes, autonomy frustration (CR: d=.224, p<.01; CE: d=.263, p<.001) as well as low autonomy satisfaction (CR: d=.145, p<.05; CE: d=.217, p<.05) are both necessary conditions for cynicism, whereas no other needs are necessary. In other words, employees would have higher cynicism at Time 2 only if they had low autonomy satisfaction and high autonomy frustration at Time 1. For somatic health complaints, autonomy frustration (CR: d=.121, p<.05; CE: d=.134, p<.05) as well as low autonomy satisfaction (CR: d=.138, p<.05; CE: d=.192, p<.01) are both necessary conditions, whereas no other needs are necessary. In other words, employees would report more somatic complaints at Time 2 only if they had low autonomy satisfaction and high autonomy frustration at Time 1. This finding is consistent with the cross-sectional results. There were no consistently significant and meaningful results for exhaustion and personal accomplishment (Table 8).

Post hoc analyses

Similar to Study 1, we conducted additional analyses on the potential role of total need satisfaction and total need frustration as necessary conditions for well-being and ill-being.

At the cross-sectional level of analysis, for well-being outcomes, low total need frustration (CR: d=.143, p<.05; CE: d=.136, p<.05) was a necessary condition for work engagement. Regarding ill-being outcomes, high total need frustration was a necessary condition for emotional exhaustion (CR: d=.120, p<.01; CE: d=.141, p<.05). It must be noted that high frustration of any specific need was not a necessary condition for emotional exhaustion. Low total need satisfaction (CR: d=.108, p<.05; CE: d=.129, p<.01) and high total need frustration (CR: d=.205, p<.01; CE: d=.209, p<.01) were both necessary conditions for cynicism. It must be noted that low satisfaction of any specific need was not a necessary condition for cynicism.

At the longitudinal level of analysis, for well-being outcomes, no total need satisfaction or frustration as necessary condition was found. For ill-being outcomes, low total need satisfaction (CR: d=.172, p<.01; CE: d=.191, p<.01) at Time 1 was a necessary condition for somatic complaints at Time 2. Moreover, high total need frustration at Time 1 was a necessary condition for emotional exhaustion (CR: d=.187, p<.001; CE: d=.154, p<.001) and cynicism (CR: d=.224, p<.05; CE: d=.276, p<.05) at Time 2. It must be noted that high frustration of any specific need at Time 1 was not a necessary condition for emotional exhaustion at Time 2.

General results

Across these three studies, we have investigated seven well-being outcomes (work engagement in each of the three studies, eudaimonic work well-being in Study 1, positive affect and life satisfaction in Study 2, and work engagement at the longitudinal level in Study 3; for reference, see Tables 9 and 10), and twelve ill-being outcomes (emotional exhaustion in each of the three studies, including a longitudinal measurement in Study 3, work stress in Study 1, negative affect in Study 2, and cynicism, personal accomplishment, and somatic complaints in Study 3 (cross-sectionally and longitudinally; for reference, see Tables 9 and 10). Considering the results across the three studies combined, we find that autonomy satisfaction is shown to be a necessary condition for work engagement and eudaimonic well-being in Study 1 and life satisfaction in Study 2, giving H1a partial support with three out of seven outcomes. Competence satisfaction is shown to be a necessary condition only for work engagement in Study 1 and for work engagement at a second timepoint in Study 3, giving H1b partial support with two out of seven outcomes. Relatedness satisfaction is only a necessary condition for life satisfaction, supporting H1c for one out of seven outcomes. Furthermore, autonomy frustration is a necessary condition for work stress in Study 1, and somatic complaints and cynicism (both cross-sectionally and longitudinally for each outcome) in Study 3, partially supporting H2a with five out of twelve outcomes. H2b and H2c are not supported as competence frustration and relatedness frustration are not related to any significant result.

For the H3a–c concerning lack of need frustration as a necessity for well-being, the combined results showed that low autonomy frustration is a necessary condition for

work engagement (both cross-sectionally and longitudinally) in Study 3, partially supporting H3a with two out of seven outcomes. Low competence frustration is a necessary condition for all well-being outcomes across studies at the cross-sectional level, supporting H3b with six out of seven outcomes. Low relatedness frustration is a necessary condition for work engagement in Study 1, partially supporting H3c with one out of seven outcomes. Finally, considering the H4a–c on lack of need satisfaction as a necessity for ill-being, the combined results showed that low autonomy satisfaction is a necessary condition for negative affect in Study 2, and somatic complaints (both cross-sectionally and longitudinally) and cynicism (longitudinally) in Study 3, partially supporting hypothesis H4a with four out of twelve outcomes. H4b and H4c are not supported as autonomy is the only basic psychological need whose lack of satisfaction is a necessity for ill-being.

As a complementary perspective on the results, the correlation between the need states and the outcomes can, in some occurrences, be consistent with the necessary condition, and inconsistent in other occurrences. For instance, eudaimonic well-being is highly correlated with autonomy satisfaction (r=.63), and high correlation is consistent with autonomy satisfaction being a necessary condition in that case, while relatedness satisfaction is not a necessary condition for that same outcome despite the high correlation between them (r=.54). This inconsistency between necessity and correlation effect size can also be seen in cases where correlations are low, but necessary conditions are present, such as relatedness satisfaction (r=.25) and competence frustration (r =–.25) with life satisfaction, or autonomy frustration with negative affect (r =–.24).

To further our complementary perspectives on the results, post hoc analyses on total need satisfaction and frustration give us some additional insights. We find that high total need satisfaction is a necessary condition for work engagement and eudaimonic well-being in Study 1, making it a condition for well-being for two out of seven outcomes. We also find that high total need frustration is a necessary condition for emotional exhaustion in Studie 2 and 3, both cross-sectionally and longitudinally in the latter case, as well as a necessary condition for cynicism in Study 3, both cross-sectionally and longitudinally, and a necessary condition for negative affect in Study 2, making it a condition for ill-being for six out of twelve outcomes.

By contrast, low total need satisfaction is a necessary condition for cynicism cross-sectionally and somatic symptoms longitudinally in Study 3, making it a condition for ill-being for two out of twelve outcomes. Finally, low total need frustration is a necessary condition for work engagement in Study 3 and eudaimonic well-being in Study 1, making it a condition for well-being for two out of seven outcomes.

It must be noted that there are three cases where high total need frustration is a necessary condition for ill-being outcomes for which frustration of specific needs is not, and one case where low total need satisfaction is a necessary condition for ill-being outcomes for which low satisfaction of specific needs is not.

Discussion

SDT defines the basic needs as necessary conditions for human thriving, flourishing and wellbeing. The purpose of the current study was to utilize NCA to examine this underlying necessity assumption of basic needs in predicting both well-being and ill-being outcomes within the context of work. The main findings across the three included studies are twofold: overall, basic psychological needs, through need states of satisfaction and frustration, are necessary conditions for well-being and ill-being outcomes, but these necessary conditions, while clearly present, are inconsistent across outcomes and studies. Autonomy satisfaction and low competence frustration are the most consistent necessary conditions for well-being. By contrast, low autonomy satisfaction and high frustration are the most consistent necessary conditions for ill-being. For the need for relatedness, only a few meaningful results were observed, yet these highlight its importance for specific outcomes. With this, we offer theoretical, empirical, and methodological contributions to the broader SDT literature, and specifically to the SDT organizational literature.

Theoretical implications

Extensive literature has highlighted the role of basic psychological needs in employees' thriving and wellbeing within the context of work (Deci et al., 2017; Forest et al., 2023; Van den Broeck et al., 2016). Typically, these studies test the association or prediction of basic psychological need satisfaction and frustration in relation to various indicators of wellbeing (e.g., Olafsen et al., 2017; Trépanier et al., 2016; Van den Broeck et al., 2008). The present study goes beyond the common study of associations between basic psychological need states and wellbeing. Rather, it tests the necessary role of satisfaction and frustration of the basic psychological needs for autonomy, competence, and relatedness in employee well-being and ill-being, respectively. Because the very definition of basic psychological needs concerns their necessity for psychological wellbeing (Ryan, 1995), an important theoretical contribution is therefore investigating this foundational premise of SDT. This is particularly

significant as our results demonstrate that correlations alone do not equal necessity as defined by NCA criteria.

Considering the combined results across the three samples, we would generally conclude that there is support for viewing the basic psychological needs as necessary requirements for wellbeing in line with the theoretical postulates. Still, it is clear that the necessity assumption for basic psychological needs varies across both outcomes and samples. Hence, the results portray a more nuanced picture than when strictly following the assumptions and criteria postulated theoretically. Because a core assumption within SDT is that satisfaction of the three basic needs indeed is necessary for people to grow, thrive, and be well, we expected that a minimum level of satisfaction of all three needs would show up as a necessary condition for the various well-being outcomes. However, as the results show that satisfaction of different needs is necessary for different outcomes, the findings give nuance to existing correlational results that tend to show that satisfaction of all three needs is positively associated with indicators of well-being and negatively associated with indicators of ill-being (Van den Broeck et al., 2016). Furthermore, the level of correlation between a need and an outcome is not always consistent with the necessity of that need, with cases of high correlations and the absence of necessary conditions, as well as cases of low correlations and the presence of necessary conditions. However, it is important to note that some of the outcomes are general well being outcomes, where satisfaction in other life domains will also have an impact. Similarly, well being at work does not exist in isolation from other life domains. Non-work -related factors—including need satisfaction and frustration outside of work—can significantly influence both general wellness and work-specific outcomes. For instance, recent research by DeHaan et al. (2024) highlights how personal resources, such as vitality derived from need satisfaction in non-work contexts, can shape work-related variables, including burnout and engagement. This underscores the importance of considering employees' lives holistically, as experiences across life domains may spill over and interact with workplace dynamics.

Similarly, the postulate that need frustration should lead to ill-being is supported for some needs while not for others. An interesting finding is that although need frustration was introduced as a distinct need state with the assumption that need frustration is necessary for ill-being, while lack of satisfaction does not necessarily lead to such negative outcomes, the results from the current study challenge this by showing that low need satisfaction, in particular for autonomy, does have implications for ill-being. This finding opens the possibility of distinguishing needs as dual necessities (e.g., presence of autonomy frustration *and* lack of autonomy satisfaction as conditions of ill-being) and needs as one-sided necessities (e.g., lack of competence frustration as a condition of well-being). The bright and dark paths appear to be closely intertwined, reflecting a complex interplay between positive and negative dynamics. Taken together, these findings underscore the importance of a nuanced approach to theorizing and hypothesis testing when it comes to the role the basic psychological needs in psychological outcomes.

When it comes to distinct needs, both autonomy and competence are necessary for several indicators of wellbeing consistent with their theoretical definition. Although all three needs are postulated as essential nutriments within the theory, the need for autonomy has typically been highlighted as the most important, as it often shows the largest regression estimates (Van den Broeck et al., 2016). The results of the current study indeed highlight autonomy as a pivotal factor for wellbeing, confirming and extending SDT's emphasis on autonomy as crucial for psychological health. In particular, the results of the current study support the notion of the necessity of autonomy, as its satisfaction and lack of frustration were necessary for several well-being indicators. By contrast, both lack of satisfaction and the presence of frustration were necessary for several ill-being indicators. Importantly, the need for autonomy (both its satisfaction and frustration) is the only need necessary for somatic complaints, underscoring the pivotal role of autonomy in addressing adverse outcomes as a result of work.

The findings also reveal the necessity of the need for competence. Especially with regard to the indicators of well-being, the necessity of low competence frustration was the most consistent finding across studies. Relevant to these findings is that most necessary conditions showed up in relation to work-specific well-being indicators, such as work engagement and eudaimonic work wellbeing. These findings imply that supporting the need for competence is especially relevant within a work context.

In contrast to the needs for autonomy and competence, the need for relatedness did not qualify as a necessary condition for any outcomes other than life satisfaction, where the presence of satisfaction was a necessary condition, and work engagement, where low frustration was a necessary condition. In addition, in correlational studies the need for relatedness is generally the weakest predictor (see, for instance, relative weights in Van den Broeck et al., 2016). One reason might be that satisfaction of the need for relatedness can manifest in more subtle and long-term outcomes, such as overall life satisfaction (for which relatedness, in the relative weight analysis in Van den Broeck et al. (2016), was the strongest predictor), rather than in immediate job-related outcomes. These findings may also reflect that work life is not always a primary context for deeper relatedness satisfaction, particularly in roles where tasks are individual or transient

in nature. As such, relatedness needs may be more often fulfilled in other life domains. Moreover, the degree to which work contributes to relatedness satisfaction may depend on its centrality to an individual's life and identity, shaping how strongly relatedness satisfaction influences work outcomes. Yet, avoiding frustration of relatedness proves to be necessary to maintain work engagement. Furthermore, since the finding related to relatedness satisfaction differs from what Ding and Kuvaas (2023) showed in their study, where satisfaction of all three needs was necessary for engagement, it may also come down to the measurement. In the Ding and Kuvaas study, another measurement scale was used that taps into relatedness satisfaction on a more superficial level (e.g., "I get along with people at work") than the scale used in the current study (e.g., "I experience a warm and good feeling with the people I spend time with at work"). In sum, these findings and possible explanations highlight the need for a nuanced approach to understanding how relatedness functions in the workplace. Refining the measurement of relatedness could help in developing a more comprehensive understanding of the necessity of relatedness for well-being at work, aligning empirical findings with theoretical expectations in SDT.

Especially when it comes to the necessity of the presence of need frustration for indicators of ill-being, we did not find many meaningful conditions at a specific need level. A possible explanation could be that the mean value of need frustration is generally low, meaning that very few employees experience high levels of frustration with their basic psychological needs at work. For autonomy frustration, which showed the most necessary conditions in relation to H2a, the mean levels were higher than for the other two needs across all samples, which might support this logic. The same reasoning applies to the lack of need satisfaction, given that the levels of satisfaction oftentimes are quite high, indicating that employees' basic psychological needs tend to be well supported.

When considering the post hoc analysis evaluating the necessity of the needs combined, the results particularly emphasize the ill-being outcomes, in contrast to the patterns observed at the level of individual needs. Indeed, while well-being outcome results at a global need level are relatively consistent with results at a specific need level (i.e., the necessity of one or several needs is reflected at the global level, for ill-being outcomes), there are several cases where lack of total satisfaction or the presence of total frustration is a necessary condition, even though there is no such necessity for specific needs. It might thus be that for ill-being outcomes, the balance of needs (Sheldon & Niemiec, 2006), synergy of needs (Dysvik et al., 2013), or global level of needs (Sánchez-Oliva et al., 2017) is an important perspective to include when evaluating the role of the basic psychological needs for employee wellbeing.

Finally, a note regarding the somewhat inconsistent results observed across the three studies. We generally find more support for the hypotheses in Study 1 than in Studies 2 and 3. According to Dul (2016), NCA is sensitive to data range, with a narrower distribution limiting the method's ability to identify critical conditions. The consistently lower standard deviations for need satisfaction and need frustration, along with higher mean levels of need satisfaction and lower mean levels of need frustration in the Norwegian samples (see Tables 1, 4, 6), may explain why fewer necessary conditions were identified compared to the English sample.

Practical implications

Based on its findings, past SDT-based studies urge managers and organizations to ensure that employees' basic psychological needs for autonomy, competence, and relatedness are satisfied—and not frustrated—to secure their well-being and performance, ultimately supporting the achievement of organizational goals. The findings of the current study do not jeopardize this past practical advice; rather they underscore the significance of this message and offer strengthened as well as nuanced evidence for the role of these basic needs as actual necessities for organizations' goals in securing employee psychological health and well-being.

When looking at ways to improve the well-being of employees at work, managers and organizations must not only consider what may bring satisfaction to their employees but also what may curb frustration, as both sides are distinct necessary conditions. This question becomes even more crucial when considering the highest levels of well-being. Indeed, as the first study shows, the highest levels of work engagement can only be reached with satisfaction at its highest for autonomy and competence, and frustration at its lowest for competence and relatedness. This suggests that without a work context and content that substantially benefit those needs—not only enhancing the positives but also addressing the negatives—employees cannot work at their highest level of engagement. A key condition, in particular for employee well-being, is a non-frustrated need for competence. This means that one of the best ways to ensure that employees feel engaged in their work roles is to improve the parts of their jobs where they may feel that they are failing or not progressing properly.

By contrast, when looking at ways to curb ill-being in the workplace, managers and organizations must prioritize how their employees' need for autonomy is impacted by their work. Here again, it is essential to both enhance what satisfies and address what frustrates the employee, rather than

Table 6 Descriptive statistics, alphas and intercorrelations for the Study 3 variables

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Autonomy satisfaction^{T1}	**.84**															
2. Competence satisfaction^{T1}	.40**	**.84**														
3. Relatedness satisfaction^{T1}	.49**	.30**	**.86**													
4. Autonomy frustration^{T1}	−.54**	−.27**	−.40**	**.84**												
5. Competence frustration^{T1}	−.36**	−.58**	−.39**	.35**	**.89**											
6. Relatedness frustration^{T1}	−.47**	−.20**	−.68**	.49**	.44**	**.89**										
7. Emotional exhaustion^{T1}	−.37**	−.25**	−.28**	.50**	.26**	.32**	**.89**									
8. Cynicism^{T1}	−.51**	−.36**	−.36**	.51**	.37**	.38**	.56**	**.81**								
9. Personal accomplishment $^{T1(r)}$	−.42**	−.46**	−.27**	.24**	.49**	.28**	.19**	.37**	**.81**							
10. Work engagement^{T1}	.51**	.33**	.33**	−.45**	−.31**	−.24**	−.35**	−.53**	−.53**	**.91**						
11. Somatic complaints^{T1}	−.28**	−.22**	−.25**	.37**	.22**	.37**	.64**	.33**	.19**	−.25**	–					
12. Work engagement^{T2}	.43**	.34**	.21**	−.39**	−.23**	−.18*	−.39**	−.53**	−.51**	.72**	−.24**	**.93**				
13. Emotional exhaustion^{T2}	−.42**	−.30**	−.25**	.40**	.31**	.32**	.77**	.48**	.31**	−.24**	.56**	−.43**	**.89**			
14. Cynicism^{T2}	−.44**	−.29**	−.20*	.42**	.24**	.25**	.46**	.72**	.34**	−.51**	.28**	−.65**	.55**	**.82**		
15. Personal accomplishment $^{T2(r)}$	−.21**	−.24**	−.18*	.19*	.24**	.22**	.16*	.18*	.48**	−.41**	.08	−.44**	.17*	.28**	**.89**	
16. Somatic complaints^{T2}	−.33**	−.21**	−.23**	.39**	.23**	.38**	.47**	.30**	.22**	−.18*	.81**	−.25**	.58**	.30**	.11	–
Mean	5.46	6.22	5.80	2.71	1.74	1.88	3.31	3.31	1.62	5.66	1.91	5.62	3.47	2.18	1.64	1.90
Standard deviation	1.06	0.66	0.98	1.29	0.86	1.12	1.40	1.40	0.74	1.12	0.72	1.06	1.46	1.07	0.85	0.70
Skewness	– 0.90	– 0.93	– 1.11	0.80	1.85	1.76	0.51	1.5	1.54	– 1.21	1.08	– 1.21	0.38	– 1.51	2.67	1.22
Kurtosis	0.88	1.14	1.91	0.22	4.94	3.12	– 0.44	2.16	2.36	1.42	1.01	1.9	– 0.55	2.61	10.66	1.95

Alphas on the diagonal. $^{(r)}$: reverse coded

*p<.05, **p<.001

Table 7 Necessary condition analysis (NCA) results for the cross-sectional data of Study 3

Analyzed parameters	Work engagement		Emotional exhaustion		Cynicism		Personal accomplishment		Somatic complaints	
	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH
Need satisfaction										
Autonomy	.073*	.090**	.081***	.090***	.091*	.118**	.191	.256	**.103***	**.130***
Competence	0	0	.021*	.023	.008	.015	.306	.394	.064	.127*
Relatedness	.099**	.133**	0	0	.019	.025	.235	.354	0	0
Total	.104**	.099**	.070***	.080***	**.108***	**.129****	0	0	.085	.122
Need frustration										
Autonomy	**.105****	**.127****	.027*	.035	**.196*****	**.177*****	.277	.304	**.159*****	**.204*****
Competence	**.223****	**.314****	.011*	.013*	.003	.007	.377	.431	.012	.024
Relatedness	.028	.045	0	0	.004	.007	.388	.439	0	0
Total	**.143***	**.136***	**.120****	**.141***	**.205****	**.209****	.190	.247	.119	.160

Bolded: Results which are significant (p<.05) and meaningful (d>.1) across the two CE and CR measurements

CE-FDH piecewise linear ceiling line, *CR-FDH* continuous ceiling line

*p<.05. **p<.01. ***p<.001

Table 8 Necessary condition analysis (NCA) results for the longitudinal data of Study 3

Analyzed parameters	Work engagement		Emotional exhaustion		Cynicism		Personal accomplishment		Somatic complaints	
	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH	CR-FDH	CE-FDH
Need satisfaction										
Autonomy	.042	.054	.072***	.089***	**.145***	**.217***	.342	.454	**.138***	**.192****
Competence	**.111***	**.111***	.028*	.056**	.043	.086	.263	.375	.057	.080
Relatedness	.036	.040	0	0	.048	.067	.275	.420	.042	.065
Total	.043	.054	.088***	.101***	.143	.186*	.144	.205	**.172****	**.191****
Need frustration										
Autonomy	**.103***	**.126***	.070*	.078*	**.224****	**.263*****	.337	.469	**.121***	**.134***
Competence	.069	.087	.014*	.021*	.044	.065	.387	.445	.076**	.087**
Relatedness	.012	.024	0	0	.031	.047	.371	.516	.037	.055*
Total	.026	.035	**.187*****	**.154*****	**.224***	**.276***	.297	.410	.125	.156

Bolded: Results which are significant (p<.05) and meaningful (d>.1) across the two CE and CR measurements

CE-FDH piecewise linear ceiling line, *CR-FDH* continuous ceiling line

*p<.05. **p<.01. ***p<.001

focusing on just one side. Providing employees with opportunities to work on what interests them, involving them in goal setting and decision-making, and ensuring that they do not feel restricted in how their assignments are organized and executed are the best ways to ensure that they maintain good psychological and physical health at work. This matters not just for short-term resolution, but also for long-term prevention. As our results show, frustration and lack of satisfaction of autonomy at a given time can be a necessary condition of ill-being in the long run.

Finally, the mapping of need states as necessary conditions for well-being and ill-being can be a highly useful tool for planning workplace interventions. By highlighting which level of need condition affects which level of outcome, it is possible to target the most relevant necessary conditions according to the goals of the intervention. This enables new forms of articulating intervention content. Specific need states may be the conditions for "unlocking" higher levels of work engagement, whereas other need states may work best as conditions to "anchor" burnout at its lowest level, and others still may "stem" stress from a total spillover. As we have seen through the variety of studies in this research, some necessary conditions are consistent across samples, while others are more specific to distinct samples. In this sense, combining the evaluation of need states with NCA can enable a diagnostic process that comprehensively maps the specific need conditions and well-being profiles of an organization. This approach can help with the needs analysis that prepares the design of an intervention. Overall, the necessity of basic psychological need states should be considered by managers and organizations to maintain and improve the wellbeing of their workforce, with each need having its own distinct impact on different indicators of wellbeing.

Strengths, limitations and future research directions

A major strength of the current research is its three studies, and the range of wellbeing indicators examined. With this, the research provides robust evidence for findings that

Table 9 Summary of NCA results based on need satisfaction hypotheses for well-being and ill-being outcomes

Well-being outcomes	Presence of satisfaction necessity (hypothesis 1)						
	Autonomy (H1a)	Correlations	Competence (H1b)	Correlations	Relatedness (H1c)	Correlations	Total (post-hoc)
Cross-sectional							
Work engagement[S123]	1	(.47 to.61)	1	(.30 to.44)	0	(.33 to.49)	1
Eudaimonic well-being[S1]	1	.63	0	.44	0	.54	1
Positive affect[S2]	0	.28	0	.33	0	.17	0
Life satisfaction[S2]	1	.35	0	.20	1	.25	0
Longitudinal							
Work engagement[S3]	0	.43	1	.34	0	.21	0
Ill-being outcomes	Presence of satisfaction as prevention necessity (hypothesis 4)						
	Autonomy (H4a)	Correlations	Competence (H4b)	Correlations	Relatedness (H4c)	Correlations	Total (post-hoc)
Cross-sectional							
Emotional exhaustion[S123]	0	(–.29 to–.37)	0	(–.13 to −.31)	0	(–.13 to −.28)	0
Cynicism[S3]	0	–.51	0	–.36	0	–.36	1
Personal accomplishment[S3(r)]	0	–.42	0	–.46	0	–.27	0
Work stress[S1]	0	–.21	0	–.31	0	–.19	0
Negative affect[S2]	1	–.24	0	–.19	0	–.11	0
Somatic complaints[S3]	1	–.28	0	–.22	0	–.25	0
Longitudinal							
Emotional exhaustion[S3]	0	–.42	0	–.30	0	–.25	0
Cynicism[S3]	1	–.44	0	–.29	0	–.20	0
Personal accomplishment[S3(r)]	0	–.21	0	–.24	0	–.18	0
Somatic complaints[S3]	1	–.33	0	–.21	0	–.23	1

Results must be significant (p<.5) and meaningful (d>.1) across the two CE and CR measurements to be accounted. [S1]: Study 1; [S2]: Study 2; [S3]: Study 3. [(r)]: reverse coded

are mostly compatible across these samples. The research also encompasses data from two cultural backgrounds and different occupations, enhancing the generalizability of the findings. In addition, the longitudinal design employed in the third study offers valuable insights into the temporal dynamics and stability of the necessity relationships.

Despite these strengths, the research is not without limitations, which should be considered when interpreting its findings. First, the data are correlational, which constrains our ability to draw causal inferences. Second, the research has a relatively low response rate across all studies. This may introduce self-selection bias and affect the robustness of our findings regarding the identified necessary conditions, as it is possible that those who responded differ in meaningful ways from nonrespondents. Indeed, the dropout analysis undertaken for the third study shows that respondents who were high in competence frustration and low in cynicism during the first measurement were significantly less likely to respond to the second measurement. Additional studies attempting to replicate the findings are thus warranted. Third, the scope of the cultural representation in our samples was limited to Western cultures which may affect the applicability of our findings to non-Western settings. Given that SDT postulates the basic needs to be universal necessities, the necessity logic should therefore also be tested in other cultural contexts. Fourth, the occurrences in the results where necessary conditions for an outcome exist at a global level (total satisfaction or frustration), but not at a specific need level, warrant further investigation and theorization. These occurrences would likely benefit from a bifactorial approach to disentangle what is shared between the needs and what is specific to each need in terms of necessity.

Fifth, despite the present research including a variety of wellbeing indicators, future research might test the necessity assumption across other categories of outcomes covered in the definition of a fully functioning employee such as work motivation (i.e., various forms of motivation quality within the SDT motivation continuum), attitudes (e.g., job satisfaction, organizational commitment, turnover intentions), and behaviors (i.e., performance, deviant behaviors, turnover) that are commonly used as outcomes in SDT research within the context of work (Deci et al., 2017; Olafsen et al., 2021; Van den Broeck et al., 2016, 2021).

As we have shown, it is possible to test the necessity assumption for the same outcome across several studies. Future meta-analyses compiling studies and reporting the link between needs and outcomes in terms of effect sizes and correlations (e.g., Van den Broeck, 2016) could additionally report on the necessity condition. In addition, with the addition of need unfulfillment as a third psychological need state

Table 10 Summary of NCA results based on need frustration hypotheses for well-being and ill-being outcomes

Well-being outcomes	Lack of frustration necessity (hypothesis 3)						
	Autonomy (H3a)	Correlations	Competence (H3b)	Correlations	Related-ness (H3c)	Correlations	Total (post-hoc)
Cross-sectional							
Work engagement[S123]	1	(–.32 to −.45)	3	(–.28 to–.38)	1	(–.24 to–.38)	2
Eudaimonic well-being[S1]	0	–.47	1	–.37	0	–.44	1
Positive affect[S2]	0	–.16	1	–.34	0	–.15	0
Life satisfaction[S2]	0	–.27	1	–.25	0	–.30	0
Longitudinal							
Work engagement[S3]	1	–.39	0	–.23	0	–.18	0
Ill-being outcomes	Presence of frustration necessity (hypothesis 2)						
	Autonomy (H2a)	Correlations	Competence (H2b)	Correlations	Related-ness (H2c)	Correlations	Total (post-hoc)
Cross-sectional							
Emotional exhaustion[S123]	0	(.39 to.52)	0	(.26 to.43)	0	(.27 to.39)	2
Cynicism[S3]	1	.51	0	.37	0	.38	1
Personal accomplishment[S3(r)]	0	.24	0	.49	0	.28	0
Work stress[S1]	1	.37	0	.41	0	.37	0
Negative affect[S2]	0	.25	0	.40	0	.29	1
Somatic complaints[S3]	1	.37	0	.22	0	.37	0
Longitudinal							
Emotional exhaustion[S3]	0	.40	0	.31	0	.32	1
Cynicism[S3]	1	.42	0	.24	0	.25	1
Personal accomplishment[S3(r)]	0	.19	0	.24	0	.22	0
Somatic complaints[S3]	1	.39	0	.23	0	.38	0

Results must be significant (p<.5) and meaningful (d>.1) across the two CE and CR measurements to be accounted. [S1]: Study 1; [S2]: Study 2; [S3]: Study 3. [(r)]: reverse coded

(Bhavsar et al., 2020; Huyghebaert-Zouaghi et al., 2021), future research might explore the necessity of unfulfillment in employee wellbeing as it could offer deeper insight into the dynamics of need-based experiences. In particular, this could involve investigating whether need unfulfillment is a necessary condition for ill-being or whether more active frustration must occur. Similarly, in expanding the range of outcomes to also include work attitudes and behaviors, studies could investigate whether need fulfillment is a necessary condition for satisfaction- or dissatisfaction-related outcomes as well as deviant behaviors. This would assume that need unfulfillment is not as debilitating as active frustration, giving rise to suboptimal states such as boredom and decreased engagement, whereas need frustration is likely to contribute to more severe outcomes like burnout and psychosomatic complaints, reflecting a clear pathway to ill-being. In sum, future studies could explore in depth and differentiate which need states are necessary for a wide range of indicators of employee functioning. Finally, NCA offers a unique opportunity to test the necessity criteria of previously proposed candidate needs (e.g., benevolence, purpose, nature), as it enables a test of the very criteria of being labeled a basic psychological need according to SDT.

Conclusion

By utilizing NCA, the current study provides an initial test of the definition of the three basic psychological needs for autonomy, competence, and relatedness within SDT as necessary requirements for psychological wellbeing. By doing so across three studies in the context of work, we advance the understanding of the role of satisfaction and frustration of these needs on employees' wellbeing. The necessity of both autonomy and competence is demonstrated across several outcomes. While the need for relatedness gained less consistent support as a necessary condition for the variety of employee wellbeing indicators, it remains necessary for certain outcomes. The results contribute to a nuanced understanding of basic needs and need states for work functioning, and underscore the importance of a more refined approach to theorizing in future research.

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Consent Informed consent was obtained from all individual participants included in the study.

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