Information Technology, Improved Access, and Use of Prescription Drugs

Petri Böckerman[†], Mika Kortelainen[††], Liisa T. Laine[‡], Mikko Nurminen[‡‡], Tanja Saxell[‡‡‡]

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[†]University of Jyväskylä, Labour Institute for Economic Research, and IZA Institute of Labor Economics
[††]University of Turku, and Finnish Institute for Health and Welfare
[‡]University of Missouri
[‡‡]Social Insurance Institution of Finland
[‡‡‡]Aalto University, VATT Institute for Economic Research, and Helsinki GSE

Access-overuse trade-off

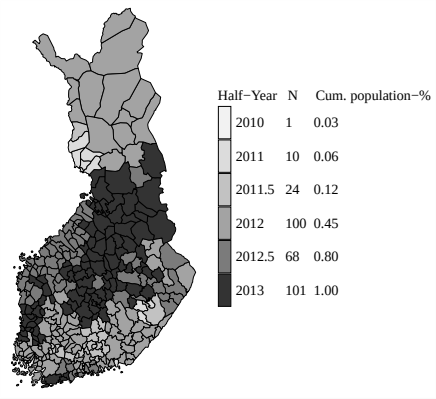
- Ensuring access to health care is a central policy goal worldwide (WHO Human Rights 2022).
- Policy measures to improve access include lowering financial and non-financial barriers for receiving health care.
  - **Social benefits:** Mitigate unmet needs for care (Patel and Prince 2010).
  - **Social costs:** Expose some patients to overuse of medical services, resulting in fewer health benefits than harms (Brownlee et al. 2017).
- Improving access to health care without exposing patients to its overuse is a challenging but important trade-off to balance.

This paper

- We study a large-scale public policy designed to improve access to medication while simultaneously limiting overuse.

- We analyze the adoption of a nationwide, fully interoperable electronic prescribing (e-prescribing) system that digitizes all prescriptions and their renewal requests in Finland.
  - **Improved medication access:** Digitization makes prescription renewal easier without an in-person physician visit.
  - **Comprehensive information on prescription history**: Can limit renewal of prescriptions for potentially overused or unnecessary medications, preventing downstream health harms.

Empirical setting



E-prescribing Adoption Half-Year in Finnish Municipalities

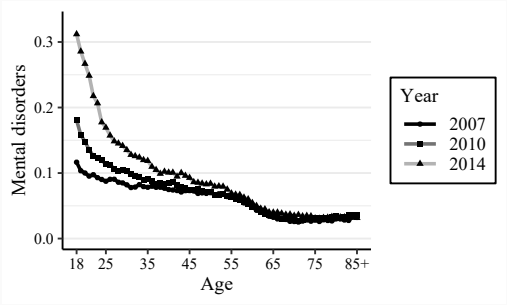
- We analyze how the technology adoption balances the access-overuse trade-off for patients treated with benzodiazepines – highly effective but potentially addictive mental health and insomnia medications.
- We estimate the effects on benzodiazepine use and downstream health outcomes, using
  - A difference-in-differences (DiD) approach based on the staggered adoption of e-prescribing in Finnish municipalities.
  - Individual-level administrative data sets.

Data

- We use nationwide administrative data sets for patients treated with benzodiazepines to analyze their prescription drug use, renewals, and downstream health outcomes at the intensive margin during 2007-2014.
  - Prescription data from the Social Insurance Institution of Finland.
  - Hospital discharge data from the Finnish Institute for Health and Welfare.
- We also combine the prescription data with the entire Finnish adult population from the Statistics Finland at the individual level to analyze first-time benzodiazepine use at the extensive margin in this population.

Access barriers are greater among younger patients

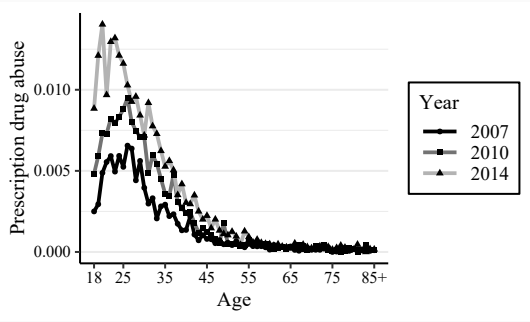
(a) Daily doses of benzodiazepines



(b) Hospitalization for mental and behavioral disorder

- Access barriers to medication, as well as mental and behavioral disorders, are more common in the younger population (Kurko et al. 2015).

Prescription drug abuse is concentrated among younger patients



Hospitalization for prescription drug abuse

- Hospitalizations for prescription drug abuse are strongly concentrated among younger patients, despite their lower level of benzodiazepine use.

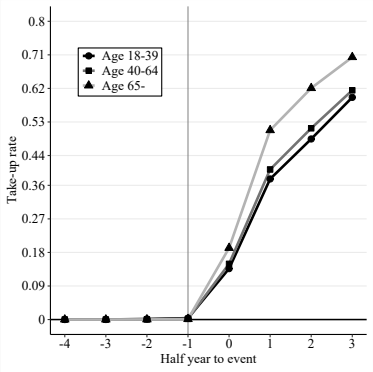
Econometric approach

We estimate DiD models using the two-way fixed effects (TWFE) specification:

$$y_{imt} = \rho \mathbb{1}[t - E_m \geq 0] + \alpha_i + \gamma_t + \epsilon_{imt},$$

- y_{imt} is a benzodiazepine-related outcome for individual i in municipality m at time t (a period of six months), $\mathbb{1}[t - E_m \geq 0]$ is the post-adoption indicator, E_m is the municipality's adoption date, and α_i and γ_t are the individual and time fixed effects.
- ρ: the intention-to-treat (ITT) effect of e-prescribing (due to voluntary take-up of the policy).
- We also estimate several other specifications that account for heterogeneous effects and address concerns related to potential pretrends and negative weights in TWFE.

Take-up rate of e-prescriptions increased sharply after municipality adoption



Conditional Take-up Rate of E-prescriptions

- Approximately 50 percent of benzodiazepine prescriptions were issued electronically one year after the municipality's technology adoption.

E-prescribing increased benzodiazepine use on average

- Our intention-to-treat (ITT) estimates show that the nationwide e-prescribing system has only little effect on the probability of initiating benzodiazepine treatment at the extensive margin.
- At the intensive margin, the total amount of benzodiazepine use per patient increases by 3% and there is also a 7% increase in long-term (more than 6-months) benzodiazepine use after e-prescribing.
- These increases at the intensive margin of benzodiazepine use result from increased prescription renewals, consistent with e-prescribing improving access to medication through easier renewal.

Benzodiazepine use increased most among younger patients

- The quantitative magnitude of the increase in the total amount of benzodiazepine use is over twice as large for younger patients (aged 18–39) as for the elderly (age over 65).
- Long-term use increased by 12 percent among younger patients after e-prescribing.
  - Long-term benzodiazepine use should be, however, avoided according to clinical treatment guidelines due to the increased risks of physical dependence, addiction, and other health harms related to medication overuse.

Health outcomes worsened for younger patients but improved for the elderly

- Hospitalizations for prescription drug abuse disorders and poisonings increased by approximately 10 percent among younger patients.
- No clear improvements in health outcomes (e.g., emergency department visits and mental health outcomes) among younger patients, despite their increased use of benzodiazepines.
- In contrast, for the elderly patients (age 65 over), e-prescribing reduces certain adverse drug effects, consistent with an improvement in information provision and success in balancing the access-overuse trade-off.

Discussion

- Our results based on a nationwide staggered adoption of information technology and individual-level administrative data show e-prescribing improving access to medication.
- Improved access predominantly affected younger patients at higher risks of mental and behavioral disorders.
- Improved medication access due to easier renewal exposed some younger patients to medication overuse and related health harms.
- In contrast, e-prescribing benefited the health of the elderly patients by mitigating certain adverse drug effects among them.

Discussion

- The ability of e-prescribing to balance the access-overuse trade-off depends on whether the improved access to medication offsets the benefits of improved information provision for physicians.
- Reducing the hassle costs associated with prescription renewal without additional monitoring for addiction in place may impair the targeting of high-risk medications.
  - Consistent with findings from research on ordeal mechanisms in social and welfare programs (e.g., Finkelstein and Notowidigdo 2019).
- Further research on other drug classes is needed to fully understand the effects of e-prescribing technology.

Literature

- Brownlee, S., K. Chalkidou, J. Doust, A. G. Elshaug, P. Glasziou, I. Heath, S. Nagpal, V. Saini, D. Srivastava, K. Chalmers, and D. Korestein (2017). Evidence for Overuse of Medical Services Around the World. The Lancet 390 (10090), 156–168.
- Finkelstein, A. and M. J. Notowidigdo (2019). Take-up and Targeting: Experimental Evidence from SNAP. The Quarterly Journal of Economics 134 (3), 1505–556.
- Hawks, L., D. U. Himmelstein, S. Woolhandler, D. H. Bor, A. Gaffney, and D. McCormick (2020). Trends in Unmet Need for Physician and Preventive Services in the United States, 1998-2017. JAMA Internal Medicine 180 (3), 439–448.
- Patel, V. and M. Prince (2010). Global Mental Health: A New Global Health Field Comes of Age. JAMA 303 (19), 1976–1977.