



Robert W. Shafer

Professor (Research) of Medicine (Infectious Diseases) and, by courtesy, of Pathology
Medicine - Infectious Diseases

CLINICAL OFFICES

- **Stanford AIDS Clinical Trial Unit**

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Bio

BIO

Dr. Robert Shafer specializes in the treatment of infectious diseases. He has practiced for more than 25 years. Dr. Shafer has a special interest in acute and chronic viral infections.

CLINICAL FOCUS

- Infectious Disease

ACADEMIC APPOINTMENTS

- Professor (Research), Medicine - Infectious Diseases
- Professor (Research) (By courtesy), Pathology
- Member, Bio-X

PROFESSIONAL EDUCATION

- Fellowship: Stanford University School of Medicine (1993) CA
- Medical Education: New York University School of Medicine (1983) NY
- Board Certification: Infectious Disease, American Board of Internal Medicine (1988)
- Fellowship: SUNY at Brooklyn School Of Medicine (1988) NY
- Board Certification: Internal Medicine, American Board of Internal Medicine (1986)
- Residency: Lenox Hill Hospital (1986) NY
- Internship: Lenox Hill Hospital (1984) NY

LINKS

- HIV Drug Resistance Database: <http://hivdb.stanford.edu>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My group's research is on the mechanisms and consequences of virus evolution with a focus on HIV therapy and drug resistance. We maintain a public HIV drug resistance database (<http://hivdb.stanford.edu>) as a resource for HIV drug resistance surveillance, interpreting HIV drug resistance tests, and HIV drug development. These three disciplines – epidemiology, clinical management, and basic science – reflect the interdisciplinary nature of antiviral drug resistance research and represent the range of our group's activities.

HIV drug resistance, once the main challenge to the very concept that antiretroviral therapy would be possible, has been countered in a striking success of modern medicine. However, HIV drug resistance persists as the main threat to the long-term effectiveness of antiretroviral therapy in the under-resourced parts of the world with the highest numbers of HIV-infected people. The paramount goal of our group's work is to inform HIV treatment and prevention policies by identifying the most important factors responsible for the emergence and spread of drug resistance.

Additional interests of our group include sequence analyses that provide insight into viral pathogenesis, open source informatics approaches that facilitate the use of genomic data in clinical practice, and new sequencing technologies.

Teaching

COURSES

2019-20

- HIV: The Virus, the Disease, the Research: BIOS 257 (Sum)

2018-19

- HIV: The Virus, the Disease, the Research: BIOS 257 (Sum)

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biomedical Informatics (Phd Program)
- Immunology (Phd Program)

Publications

PUBLICATIONS

- **The biological and clinical significance of emerging SARS-CoV-2 variants.** *Nature reviews. Genetics*
Tao, K., Tzou, P. L., Nouhin, J., Gupta, R. K., de Oliveira, T., Kosakovsky Pond, S. L., Fera, D., Shafer, R. W.
2021
- **SARS-CoV-2 Antiviral Therapy.** *Clinical microbiology reviews*
Tao, K., Tzou, P. L., Nouhin, J., Bonilla, H., Jagannathan, P., Shafer, R. W.
2021: e0010921
- **Virological Failure and Acquired Genotypic Resistance Associated With Contemporary Antiretroviral Treatment Regimens.** *Open forum infectious diseases*
Rhee, S. Y., Clutter, D. n., Hare, C. B., Tchakoute, C. T., Sainani, K. n., Fessel, W. J., Hurley, L. n., Slome, S. n., Pinsky, B. A., Silverberg, M. J., Shafer, R. W.
2020; 7 (9): ofaa316
- **Analysis of unusual and signature APOBEC-mutations in HIV-1 pol next-generation sequences.** *PloS one*
Tzou, P. L., Kosakovsky Pond, S. L., Avila-Rios, S. n., Holmes, S. P., Kantor, R. n., Shafer, R. W.
2020; 15 (2): e0225352

- **Coronavirus Antiviral Research Database (CoV-RDB): An Online Database Designed to Facilitate Comparisons between Candidate Anti-Coronavirus Compounds.** *Viruses*
Tzou, P. L., Tao, K. n., Nouhin, J. n., Rhee, S. Y., Hu, B. D., Pai, S. n., Parkin, N. n., Shafer, R. W.
2020; 12 (9)
- **Multiplex Solid-Phase Melt Curve Analysis for the Point-of-Care Detection of HIV-1 Drug Resistance** *JOURNAL OF MOLECULAR DIAGNOSTICS*
Clutter, D. S., Mazarei, G., Sinha, R., Manasa, J., Nouhin, J., LaPrade, E., Bolouki, S., Tzou, P. L., Hannita-Hui, J., Sahoo, M. K., Kuimelis, P., Kuimelis, R. G., Pinsky, et al
2019; 21 (4): 580–92
- **Trends in the Molecular Epidemiology and Genetic Mechanisms of Transmitted Human Immunodeficiency Virus Type 1 Drug Resistance in a Large US Clinic Population** *CLINICAL INFECTIOUS DISEASES*
Rhee, S., Clutter, D., Fessel, W., Klein, D., Slome, S., Pinsky, B. A., Marcus, J. L., Hurley, L., Silverberg, M. J., Pond, S., Shafer, R. W.
2019; 68 (2): 213–21
- **Trends in the Molecular Epidemiology and Genetic Mechanisms of Transmitted HIV-1 Drug Resistance in a Large U.S. Clinic Population.** *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*
Rhee, S., Clutter, D., Fessel, W. J., Klein, D., Slome, S., Pinsky, B. A., Marcus, J. L., Hurley, L., Silverberg, M. J., Kosakovsky Pond, S. L., Shafer, R. W.
2018
- **Mutational Correlates of Virological Failure in Individuals Receiving a WHO-Recommended Tenofovir-Containing First-Line Regimen: An International Collaboration.** *EBioMedicine*
Rhee, S., Varghese, V., Holmes, S. P., van Zyl, G. U., Steegen, K., Boyd, M. A., Cooper, D. A., Nsanzimana, S., Saravanan, S., Charpentier, C., de Oliveira, T., Etiebet, M. A., Garcia, et al
2017; 18: 225-235
- **Evolution of gag and gp41 in Patients Receiving Ritonavir-Boosted Protease Inhibitors.** *Scientific reports*
Manasa, J. n., Varghese, V. n., Pond, S. L., Rhee, S. Y., Tzou, P. L., Fessel, W. J., Jang, K. S., White, E. n., Rögnvaldsson, T. n., Katzenstein, D. A., Shafer, R. W.
2017; 7 (1): 11559
- **HIV-1 drug resistance and resistance testing.** *Infection, genetics and evolution : journal of molecular epidemiology and evolutionary genetics in infectious diseases*
Clutter, D. S., Jordan, M. R., Bertagnolio, S., Shafer, R. W.
2016
- **HIV-1 Protease, Reverse Transcriptase, and Integrase Variation** *JOURNAL OF VIROLOGY*
Rhee, S., Sankaran, K., Varghese, V., Winters, M. A., Hurt, C. B., Eron, J. J., Parkin, N., Holmes, S. P., Holodniy, M., Shafer, R. W.
2016; 90 (13): 6058-6070
- **Response to Therapy in Antiretroviral Therapy-Naive Patients With Isolated Nonnucleoside Reverse Transcriptase Inhibitor-Associated Transmitted Drug Resistance** *JAIDS-JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES*
Clutter, D. S., Fessel, W. J., Rhee, S., Hurley, L. B., Klein, D. B., Ioannidis, J. P., Silverberg, M. J., Shafer, R. W.
2016; 72 (2): 171-176
- **Global epidemiology of drug resistance after failure of WHO recommended first-line regimens for adult HIV-1 infection: a multicentre retrospective cohort study** *LANCET INFECTIOUS DISEASES*
Gregson, J., Tang, M., Ndembi, N., Hamers, R. L., Rhee, S., Marconi, V. C., Diero, L., Brooks, K., Theys, K., de Wit, T. F., Arruda, M., Garcia, F., Monge, et al
2016; 16 (5): 565-575
- **More effective drugs lead to harder selective sweeps in the evolution of drug resistance in HIV-1.** *eLife*
Feder, A. F., Rhee, S., Holmes, S. P., Shafer, R. W., Petrov, D. A., Pennings, P. S.
2016; 5
- **Modifying Antiretroviral Therapy in Virologically Suppressed HIV-1-Infected Patients** *DRUGS*
Collins, S. E., Grant, P. M., Shafer, R. W.
2016; 76 (1): 75-98
- **Geographic and Temporal Trends in the Molecular Epidemiology and Genetic Mechanisms of Transmitted HIV-1 Drug Resistance: An Individual-Patient- and Sequence-Level Meta-Analysis.** *PLoS medicine*
Rhee, S., Blanco, J. L., Jordan, M. R., Taylor, J., Lemey, P., Varghese, V., Hamers, R. L., Bertagnolio, S., de Wit, T. F., Aghokeng, A. F., Albert, J., Avi, R., Avila-Rios, et al

2015; 12 (4)

- **HIV-1 Drug Resistance Mutations: Potential Applications for Point-of-Care Genotypic Resistance Testing.** *PLoS one*
Rhee, S., Jordan, M. R., Raizes, E., Chua, A., Parkin, N., Kantor, R., van Zyl, G. U., Mukui, I., Hosseinipour, M. C., Frenkel, L. M., Ndembu, N., Hamers, R. L., Rinke de Wit, et al
2015; 10 (12)
- **A uniquely prevalent nonnucleoside reverse transcriptase inhibitor resistance mutation in Russian subtype A HIV-1 viruses** *AIDS*
Kolomeets, A. N., Varghese, V., Lemey, P., Bobkova, M. R., Shafer, R. W.
2014; 28 (17): F1-F8
- **Non-nucleoside reverse transcriptase inhibitor (NNRTI) cross-resistance: implications for preclinical evaluation of novel NNRTIs and clinical genotypic resistance testing** *JOURNAL OF ANTIMICROBIAL CHEMOTHERAPY*
Melikian, G. L., Rhee, S., Varghese, V., Porter, D., White, K., Taylor, J., Towner, W., Troia, P., Burack, J., deJesus, E., Robbins, G. K., Razzeca, K., Kagan, et al
2014; 69 (1): 12-20
- **Prototypical Recombinant Multi-Protease-Inhibitor-Resistant Infectious Molecular Clones of Human Immunodeficiency Virus Type 1** *ANTIMICROBIAL AGENTS AND CHEMOTHERAPY*
Varghese, V., Mitsuya, Y., Fessel, W. J., Liu, T. F., Melikian, G. L., Katzenstein, D. A., Schiffer, C. A., Holmes, S. P., Shafer, R. W.
2013; 57 (9): 4290-4299
- **Trends in Genotypic HIV-1 Antiretroviral Resistance between 2006 and 2012 in South African Patients Receiving First- and Second-Line Antiretroviral Treatment Regimens** *PLOS ONE*
van Zyl, G. U., Liu, T. F., Claassen, M., Engelbrecht, S., de Oliveira, T., Preiser, W., Wood, N. T., Travers, S., Shafer, R. W.
2013; 8 (6)
- **Nucleoside reverse transcriptase inhibitor resistance mutations associated with first-line stavudine-containing antiretroviral therapy: programmatic implications for countries phasing out stavudine.** *journal of infectious diseases*
Tang, M. W., Rhee, S., Bertagnolio, S., Ford, N., Holmes, S., Sigaloff, K. C., Hamers, R. L., de Wit, T. F., Fleury, H. J., Kanki, P. J., Ruxrungtham, K., Hawkins, C. A., Wallis, et al
2013; 207: S70-7
- **Low-Level Persistence of Drug Resistance Mutations in Hepatitis B Virus-Infected Subjects with a Past History of Lamivudine Treatment** *ANTIMICROBIAL AGENTS AND CHEMOTHERAPY*
Margeridon-Thermet, S., Svarovskaia, E. S., Babrzadeh, F., Martin, R., Liu, T. F., Pacold, M., Reuman, E. C., Holmes, S. P., Borroto-Esoda, K., Shafer, R. W.
2013; 57 (1): 343-349
- **A Review of the Virological Efficacy of the 4 World Health Organization-Recommended Tenofovir-Containing Regimens for Initial HIV Therapy** *CLINICAL INFECTIOUS DISEASES*
Tang, M. W., Kanki, P. J., Shafer, R. W.
2012; 54 (6): 862-875
- **HIV-1 Antiretroviral Resistance: Scientific Principles and Clinical Applications** *DRUGS*
Tang, M. W., Shafer, R. W.
2012; 72 (9): E1-E25
- **The efficacy of an anti-CD4 monoclonal antibody for HIV-1 treatment** *ANTIVIRAL RESEARCH*
Fessel, W. J., Anderson, B., Follansbee, S. E., Winters, M. A., Lewis, S. T., Weinheimer, S. P., Petropoulos, C. J., Shafer, R. W.
2011; 92 (3): 484-487
- **HIV-1 Integrase Inhibitor Resistance and Its Clinical Implications** *JOURNAL OF INFECTIOUS DISEASES*
Blanco, J., Varghese, V., Rhee, S., Gatell, J. M., Shafer, R. W.
2011; 203 (9): 1204-1214
- **Comparison of the Mechanisms of Drug Resistance among HIV, Hepatitis B, and Hepatitis C** *VIRUSES-BASEL*
Margeridon-Thermet, S., Shafer, R. W.
2010; 2 (12): 2696-2739
- **HIV-1 Protease Mutations and Protease Inhibitor Cross-Resistance** *ANTIMICROBIAL AGENTS AND CHEMOTHERAPY*
Rhee, S., Taylor, J., Fessel, W. J., Kaufman, D., Towner, W., Troia, P., Ruane, P., Hellinger, J., Shirvani, V., Zolopa, A., Shafer, R. W.
2010; 54 (10): 4253-4261

- **Minority Variants Associated with Transmitted and Acquired HIV-1 Nonnucleoside Reverse Transcriptase Inhibitor Resistance: Implications for the Use of Second-Generation Nonnucleoside Reverse Transcriptase Inhibitors** *JAIDS-JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES*
Varghese, V., Shahriar, R., Rhee, S., Liu, T., Simen, B. B., Egholm, M., Hanczaruk, B., Blake, L. A., Gharizadeh, B., Babrzadeh, F., Bachmann, M. H., Fessel, W. J., Shafer, et al
2009; 52 (3): 309-315
- **Predictive Value of HIV-1 Genotypic Resistance Test Interpretation Algorithms** *JOURNAL OF INFECTIOUS DISEASES*
Rhee, S., Fessel, W. J., Liu, T. F., Marlowe, N. M., Rowland, C. M., Rode, R. A., Vandamme, A., Van Laethem, K., Brun-Vezinet, F., Calvez, V., Taylor, J., Hurley, L., Horberg, et al
2009; 200 (3): 453-463
- **Ultra-Deep Pyrosequencing of Hepatitis B Virus Quasispecies from Nucleoside and Nucleotide Reverse-Transcriptase Inhibitor (NRTI)-Treated Patients and NRTI-Naïve Patients** *15th Conference on Retroviruses and Opportunistic Infections*
Margeridon-Thermet, S., Shulman, N. S., Ahmed, A., Shahriar, R., Liu, T., Wang, C., Holmes, S. P., Babrzadeh, F., Gharizadeh, B., Hanczaruk, B., Simen, B. B., Egholm, M., Shafer, et al
OXFORD UNIV PRESS INC.2009: 1275-85
- **Drug Resistance Mutations for Surveillance of Transmitted HIV-1 Drug-Resistance: 2009 Update** *PLOS ONE*
Bennett, D. E., Camacho, R. J., Otelea, D., Kuritzkes, D. R., Fleury, H., Kiuchi, M., Heneine, W., Kantor, R., Jordan, M. R., Schapiro, J. M., Vandamme, A., Sandstrom, P., Boucher, et al
2009; 4 (3)
- **Low-Abundance Drug-Resistant HIV-1 Variants: Finding Significance in an Era of Abundant Diagnostic and Therapeutic Options** *JOURNAL OF INFECTIOUS DISEASES*
Shafer, R. W.
2009; 199 (5): 610-612
- **A transitional endogenous lentivirus from the genome of a basal primate and implications for lentivirus evolution** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Gifford, R. J., Katzourakis, A., Tristem, M., Pybus, O. G., Winters, M., Shafer, R. W.
2008; 105 (51): 20362-20367
- **Characterization of mutation spectra with ultra-deep pyrosequencing: Application to HIV-1 drug resistance** *GENOME RESEARCH*
Wang, C., Mitsuya, Y., Gharizadeh, B., Ronaghi, M., Shafer, R. W.
2007; 17 (8): 1195-1201
- **HIV-1 subtype B protease and reverse transcriptase amino acid covariation** *PLOS COMPUTATIONAL BIOLOGY*
Rhee, S., Liu, T. F., Holmes, S. P., Shafer, R. W.
2007; 3 (5): 836-843
- **Genotypic predictors of human immunodeficiency virus type 1 drug resistance** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Rhee, S., Taylor, J., Wadhwa, G., Ben-Hur, A., Brutlag, D. L., Shafer, R. W.
2006; 103 (46): 17355-17360
- **Rationale and uses of a public HIV drug-resistance database** *Symposium on Bridging Generations Toward an Understanding of Infectious Disease Pathogenesis*
Shafer, R. W.
UNIV CHICAGO PRESS.2006: S51-S58
- **HIV-1 pol mutation frequency by subtype and treatment experience: extension of the HIVseq program to seven non-B subtypes** *AIDS*
Rhee, S. Y., Kantor, R., Katzenstein, D. A., Camacho, R., Morris, L., Sirivichayakul, S., Jorgensen, L., Brigido, L. F., Schapiro, J. M., Shafer, R. W.
2006; 20 (5): 643-651
- **Panel of prototypical infectious molecular HIV-1 clones containing multiple nucleoside reverse transcriptase inhibitor resistance mutations** *AIDS*
Johnston, E., Dupnik, K. M., Gonzales, M. J., Winters, M. A., Rhee, S. Y., Imamichi, T., Shafer, R. W.
2005; 19 (7): 731-733
- **Impact of HIV-1 subtype and antiretroviral therapy on protease and reverse transcriptase genotype: Results of a global collaboration** *PLOS MEDICINE*
Kantor, R., Katzenstein, D. A., Efron, B., CARVALHO, A. P., Wynhoven, B., Cane, P., Clarke, J., Sirivichayakul, S., Soares, M. A., Snoeck, J., Pillay, C., Rudich, H., Rodrigues, et al

2005; 2 (4): 325-337

- **Comparison of four-drug regimens and pairs of sequential three-drug regimens as initial therapy for HIV-1 infection** *NEW ENGLAND JOURNAL OF MEDICINE*
Shafer, R. W., Smeaton, L. M., Robbins, G. K., De Gruttola, V., Snyder, S. W., D'Aquila, R. T., JOHNSON, V. A., Morse, G. D., Nokta, M. A., Martinez, A. I., Gripshover, B. M., Kaul, P., Haubrich, et al
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- **Colinearity of reverse transcriptase inhibitor resistance mutations detected by population-based sequencing** *JAIDS-JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES*
Gonzales, M. J., JOHNSON, E., Dupnik, K. M., Imamichi, T., Shafer, R. W.
2003; 34 (4): 398-402
- **Extended spectrum of HIV-1 reverse transcriptase mutations in patients receiving multiple nucleoside analog inhibitors** *AIDS*
Gonzales, M. J., Wu, T. D., Taylor, J., Belitskaya, F., Kantor, R., Israelski, D., Chou, S., Zolopa, A. R., Fessel, W. J., Shafer, R. W.
2003; 17 (6): 791-799
- **Mutation patterns and structural correlates in human immunodeficiency virus type 1 protease following different protease inhibitor treatments** *JOURNAL OF VIROLOGY*
Wu, T. D., Schiffer, C. A., Gonzales, M. J., Taylor, J., Kantor, R., Chou, S. W., Israelski, D., Zolopa, A. R., Fessel, W. J., Shafer, R. W.
2003; 77 (8): 4836-4847
- **Human immunodeficiency virus reverse transcriptase and protease sequence database** *NUCLEIC ACIDS RESEARCH*
Rhee, S. Y., Gonzales, M. J., Kantor, R., Betts, B. J., Ravela, J., Shafer, R. W.
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- **Human immunodeficiency virus type 1 reverse transcriptase and protease mutation search engine for queries** *NATURE MEDICINE*
Shafer, R. W., Jung, D. R., Betts, B. J.
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- **Multiple concurrent reverse transcriptase and protease mutations and multidrug resistance of HIV-1 isolates from heavily treated patients** *ANNALS OF INTERNAL MEDICINE*
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- **Predictors of survival in HIV-infected tuberculosis patients** *AIDS*
Shafer, R. W., Bloch, A. B., Larkin, C., VASUDAVAN, V., SELIGMAN, S., Dehovitz, J. D., DiFerdinando, G., Stoneburner, R., Cauthen, G.
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Shafer, R. W., Small, P. M., Larkin, C., Singh, S. P., Kelly, P., Sierra, M. F., SCHOOLNIK, G., Chirgwin, K. D.
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- **COMBINATION THERAPY WITH ZIDOVUDINE AND DIDANOSINE SELECTS FOR DRUG-RESISTANT HUMAN-IMMUNODEFICIENCY-VIRUS TYPE-1 STRAINS WITH UNIQUE PATTERNS OF POL GENE-MUTATIONS** *JOURNAL OF INFECTIOUS DISEASES*
Shafer, R. W., Kozal, M. J., Winters, M. A., Iversen, A. K., Katzenstein, D. A., Ragni, M. V., Meyer, W. A., Gupta, P., Rasheed, S., COOMBS, R., Katzman, M., Fiscus, S., Merigan, et al
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- **EXOGENOUS REINFECTION WITH MULTIDRUG-RESISTANT MYCOBACTERIUM-TUBERCULOSIS IN PATIENTS WITH ADVANCED HIV-INFECTION** *NEW ENGLAND JOURNAL OF MEDICINE*
Small, P. M., Shafer, R. W., Hopewell, P. C., Singh, S. P., MURPHY, M. J., Desmond, E., Sierra, M. F., SCHOOLNIK, G. K.
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- **EXTRAPULMONARY TUBERCULOSIS IN PATIENTS WITH HUMAN-IMMUNODEFICIENCY-VIRUS INFECTION** *MEDICINE*
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- **Temporal Trends in HIV-1 Mutations Used for the Surveillance of Transmitted Drug Resistance.** *Viruses*
Rhee, S., Tzou, P. L., Shafer, R. W.
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- **Integrase Strand Transfer Inhibitor Resistance in Integrase Strand Transfer Inhibitor-Naïve Persons.** *AIDS research and human retroviruses*
Bailey, A. J., Rhee, S. Y., Shafer, R. W.
2021
- **SARS-CoV-2 Neutralization Resistance Mutations in Patient with HIV/AIDS, California, USA.** *Emerging infectious diseases*
Hoffman, S. A., Costales, C., Sahoo, M. K., Palanisamy, S., Yamamoto, F., Huang, C., Verghese, M., Solis, D. C., Sibai, M., Subramanian, A., Tompkins, L. S., Grant, P., Shafer, et al
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- **A SARS-CoV-2 antiviral therapy score card.** *Global health & medicine*
Shafer, R. W.
2020; 2 (6): 346-49
- **In vitro cross-resistance to doravirine in a panel of HIV-1 clones harbouring multiple NNRTI resistance mutations.** *The Journal of antimicrobial chemotherapy*
Saladini, F., Giammarino, F., Hosseini, B. A., Giannini, A., Boccutto, A., Dragoni, F., Vicenti, I., Shafer, R. W., Zazzi, M.
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- **Next-Generation Sequencing for HIV Drug Resistance Testing: Laboratory, Clinical, and Implementation Considerations.** *Viruses*
Avila-Rios, S., Parkin, N., Swanstrom, R., Paredes, R., Shafer, R., Ji, H., Kantor, R.
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- **Cost-effectiveness analysis of pre-ART HIV drug resistance testing in Kenyan women.** *EClinicalMedicine*
Duarte, H. A., Babigumira, J. B., Enns, E. A., Stauffer, D. C., Shafer, R. W., Beck, I. A., Garrison, L. P., Chung, M. H., Frenkel, L. M., Bendavid, E.
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Tzou, P. L., Descamps, D., Rhee, S., Raugi, D. N., Charpentier, C., Taveira, N., Smith, R. A., Soriano, V., de Mendoza, C., Holmes, S. P., Gottlieb, G. S., Shafer, R. W.
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- **HIV-1 transmitted drug resistance surveillance: shifting trends in study design and prevalence estimates.** *Journal of the International AIDS Society*
Rhee, S. Y., Kassaye, S. G., Barrow, G. n., Sundaramurthi, J. C., Jordan, M. R., Shafer, R. W.
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- **Prospective Evaluation of the Vela Diagnostics Next-Generation Sequencing Platform for HIV-1 Genotypic Resistance Testing.** *The Journal of molecular diagnostics : JMD*
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2019
- **Amino Acid Prevalence of HIV-1 pol Mutations by Direct PCR and Single Genome Sequencing.** *AIDS research and human retroviruses*

- Tzou, P. L., Rhee, S., Shafer, R.
2019
- **The Clinical Implications of Pretreatment Drug Resistance-A Moving Target** *CLINICAL INFECTIOUS DISEASES*
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 - **Curbing the rise of HIV drug resistance in low-income and middle-income countries: the role of dolutegravir-containing regimens** *LANCET INFECTIOUS DISEASES*
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