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Anticipated Attention and Procrastination: Nudges, Deadlines, and the Timing of Registration for Occupational Health Support

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# Anticipated Attention and Procrastination: Nudges, Deadlines, and the Timing of Registration for Occupational Health Support*

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**Abstract**

Why do employees act promptly on a health recommendation rather than wait? This paper develops a three-period model in which an employee has two opportunities to register for occupational health support before a deadline. Registration carries an immediate hassle cost, present bias favors postponement, and an employee who waits reconsiders the task later only with some probability. Lowering hassle costs or raising benefit salience at both opportunities shifts registration earlier and raises registration by the deadline. An anticipated improvement in later attention has an ambiguous effect: it helps those who would wait anyway but induces others to replace certain immediate action with uncertain waiting. In a randomized trial at a Japanese employer, a behaviorally informed email increased registration by the deadline by approximately 12 percentage points among allocated employees; daily records show that the difference arose mainly after the first email and narrowed following a company-wide reminder accompanied by supervisor notification. The email thus appears to have primarily shifted the timing of registration, a pattern consistent with reduced hassle costs or greater benefit salience, although the underlying mechanisms cannot be separately identified.

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## 1 Introduction

After workplace health checkups, employees advised to seek additional support may delay registration, even when they eventually register. Such delays can postpone access to occupational health support and require additional reminders or outreach.

Why would an employee act on such a recommendation at the first opportunity rather than wait? If registration costs the same and yields the same benefit whenever it is completed, and if the employee is sure to complete it later, then a present-biased employee may prefer to wait because postponement defers the immediate hassle cost. This is the familiar logic of present bias (Laibson, 1997; O'Donoghue and Rabin, 1999, 2001): an immediate hassle cost weighs more heavily than a delayed benefit, so a simple administrative task is postponed even by someone who values its benefit. Any account of prompt action must therefore specify what is lost by waiting. In this paper what is lost is certainty. An employee who postpones registration must notice the task again before the deadline, and imperfect memory and attention make that uncertain (Ericson, 2017; Altmann, Traxler and Weinschenk, 2022). The same risk is what gives small frictions and the salience of the benefit their leverage over timing (Bhargava and Manoli, 2015). Planning prompts provide another approach to encouraging follow-through (Milkman et al., 2011).

The analysis is closest to Ericson (2017), who combines present bias and imperfect memory in a general dynamic model and shows that anticipated reminders can lead present-biased agents to procrastinate more. The present model is far simpler, with two decision opportunities and one deadline, and this simplicity buys two things. It characterizes behavior by explicit cost thresholds, so that the effect of a communication on the timing of registration can be read off directly. And it separates changes in hassle costs and benefit salience from changes in actual future attention and in beliefs about future attention, the distinction that the trial's daily registration pattern turns out to speak to. Reminders have been studied mainly as a question of whether and when to send them (Karlan et al., 2016; Heffetz, O'Donoghue and Schneider, 2022); here the question is what a communication repeated at both opportunities does to the choice between acting now and waiting.

This paper develops a three-period model with two opportunities to register before a deadline and an incremental benefit realized afterward. Registration carries an immediate hassle cost, and employees may exhibit present bias. Conditional on considering the initial invitation and postponing registration, an employee reaches the later decision opportunity with probability $q$. This attention probability represents reconsideration of the registration task, not completion of registration. The model yields four main results. First, employees with relatively low hassle costs register immediately; those with intermediate costs postpone and register later only if they reconsider the task; and those with sufficiently high costs do not register before the deadline. Second, a common reduction in hassle costs or increase in benefit salience at both opportunities weakly increases immediate and deadline registration. Third, when employees correctly anticipate an increase in future attention, immediate

registration weakly falls but the effect on registration by the deadline is ambiguous: improved follow-through can be offset by induced postponement. Fourth, overestimating the likelihood of future attention can further reduce deadline registration.

The model is motivated by, and is then confronted with, a stratified randomized controlled trial at a Japanese employer (Muto and Ohtake, 2026). Employees were assigned either a behaviorally informed or a standard invitation email on July 5, 2022, and the same assigned email was resent on July 11; the initial emails stated the July 12 registration deadline but did not announce the repetition. In the main stratum, registration by July 12 was 64.7% in the behaviorally informed group and 50.9% in the standard group among employees in the published analytic sample (57.7% and 45.6% of all allocated employees). Daily registration records show that the difference arose mainly in the days after the first email and subsequently narrowed following a company-administered group-task reminder on July 13 that also notified supervisors. By July 20, cumulative registration rates were 89.2% and 89.7% of allocated employees, respectively. These findings suggest that the intervention primarily advanced registration before the initial deadline. Figure 3 displays the daily pattern.

The remainder of the paper is organized as follows. Section 2 describes the trial. Section 3 presents the model. Section 4 derives the main results. Section 5 relates the theoretical predictions to observed registration timing and discusses their implications for future research. Section 6 concludes. Proofs appear in the Appendix.

## 2 The Randomized Trial

The model is motivated by a stratified randomized controlled trial conducted at a Japanese employer (Muto and Ohtake, 2026). The trial evaluated alternative invitation emails encouraging employees to register for an online orientation associated with a workplace health support program. The outcome was completion of registration by a specified deadline, rather than actual attendance at the orientation or subsequent health outcomes. Of 871 allocated employees, 378 and 377 were assigned to the behaviorally informed and standard email groups in the main stratum, respectively. This stratum included employees who had not obtained recommended medical care, had discontinued care, or had not completed follow-up after an initial visit. A separate questionnaire-non-responder stratum included 58 employees in each group.

The assigned emails were sent on July 5, 2022, and repeated on July 11. Two templates were prepared for each stratum, a behaviorally informed version and a standard version, so that four templates were used in total. All four specified July 12 as the registration deadline[§] and provided information on registration procedures and available orientation sessions; none announced the subsequent repetition. The templates assigned to the behaviorally informed groups were more concise

[§] The primary outcome was specified in the trial's statistical analysis plan, although the trial was not prospectively registered.

and action-oriented, placing the registration request, deadline, and registration instructions prominently near the beginning of the message. The standard templates opened with a more extensive motivational explanation of the health-support program before presenting the registration procedures. Thus, the templates differed not only in length but also in information ordering, deadline salience, and the prominence of the requested action. In terms of the channels in Table 2, the behaviorally informed design is most naturally read as lowering the perceived hassle cost of registration and raising the salience of the deadline, but these components were bundled, and the trial did not independently manipulate individual behavioral mechanisms. On July 13, the company issued a group-task reminder to all 871 eligible employees and simultaneously notified their supervisors. The reminder used a concise, action-oriented message highlighting the required action and deadline and remained displayed until the employee clicked the "Complete" button. Because supervisors were notified simultaneously, the reminder may have operated not only through renewed attention but also through accountability or perceived social pressure. Registration remained possible after the stated deadline, and registration status was assessed on July 20.

The final analytic sample comprised 749 employees: 337 and 338 in the two main-stratum groups and 38 and 36 in the questionnaire-non-responder stratum. Two allocated employees declined participation, and 120 remained unregistered by July 20. In the main stratum, exclusions from the final analysis were 41/378 (10.8%) and 39/377 (10.3%), respectively. Although the exclusion proportions were similar, selection based on post-randomization registration status may affect comparisons between the analyzed groups.

Among employees included in the final analytic sample, registration by July 12 was 64.7% in the behaviorally informed email group and 50.9% in the standard email group in the main stratum, an unadjusted difference of 13.8 percentage points (approximate standard error, 3.8 percentage points; 95% confidence interval, 6.4–21.2 percentage points). The reported adjusted odds ratio was 1.81 (95% confidence interval, 1.32–2.47). Because the final analytic sample excluded employees who declined participation or remained unregistered by July 20, this comparison is not an intention-to-treat estimate for the full allocated population.

## 3 Model

### 3.1 Timing and Preferences

The model has three periods, $t \in \{0,1,2\}$, with two decision opportunities before a registration deadline. Period $t = 0$ represents the initial decision opportunity associated with the first invitation email, $t = 1$ the later opportunity associated with the repeated email and approaching deadline, and $t = 2$ the realization of the incremental benefit of timely registration (Table 1). In the trial, employees could register at any time from July 5 to July 12. The model compresses this continuous window into two discrete decision points for analytical tractability.

The model focuses on registration before the early deadline and does not explicitly represent subsequent registration decisions. The payoff from missing that deadline is normalized to zero, and $B > 0$ denotes the incremental benefit of timely registration relative to that normalized alternative. The normalization does not imply that employees who miss the deadline necessarily register later; some allocated employees remained unregistered at the later follow-up date.

Registration at either decision opportunity entails an immediate hassle cost $C > 0$, capturing time and effort in accessing the registration system, selecting an orientation session, and interrupting work. Perceived relevance of the benefit is represented by a salience parameter $s \in (0,1]$. The baseline model assumes that $C$ and $s$ are identical at both decision points.

Employees have quasi-hyperbolic preferences with $0 < \beta < 1$. The model abstracts from conventional exponential discounting by setting $\delta = 1$. As the intervals between the modeled periods represent different calendar durations, this normalization sets aside differences in conventional discounting and isolates present bias and imperfect attention.

Define $b \equiv \beta sB$. At $t = 1$, registration entails the immediate cost $C$ and produces a benefit at $t = 2$, so the utility evaluated at $t = 1$ is

$$U_1 = -C + b.$$

Likewise, the utility of immediate registration evaluated at $t = 0$ is

$$V_0 = -C + b.$$

With conventional discounting set to one, registration at either decision point yields the same perceived later benefit, whereas the registration cost is incurred immediately at the point chosen. Postponement changes the cost's timing: from the perspective of $t = 0$, the registration cost incurred at $t = 1$ is a future cost and is weighted by $\beta$. This creates an incentive to postpone registration.

### 3.2 Imperfect Attention and the Value of Waiting

The baseline model conditions on the employee having considered the initial invitation at $t = 0$. Arrival at this first decision point is thus assumed, not modeled probabilistically; the assumption does not imply that every employee in the trial opened or noticed the first email.

Conditional on postponing registration, the employee reaches the second decision opportunity with probability $q \in [0,1]$, the *attention probability*. It captures noticing the repeated email, recalling the registration task, or otherwise reconsidering the decision. It is not the probability of completing registration. When deciding whether to act at $t = 0$, the employee anticipates some possibility of reconsidering registration before the deadline. This assumption does not require advance knowledge of the repeated email, which was not announced in the initial invitation. The baseline employee accurately anticipates $q$ and her preferences at $t = 1$. Conditional on reaching that later decision point, she registers if and only if $C \leq b$. The expected value of waiting, evaluated at $t = 0$, is

$$W_0 = q\,\mathbf{1}\{C \le b\}\,\beta(sB - C) = q\,\mathbf{1}\{C \le b\}(b - \beta C).$$

Here $\mathbf{1}\{\cdot\}$ is an indicator function. The present-bias parameter $\beta$ discounts the future benefit under both immediate registration and waiting, as reflected in $b = \beta sB$. The difference is that postponement also moves the registration cost into the future: the cost enters the value of waiting as $\beta C$, whereas the cost of immediate registration enters as $C$.

The employee chooses immediate registration when $V_0 \ge \max\{0, W_0\}$, with ties resolved in favor of immediate registration. Because the model conditions on consideration of the initial invitation, its aggregate predictions need not correspond directly to rates in the full trial population, which may include employees who did not initially attend to the invitation.

### 3.3 Communication and Aggregate Outcomes

The model considers three potential behavioral channels through which communication may affect registration decisions: hassle costs, benefit salience, and future attention (Table 2). The channels are examined separately; Section 2 explains why the trial does not identify them separately.

The effective hassle cost is bounded below by zero, while benefit salience and the attention probability are bounded above by one. The hypothetical parameter changes are therefore defined as

$$C' = \max\{0, C - \Delta_C\}$$
$$s' = \min\{1, s + \Delta_s\}$$

and

$$q' = \min\{1, q + \Delta_q\},$$

where $\Delta_C, \Delta_s, \Delta_q \ge 0$.

In the baseline comparative-static analysis, changes in hassle costs and benefit salience apply at both decision opportunities. Changes in future attention are examined separately, with Proposition 3 assuming that employees correctly anticipate the change.

Suppose baseline hassle costs $C$ vary across employees with cumulative distribution function $G$ and density $g$ on $(0, \infty)$; other parameters are common for exposition. Let $E_0$ denote the immediate-registration proportion and $\mathcal{R}$ the proportion registered by the early deadline. The latter corresponds to the trial's primary outcome.

## 4 Analysis

### 4.1 Timing of Registration

**Proposition 1 (Timing of registration).** Suppose $0 < \beta < 1$ and $0 \le q \le 1$. Define

$$\kappa_0(q) = \frac{b(1-q)}{1-\beta q}, \qquad \kappa_1 = b.$$

Then: (i) an employee with $C \leq \kappa_0(q)$ registers immediately at $t = 0$; (ii) an employee with $\kappa_0(q) < C \leq \kappa_1$ postpones registration and registers at $t = 1$ with probability $q$; (iii) an employee with $C > \kappa_1$ does not register before the deadline.

The immediate-registration threshold is strictly decreasing in $q$, with $\kappa_0(0) = b$ and $\kappa_0(1) = 0$. The later-registration threshold $\kappa_1$ is strictly increasing in $\beta$, while the immediate-registration threshold $\kappa_0(q)$ is strictly increasing in $\beta$ for $q < 1$.

Aggregate rates are

$$E_0 = G\big(\kappa_0(q)\big), \qquad \mathcal{R} = (1-q)G\big(\kappa_0(q)\big) + qG(\kappa_1).$$

See Figure 1 for a schematic representation of the three cost regions.

Three observations follow. First, with $q = 1$, later consideration is certain and, for $0 < \beta < 1$, an employee who would register later strictly prefers postponing the immediate cost. Second, for $q < 1$, the intermediate postponement region shrinks as present bias vanishes ($\beta \to 1$); without present bias, a person willing to register has no cost-based incentive to postpone a decision that entails a risk of forgetting. Third, a lower $\beta$ reduces $\kappa_1$ and, for $q < 1$, also reduces $\kappa_0(q)$. Individuals with $b < C \leq b/\beta = sB$ would find later registration worthwhile under a time-consistent evaluation but decline it under actual present-biased preferences.

### 4.2 Friction and Salience

**Proposition 2 (Common reduction in friction or increase in salience).** Suppose a hypothetical change lowers effective registration costs by $\Delta_C \geq 0$ and/or increases benefit salience by $\Delta_s \geq 0$ at both decision opportunities, with costs floored at zero and salience capped at one, while keeping $q$ fixed. Then:

(i) No employee who registers at $t = 0$ under the baseline parameters switches to waiting under the change; no employee willing to register at $t = 1$ under the baseline parameters becomes unwilling.

(ii) The immediate-registration rate $E_0$ and deadline registration rate $\mathcal{R}$ both weakly increase. Each increase is strict when the baseline cost distribution assigns positive probability to newly eligible cost values with a positive weight in the corresponding aggregate registration rate.

To clarify the effect of the cost reduction, let $b' = \beta s' B$. Expressed in terms of the original hassle cost $C$, the new immediate- and later-registration cutoffs are

$$\tilde{\kappa}_0(q) = \Delta_C + \frac{b'(1-q)}{1-\beta q}$$

$$\tilde{\kappa}_1 = \Delta_C + b'$$

Both cutoffs weakly increase when hassle costs fall or benefit salience rises, holding future attention fixed. Consequently, immediate and deadline registration weakly increase. The monotonicity holds even when employee characteristics are heterogeneous, because each individual's deadline-registration probability weakly increases. The algebraic proof is in the Appendix.

The assumption that the change applies at both decision opportunities matters. A reduction in cost confined to $t = 1$ could increase the attractiveness of waiting without changing the immediate-registration payoff, thereby inducing postponement. The result also extends to time-consistent preferences $\beta = 1$, subject to the specified tie-breaking rule; a positive email effect does not by itself establish present bias.

### 4.3 Future Attention and Procrastination

**Proposition 3 (Anticipated increase in attention).** Suppose a hypothetical change increases the attention probability from $q$ to $q' > q$, with $0 \leq \mathrm{q} < q' \leq 1$, and employees correctly anticipate this increase. Costs and salience remain unchanged. Then:

(i) Immediate registration $E_0$ weakly falls, while the share newly registering at $t = 1$ weakly rises.

(ii) The effect on deadline registration is

$$\Delta\mathcal{R} = (q' - q)\big[G(\kappa_1) - G\big(\kappa_0(q)\big)\big] \\ -(1 - q')\big[G\big(\kappa_0(q)\big) - G\big(\kappa_0(q')\big)\big],$$

whose sign is ambiguous. The first term represents improved follow-through among employees who would wait under either regime. The second represents lost deadline registrations among those induced to move from immediate registration to waiting. The same change can make the future opportunity more likely while also making postponement more attractive.

**Uniform-cost illustration.** Suppose $C \sim \mathrm{Uniform}[0, \bar{C}]$ with $\bar{C} \geq b$. Then

$$\frac{\mathcal{R}(q)}{G(b)} = q + \frac{(1 - q)^2}{1 - \beta q}.$$

The normalized registration rate equals one at $q = 0$ and $q = 1$, is lower in between for $0 < \beta < 1$, and has a unique interior minimum at

$$q^* = \frac{1 - \sqrt{1 - \beta}}{\beta}.$$

For $\beta = 0.7$, $q^* \approx 0.65$ and the minimum is approximately 87.5% of its level at either endpoint. Figure 2 illustrates this relationship. A U shape is not a general implication for arbitrary cost distributions.

### 4.4 Optimistic Beliefs and Partial Naiveté

Let $\hat{q} \in [q, 1]$ denote perceived future attention and $\hat{\beta} \in [\beta, 1]$ the perceived present-bias parameter of the future self.

**Proposition 4 (Optimistic beliefs).**

(i) An employee registers at $t = 0$ if and only if $C \leq \kappa_0(\hat{q})$. Actual deadline registration is

$$\mathcal{R}(q, \hat{q}) = (1 - q)G\big(\kappa_0(\hat{q})\big) + qG(\kappa_1),$$

which is weakly decreasing in $\hat{q}$. Relative to accurate beliefs about attention, the reduction is

$$\mathcal{R}(q, q) - \mathcal{R}(q, \hat{q}) = (1 - q)\big[G\big(\kappa_0(q)\big) - G\big(\kappa_0(\hat{q})\big)\big] \geq 0.$$

(ii) With equal registration costs at both opportunities, $\hat{\beta}$ affects planned future registration but not the initial registration decision or realized deadline registration, holding actual preferences and attention fixed. For $b < C \leq \hat{\beta}sB$, the employee plans to register if attentive at $t = 1$ but does not actually register then.

(iii) Holding $\hat{q}$ fixed, raising actual $q$ weakly raises $\mathcal{R}$; holding actual $q$ fixed, raising $\hat{q}$ weakly lowers $\mathcal{R}$.

This proposition distinguishes actual future attention from beliefs about future attention. Improving actual attention may have its beneficial effect partly offset if an intervention also induces greater optimism about follow-through. The result concerning $\hat{\beta}$ depends on identical registration costs; with different future costs, beliefs about future willingness may affect the initial decision. Overestimation of future self-control corresponds to partial naiveté in the sense of O'Donoghue and Rabin (2001), while evidence of overconfidence about prospective memory provides related motivation (Ericson, 2011).

**4.5 Registration Rates and Welfare**

Registration by the deadline is the principal behavioral outcome, but is not itself a measure of employee welfare. Two evaluation criteria are considered: the expected utility of the self, retaining present bias, and a time-consistent benchmark that removes present bias while holding benefit salience fixed. Neither is assumed to measure objective health benefits.

For a sophisticated employee who correctly anticipates future attention, an exogenous, costless increase in $q$, holding other parameters fixed, weakly increases maximum expected utility evaluated at $t = 0$. Even when deadline registration declines, employees who switch from immediate registration to waiting do so because the latter is more attractive according to that evaluation. The conclusion need not hold for employees who have inaccurate beliefs about future attention; optimistic beliefs can encourage postponement based on an incorrect expectation and reduce actual expected utility.

Under the time-consistent benchmark $\beta = 1$, registering at the later opportunity is worthwhile when $C \leq sB$, whereas the present-biased employee registers then only when $C \leq \beta sB$. Consequently, present bias may prevent registration among employees with $\beta sB < C \leq sB$, even though registration would yield nonnegative net surplus under the specified time-consistent valuation. This benchmark holds benefit salience fixed and should not be interpreted as a measure of objective health benefits.

Within the maintained model, reducing the actual hassle cost at both opportunities weakly improves expected utility under either criterion, holding other parameters fixed. Increases in salience alter perceived utility but should not automatically be equated with objective welfare gains.

## 5 The Model and the Trial

Figure 3 illustrates the timing of registration in the trial. Cumulative registration in the behaviorally informed group rose faster than in the standard group after the first email, while the between-group difference changed little following the repeated email. The registration rates subsequently converged following the company-wide group-task reminder on July 13, which was accompanied by supervisor notification. Section 5.1 examines registration by the initial deadline, and Section 5.2 relates registration timing before that deadline to the model's predictions.

### 5.1 The Primary Outcome

In the main stratum, registration by July 12 was 64.7% in the behaviorally informed email group and 50.9% in the standard email group within the published analytic sample, an unadjusted difference of 13.8 percentage points (approximate standard error, 3.8 percentage points; 95% confidence interval, 6.4–21.2 percentage points). The analytic sample excluded employees who declined participation or remained unregistered by July 20, so this contrast is not an intention-to-treat estimate for the full allocated population. Using all allocated main-stratum employees as denominators, the rates were 57.7% and 45.6%, a difference of 12.0 percentage points. The two comparisons are close because exclusions were similar across groups (Section 2).

The model's deadline-registration rate corresponds conceptually to the primary outcome, although the model conditions on employees who considered the initial invitation, whereas the allocated population may include employees who did not notice the first email. Proposition 2 predicts weakly higher deadline registration from reducing costs or increasing salience at both opportunities, holding attention fixed, and Proposition 3 predicts an ambiguous effect when employees correctly anticipate improved future attention. The observed pattern is compatible with the former; because the email components were bundled and the behavioral parameters were not measured, however, it does not identify any single channel.

Registration after the deadline is equally informative. Of the 871 allocated employees, 120 remained unregistered by July 20 and two declined participation. In the main stratum, 119 employees in the behaviorally informed group and 166 in the standard group registered between July 13 and July 20, after the company-administered group-task reminder, so that cumulative registration by July 20 was 89.2% and 89.7% of allocated employees (Table 4; Figure 3). These findings suggest that the behaviorally informed email primarily advanced registration before the initial deadline, while cumulative registration rates were similar by July 20. Because the company-administered group-task reminder was issued to all eligible employees with simultaneous supervisor notification, its separate

causal effect on the convergence cannot be identified. The model's normalization of the payoff from missing the early deadline does not imply universal eventual registration.

In the questionnaire-non-responder stratum, registration by July 12 was 31.6% with the behaviorally informed email and 22.2% with the standard email in the final analytic sample (adjusted odds ratio 1.64; 95% confidence interval 0.57–4.95). With 38 and 36 analyzed employees, respectively, the between-group difference in this stratum is imprecisely estimated, and the data do not establish differences in treatment effects between the two strata.

**5.2 Predictions on Registration Timing before the Deadline**

Table 3 summarizes comparative-static predictions for new registrations during each interval and cumulative registration by the deadline. The calendar intervals approximate the two decision opportunities in the model, whereas employees in the trial could register continuously throughout the registration window.

Individual-level registration dates were available for all 749 employees in the final analytic sample; employees not registered by July 20 are treated as having no registration. Table 4 and Figure 3 summarize registration timing in the main stratum using all allocated employees as denominators, which is the quantity to which Table 3 refers. Between July 5 and July 10, 37.8% of the behaviorally informed group and 26.3% of the standard group registered, a difference of 11.6 percentage points. Between July 11 and July 12, after the repeated email, new registrations were 19.8% and 19.4%, respectively, essentially identical.

Conditional on remaining unregistered at the beginning of July 11, the proportions registering during July 11–12 were 31.9% (75/235) and 26.3% (73/278). These conditional proportions are affected by post-randomization selection, because the populations remaining unregistered after the first interval differ across groups, and are reported only for completeness.

This pattern is qualitatively consistent with the first row of Table 3: a higher share of new registrations in the first interval, a roughly unchanged share in the second, and a higher cumulative rate by the deadline, as is possible under a common reduction in hassle costs or increase in salience with attention held fixed. It is less consistent with the second row, which predicts a weak decrease in immediate registration when an improvement in future attention is correctly anticipated. An unanticipated improvement in future attention alone, as described in the third row, would leave immediate registration unchanged and therefore cannot explain the early divergence. Thus, the observed timing pattern is more consistent with the first mechanism than with either attention-only mechanism considered separately. The comparison is descriptive rather than a test of mechanisms: the intervention components were bundled,

employees could register throughout the window, and the two intervals differ in duration. Future studies could distinguish the mechanisms more directly by independently randomizing communication components, varying reminder timing, and collecting direct measures of attention and of beliefs about future attention.

## 6 Conclusion

This paper asks why an employee registers promptly for occupational health support rather than postponing. Within the maintained three-period model, present-biased employees may register immediately when waiting entails a risk of failing to reconsider the task. Employees sort by hassle cost into immediate registrants, those who postpone, and those who do not register before the deadline.

In the model, changes in hassle costs, benefit salience, and future attention affect this sorting. A common reduction in costs or increase in salience weakly raises immediate and deadline registration. An increase in future attention, when correctly anticipated by employees, weakly reduces immediate registration but has an ambiguous effect on registration by the deadline, reflecting the opposing effects of improved later follow-through and induced postponement.

The trial motivates the setting but does not separately identify these channels. Its daily registration records nevertheless show the pattern the model is built to interpret: the behaviorally informed email raised registration before the deadline, mainly in the days after the first email, while registration by a later date was nearly identical across groups once the company had issued a group-task reminder to all eligible employees and simultaneously notified their supervisors. The findings suggest that the email primarily advanced registration before the initial deadline, while cumulative registration rates were similar by the later follow-up date. The model's value is to clarify distinct predictions for initial registration and registration by a deadline, and to inform future designs with independently randomized components and direct measures of attention and beliefs.

## Appendix: Proofs

**Notation and maintained assumptions.** Set $\delta = 1$ throughout, and let $0 < \beta < 1$, $B > 0$, $0 < s \leq 1$, $C > 0$ and $0 \leq q \leq 1$. Write $b = \beta s B$. An employee registers immediately in the case of indifference. The same hassle cost applies at both opportunities unless explicitly stated. Let $G$ denote the baseline hassle cost distribution; for the uniform-cost example, $C \sim \text{Uniform}[0, \bar{C}]$ with $\bar{C} \geq b$.

**Proof of Proposition 1 (Timing of registration)**

At $t = 1$, a decision maker who reaches the later decision point registers exactly when $U_1 = -C + b \geq 0$, or $C \leq b$. If she waits at $t = 0$, her expected value is $W_0 = q\,\mathbf{1}\{C \leq b\}(b - \beta C)$; immediate registration is worth $V_0 = b - C$.

When $C > b$, immediate registration has negative utility and the later self would not register; the employee therefore does not register before the deadline. When $C \le b$, $W_0 \ge 0$. Immediate registration is chosen if and only if $V_0 \ge W_0$, equivalently,

$$b - C \ge q(b - \beta C) \quad \Leftrightarrow \quad C(1 - \beta q) \le b(1 - q).$$

Since $1 - \beta q > 0$, the initial threshold is $\kappa_0(q) = b(1 - q)/(1 - \beta q)$, and $\kappa_1 = b$. Differentiating,

$$\frac{\partial \kappa_0}{\partial q} = -\frac{b(1-\beta)}{(1-\beta q)^2} < 0,$$

$$\frac{\partial \kappa_0}{\partial \beta} = \frac{sB(1-q)}{(1-\beta q)^2}, \qquad \frac{\partial \kappa_1}{\partial \beta} = sB > 0.$$

The derivative of $\kappa_0$ with respect to $\beta$ is strictly positive when $q < 1$ and equals zero at $q = 1$. Integrating over $C$ gives $E_0 = G\big(\kappa_0(q)\big)$ and $\mathcal{R} = (1 - q)G\big(\kappa_0(q)\big) + qG(\kappa_1)$.

**Proof of Proposition 2 (Common reduction in friction or increase in salience)**

Write $C' = \max\{0, C - \Delta_C\}$ and $s' = \min\{1, s + \Delta_s\}$, with $\Delta_C, \Delta_s \ge 0$, and let $b' = \beta s' B \ge b$. Expressed in the original cost $C$, the new thresholds are

$$\tilde{\kappa}_0 = \Delta_C + \frac{b'(1-q)}{1-\beta q}, \qquad \tilde{\kappa}_1 = \Delta_C + b'.$$

The threshold expressions remain valid with costs floored at zero: employees with $C \le \Delta_C$ have zero effective hassle cost and choose immediate registration under the tie-breaking convention. Because $\tilde{\kappa}_0 \ge \kappa_0$ and $\tilde{\kappa}_1 \ge \kappa_1$, no initial registrant switches to waiting and no later willing registrant becomes unwilling. Thus,

$$E_0{}' = G(\tilde{\kappa}_0) \ge G(\kappa_0) = E_0,$$

$$\mathcal{R}' - \mathcal{R} = (1-q)[G(\tilde{\kappa}_0) - G(\kappa_0)] + q[G(\tilde{\kappa}_1) - G(\kappa_1)] \ge 0.$$

The increase in $E_0$ is strict if $G$ assigns positive mass to $(\kappa_0, \tilde{\kappa}_0]$. The increase in $\mathcal{R}$ is strict if $q < 1$ and that interval has positive mass, or if $q > 0$ and $(\kappa_1, \tilde{\kappa}_1]$ has positive mass. Individual monotonicity also establishes the aggregate result under heterogeneity in $C, B, s, \beta, q$, provided costs and salience move in the specified directions and actual attention remains unchanged.

For $\beta = 1$, if $q < 1$, an employee with $C \le sB$ registers immediately. If $q = 1$, immediate and delayed registration are indifferent for employees willing to register; the tie-breaking rule selects immediate registration. Thus, the monotonicity extends to the time-consistent case, although the $\kappa_0$ formula should not be evaluated mechanically at $\beta = q = 1$.

**Proof of Proposition 3 (Anticipated increase in attention)**

Let $q' > q$ be the new correctly anticipated attention probability, $q' \leq 1$. Because $\kappa_0(q)$ falls as $q$ rises and $\kappa_1 = b$ is fixed, immediate registration weakly falls. Later registration is $q\big[G(b) - G\big(\kappa_0(q)\big)\big]$, which weakly increases in $q$. The change in deadline registration decomposes as

$$\Delta\mathcal{R} = (q' - q)\big[G(b) - G\big(\kappa_0(q)\big)\big] \\ -(1 - q')\big[G\big(\kappa_0(q)\big) - G\big(\kappa_0(q')\big)\big].$$

The first term is the gain in follow-through among those who wait regardless of the change; the second is the loss among employees induced to switch from immediate registration to waiting. The sign need not be positive.

For $C \sim \text{Uniform}[0, \bar{C}]$ with $\bar{C} \geq b$,

$$\frac{\mathcal{R}(q)}{G(b)} = q + \frac{(1-q)^2}{1 - \beta q},$$

so

$$\frac{d}{dq}\left[\frac{\mathcal{R}(q)}{G(b)}\right] = \frac{(1-\beta)(2q - \beta q^2 - 1)}{(1 - \beta q)^2}.$$

For $0 < \beta < 1$, the unique interior minimum occurs at $q^* = \big(1 - \sqrt{1-\beta}\big)/\beta$. The derivative is negative below this point and positive above it. The normalized rate equals one at $q = 0$ and $q = 1$, but below one at interior values. This U-shaped property is specific to the uniform-cost illustration and is not asserted for general $G$.

**Proof of Proposition 4 (Optimistic beliefs)**

The analysis of optimistic beliefs focuses on $\hat{q} \geq q$. Let actual present-bias parameter be $\beta$ and perceived present-bias parameter of the future self be $\hat{\beta} \in [\beta, 1]$. The period-0 self correctly evaluates immediate registration as $V_0 = b - C$, where $b = \beta s B$, but believes the future self will register if $C \leq \hat{b} = \hat{\beta} s B \geq b$.

For $C > b$, immediate registration has negative utility and is not chosen. For $C \leq b$, the perceived waiting value is $\hat{q}(b - \beta C)$, so

$$b - C \geq \hat{q}(b - \beta C) \quad \Leftrightarrow \quad C \leq \kappa_0(\hat{q}).$$

Because $\kappa_0(\hat{q}) \leq b$, this characterization covers all $C$. The initial registration decision therefore depends on $\hat{q}$ but not on $\hat{\beta}$. Actual later registration occurs only when the later decision point is reached and $C \leq b$. Hence

$$\mathcal{R}(q, \hat{q}) = (1 - q)G\big(\kappa_0(\hat{q})\big) + qG(b).$$

Relative to correct beliefs about attention, the difference is

$$\mathcal{R}(q, q) - \mathcal{R}(q, \hat{q}) = (1 - q)\big[G\big(\kappa_0(q)\big) - G\big(\kappa_0(\hat{q})\big)\big] \geq 0.$$

Holding $\hat{q}$ fixed, increasing actual $q$ weakly raises $\mathcal{R}$ because $G(b) \geq G\big(\kappa_0(\hat{q})\big)$. Holding actual $q$ fixed, increasing $\hat{q}$ weakly reduces $\mathcal{R}$ because $\kappa_0(\hat{q})$ is weakly decreasing. The belief $\hat{\beta}$ affects plans, not actual registration, with equal registration costs. If $b < C \leq \hat{b}$, the earlier self expects future registration if attentive, whereas the later self does not register.

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**Tables**

**Table 1. Timing of the model and trial**

| Period | Trial | Event |
|---|---|---|
| $t = 0$ | July 5 | Initial email; register or postpone |
| $t = 1$ | July 11–12 | Repeated email sent July 11; final modeled decision opportunity before July 12 deadline |
| $t = 2$ | Later | Incremental benefit associated with timely registration is realized |

**Table 2. Hypothesized behavioral channels and model parameters**

| Hypothetical channel | Parameter | Model transformation |
|---|---|---|
| Lower perceived hassle cost | $C$ | $C' \leq C$ |
| Greater benefit salience | $s$ | $s' \geq s$ |
| Greater future attention | $q$ | $q' \geq q$ |

*Note.* The channels represent separate theoretical parameter changes, not independently randomized components of the trial. Proposition 3 additionally assumes that employees correctly anticipate a change in future attention.

**Table 3. Theoretical predictions for registration timing**

| Hypothetical change | New registrations, July 5–10 | New registrations, July 11–12 | Cumulative by July 12 |
|---|---|---|---|
| Lower hassle cost or higher salience at both opportunities; $q$ fixed | Weakly higher | Ambiguous | Weakly higher |
| Anticipated improvement in future attention; other parameters fixed | Weakly lower | Weakly higher | Ambiguous |
| Unanticipated improvement in actual attention; beliefs fixed | Unchanged | Weakly higher | Weakly higher |

*Note*. Entries are increments expressed as proportions of the modeled population, not hazards conditional on remaining unregistered. Rows 1 and 2 follow from Propositions 2 and 3; row 3 follows from Proposition 4(iii). Strict effects require positive probability mass in the relevant cost ranges.

**Table 4. Registration timing in the main stratum (descriptive reconstruction)**

| Event or interval | Behaviorally informed email (allocated $n = 378$) | Standard email (allocated $n = 377$) |
|---|---|---|
| New registrations, July 5–10 | 143 (37.8%) | 99 (26.3%) |
| New registrations, July 11–12 | 75 (19.8%) | 73 (19.4%) |
| Cumulative registration by July 12 | 218 (57.7%) | 172 (45.6%) |
| New registrations, July 13–20 | 119 (31.5%) | 166 (44.0%) |
| Cumulative recorded registration by July 20 | 337 (89.2%) | 338 (89.7%) |

*Note.* Percentages use all originally allocated employees, not only those included in the published analytic sample. No registration by July 20 was recorded for 40 and 38 employees in the respective arms, and one further employee in each arm declined participation. The first two rows count first registrations during the indicated intervals, not daily hazards. Source: registration-date file for the 749 analyzed employees and the published participant-flow counts; values are descriptive.

## Figures

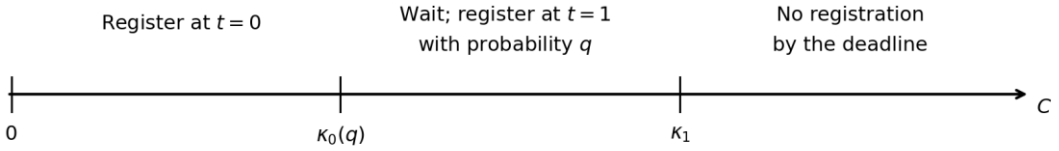


**Figure 1. Timing regimes by baseline hassle cost**
*Note.* For $0 < \beta < 1$ and $0 < q < 1$, $0 < \kappa_0(q) < \kappa_1$. The figure is schematic.

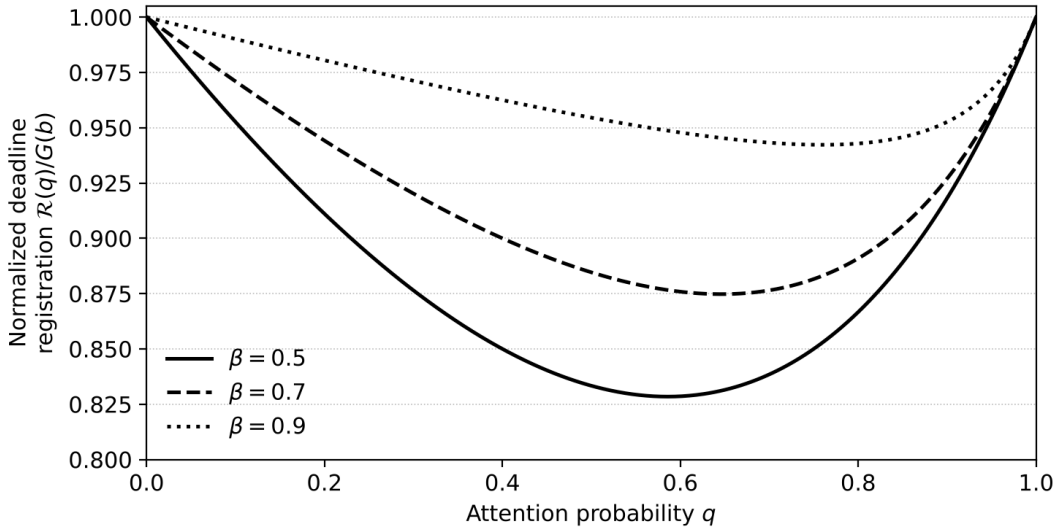


**Figure 2. Theoretical normalized registration by attention probability under uniform costs**
*Note.* Illustrative theoretical relationship for a uniform cost distribution, not trial outcomes.

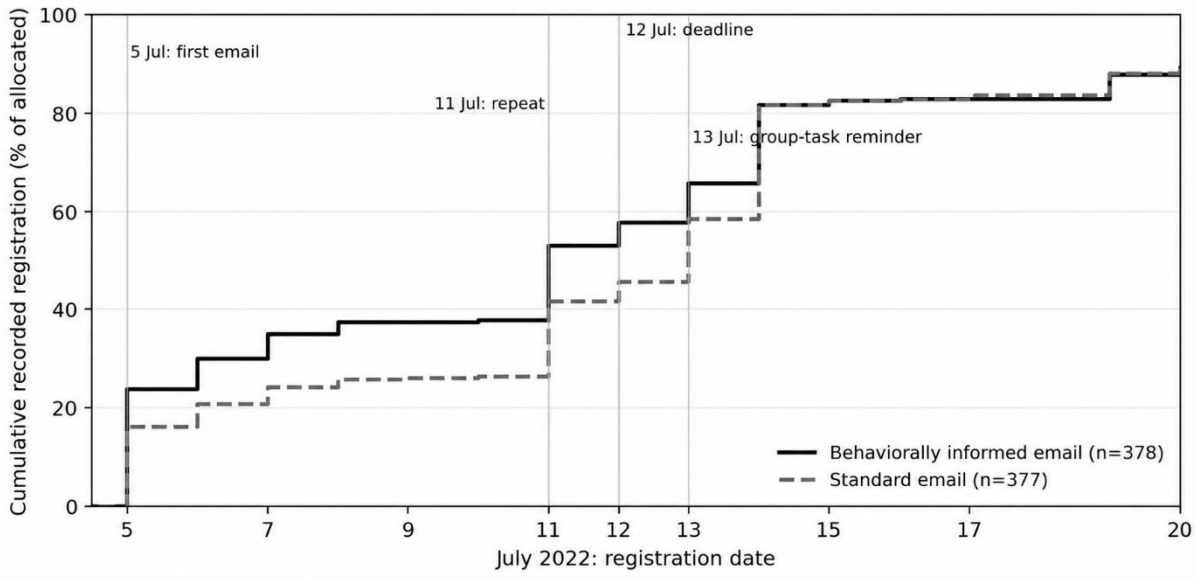


**Figure 3. Daily cumulative recorded registration, main stratum**

*Note.* Registration dates are available for employees in the selected final analytic sample. The 40 and 38 employees who remained unregistered by July 20 are counted as nonregistrants, while one employee who declined participation in each group is assumed to have no recorded registration for the descriptive reconstruction. The lines are descriptive reconstructions, not intention-to-treat estimates. Events were observed continuously, not only when emails were sent. The July 13 group-task reminder was issued company-wide, with simultaneous notification of supervisors.