

$$Q_l \propto \frac{u_1^3}{\eta} \Delta p \quad (4)$$

where η is the fluid viscosity, and Δp is the pressure differential across the masks as shown in Eq. (3).⁸

Results

The increased pulsating pressure differential created by an overlying surgical mask potentially causes increased leakage according to Eq. (4).^{8,9}

Discussion

The analytical model includes simplifying assumptions such as negligible effects of multiphase flow and leakage around the surgical mask edges. In addition, the seal's balance ratio might increase during inhalation, thereby creating a countering increase in seal competence.

Covering N95 FFRs with a surgical mask can potentially increase the occurrence of N95 FFR leakage. Appropriate assessment of this risk will require additional research, including higher-order theoretical analysis, computational fluid dynamics modeling, bench tests, and/or human studies. As we engage in that work, we encourage others to do the same. Pending further study, N95 FFR clinical guidance and instructions to cover N95 FFRs with surgical masks should consider and assess this risk.

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References

1. Tran K, Cimon K, Severn M, Pessoa-Silva CL, Conly J. Aerosol-generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review. *PLoS One* 2012;7(4): e35797.
2. Interim infection prevention and control recommendations for healthcare personnel during the coronavirus disease 2019 (COVID-19) pandemic. Centers for Disease Control and Prevention website. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>. Published 2020. Updated July 15, 2020. Accessed August 12, 2020.
3. Bartoszko JJ, Farooqi MAM, Alhazzani W, Loeb M. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: a systematic review and meta-analysis of randomized trials. *Influenza Other Respir Viruses* 2020;14:365–373.
4. Czubyrt MP, Stecy T, Popke E, *et al*. N95 Mask reuse in a major urban hospital—COVID-19 response process and procedure. *J Hosp Infect* 2020; 106:277–282.
5. Whitaker S. Flow in porous media—a theoretical derivation of Darcy's Law. *Transport Porous Med* 1986;1(1):3–25.
6. Nishiyama N, Yokoyama T. Permeability of porous media: role of the critical pore size. *J Geophys Res-Sol Ea* 2017;122:6955–6971.
7. Hagen KD. *Heat Transfer with Applications*. Upper Saddle River, NJ: Prentice Hall; 1999.
8. Lorenz B, Persson BNJ. Leak rate of seals: comparison of theory with experiment. *Epl-Europhys Lett* 2009;86(4):44006.
9. Persson BNJ, Yang C. Theory of the leak-rate of seals. *J Phys-Condens Mat* 2008;20(31):315011.

Use and perceptions of antibiotics among US adults aged 50–80 years

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Although antibiotics can be life-saving agents, inappropriate use contributes to antibiotic resistance and drug-related adverse effects.^{1,2} The University of Michigan National Poll on Healthy Aging (NPHA) is a nationally representative survey of adults aged 50–80 years that surveys participants in Ipsos KnowledgePanel (Ipsos Public Affairs, Washington, DC). This survey was fielded in May 2019. The University of Michigan Institutional Review Board deemed this study exempt from review.

Along with demographics and self-reported health status, respondents were asked several questions about personal use of oral antibiotics during the previous 2 years. The survey completion rate was 76%. The

margin of error was $\pm 1\%$ – 2% for questions asked of the full sample, and it was higher among subgroups. Analyses used poststratification weights to draw national inferences and were performed using Stata version 15.1 software (StataCorp, College Station, TX). A 2-tailed $P < 0.05$ was considered statistically significant. The weighted proportion of respondents for each covariate, stratified by use of antibiotics in the previous 2 years, was calculated, and χ^2 tests were performed.

Among 2,256 respondents aged 50–80 years, 47.7% (95% confidence interval [CI], 45.5–49.9) reported an antibiotic prescription in the previous 2 years. The most common indications included respiratory (49.7%), dental (17.6%), urinary tract (16.6%) and skin (11.7%) infections. Among those who filled a prescription, 139 of 1,091 (12.7%; 95% CI, 10.7%–14.9%) had leftover medication, with similar percentages among younger and older respondents. The top reasons for having leftover

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antibiotics included the following: given more doses than needed (33.5%), stopped because they felt better (32.4%), stopped due to side effects (18.2%), forgot or skipped doses (14.4%), and stopped taking because it did not help (7.0%).

Among respondents who had leftover antibiotics, 65.0% kept them, 20.0% threw away or flushed them down the toilet, and 15.1% did not remember or did not specify what they did. Among those who kept leftover antibiotics, 59.7% said they did so in case they got another infection, 6.0% kept them in case a family member gets an infection, 4.1% were not sure how to dispose of leftovers, 1.9% forgot to dispose of them, and 28.2% said there was no specific reason.

Among all respondents, 422 of 2,256 (18.7%) reported ever taking leftover antibiotics without talking to a healthcare professional (16.8% took their own medication and 3.4% took someone else's). Among respondents who had leftover antibiotics in the previous 2 years, 71 of 141 (50.7%) had ever taken antibiotics without talking to a healthcare professional. For those who had a prescription for antibiotics but did not have leftover medication in the previous 2 years, 215 of 948 (22.7%) reported taking antibiotics without talking to a healthcare professional. In contrast, among those who did not have an antibiotic prescription in the previous 2 years, 138 of 1,151 (12.0%) reported ever taking antibiotics without talking to a healthcare professional ($P < .01$). Respondents aged 50–64 years were more likely than older respondents (aged 65–80 years) to have taken leftover antibiotics without talking to a healthcare professional: 239 of 1,138 (21.0%) versus 168 of 1,118 (15.0%), respectively ($P < .01$). Women were more likely than men to have taken leftover antibiotics: 176 of 1,064 (20.7%) versus 247 of 1,192 (16.5%), respectively ($P = .01$).

Most respondents with a prescription reported talking to either their healthcare professional or pharmacist on how to take the antibiotic (88.0%) and about potential side effects and drug interactions (65.8%). However, respondents who self-reported their mental health as fair or poor were less likely to have talked with a healthcare professional or pharmacist about how to take the antibiotic compared with those reporting good, very good, or excellent mental health (79.3% vs 86.6% vs 89.6%, respectively), and also less likely to have talked about potential side effects and drug interactions (51.0% vs 62.5% vs 68.6%, respectively).

Most older adults agreed (either strongly or somewhat) that they are cautious about the use of antibiotics (91.5%) and that overuse can lead to antibiotics not working the next time they are needed (88.6%). Most respondents were concerned (either strongly or somewhat) about side effects from antibiotics (60.6%) with concern being more common among those aged 65–80 years compared with those aged 50–64 years (65.1% vs 57.9%), and among women compared with men (63.6% vs 57.4%).

Adults aged 50–80 years (55.9%) agreed (strongly or somewhat) that doctors overprescribe antibiotics, and 22.8% agreed (strongly or somewhat) that doctors do not prescribe antibiotics when they should. If they have a cold that lasts long enough for them to visit a doctor, 41.3% of respondents said they expect a prescription for an antibiotic and 34% believed antibiotics help them get better sooner if they get a cold or flu.

Despite targeted efforts to decrease inappropriate prescribing of antibiotics, many patients still ask for and expect antibiotics when they are unlikely to be helpful. Moreover, most stewardship activities focus on inpatient settings even though 80%–90% of all antibiotic use occurs among outpatients.³

Among respondents in this poll, nearly half reported filling a prescription for antibiotics during the previous 2 years, consistent

with other contemporary data.¹ Although most respondents reported being cautious about antibiotic use and were knowledgeable about the risk of resistance and overuse, 41% of older adults still expected an antibiotic if they were ill long enough to see a doctor. This highlights the continued need to reinforce consumer messages regarding appropriate indications for antibiotics, and to provide clinicians with strategies to respond to patients who request antibiotics that are not indicated.

Most older adults who kept leftover antibiotics said they did so in case they got another infection. Across the population, leftover antibiotics represent millions of doses. The use of leftover antibiotics without supervision could result in serious drug interactions, cause other side effects, and contribute to resistance. Nonprescription antibiotic use has been identified as a prevalent and understudied public health concern.^{4,5}

In addition to counseling patients to take all antibiotics as prescribed, prescribers should consider the number of pills dispensed and follow guidance supporting shorter treatment durations for common infections. As has been done with opioids, consumers should be encouraged to bring unused antibiotics to community “take back” events or follow guidelines for proper disposal. Educational efforts should emphasize the risks of taking antibiotics without a prescription.

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References

1. Fleming-Dutra KE, Hersh AL, Shapiro DJ, *et al*. Prevalence of inappropriate antibiotic prescriptions among US ambulatory care visits, 2010–2011. *JAMA* 2016;315:1864–1873.
2. Barlam TF, Cosgrove SE, Abbo LM, *et al*. Executive summary: implementing an antibiotic stewardship program: guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. *Clin Infect Dis* 2016;62:1197–1202.
3. Measuring outpatient antibiotic prescribing. Centers for Disease Control and Prevention website. <https://www.cdc.gov/antibiotic-use/community/programs-measurement/measuring-antibiotic-prescribing.html> Accessed October 13, 2020.
4. Grigoryan L, Germanos G, Zoorob R, *et al*. Use of antibiotics without a prescription in the US population: a scoping review. *Ann Intern Med* 2019;171:257–263.
5. Zoorob R, Grigoryan L, Nash S, Trautner BW. Nonprescription antimicrobial use in a primary care population in the United States. *Antimicrob Agents Chemother* 2016;60:5527–5532.