Original Investigation

History and Correlates of Smoking Cessation Behaviors Among Individuals With Current or Past Major Depressive Disorder Enrolled in a Smoking Cessation Trial

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Abstract

Introduction: Smoking among adults with major depressive disorder (MDD) is at least double that of the general US population. More effective smoking cessation interventions for depressed smokers may be facilitated through a better understanding of the smoking and depression-related characteristics of this population.

Methods: We used baseline data from 300 participants enrolled in randomized clinical trial for smokers with current or past MDD. We described history of smoking cessation behaviors (ie, quit attempts, quit motivation, and cessation treatment utilization) and used multivariate regression to identify demographic and depression-related correlates of these behaviors.

Results: Sixty-eight percent of participants reported at least one quit attempt in the past year, nearly 51% reported motivation to quit in the subsequent 30 days, and 83% reported prior use of a nicotine replacement therapy. A greater readiness to quit smoking was associated with increased age ($p = .04$) and lower cigarettes per day ($p = .01$). Greater use of smoking cessation medication was associated with greater education and nicotine dependence, minority race, and greater use of complementary reinforcers (eg, activities associated with increased reinforcing value of smoking; p's $< .05$).

Conclusions: These data indicate that smokers with current or past MDD are highly motivated to quit smoking and have a history of engaging in efforts to quit. Interventions to promote smoking cessation behaviors should address younger and lighter smokers, who may perceive less risk from tobacco use, and efforts to promote smoking cessation medications and counseling should address minority smokers who are engaging in complementary reinforcers.

Implications: These data are inconsistent with the assumption that smokers with serious mental illness are not willing to quit smoking and suggest the need for studies that test behavioral interventions that address complementary reinforcers to treat tobacco use in this community.

Introduction

The rate of smoking among individuals with major depressive disorder (MDD) is 2–3 higher than in the general population.[1] The rate of smoking increases as depression severity increases and smokers have a higher prevalence of MDD than never smokers.[2,3] Since MDD is one of the most prevalent types of serious mental illness (SMI), affecting an estimated 1 in 10 Americans, the high level of comorbidity with tobacco use translates into a substantial subgroup within the overall population of US smokers.[4] Indeed, a recent study using the National Household Survey on Drug Use indicated that more than 10% of current US adult smokers reported past-year depression, which would translate to an estimated 3.4 million Americans.[2,5] Co-occurring depression and smoking contribute to higher rates of tobacco-related disease morbidity such as cancer and heart disease, which, in turn, leads to an average loss of about 25 years of life in this group.[6] Treating tobacco use in this disparity group has assumed ever-increasing importance.[7]

Unfortunately, with few exceptions, most smoking cessation clinical trials have excluded this important group from trial enrollment.[8] Moreover, clinicians who work with smokers have SMI inadequately provide tobacco use treatments to their patients with one study showing that evidence-based tobacco use interventions were offered to only 34% of patients.[9,10] Beliefs that smokers with SMI are not interested in quitting smoking or cannot be safely treated with tobacco use treatments are common and undermine clinical care.[11] A recent study found that 65% of mental health clinicians indicated that their patients do not want to quit smoking and the perceived lack of client interest in smoking cessation treatment is a barrier to providing care.[12]

Despite the high co-occurrence of smoking and depression, little is known about how to design interventions for smokers with current or lifetime MDD.[13,14] Understanding smoking cessation behaviors and factors associated with such behaviors can help develop effective interventions that may show increased use in this population. Yet, much of what is known about smoking among those with MDD is from studies with clinical populations (eg, recruited through inpatient or outpatient treatment centers) or from large epidemiologic studies versus community-based smokers with MDD (ie, smokers with current or past MDD recruited from the community and not a clinical setting), which may provide a more generalizable sample of smokers with current or past depression. Since about a third of those with MDD are not engaged in treatment for their depression, ascertaining information about tobacco use from community-based samples can help generalize to the broader population of smokers with MDD.[7,15,16]

Improving our understanding of smoking cessation behaviors among those with MDD, including quit motivation, frequency of quit attempts, and use of cessation treatments, as well as the depression-related correlates of these steps in the smoking cessation process, may help guide the design of smoking cessation treatments that may be suited to smokers with current or a history of MDD who are not engaged in formal mental healthcare. Though previous studies have examined this issue in the general population of smokers, few studies have done so among those with SMI[17] or have included a heterogeneous sample of smokers with various types of SMI,[12] which may differ from smokers with MDD. Furthermore, though previous studies have examined correlates of these cessation behaviors among smokers with SMI, few studies have examined a broad range of correlates of these cessation behaviors, including more recently developed measures of key constructs within new

models of smoking among those with MDD, such as the reinforcing value of smoking (ie, the degree to which smokers value tobacco use relative to other rewards), alternative reinforcers (ie, activities that can take the place of tobacco use), hedonic capacity (ie, the ability to experience pleasure), and smoking motives (ie, reasons for tobacco use).[18,19] Understanding the potential role of how these variable relate to smoking cessation behaviors in this study may help identify new targets for interventions as outlined in a recent review of the literature on depression and smoking comorbidity.[19]

Therefore, this study used baseline data collected as part of a randomized smoking cessation clinical trial that targeted smokers with current or past MDD to describe their smoking cessation behaviors prior to treatment and the sociodemographic, smoking, and depression-related correlates.

Methods

Design

Data for this study were obtained from a randomized clinical trial testing varenicline and behavioral activation (BA) therapy for smokers with current or past MDD (ClinicalTrials.gov ID: NCT02378714). For the present analyses, we used the baseline data from participants who were eligible and enrolled into the trial at the two clinical sites. The Institutional Review Boards at Northwestern University and the University of Pennsylvania–provided approval.

Participants

Three hundred participants enrolled in the trial. To be eligible, participants had to endorse having an interest in quitting smoking (categorical variable: yes vs no), be ≥18 years of age, reside in the geographic area for >8 months, have access to a phone, smoke ≥1 cigarette/d, have a lifetime DSM-5 diagnosis of MDD without psychotic features, able to communicate in English, and able to provide informed consent. Exclusion criteria included self-reported suicide attempt in the last 12 months or active suicidal ideation with intent to act in past 30 days, self-reported current or planned pregnancy, women of childbearing potential refusal to use a medically acceptable method of birth control, current use of smoking cessation medications, heavy alcohol consumption defined as >28 drinks per week, lifetime DSM-5 bipolar or psychotic disorder as determined by self-report or by the Mini International Neuropsychiatric Interview (MINI), and uncontrolled hypertension (systolic > 185 or diastolic > 110).[20,21]

Measures

Smoking Cessation Behaviors

We assessed four indicators of smoking cessation behavior: current quit motivation, prior quit attempts, prior use of behavioral smoking cessation treatment, and prior use of FDA-approved smoking cessation medications. The Readiness Ladder was used as a continuous measure to evaluate level of quit motivation by asking participants to indicate what they thought about quitting on a scale from 1 (I have no interest in quitting) to 10 (I have quit and will never smoke again).[22] For quit attempts, participants were asked, "How many times in the past year did you quit for at least 24 hours?" Both quit motivation and quit attempts were assessed as continuous variables. We asked yes/no questions to examine participant's history of tobacco cessation medication use in their attempts to quit smoking. Participants were coded as having used smoking cessation medication

if they said "yes" to using nicotine replacement therapy (patch, lozenge, spray, gum, inhaler), bupropion, or varenicline. For behavioral counseling, participants indicated "yes" or "no" to whether in the past they received behavioral counseling to quit smoking.

Demographic and Smoking History

Demographic information was collected from all participants (sex, age, race, education, employment, income, and marital status), as was smoking history data (age at smoking initiation, expired carbon monoxide [CO], average cigarettes per day, and past quit attempts), including the Fagerström Test for Cigarette Dependence, a six-item measure validated in smokers with mental health disorders.[23,24]

Smoking Motives

The brief Wisconsin Inventory for Smoking Dependence Motives was used to assess smoking dependence motives.[25] The Wisconsin Inventory for Smoking Dependence Motives consists of 37 items that are rated on a scale from 1 (not true at all of me) to 7 (extremely true of me). Only the Wisconsin Inventory for Smoking Dependence Motives total score and the affect enhancement and cognitive enhancement subscales were used in this study.

Hedonic Capacity

The 14-item Snaith-Hamilton Pleasure Scale was used to assess rewarding life experiences and the degree to which individuals have capacity to experience pleasure.[26] The Snaith-Hamilton Pleasure Scale has been used in nonclinical and clinical populations.[27,28]

Reward Value of Smoking

Preferences for engaging in smoking versus other rewarding activities were measured using a cigarette reward value scale.[29] Participants made 15 forced choices between smoking and a variety of rewards likely to be accessible and enjoyed, such as eating their favorite candy, seeing a movie, and receiving a gift. The choice of smoking was scored as 1, and the choice of the alternative reward was scored as 0, creating a total score with a range of 0–15. Higher scores indicate greater reward value of smoking.

Alternative Reinforcers

The 45-item Pleasant Events Schedule was used to measure rewarding activities occurring in a person's life.[30] The cross-product score of frequency (0 = none to 2 = often) and level of enjoyableness (0 = none to 2 = very) for each item provides a measure of activity reward. Participants were also asked whether they associate the activity with smoking or the urge to smoke. If the activity is associated with smoking, it is considered a complementary reinforcer. If the activity is not associated with smoking, it is considered a substitute reinforcer. The cross products of substitute reinforcers are summed to provide a score for substitute alternative reinforcers, and those for complementary reinforcers are summed to provide a score for complementary alternative reinforcers.

Psychiatric Characteristics

Measures of psychiatric clinical status included other DSM-5 diagnoses, suicidality as measured by the Columbia Suicidality Severity Rating Scale, number of hospitalizations for a psychiatric condition, prior psychotherapy for depression, and lifetime MDD (current and/or past). MDD and other psychiatric disorders (substance or alcohol use disorder, generalized anxiety disorder, post-traumatic

stress disorder, social anxiety disorder, obsessive compulsive disorder, agoraphobia, panic disorder) were assessed via the MINI.[31] Self-reported current depression and anxiety symptoms were measured using the Beck Depression Inventory II and the Beck Anxiety Inventory.[32,33] Past-week sleep disturbance and impairment was measured using the PROMIS short-term sleep disturbance (four items) and sleep impairment (eight items) scales.[34]

Statistical Analyses

Descriptive statistics were used to characterize the sample on the smoking cessation behaviors and other baseline variables and to assess for normality and the presence of outliers. Missing data were excluded from analysis. *T*-tests, Spearman's correlation, and chi-square tests were used to assess demographic, smoking, and psychiatric characteristics, smoking motives, the reinforcing value of smoking, alternative reinforces, and hedonic capacity (independent variables) as correlates of smoking cessation behaviors (dependent variables). As done previously, factors related to smoking cessation behaviors ($p < .1$) were included in multiple regression models.[18] Separate multiple regression models (for both binary and continuous dependent variables) were tested for each smoking cessation behavior and predictors were evaluated using standardized coefficients or odds ratios (OR), as well as probabilities ($p < .05$) and 95% confidence intervals.

Results

Sample Characteristics

Women comprised 55% of the sample and 65% identified as a member of a racial and/or ethnic minority group (52% African American/Black, 6% Hispanic). The average age of participants was 49.7 years (SD = 12.6); 69% of participants reported completing some college or more, 29% were employed full-time, and 16% were married. Participants reported starting smoking, on average, at 16.9 years old (range = 8–45, SD = 5.0), reported 15 cigarettes per day (SD = 7.9), with a CO level of 12.7 parts per million (ppm); 67% of participants exhibited a moderate level of cigarette dependence on the Fagerström Test for Cigarette Dependence (M = 5.2, SD = 2.1) and 46% would smoke their first cigarette within 5 minutes of waking.

Half the sample (51%) reported only past depression, while slightly less than half (40%) reported current and past depression (chronic MDD), while a small percent (9.3%) were currently depressed with no past depression. Forty-two percent reported DSM-5-based psychiatric comorbidities, including substance or alcohol use (17%), generalized anxiety (13%), post-traumatic stress (12%), social anxiety (10%), obsessive compulsive (7%), agoraphobia (7%), or panic disorder (6%). Participants reported, on average, mild depressive symptoms on the Beck Depression Inventory II (M = 18.7, SD = 11.5) and a minimal level of anxiety via the Beck Anxiety Inventory (M = 12.5, SD = 11.0). However, 43% (*n* = 129) of Beck Depression Inventory II scores fell into the moderate to severe range. Twenty-nine percent of Beck Anxiety Inventory scores fell into the moderate to severe range. Nearly 40% of participants endorsed drinking alcohol on a regular basis. See Table 1 for sample characteristics.

History of Smoking Cessation Behaviors

The mean score on the Readiness Ladder was 6.8 (SD = 1.2), indicating a plan to quit within the next 30 day to 6 months. Sixty-eight percent

Table 1. Characteristics of participants enrolled in the smoking cessation trial (*N* = 300)

Characteristic	Mean and SD or *N* and %
Age (y)	50.0 (12.6)
Sex (% women)	165 (55.0)
Race	
American Indian/Alaska Native	2 (0.7)
Asian	4 (1.3)
Black/African American	157 (52.3)
White	116 (38.7)
More than one race	16 (5.3)
Unknown or not reported	3 (1.0)
Refused	2 (0.7)
Ethnicity (% Hispanic/Latino)	18 (6.0)
Marital status	
Never married	129 (43.0)
Married	47 (15.6)
Divorced/separated	84 (28.0)
Widowed	15 (5.0)
Living as married	23 (7.6)
Education	
Grade school	1 (0.3)
Some high school	16 (5.3)
High school graduate or GED	76 (25.3)
Some college/technical school	116 (38.8)
College graduate	91 (30.3)
Employment	
Retired/unemployed	153 (51.0)
Part-time	60 (20.0)
Full-time	87 (29.0)
Cigarettes smoked per day	15.2 (7.9)
Duration of smoking (y)	31.2 (14.0)
FTCD	5.2 (2.1)
Time to first cigarette after waking	
5 min or less	138 (46.0)
More than 5 min	162 (54.0)
Cigarette type	
Menthol cigarettes only	178 (59.3)
Regular cigarettes (or both)	120 (40.0)
Carbon monoxide level (ppm)	12.7 (7.5)
Major depressive disorder status[a]	
Current and past MDD	119 (39.7)
Current MDD only	28 (9.3)
Past MDD only	153 (51.0)
Antidepressant medication (% yes)	82 (27.3)
Other psychiatric diagnosis	49 (16.3)
Depressive symptoms (BDI-II)	18.7 (11.5)
BDI-II classification	
Minimal	100 (33.3)
Mild	71 (23.7)
Moderate	75 (25.0)
Severe	54 (18.0)
Anxiety symptoms (BAI)	12.5 (11.0)
BAI classification	
Minimal	119 (39.7)
Mild	82 (27.3)
Moderate	49 (16.3)
Severe	38 (12.7)
Regular alcohol drinker (% yes)	160 (53.7)
Alcohol drinks in a typical week	6.5 (5.9)

Some percentages do not add to 100% due to missing data. BDI-II interpretation: 0–13 minimal, 14–19 mild, 20–28 moderate, 29–63 severe. BAI interpretation: 0–7 minimal, 8–15 mild, 16–25 moderate, 26–63 severe. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; FTCD = Fagerström Test for Cigarette Dependence; MDD = major depressive disorder.
[a]DSM-5 defined MDD without psychotic features.

Table 2. Baseline correlates of number of prior quit attempts and readiness to quit smoking

| Variable | Test Statistic | | | |
	β	SD	*z*	*p*
Quit attempts				
Carbon monoxide level	–0.50	0.23	–2.23	0.03*
Substitute reinforcers	0.12	0.08	1.28	0.17
FTCD	–0.82	0.84	–0.98	0.33
Readiness to quit smoking				
Age	0.01	0.01	2.07	0.04*
Race	–0.11	0.16	–0.68	0.50
Cigarettes per day	–0.02	0.01	–2.46	0.01*
WISDM: cognitive enhancement	–0.06	0.04	–1.33	0.19
Substitute reinforcers	0.00	0.00	1.18	0.24
Cigarette reward value	–0.03	0.02	–1.45	0.15

FTCD = Fagerström Test for Cigarette Dependence, WISDM = Wisconsin Inventory of Smoking Dependence Motives, PES = Pleasant Events Schedule.
*$p < .05$.

Table 3. Baseline correlates of prior use of smoking cessation medication and behavioral counseling

| Variable | Test statistic | |
	Odds ratio	95% confidence interval
Medication use		
Education	2.86*	1.67, 4.99
Cigarettes per day	0.98	0.94, 1.02
Carbon monoxide level	1.03	0.99, 1.07
Menthol cigarette use	0.98	0.54, 1.76
FTCD	1.22*	1.05, 1.42
Race (minority)	0.56*	0.31, 1.00
Complementary reinforcers	0.99*	0.97, 1.00
Behavioral counseling		
Age	1.03	0.99, 1.07
Substitute reinforcers	1.02*	1.00, 1.04
Beck Anxiety Inventory	1.04*	1.01, 1.08
Prior hospitalizations for psychiatric condition	1.10	0.96, 1.35

FTCD = Fagerström Test for Cigarette Dependence; PES = Pleasant Events Schedule.
*$p < .05$.

of participants had made at least one prior quit attempt. Average number of lifetime quit attempts was 12 (SD = 25.86). Most participants had used a smoking cessation medication: 83% had used a form of nicotine replacement therapy, whereas 15% had used either bupropion or varenicline. Only 8% of participants reported having received behavioral counseling to quit smoking.

Correlates of Smoking Cessation Behaviors
Prior Quit Attempts
In the bivariate analyses of each individual predictor on the dependent variables, higher CO (ρ = –0.18, *p* = .002) and cigarette dependence (ρ = –0.16, *p* = .004) were correlated with fewer past quit attempts. A higher level of substitute reinforcers (ρ = 0.19, *p* < .001) was correlated with a greater numbers of past quit attempts.

Readiness to Quit
Participants with higher levels of motivation to quit were older (ρ = 0.15, *p* = .01), more likely to belong to a racial minority group

(t(281) = 1.65, p = .10), smoked fewer cigarettes per day (ρ = −0.17, p = .004), reported lower cognitive enhancement motives (ρ = −0.16, p = .009), showed a lower reward value of cigarettes versus other rewarding activities (ρ = −0.18, p = .002), and had greater level of substitute reinforcers (ρ = 0.01, p = .06).

Prior Use of Smoking Cessation Treatment

Greater participant use of smoking cessation medications was associated with greater cigarette dependence (t(296) = 3.09, p < .001), more cigarettes smoked per day (t(296) = 1.93, p = .05), higher CO (t(297) = 2.93, p = .004), and a lower level of complementary reinforcers for smoking (t(297) = −1.79, p = .07). In addition, participants who were not a racial minority (χ^2 = 10.16, p < .01), had at least some college education (χ^2 = 16.72, p < .01), or smoked regular cigarettes (χ^2 = 2.78, p = .01) reported greater use of smoking cessation medication.

Prior Use of Behavioral Counseling

Greater prior use of behavioral counseling for smoking cessation was associated with older age (t(297) = 1.71, p = .09), a greater level of anxiety symptoms (t(285) = 2.17, p = .03), more substitute reinforcers for smoking (t(297) = 1.72, p = .09), and a greater number of past hospitalizations for mental illness (t(288) = 2.43, p = .02).

Multivariate Models of Smoking Cessation Behaviors

With respect to prior quit attempts, lower CO levels were associated with a greater number of prior quit attempts (β = −0.50, p = .03). Higher levels of motivation to quit were associated with older age (β = 0.01, p = .05) and smoking fewer cigarettes per day (β = −0.02, p = .02). Participants with higher levels of cigarette dependence (OR = 1.22, 95% confidence interval [CI] = 1.05–1.42) and greater educational attainment (OR = 2.86, 95% CI = 1.67–4.99) were more likely to report prior use of a smoking cessation medication; a greater level of complementary reinforces (OR = 0.99, 95% CI = 0.97–1.00) and belonging to a racial minority group (OR = 0.56, 95% CI = 0.31–1.00) was associated with lower prior use of smoking cessation medications. Lastly, a greater level of substitute reinforcers (OR = 1.02, 95% CI = 1.00–1.04) and greater anxiety symptoms (OR = 1.04, 95% CI = 1.01–1.08) were associated with greater use of behavioral counseling for smoking (Tables 2 and 3).

Conclusion

This study characterized smoking behaviors that are highly predictive of cessation among smokers with MDD and examined correlates of these behaviors to help guide smoking cessation interventions for this underserved community of smokers. Overall, the results indicate that smokers with MDD report a high rate of quit motivation, an active history of quit attempts, and substantial use of medications to treat tobacco use, albeit very low rates of smoking cessation behavioral counseling. These results also identify potential factors associated with these smoking behaviors that could help guide treatment development, namely alternative reinforcers. These findings challenge the notion that smokers with MDD are disinterested in quitting smoking but highlight the need to improve the utilization of smoking cessation counseling and varenicline since these approved treatments appear to be greatly underutilized. These results also help to identify demographic, smoking, and behavioral characteristics that could be useful in the development of smoking cessation interventions for this population.

The present data on smoking cessation behaviors indicate that most smokers with MDD have tried to quit smoking and are eager to quit. Close to 70% of the present sample had tried to quit at least one time in the past year and over half of the sample reported wanting to quit within the next 30 days. These data converge with studies in the general population of smokers and provide further support to recent studies of smokers with SMI that challenge the idea that this subgroup of smokers is content to continue to smoke.[18,35–38] Furthermore, most of the study participants reported using a medication to quit smoking, but the vast majority used nicotine replacement therapy, rather than more effective medications like varenicline. These data also converge well with studies with the general population of smokers and with smokers with SMI.[18,39–41] In contrast, as with past studies with the general population of smokers and smokers with an SMI smokers with MDD generally greatly underutilize smoking cessation behavioral counseling, indicating the need to prioritize this form of treatment for this population since we know that the addition of behavioral counseling to medication use offers the best chances for cessation.[18,42,43]

The present results also offer guidance on potentially how to target interventions to increase cessation behaviors. Interventions developed to increase smoking cessation behaviors among smokers with MDD may need to be targeted to smokers who report lower CO, are younger, and report less experience with behavioral therapies for SMI. Previous studies have suggested that younger adults and those with lower CO may be less motivated to quit smoking and less engaged in tobacco cessation treatment.[44] This may reflect a reduced perception of risk given that more serious tobacco-related disease morbidity occurs later in life and that lower consumption may limit health risk. Lastly, participants who are from racial/ethnic minority groups report fewer quit attempts and less engagement with smoking cessation medications; considering the substantial disparities in the adverse effects of tobacco use among racial/ethnic minority groups, future efforts to address tobacco use among those with SMI should similarly target underserved subgroups with enhanced efforts to promote FDA-approved tobacco cessation medications.

Lastly, the content of behavioral counseling treatments for smokers with MDD may improve quit rates by focusing on increasing substitute reinforcers and decreasing complementary reinforcers, consistent with behavioral activation models. BA is a counseling approach first developed to treat smoking, but subsequently adapted for tobacco use, and it focuses on addressing tobacco use by encouraging smokers to reduce engagement in complementary reinforcers while increasing engagement in substitute reinforcers. Several relatively small studies have suggested that BA may be a promising new behavioral counseling model to treat tobacco use.[45–47]

The results from this study should be interpreted in the context of important limitations. First, the data used in these analyses are cross-sectional, so no causal interpretations can be inferred. Second, the participants in this study were part of a clinical trial that required the use of inclusion and exclusion criteria, so the generalizability of the findings may be limited. In particular, assessing the level of motivation to quit among smokers entering an intervention study may portray a higher level of quit motivation than is the case across the broader population, especially since they had to categorically endorse a general interest in quitting smoking to enter the trial.

Nevertheless, the results from this study provide important support to challenge long-held beliefs about smokers with an SMI and offer information that can help guide efforts to develop and evaluate smoking cessation interventions with this important subgroup of smokers. Smokers with current or past MDD are motivated to quit smoking,

receptive to interventions, and engage in repeated quit attempts. Boosting the use of behavioral interventions—particularly those that address alternative reinforcers to smoking—and varenicline is needed, as are efforts to increase smoking cessation behaviors among racial/ethnic minority groups, younger smokers, and lighter smokers. With increased efforts to address smoking in this underserved population, important health disparities may be reduced.

Supplementary Material

A Contributorship Form detailing each author's specific involvement with this content, as well as any supplementary data, are available online at https://academic.oup.com/ntr.

Declaration of Interests

R.S. has received varenicline and placebo free from Pfizer and has provided consultation to Pfizer. R.S. has provided consultation to GlaxoSmithKline and Palliatech. B.H. has received varenicline and placebo free from Pfizer.

Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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