Long-term Benzodiazepine Use and Negative Socioeconomic Outcomes: Are physicians to blame?

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Introduction

Long-term use of benzodiazepines (BZD) is a little known but growing problem among those treated for conditions such as insomnia, anxiety disorders, and depression. Since their introduction BZD have a been a safer alternative to earlier anxiolytics and hypnotics (Simon, VonKorff, William, Pabiniak, & Wagner, 1996), however long-term usage can lead to dependence and side effects that often exacerbate the condition they were initially prescribed for. Withdrawal from BZD is known to be much more extreme than that of illicit drugs like heroin, crack-cocaine, and methamphetamine. As a result withdrawal can be a process that lasts anywhere from months to well over a year depending on factors such as dosage, potency, and length of use of the BZD in question (Ashton, 2002) (Simon, VonKorff, William, Pabiniak, & Wagner, 1996). For this reason indications for BZD usage have long been a source of controversy.

In general, BZD should only be prescribed for periods of 2-4 weeks (Ashton, 2002). Prescribing guidelines caution against long-term use, particularly in the elderly or those with insomnia. Nevertheless this advice is frequently ignored in practice causing BZD to be inappropriately prescribed long-term for conditions they are not indicated for. For example, antidepressants do not produce immediate beneficial effects so they are sometimes combined with BZD to provide quicker relief. In these cases, American Psychiatric Association guidelines suggest cautious usage while reassessing continued need on a regular basis (Ashton, 2002) (Marcia Valenstein, Kiran Khanujua Taylor, Karen Austin, Helen C. Kales, John F. McCarthy, & Frederic C. Blow, 2004). Furthermore, BZD tend to lose their efficacy after a few weeks or months of regular use due to tolerance building, this can leading to withdrawal symptoms even though the user continues to take the drugs (Ashton, 2002).

In addition to dependence long term usage comes with side affects such as poor memory and cognition, lack of motor coordination (particularly in the elderly), emotional blunting, depression, and increased anxiety (Ashton, 2002). While the medical literature has been reasonably informed on this issue little work has been done to shed light on the socioeconomic consequences of this irresponsible prescription behavior. Users driven into anxiety and depression can suffer marital and/or domestic problems, job loss, engage in self-harm and/or attempt suicide due to emotional and cognitive impairment. Outside of this BZD reduce motor coordination and increased risk of accidents at home, work, or while driving. Additionally, some users may be at increased risk of aggressive behaviors and criminal acts such as shoplifting or assault (Ashton, 2002).

With the exception of the minority of users who seek out illegal sources of BZD for recreational use or self-medication these drugs are available to users via prescription only. Although user feedback is important for dosage adjustments the

final prescribing decision is ultimately that of the physician. Given the dangers of long-term usage and the myriad of individuals who have experienced negative health and socioeconomics outcomes many of these prescriptions are being made irresponsibly. However, the question of whether or not this prescription behavior is negligent has received little, if any, attention in economic and medical malpractice literature. For this reason I propose breaking ground on a new area of research to investigate the possibility of widespread negligent prescribing of BZD.

By modeling risk of an adverse reaction it is possible to identify physician's marginal contribution to suicide risk in long-term BZD users. Once this contribution has been identified the Learned Hand Rule can be applied in a cost benefit analysis to determine if the prescription behavior is in fact negligent. The current level of long-term BZD usage comes at great private and social cost, costs that may not be justified by their benefits; by answering this question appropriate interventions can be made. If this is a case of widespread negligence then victims deserve access to compensation. On the other hand, if negligent prescribing behavior is not to blame then more research must be done to identify strategies that can mitigate the harms of long-term BZD use.

Literature Review

Little to no economic or medical malpractice literature addresses the question of widespread negligent prescribing of BZD. No matter the answer to this question, it is likely to have far reaching consequences. If negligent behavior is not occurring then efforts can be refocused on other ways of preventing the harms of long-term BZD usage. On the other hand if negligence is uncovered it might precipitate an uptick in malpractice claims. Previous studies have shown that fluctuation in medical malpractice claims has the potential to influence physician supply decisions on both the extensive and intensive margin. While physicians that prescribe psychiatric medications have not been identified to be among the specialties sensitive to malpractice pressure answering the questions proposed here may increase exposure, prompting practitioners to reduce supply of important psychiatric services. Victims certainly deserve to be compensated, but given the evidence presented in previous research it may be necessary to implement malpractice reforms to head off unintended changes in supply.

Here we will survey three studies that comment on the effect of malpractice pressure and reforms on physician supply. (Helland & H., 2009) examines supply decisions on the intensive margin by examining the link between liability risk and physician hours worked. On the other hand, (Klick & Stratman, 2007) study effects on the extensive margin through estimating malpractice reform's impact on location decisions for physicians in high-risk specialties. Lastly, (Kessler & McClellan, 2002) explore the mechanisms through which these reforms affect physician behavior. While these studies make comment on health outcomes the discussion here will be centered on supply. It is unclear whether these studies are valid when applied in the context of psychiatric medicine however considering these factors is important to understanding the potential impact of malpractice pressure on the market for psychiatric services.

(Helland & H., 2009) points out that malpractice pressure can cause existing physicians to work shorter hours and see fewer patients in response to the increase costs of practicing. One of their key contributions is the development of a malpractice pressure index that allows them to exploit variation in liability risk across states and specialties. Since states can differ in underlying risk of malpractice claims the same reform in different states can affect supply decisions differently. This is a marked improvement over related work that relies on binary variables to identify treatment.

In summary, they find evidence suggesting that greater malpractice pressure does in fact drive physicians to alter their labor supply. Their elasticity estimates of hours worked with respect to liability exposure is -0.285. Interestingly they find that this effect is increasing in age and strongest for physicians over 55. For these physicians the estimate is -1.224, consistent with anecdotal evidence that increased liability accelerates retirement patterns. They also examine the effect of malpractice pressure on insurance premiums and find that a $1 increase in expected liability is associated with a $0.70-$1.05 increase in premiums. While this study falls short of tying liability pressure to extensive margin effects it serves as complement to work that succeeds in making this link.

It was shown in (Klick & Stratman, 2007) that medical malpractice reforms can have an impact on physician location decisions; this study notes that only high liability physicians make extensive margin decisions in response to malpractice pressure. By using low liability physicians as a control group they employ a triple difference estimation strategy to identify the effect of various kinds of reforms, an improvement on previous literature that confounded their differing effects. While this is a major advantage, the study lacks the ability to identify specific mechanisms through which reforms act.

Only non-economic damage caps are shown to have a consistently statistically significant effect on per-capita levels of physicians in a given state. For the five highest risk specialties, states see an increase of more than 6% in the per-capita level of physicians when these damage caps come into effect. When 10 of the highest risk specialties are included this affects drops to around 4%. All other reforms considered[1] were statistically insignificant across specifications.

(Kessler & McClellan, 2002) do an investigation that identifies mechanisms through which these reforms effect physician supply decision, medical spending, and health outcomes. They estimate instrumental variables models of the effects of malpractice pressure on medical treatment decisions for elderly heart disease patients and there consequences on total hospital expenditures. Ultimately they are able to validate claims made in previous studies that direct reforms improve healthcare productivity by reducing defensive medicine practices. However, their results are limited in the sense that there is not sufficient variation in medical malpractice reforms to identify the joint effects of liability on health and cost outcomes.

The authors are forced to estimate the effects of different dimensions of malpractice pressure separately. They find that defending against a malpractice

[1] Reforms include collateral source reform, joint and several liability reform, caps on attorney contingency fees, and mandatory period payment of future damages.

claim in a given year is associated with an approximate 3% increase in expenditures for treatment of heart attacks and a 2.1% increase for new ischemic heart disease. A one percentage point increase in probability of defending a claim with a long-term resolution process leads to a 2.8% and 2.1% increase in expenditures for heart attacks and ischemic heart disease respectively. With respect to making a non-zero payment in a given claim, a 4.3% and a 2.9% increase in expenditures. These results demonstrate that direct reform's negative effect on claim and compensation reduces treatment intensity that drives up expenditure.

The findings of previous studies suggest that physicians practicing psychiatric medicine may adjust supply if exposed to increased malpractice pressure. (Klick & Stratman, 2007)and (Helland & H., 2009) indicate that changes in supply may be made on both the extensive and intensive margin if long-term prescription of BZD can be construed as negligent, ultimately leading to non-optimal care. (Kessler & McClellan, 2002) show there is reason to believe defensive medicine may drive greater expenditure but can possibly be mitigated with direct reforms. Appropriate reforms may allow victims to receive fair compensation while preventing unintended physician supply changes.

Data

To model risk of an adverse event individual medical, socioeconomic, and demographic data will be needed. In general, this will require linking pharmacy data to clinical data along with data on factors such as age, income, education, and personal and family history. In addition to treated individuals, a representative sample of healthy individuals would also be needed. The pharmacy data needed would include the type of benzodiazepine being prescribed along with any other drugs the user is taking. It will be necessary to have data on the number of dosage increases, decreases, and length of the prescription. The date the prescription is filled can serve as the treatment start date and the last prescription filled would serve as the end date. Clinical data would include the diagnosis, which could then be coded into broad categories such as anxiety, depression, insomnia, or other. Additionally I would need data on whether or not the user has a history of these psychiatric issues and any available data on family history. Either from clinical data or another source I also need data on whether or not an adverse reaction occurred. Lastly, I would have to match controls for age, sex, race, place of residence, and socioeconomic indicators such as income.

Model and Cost-Benefit Analysis

Estimating a probability model that cleanly identifies physician's marginal contribution to risk of an adverse reaction is critical to answering the question of negligent prescribing behavior. For simplicity I consider suicide only. The estimation strategy must be fair to all parties: physicians, victims, and society as a whole. This research is first of its kind; while medical literature is relatively informed on the dangers of long-term BZD use nothing to my knowledge has been done to inform economic and malpractice literature on the issue at hand.

Long-term users suffering from the side affects discussed above are prone to tolerance building that can reduce the efficacy of BZD. Once tolerance to a dosage has been built withdrawal symptoms are apt to occur (Ashton, 2002). Users in this situation are likely to perceive these withdrawal symptoms as re-manifestation of their original condition and refer to their prescribing physician who may increase the dosage without thorough evaluation. To compare behavior across physicians I propose that the ratio of net dosage increases to the length of time the user is on BZD be the identifying measure. This ratio will adjust for the fact that different users with personal tolerance levels are being prescribed BZD of varying potency for different amounts of time.

While BZD are indicated for periods of 2-4 weeks models should be estimated for a variety of definitions of long-term usage. Here, I propose that models be estimated for 60,90,120, and 180 days to allow for reasonable deviations from established guidelines.[2] The time in which treatment started and time in which the treatment ended will be controlled for along with psychiatric condition.[3] In addition the model will also control for demographic, personal and family history factors that may be correlated with both treatment and probability of suicide. The initial model to be estimated is as follows.

$$P_i = \alpha_i + \delta_1 RATIO_i + \delta_2 LT_i + \delta_3 TIMESTART_i + \delta_4 TIMEEND_i + CONDITION_i'\theta + X_i'\beta + \varepsilon_i$$

Where **RATIO** is the ratio of net dosage increases to treatment length, **LT** indicates long-term usage, **TIMESTART** is the time in which treatment started, **TIMEEND** is the time in which treatment ended or a suicide occurred, **CONDITION** is a vector of psychiatric conditions, and **X** is a vector of demographic and personal/family history controls. The model will need to be estimated with varying definitions of long-term use and the coefficient on **RATIO** identifies the marginal impact of a dosage increase per time period.

Next **RATIO**, **CONDITION**, and **LT** will be interacted and the model estimated.

$$P_i = \alpha_i + \delta_1 INTERACTION_i + \delta_2 RATIO_i + \delta_3 LT_i + \delta_4 TIMESTART_i + \delta_5 TIMEEND_i + CONDITION_i'\theta + X_i'\beta + \varepsilon_i$$

This **INTERACTION** identifies the marginal impact of a dosage increase per time period in long-term users. Since only a physician can diagnose and make treatment decisions regarding dosage and script length the coefficient on this term reflects the marginal probability of suicide that is solely due to the physician's prescribing behavior.

For the specifications discussed above linear probability, probit, and logit models can be estimated as a robustness check. Falsification tests can be ran by

[2] The medical literature has conflicting definitions of long-term usage that range between 60 and 180 days.
[3] Depression, anxiety, and insomnia are among the most common condition for which BZD are prescribed

replacing the outcome variable with a variable for which the regressors would have little to no explanatory power. A t-test can be applied to confirm that individual coefficients are statistically different from zero and an F-test can be applied to confirm that RATIO and INTERACTION are jointly significant and that the model has explanatory power in predicting probability of suicide.

Physician's contribution to probability of suicide can then be used in a cost benefit analysis to test whether or not their behavior is in fact negligent. In this case applying the Learned Hand rule is an appropriate test of negligence. Here, I will use the value of a statistical life as the value of damages, $9.1 million (US Department of Transportation, 2013). Considering that Medicare's bargaining power with providers allows them to bill very close to marginal cost I assume that the marginal cost of physician's time is equivalent to Medicare reimbursement for psychiatric services.[4] For the kind of services in question Medicare reimburses $125.02.[5]

If withdrawal takes 12 months to complete and the user meets with their prescribing physician twice a month this amounts to $3000.48 in prevention costs not including factors such as the opportunity cost of the provider seeing another patient, the cost of medication, and the value of the users time lost seeing the provider or time the user is rendered unproductive due to withdrawal symptoms (e.g. missed work and spousal duties). Because the withdrawal symptoms can be quite uncomfortable there may also be non-economic costs not accounted for here. See Appendix A for hypothetical total prevention costs and the implied marginal probability of suicide that just passes the Learned Hand rule test for negligence.

Conclusion

The above discussion demonstrates that it is possible to determine whether or not physicians are negligently prescribing BZD on a wide spread basis. If the results were to indicate negligence, literature linking malpractice pressure to physician supply decisions suggests that there may be consequences in terms of unnecessary health expenditures and non-optimal care. These potential unintended consequences may call for malpractice reforms that allow victims to be compensated while not placing an undue burden on physicians. Modeling probability of suicide as discussed will give an average effect for the entire population of long-term BZD users; even if results do not suggest widespread negligence it does not mean that absolutely none is occurring as long-term BZD use may disproportionately impact subsets of the population. Even though the cost benefit analysis performed here is simple and makes very strong assumptions it clearly demonstrates that a more realistic analysis can be done. Given the appropriate data it is possible to do all parties justice no matter if it identifies negligence or absolves physicians of liability and calls for further investigation into who or what is responsible for the myriad of negative health and socioeconomic outcomes that long-term BZD use precipitate.

[4] In estimating the cost of prevention I further assume that the user meets with the physician for a 60-minute psychotherapy session that includes medication management and a degree of complexity to the visit (e.g. a family member is present who is also participating in the psychotherapy session).
[5] This is a nationwide average.

Bibliography

Ashton, P. C. (2002). *The Ashton Manual.* New Castle Upon Tyne, England: Harwood Academic Publishers.

Helland, E., & H., S. M. (2009). The Impact of Liability on the Physician Labor Market . *Journal of Law and Economics* , 635-663 .

Kessler, D. P., & McClellan, M. B. (2002). How liability law affects medical productivity . *Journal of Heath Economics* , 931-955.

Klick, J., & Stratman, T. (2007). Medical Malpractice Reform and Physicians in High-Risk Specialties. *Journal of Legal Studies* , S121-S142.

Marcia Valenstein, M. M., Kiran Khanujua Taylor, M., Karen Austin, M., Helen C. Kales, M., John F. McCarthy, P., & Frederic C. Blow, P. (2004). Benzodiazepine Use Among Depressed Patients Treated in Mental Health Settings. *American Journal of Psychiatry* , 654-661.

Simon, G., VonKorff, M., William, B., Pabiniak, C., & Wagner, E. (1996). Predictors of Chronic Benzodiazepine Use in a Health Maintenance Organization Sample. *Journal of Clinical Epidemiology* , 1067-1073.

US Department of Transportation. (2013). Guidance on Treatment of the Economics Value of a Statistical Life in U.S. DOT Analyses. Washington D.C., USA: Office of the Secretary of Transportation.

Appendix A Total Prevention Costs and Implied Probability

Prevention Cost	Implied Probability
$25000	.3%
$50000	.5%
$100000	1.1%
$200000	2.2%
$500000	5.5%