Motivation Science

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Online First Publication, October 25, 2021. http://dx.doi.org/10.1037/mot0000250

CITATION

Morbée, S., Vermote, B., Waterschoot, J., Dieleman, L., Soenens, B., Van den Bergh, O., Ryan, R. M., Vanhalst, J., De Muynck, G.-J., & Vansteenkiste, M. (2021, October 25). Adherence to COVID-19 Measures: The Critical Role of Autonomous Motivation on a Short- and Long-Term Basis. *Motivation Science* . Advance online publication. http://dx.doi.org/10.1037/mot0000250

AMERICAN PSYCHOLOGICAL ASSOCIATION

Motivation Science

© 2021 American Psychological Association
ISSN: 2333-8113

https://doi.org/10.1037/mot0000250

Adherence to COVID-19 Measures: The Critical Role of Autonomous Motivation on a Short- and Long-Term Basis

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To limit the spreading of the SARS-CoV-2-virus, governments worldwide have introduced behavioral measures that require considerable effort from their citizens to adhere to. Grounded in Self-Determination Theory, the present research sought to examine in a study among Belgian citizens the cross-sectional (total $N = 45975$, $M_{age} = 50.42$), week-to-week (subsample 1; $N = 981$, $M_{age} = 41.32$), and long-term (subsample 2; $N = 5643$, $M_{age} = 53.09$) associations between various individual motives to follow government guidelines and their self-reported adherence to these measures. Controlling for COVID-specific concerns and perceived risk for infection, autonomous motivation related positively to citizens' concurrent adherence (total sample), their increased week-to-week adherence during the lockdown (subsample 1), and their persistent adherence during an exit phase (subsample 2). Introjected regulation and external regulation were positively and negatively associated with concurrent adherence, respectively, but had no long-term predictive value. The findings indicate that citizens' autonomous motivation is a robust predictor of adherence, suggesting that politicians, policymakers, and experts do well to adopt a communication style that ongoingly fosters autonomous motivation.

Keywords: COVID-19, motivation, self-determination theory, adherence

Supplemental materials: https://doi.org/10.1037/mot0000250.supp

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Containing the COVID-19 pandemic critically relies on the behavior of the population. Most governments have therefore imposed invasive and long-lasting behavioral measures that interfered with individuals' daily routines and placed substantial constraints on their autonomy. This implies a huge motivational challenge for individuals to keep following the much-needed behavioral measures aimed at containing the spread of the coronavirus. Recruiting citizens' motivation is therefore paramount to facilitate the adoption of new behaviors and foster adherence to these health-based measures (Radel et al., 2017).

A motivational theory that has garnered increasing interest in health care and behavior change is Self-Determination Theory (SDT; Ng et al., 2012; Ntoumanis et al., 2021). Within SDT, a distinction is made between fully internalized (or autonomous) and poorly internalized (or externally controlled) types of motivation (Ryan & Deci, 2020). Autonomous motivation occurs when citizens perceive the

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We have no conflict of interest to disclose.

This work was supported by Research Foundation Flanders (FWO) [Grant 3F023819].

Sofie Morbée, Branko Vermote, Joachim Waterschoot, and Maarten Vansteenkiste developed the study concept and collected data. Sofie Morbée, Lisa Dieleman, Janne Vanhalst, and Gert-Jan De Muynck performed data analysis and interpretation under supervision of Omer Van den Bergh and Maarten Vansteenkiste. Sofie Morbée drafted the manuscript, and all coauthors provided critical revisions. All authors approved the final version of the manuscript for submission.

The authors have complied with the APA ethical standards in the treatment of their sample. The deidentified participant data that support the findings of this study are available from the corresponding author upon reasonable request.

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measures as relevant and congruent with their personal values (e.g., solidarity, health). Importantly, also imposed measures (e.g., by the government) can be internalized if one can identify with their necessity and meaning. However, collective measures can also be experienced as pressuring demands. In that case, citizens follow the measures to avoid a sanction, that is, they display external regulation. In this case, adhering to the measures is typically dependent on the salience of external contingencies. A third type involves introjected regulation, which is in-between autonomous and external regulation: citizens follow the measures, for instance, to avoid guilt or shame or to show that they act as dutiful citizens. Such introjected motives are partially internalized, that is, they are less self-alienating than in the case of external regulation but not as volitional as in the case of autonomous motivation.

Studies in diverse life domains underscore the importance of fostering autonomous motivation, demonstrating its positive effects on well-being, persistence, and performance (e.g., Ng et al., 2012; Ntoumanis et al., 2021). Concerning adherence, more autonomous motivation predicts greater persistence and a lower risk of drop-out among athletes (Sarrazin et al., 2002) and students (Vallerand et al., 1997; Vansteenkiste et al., 2005), more consistent intake of prescribed medications (Williams et al., 1998), and greater care of dental hygiene (Halvari & Halvari, 2006). In addition, autonomous motivation is associated with greater transfer to different contexts (Hagger & Chatzisarantis, 2016), suggesting that adherence to lockdown measures might generalize to adherence to other measures during an exit phase.

Although many studies within SDT have demonstrated that autonomous motivation predicts maintained behavior, the current article is unique because of (a) the type of studied behavior, (b) the broader context which may alter the predictive validity of the motives observed in other studies, and (c) the design. First, much of the work within SDT has studied the dynamics involved in intrinsically motivating activities or activities for which intrinsic motivation constitutes one of the multiple reasons for activity engagement (e.g., sports, learning activities). Yet, following measures or adhering to rules is an activity where intrinsic motivation is notably absent. Although a broad range of studies focused on the internalization of "uninteresting" activities, such as paying taxes (Sheldon et al., 2005) or voting (Losier & Koestner, 1999), as well as on the acceptance of "uninteresting" measures, such as rules at school (e.g., Aelterman et al., 2019) and at home (Vansteenkiste et al., 2014), the internalization of the COVID-19 rules may be more hindered because of their drastic and intrusive nature. Indeed, some of the measures are not only inconvenient (e.g., wearing a mouth mask), but even go against our natural inclinations. For example, the measure to limit social contacts goes against our basic psychological need for relatedness. Also, these decisions were made top-down, with little, if any input or voice by citizens. Because of their intrusive nature and their top-down introduction, these measures are also strongly opposed to other autonomous motives, thereby requiring a thorough rearrangement of our lifestyle. Moreover, although motives underlying the exhibit of health-related behaviors have been well studied, many of these have been focused on specific clinical subgroups (e.g., patients with schizophrenia [Vancampfort et al., 2013]; adult outpatients [Williams et al., 1998]; obese individuals [Williams et al., 1996]). This is one of the first studies in which the motivational basis of health behaviors that have broad social relevance is considered. Also, while many of the health-related behaviors studied in previous research are relevant to the individual (e.g., individual therapy compliance, being more physically active), in the COVID-19 context, these health behaviors also have manifest interpersonal consequences (i.e., you may infect or protect others). These social consequences might make it easier to internalize the measures, but they might also make the measures more morally charged, bringing introjection closer to autonomous motivation on the SDT-continuum. The question, therefore, is whether the earlier obtained effects of introjection and autonomous motivation would by definition generalize to the COVID-19 context. Moreover, external regulation may have a somewhat different effect in the current context because the punishments (e.g., high fines for noncompliance with corona measures) have high informational value (Mulder, 2008), signaling that adherence to the required sanitary behaviors is of utmost importance to protect others. Third, the current study is unique from a methodological perspective as it contains a series of studies, addressing the motivational dynamics concurrently and over time, at the between- and within-person level. The majority of prior SDT-studies were cross-sectional and focused on between-person differences only (see meta-analysis by Ng et al., 2012).

Although researchers did try to explain adherence to the COVID-19 measures by using other theories such as the Protection Motivation Theory (e.g., van Loenhout et al., 2021) or personality theories (Krupić et al., 2021), to our knowledge, there are no published studies that consider the different SDT-based types of motivation as predictors of adherence in the same systematic way as is the case in the presented package of studies in our contribution. However, two SDT-based studies explored the role of autonomous and controlled motivation in the prediction of adherence to one specific COVID-19 measure each, that is the measure to stay at home (Legate & Weinstein, 2021) and the prohibition of social gatherings during the holiday season (Guay et al., in press). The study of Legate and Weinstein (2021) showed that increases in autonomous motivation over time predicted actual time spent at home, while increases in controlled motivation did not contribute. Similarly, rule compliance in the study of Guay and colleagues (in press) was predicted positively by autonomous motivation, while controlled-approach motivation was not a significant predictor. However, adherence was negatively predicted by controlled-avoidance motivation.

Grounded in SDT (Ryan & Deci, 2017), the present research examined whether different types of motivation would differentially predict adherence to the behavioral measures to contain virus spreading, both concurrently (main sample), from week to week (subsample 1), and over time when the lockdown was released and an exit phase had commenced (subsample 2). Understanding which types of motivation are predictive of adherence is of critical importance because policymakers can then adjust their communication strategy to promote desirable types of motivation among citizens (Martela et al., 2021). In doing so, we controlled for the role of citizens' corona-related concerns (in all samples) and their perceived risk of infection (in subsample 2), as concerns (Durazo & Cameron, 2019) and perceived risk (Sidebottom et al., 2018) were found to predict greater adherence in other health care domains. All procedures were approved by the ethics committee of our faculty (N° 2020/37).

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Main Sample: Concurrent Associations

Within a cross-sectional sample, we hypothesized that autonomous motivation would be positively related to adherence, whereas external regulation was expected to yield a negative correlation. Finally, we expected that introjected regulation would be positively associated with adherence, but less robustly compared to autonomous motivation.

Method

Procedure and Sample

On February 3, 2020; a first infection with the SARS-CoV-2 virus was detected in Belgium. As the situation escalated, on March 17 it was decided by the government to declare a lockdown (e.g., avoid contact with the outside world), starting the afternoon of March 18th. Beginning March 19th and continuing until June 7, 2020; an online survey was conducted among Belgian citizens. Participants were recruited through a paid advertising campaign on Facebook, as well as by contacting different organizations (e.g., cultural associations) and media (e.g., online newspapers). After completing an online informed consent form, a total cross-sectional sample of 45975 citizens (71.3% female; M_{age} = 50.42, range = 18–100 years) participated in this survey. No power calculation was performed given the large sample that was collected. Of these participants, 23.2% reported having one or more chronic diseases, placing them at greater risk for negative effects from COVID-19. One-third (32.4%) reported not having a life partner. Finally, 38% did not attend higher education, 38.9% had a bachelor's degree, and 23.1% had a master's degree.

Materials

Motivation to Adhere. People's motivation to adhere to the corona measures was assessed with an adapted version of the Behavioral Regulation in Sport Questionnaire (Lonsdale et al., 2008). After the stem "Over the past week, I've adhered to these measures because", people answered to items for autonomous motivation (4 items; three items measured identified regulation, e.g., ". . . because I find it personally relevant"; and one item measured integrated regulation, e.g., "because these are an expression of my personal values"), introjected regulation (3 items; e.g., ". . . I would feel ashamed if I didn't"), and external regulation (3 items; e.g., ". . . I feel compelled to do so"). Items were rated on a 5-point scale ranging from 1 (*not at all true*) to 5 (*totally true*). To shorten the questionnaire, it was decided on May 4 to remove the items assessing introjected regulation, resulting in a subsample of 24966 people with data on this type of motivation. Internal consistencies were as follows: $\alpha_{autonomous}$ = .82, $\alpha_{introjected}$ = .62, and $\alpha_{external}$ = .75.

Concerns. Three items were developed to assess people's COVID-specific concerns. Following the stem "In the past week during the corona crisis . . .," participants were asked to indicate their concerns (e.g., "I was concerned about . . .") regarding their health, financial situation, and how the situation would evolve. Each item was rated on a scale ranging from 1 (*not at all true*) to 5 (*totally true*). Internal consistency was α = .56.

Adherence to the Measures. People's self-reported adherence was assessed with one item for each of the four most important corona measures introduced in Belgium, that is, "to wash your hands frequently", "to make only essential transfers (e.g., food stores, doctor)," "to avoid contact with the outside world as much as possible", and "to maintain physical distance from others." Participants were asked to indicate on a scale ranging from 1 (*I do not adhere to it at all)* to 5 (*I totally adhere to it*) the extent to which they followed each of the four measures. Internal consistency was α = .75.

Results

Preliminary Analyses

Bivariate Pearson-correlations indicated an ordered pattern of correlations between the motivation subtypes and adherence, with the correlations becoming decreasingly positive as one moves along the continuum from autonomous motivation to external regulation (see Table 1). Moreover, introjected regulation correlated more strongly with autonomous motivation than with external regulation.

Primary Analyses

To identify the unique contribution of the three different types of motivation to adherence, structural equation modeling (SEM) with latent variables and observed indicators was conducted, using the robust MLR estimator in Mplus (Muthén & Muthén, 1998–2012). All predictors were allowed to correlate, whereas the residuals were not correlated. Background characteristics, autonomous motivation, introjection, external regulation, and corona-specific concerns were simultaneously inserted as predictors (see Figure 1). This structural model showed acceptable model fit model (χ2[221] = 20909.10, $p < .001$, RMSEA = .05, CFI = .88, SRMR = .06; Hu & Bentler, 1999). Results indicated that autonomous motivation was uniquely and positively related to adherence, whereas the unique relation for external regulation

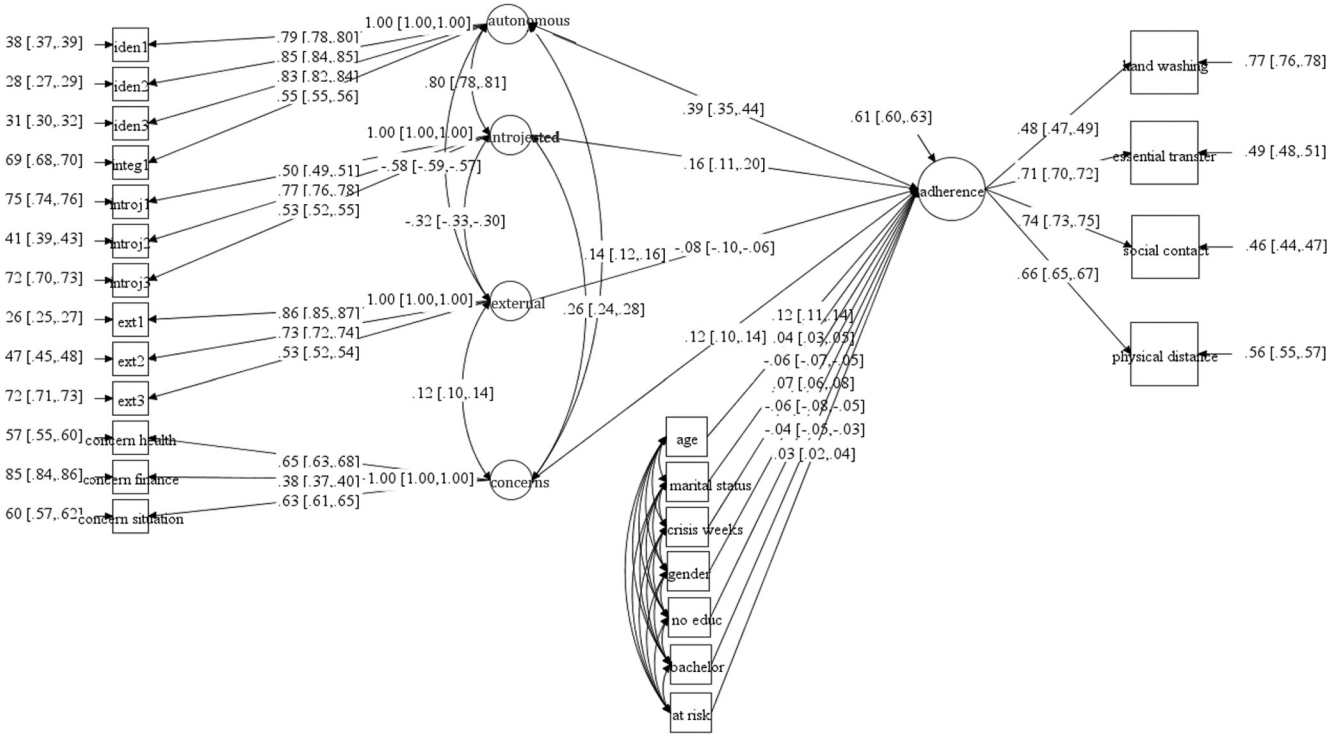
Table 1
Bivariate Pearson Correlations Between the Latent Study Variables (Main Sample)

Variable	*M*	*SD*	1	2	3	4
1. Autonomous motivation	4.02	.80				
2. Introjected regulation	3.53	.88	.79*			
3. External regulation	2.29	.94	−.58*	−.31*		
4. Concerns	3.07	.81	.14*	.26*	.12*	
5. Adherence	4.42	.59	.61*	.55*	−.37*	.21*

* $p \leq .001$.

Figure 1

Adherence Predicted by Behavioral Regulations and Corona-Specific Concerns (Main Sample)



Note. Marital status = life partner vs single; gender = women vs men; no educ = no higher education vs other educational levels; bachelor = bachelor's degree vs other educational levels; at-risk = one or more COVID-related risk factors vs none. Estimates are standardized.

was negative. Unique relations for introjected regulation fell in between. The effect size of this model (R^2 = .39) should be interpreted as large (Cohen, 1988).

Brief Discussion

More internalized forms of motivation related to greater adherence to the behavioral measures, with autonomous motivation being the strongest positive predictor and external regulation being negatively related.

Subsample 1: Week-to-Week Associations

The cross-sectional analyses for the total sample did not allow to investigate whether variation in individuals' motivation would predict variation in adherence over time. Therefore, a subsample was followed up for 10 consecutive weeks to readdress our key hypothesis at both the between- and within-person levels. We expected that within- and between-person differences in motivational regulation would relate to within- and between-person differences in adherence. To illustrate: individuals who were higher on autonomous motivation relative to other people across these 10 weeks were expected to display more overall adherence than people scoring lower on autonomous motivation (i.e., between-person). In addition, individuals were expected to display more adherence during weeks in which their autonomous motivation was elevated (relative to their own baseline; i.e., within-person). Further, we examined whether variations in motivational subtypes predict changes in adherence during the subsequent week.

Method

Procedure and Sample

Of the broader sample gathered in the first week of the study (N = 3284), a subsample (41.63%) gave informed consent for a weekly follow-up assessment allowing for a longitudinal part of the study (N = 1367; 76.8% female; M_{age} = 39.64, range = 18–82 years). Ten data waves were collected and participants could decide each week if they wanted to continue participating in the survey. Of this subsample, 61.1% participated on T2, 54.7% on T3, 52.8% on T4, 47.1% on T5, 46% on T6 assessment, 42.8% on T7, 35.3% on T8, 37.2% on T9, and 36.6% on T10. Participants were only included in the data analysis if they participated twice or more. The final sample included 986 participants (76.3% female; M_{age} = 41.28, range = 18–82 years). From the final sample, 14.7% reported having one or more chronic diseases. One-third (34.3%) reported not having a life partner. Regarding educational status, 17.5% did not attend higher education, 37.1% had a bachelor's degree, and 45.3% had a master's degree. Drop-out analyses indicated that participants who participated twice or more were more likely to be older (OR = 1.03, $p \leq .001$). No differences in motivation or adherence to the measures were found.

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Materials

The same questionnaires were used across ten weeks. The average internal consistency during ten waves was α = .80 (ranging from α_{wave1} = .72 to α_{wave9} = .85) for autonomous motivation, α = .70 (ranging from α_{wave1} = .51 to $\alpha_{wave9\&10}$ = .78) for introjected regulation, α = .82 (ranging from α_{wave1} = .76 to α_{wave5} = .84) for external regulation, α = .57 (ranging from α_{wave1} = .52 to α_{wave10} = .62) for concerns, and α=.67 (ranging from $\alpha_{wave1\&3}$ = .57 to $\alpha_{wave7\&9}$ = .74) for adherence.

Results

Preliminary Analyses

Bivariate Pearson-correlations showed the same patterns between the regulation types and adherence as in the total sample, both at between- and within-person level (see Table 2).

Primary Analyses

Using the MLR-estimator in the lavaan-package in R (Rosseel, 2012), multilevel modeling with latent factors and observed indicators was conducted, to address the nested structure of the data in which the ten waves represented the within-person level (level 1) which were nested within participants, representing the between-person level (level 2). As the lavaan-package automatically separates the within and between components of the level 1 variables, there was no need to center the variables. The predictors were allowed to correlate, whereas the residuals were not correlated. To examine whether there was significant variability in the weekly variables, we estimated intercept-only models, which allow for an estimation of intraclass correlations (ICC). The ICCs indicated that for each study variable, about half of the variance was situated at the within-person level (see Table 2).

To test whether within- and between-person differences in motivational regulation related to within- and between-person differences in adherence, the three regulation types were simultaneously entered as predictors (both at the within- and between-person level) while controlling for relevant background characteristics and corona-specific concerns. The model fit was acceptable (χ2[314] = 1828.59, $p < .001$, RMSEA = .03, CFI = .92, SRMR within = .02 – SRMR between = .09; Hu & Bentler, 1999). The within-person associations indicated that weekly variation in autonomous motivation and introjected regulation related positively to the weekly variation in adherence. At the between-person level, autonomous motivation related positively to adherence, whereas external regulation was negatively related (Table 3, model 1). The effect size at the within-person level (R^2 = .22) should be interpreted as medium and the effect size at the between-person level (R^2 = .35) should be interpreted as large (Cohen, 1988).

To examine the predictive role of motivation over time, we conducted similar models in which the regulation types on a given week (week x) predicted adherence during the subsequent week (week x + 1). Because it was not possible to predict adherence during the week following the tenth week, these analyses were based on a truncated dataset (i.e., nine weeks). The model fit was acceptable (χ2[314] = 1616.27, $p < .001$, RMSEA = .03, CFI = .91, SRMR within = .02 – SRMR between = .09; Hu & Bentler, 1999). When predicting adherence during the subsequent week, the predictive value of autonomous motivation as seen in the first model remained significant, whereas introjected regulation (as seen at the within-person level) and external regulation (as seen at the between-person level) were no longer significant (Table 3, model 2). The effect size at the within-person level (R^2 = .19) should be interpreted as medium and the effect size at the between-person level (R^2 = .34) should be interpreted as large (Cohen, 1988).

Brief Discussion

The results of this week-to-week analysis confirmed and extended the cross-sectional results in various ways. First, between-person differences in autonomous motivation related positively to adherence across the lockdown, whereas between-person differences in external regulation related negatively to adherence. Second, regarding week-to-week variations, adherence was peaking in weeks when autonomous motivation and introjected regulation peaked. Importantly, only the benefits of autonomous motivation were found to last over time.

Subsample 2: Long-Term Benefits for Adherence

A second subsample that was followed up over time allowed us to build on previous analyses in two important ways. First, the findings reported so far applied to the lockdown phase. The question can be raised whether the observed effects of autonomous motivation extend into an exit phase during which individuals' self-control to comply with the measures might be increasingly challenged. For example, social distance is fairly easy when nobody is out on the streets. Yet, when public life gradually resumes, it may be far more effortful to remain compliant with the measures. A second novel aspect is that we aim to test the role of motivation even more conservatively by taking into account citizens' perceived personal and collective risk of infection. Perceived risk is related to, yet distinct from, concerns (Sjöberg, 1998). Whereas the tendency to be concerned is rooted in dispositional negativity and may involve disproportional concerns (Shackman

Table 2

Means, Standard Deviations, Intra-Class Correlations, and Within-Person and Between-Person Correlations Between the Variables of Interest (Subsample 1)

Variable	*M*	*Sd*	Icc	1	2	3	4	5
1. Autonomous motivation	4.22	.68	.41−.61		.69	−.38	.24	.42
2. Introjected regulation	3.36	.91	.47−.62	.48		−.02	.23	.36
3. External regulation	2.36	.95	.56−.58	−.49	.16		−.10	−.18
4. Concerns	2.88	.80	.54−.73	−.11	.21	.37		.20
5. Adherence	4.47	.51	.33−.61	.54	.26	−.35	.00	

Note. Between-person correlations are presented below the diagonal, within-person correlations are presented above the diagonal.

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Table 3
Results of Multilevel Structural Equation Modeling Predicting Concurrent and Subsequent Adherence by Behavioral Regulations and Corona-Specific Concerns (Subsample 1)

	Adherence	
Variable	Model 1 Concurrent adherence (wave x) β (*SE*)	Model 2 Subsequent adherence (wave x + 1) β (*SE*)
Person-level background variables		
Age	.17 (.00)***	.16 (.00)**
Gender[1]	.01 (.02)	.02 (.03)
COVID-related risk factors[2]	.00 (03)	.01 (.03)
Partner[3]	.06 (.02)	.08 (.02)
Educational level (D1)	−.04 (.03)	−.01 (.03)
Educational level (D2)	−.07 (.02)	−.05 (.02)
Person-level predictors		
Autonomous motivation	.47 (.06)***	.54 (.06)***
Introjected regulation	.05 (.02)	−.02 (.03)
External regulation	−.12 (.02)*	−.06 (.02)
Concerns	.13 (.03)**	.12 (.03)*
Within-level predictors (wave x)		
Autonomous motivation	.30 (.04)***	.32 (.05)***
Introjected regulation	.13 (.04)*	.03 (.05)
External regulation	−.06 (.01)	−.06 (.01)
Concerns	.11 (.01)**	.17 (.02)***
$R^2_{between}$	.35	.19
R^2_{within}	.22	.34

Note. D1 = No higher education versus other educational levels. D2 = Bachelor's degree versus other educational levels.
[1] Men versus women. [2] One or more COVID-related risk factors versus none. [3] Life partner versus single.
* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

et al., 2016), perceived risk may reflect an appropriate assessment of the situation in the corona crisis.

We expected that autonomous motivation, as assessed during the lockdown phase, would predict an increase in adherence during the exit phase. An opposite pattern of associations was expected for external regulation. In a more conservative set of analyses, we controlled for adherence and COVID-specific concerns during the lockdown, as well as for the perceived personal and collective risk of infection during the exit phase.

Method

Procedure and Sample

Of the total sample participating in the cross-sectional assessment during the lockdown period, a subsample of 11649 (25.33%) participants was invited to complete a questionnaire during the exit phase. Of this group, 5643 (48.44%) participants gave their informed consent to participate and completed a second questionnaire between July 11 and August 3, 2020; at a moment when government measures were gradually being relaxed. Drop-out analyses indicated that participants who participated during the exit phase were more likely to be older (*OR* = 1.03, $p < .001$), whereas participants who dropped out were more likely to possess a bachelor's degree (*OR* = .84, $p < .001$) or to not have a higher education diploma (*OR* = .71, $p < .001$). No differences in scores on motivational regulations and adherence were present. There were on average 82 days (range = 30–133 days) between completing the questionnaire during the lockdown period and completing the questionnaire during the exit phase. The sample that completed both questionnaires consisted of 70.4% women and had an average age of 53.09 years (range = 18–89 years). A minority of 27% reported having one or more chronic diseases. One-third (32.7%) reported not having a life partner. Regarding educational level, 32.4% did not attend higher education, 40% had a bachelor's degree, and 27.7% had a master's degree.

Material

During the lockdown phase, participants answered the previously described questionnaires that assessed adherence to the measures (4 items, α = .72), autonomous motivation (4 items, α = .82), introjected regulation (3 items, α = .61), external regulation (3 items, α = .75), and COVID-specific concerns (3 items, α = .58). In addition, during the exit phase, the following two concepts were assessed.

Adherence to the Measures. People's adherence was assessed with one item for each of the four most important measures during the exit phase in Belgium. Two measures were the same as during the lockdown, that is, "to wash your hands frequently" and "to maintain physical distance from others." Two other measures differed from those during the lockdown, that is, "to wear a mouth mask when required or recommended" and "to limit social contacts to the maximum number of persons allowed." Participants indicated on a scale ranging from 1 (*I do not adhere to it at all)* to 5 (*I totally adhere to it*) the extent to which they followed each of the four measures. Internal consistency was α = .72.

Perceived Risk. Participants' perceived personal and collective risk of infection during the exit phase was calculated by multiplying the perceived probability of infection by its perceived severity (Wolff et al., 2019). Personal probability and

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severity were assessed with one item each, that is, "What are your chances of getting infected with the coronavirus in the near future?" and "If you were infected with the coronavirus, how serious do you think the consequences would be?." Similarly, collective probability and severity were assessed with one item each: "How high do you estimate the risk of coronavirus infection for the general population?" and "How seriously do you assess the consequences of a coronavirus infection for the population in general?." Each probability item was rated on a scale ranging from 1 (*very small*) to 5 (*very big*), while the severity items were rated on a scale ranging from 1 (*not at all serious*) to 5 (*very serious*). Finally, the 25-point scale created by multiplying the two concepts was rescaled to a five-point scale.

Results

Preliminary Analyses

Bivariate Pearson-correlations (Table 4) indicated that autonomous motivation was strongly and positively correlated with continuing adherence during the exit phase, while the correlations for introjected and external regulation were positive and negative, respectively.

Primary Analyses

To identify the unique contribution of the motivational types during the lockdown period in the prediction of people's adherence during the exit phase, structural equation modeling with latent variables and observed indicators was performed, using the robust MLR estimator in Mplus (Muthén & Muthén, 1998–2012). All predictors were allowed to correlate, whereas the residuals were not correlated. Autonomous motivation, introjection, and external regulation during the lockdown period were inserted simultaneously as predictors. Thereby we controlled for relevant background characteristics, adherence, corona-specific concerns during the lockdown period, and perceived personal and collective risk of infection during the exit phase to examine whether the initial contribution of the different motivational subtypes would remain significant (see Figure 2). This structural model showed acceptable model fit ($\chi 2[354] = 6042.24$, $p < .001$, RMSEA = .06, CFI = .82, SRMR = .08; Hu & Bentler, 1999). Results indicated that autonomous motivation during the lockdown was uniquely and positively related to adherence during the exit phase. No significant relation was found for introjected regulation or external regulation. The effect size of this model ($R^2 = .49$) should be interpreted as large (Cohen, 1988).

Brief Discussion

In this subsample, we examined how motivation, alongside corona-related concerns and risk perceptions predicted continued adherence in the exit phase, during which the government relaxed the behavioral measures. Autonomous motivation related to greater continued adherence to the measures, whereas introjected and external regulation were no longer predictive.

General Discussion and Conclusion

In three series of analyses, we sought to examine how different motivational types for following corona-related measures differentially predict individuals' adherence to these measures. Finding out whether some motivational types are more critical than others in the adherence of the governmentally imposed measures is of vital importance from a prevention perspective because these findings can directly inform policymakers and scientists to adjust their communication pattern to foster the motivation that carries the most positive predictive validity. It is also of scientific interest since it puts to the test in a real-world context some fundamental SDT-assumptions (Ryan & Deci, 2017).

Type of Motivation Matters

Although the motivation to adhere to corona-related measures was critical to contain virus spreading, not all types of motivation are created equal (Vansteenkiste et al., 2006). As predicted within SDT, individuals who experienced greater ownership of governmental measures showed greater adherence and reported less erosion of adherence over time. The pattern of correlates for introjected regulation was similar, yet, less pronounced and less consistent across time. On the other hand, individuals who experienced more external pressure to stick to the measures reported being less adherent. This finding suggests that being motivated via external regulation may backfire, driving individuals away from what is needed (Van Petegem et al., 2015).

The effects of different types of motivation were not only observed at the between-person level but also at the within-person level. As the situation quickly shifted on a week-to-week basis, with new measures being introduced and others being relaxed, it is logical that individuals' motivation underwent ups and downs. Across a 10-week period, a large portion of the variance was

Table 4
Bivariate Pearson Correlations Between the Variables of Interest (Subsample 2)

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Autonomous motivation[a]	4.15	.76							
2. Introjected regulation[a]	3.58	.87	.77***						
3. External regulation[a]	2.17	.92	−.57***	−.27***					
4. Concerns[a]	3.06	.82	.12***	.22***	.13***				
5. Personal risk perception[b]	1.90	.80	.18***	.18***	−.10***	.47***			
6. Collective risk perception[b]	2.74	.94	.30***	.32***	−.18***	.36***	.50***		
7. Adherence[b]	4.43	.58	.50***	.46***	−.35***	.17***	.26***	.40***	
8. Adherence[a]	4.51	.54	.58***	.50***	−.34***	.22***	.19***	.30***	.66***

[a] During lockdown period. [b] During exit phase.
*** $p \leq .001$.

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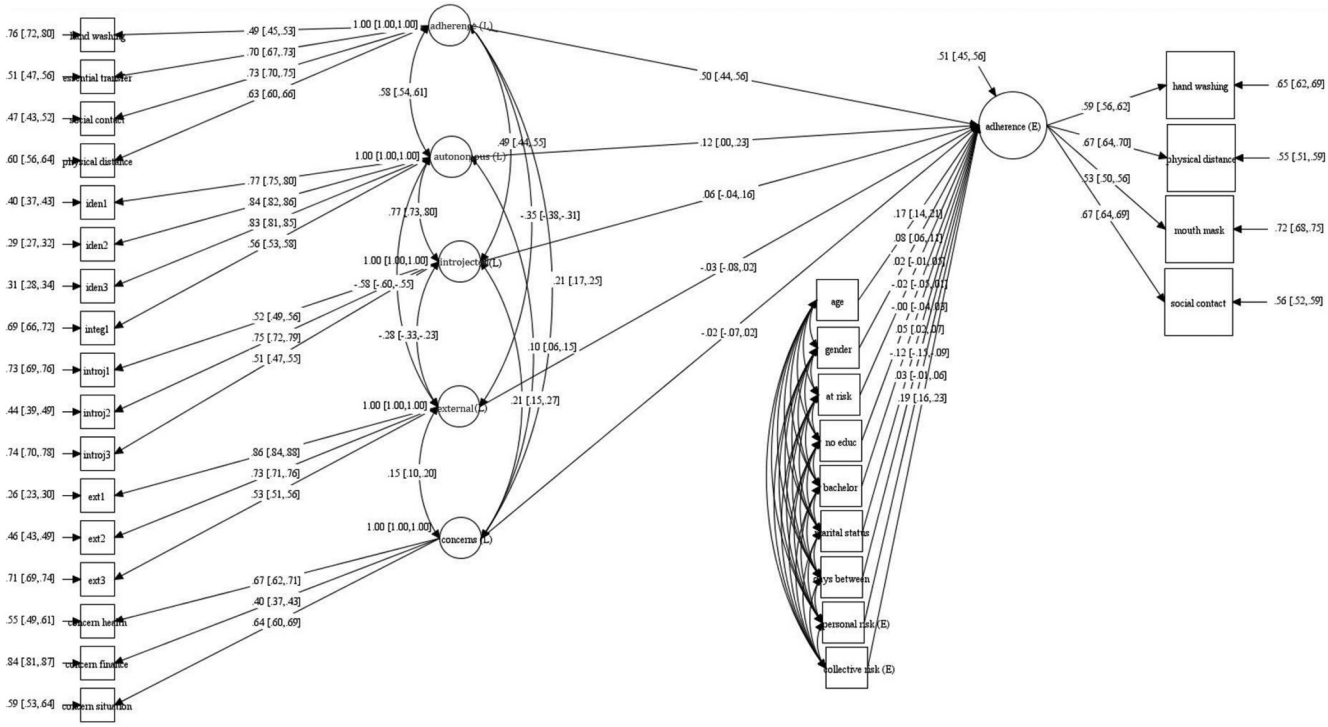
Figure 2

Adherence During the Exit Phase Predicted by Behavioral Regulations, Concerns, Risk Perception, and Adherence During Lockdown Phase (Subsample 2)



Note. Gender = women vs men; at-risk = one or more COVID-related risk factors vs none; no educ = no higher education vs other educational levels; bachelor = bachelor's degree vs other educational levels; marital status = life partner vs single; days between = days between two assessments; (L) = during lockdown phase; (E) = during exit phase. Estimates are standardized.

situated at the within-person level. During weeks that autonomous motivation peaked, individuals reported being more adherent. Likewise, people were more adherent in weeks they reported more introjection. In contrast to introjection, autonomous motivation at one moment was able to predict adherence in the subsequent week and the exit phase. Introjection did not have such lasting effects, demonstrating that introjection can work temporarily, but is less effective in inducing persistent adherence. The fact that autonomous motivation, the strongest predictor of adherence, waxes and wanes across time highlights the importance of persistent communication to support internalization (see Martela et al., 2021 for key communication guidelines).

A number of mechanisms may explain the persistence benefits of autonomous forms of motivation. First, individuals displaying more autonomous motivation may expose themselves less to situations that might seduce them to transgress the rules. To illustrate, those high in autonomous motivation may simply have decided not to extend their social network when it was allowed, making adherence more likely. Second, those with more internalized motives may have been less depleted by their continuous adherence. Evidence suggests that volitional behavior is less depleting than controlled actions (Moller et al., 2006). When people feel that they *have to* control themselves, their self-control is more likely to fall apart because of its demanding nature compared to when they *want* to engage in self-control because they understand its importance (Muraven et al., 2008). Third, when facing difficulty in adhering to the measures, autonomously motivated individuals may have mobilized more adaptive coping mechanisms, such as seeking social support or rehearsing the rationale for the imposed regulations (Smith et al., 2011). Therefore, they could perhaps more easily comply with the imposed measures.

However, we would like to add a nuance here. Although people could identify with the self-importance of adhering to the measure, for instance, to protect their own health, this identification may remain relatively isolated and fails to get deeply integrated. Within Organismic Integration Theory (Ryan et al., 2021), horizontal and vertical aspects of integration are distinguished. Horizontally, integration implies the experience of harmony between different roles and identifies. Clearly, during the first lockdown, several people experienced a lack of harmony or even conflict between different roles. Parents had to take care of the children at home, engage in telework, and stick to the measures. Although they may identify with the importance of each of these roles, they may not necessarily be synthesized. With flexibility allowed by different companies, some parents were better capable to coordinate these different roles. This example suggests that although one may see the value of the measures, adhering to the measures in a consequent way also had implications for other roles. In terms of vertical integration, some individuals may identify with the self-importance of the measures in a more shallow way, thereby primarily seeing the benefit for

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themselves (e.g., protecting their own health). Yet, a deep anchoring of the measures requires a stronger foundation, with the measures being perceived as useful for attaining key life values, such as taking care of others and contributing to the community.

Limitations

Our access to a large sample with multiple measurement points allowed for a detailed and varied set of analyses. However, a major limitation is the use of a survey methodology, which was not accompanied by behavioral observations. Studies of adherence are most compelling when they can tie results to objective outcomes. In this case, outcomes such as travel tracked via GPS, or observations of mask use would improve the quality of assessment. A second limitation is the nonprobability sampling method. Although a representative sample was less critical in this study because we did not aim to report the prevalence, the observed relations might have been partially influenced by a biased sample. Third, to keep the length of the questionnaire feasible, choices had to be made in terms of the variables surveyed. Because it was less relevant to question amotivation in the early stages of the lockdown, the decision to include this variable was taken one month after the start of the survey. This resulted in a limited sample of participants who had reported on all predictors simultaneously, which is why we chose not to include amotivation in our primary analyses (see online supplemental materials for additional analyses with amotivation on a subsample of participants). Similarly, it would have been interesting to split introjected regulation into its approach and avoidance forms (Assor et al., 2009), as introjection approach regulation may yield somewhat more beneficial effects because of its more volitional nature compared to introjection avoidance regulation. Assessing both subcomponents with a more extensive set of items would have allowed us to split both subtypes to examine their differential predictive validity. Finally, this study took place exclusively within Belgium. Governments and cultures around the world vary in terms of regulatory and communicatory practices and citizens' perceptions of trust and legitimacy. Accordingly, generalizing results across nations should be done with caution.

Implications

The findings point to the importance of ownership around imposed measures. Accordingly, fostering internalization can be a focus for health policy and messaging. A growing literature within SDT is detailing strategies to foster greater internalization (e.g., Gillison et al., 2019; Martela et al., 2021). For instance, it is essential to offer a solid rationale for the measures to legitimize its introduction and maintenance in light of the changing situation. As the crisis lasts, politicians could empathize more with the increased effort required from citizens and continue to model the required behavior. Fostering corona awareness by communicating about the personal and collective risks may help citizens to more fully endorse the decision to persist in their efforts. Because motivating communication by the government may not suffice for those high in external regulation, health care workers may need to engage in one-to-one interactions thereby making use of principles of motivational interviewing (Vansteenkiste & Sheldon, 2006) to foster greater autonomous motivation.

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Received April 26, 2021
Revision received August 25, 2021
Accepted August 26, 2021 ■

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