# Giving Naloxone to Heroin Users Reduces Overdose Death and is Highly Cost-Effective

Opioid overdose is a major cause of death globally. Naloxone, the antidote used to reverse opioid overdose, is among the safest drugs known and is on the World Health Organization list of essential medicines. Hundreds of programs around the world have provided naloxone directly to drug users, their families and friends to use to rescue loved ones from opioid overdose.

Naloxone has no potential for abuse and lay persons can easily be trained to use it to reverse overdose. In the U.S., for example, 188 programs have distributed naloxone to 53,032 people and documented 10,171 reversals.[8] In addition to reversing individual overdoses, naloxone distribution programs have been associated with reductions in overdose death in communities.[1,9-15]

Since naloxone is inexpensive, handing it out is probably well worth the expense. Governments often use such "cost-effectiveness" analyses, looking at how much a health program costs for the years of life gained by the intervention, to decide what should be funded. Some have argued, however, that since heroin users who overdose are at heightened risk of overdosing again,[16] naloxone may merely delay death. Moreover, naloxone is not always required to save someone from an overdose–sometimes physical stimulation and rescue breathing are enough. Finally, some policymakers might feel that heroin users are too expensive to keep alive.

To address these concerns, we explored whether naloxone distribution programs are in fact cost-effective in two countries. To do this, we developed a mathematical model of heroin use, overdose, and naloxone distribution based on published data. The model looked at costs and lives saved by naloxone in the U.S. and the Russian Federation (Russia) with techniques accepted in the health economics field (Markov and decision analytic modeling with deterministic and probabilistic analyses). To make the models as accurate as possible for each country, we used local death rates and average ages of initiating heroin use, as well as other information specific to the countries (including risk of overdose, roles of witnesses and emergency medical services, rates of abstinence from and relapse to heroin use, and costs). As is standard in many cost-effectiveness analyses, the outcomes we explored were deaths prevented and the cost of gaining one quality-adjusted life year (QALY, or a year of healthy life).

## Deaths prevented:

Naloxone distribution prevented deaths in all analyses. In the U.S., reaching 20% of heroin users would prevent 10.6% of overdose deaths in the first 5 years of the program; on average 101 kits would need to be given out to prevent one death. In Russia, reaching 20% of heroin users would prevent 13.4% of overdose deaths in the first 5 years; on average 29 naloxone kits would need to be given out to prevent one death.

## Cost-effectiveness:

Naloxone distribution was cost-effective in all analyses, requiring far less per QALY gained than many health interventions currently supported by the governments.

In the U.S., naloxone distribution would cost $421 for each QALY gained. If we included the costs of national drug-related expenditures on criminal justice, healthcare and research, naloxone distribution would cost $2,429 for each QALY gained. In a worst-case scenario—where we assumed overdose was rarely witnessed and naloxone was rarely used, minimally effective, and expensive—naloxone distribution would cost $14,000 for each QALY gained. All of these values are well below the usual cut-off for cost-effectiveness (in the US any value less than $50,000 for each QALY gained is regarded as cost-effective).

In Russia, naloxone distribution would cost $56 for each QALY gained. If we included the costs of national drug-related expenditures on criminal justice, HIV and tuberculosis, naloxone distribution would cost $847 for each QALY gained. Naloxone distribution is clearly cost-effective in Russia as well.

## Conclusions:

Naloxone distribution to heroin users for overdose reversal is highly likely to reduce overdose deaths and is robustly cost-effective in both the U.S. and Russia, even under the most conservative assumptions. The cost-effectiveness of naloxone distribution in the U.S. is similar to checking blood pressure to screen for high blood pressure at a physician's office—something that is regarded as routine and indispensable. Even if we assume the most limited effects of naloxone and include costs related to criminal justice and other services for those heroin users who survive, naloxone distribution is a remarkably inexpensive way to save lives.

## References

1. Green TC, Heimer R, Grau LE. Distinguishing signs of opioid overdose and indication for naloxone: an evaluation of six overdose training and naloxone distribution programs in the United States. Addiction. Jun 2008;103(6):979-989.

2. Grau LE, Green TC, Torban M, et al. Psychosocial and contextual correlates of opioid overdose risk among drug users in St. Petersburg, Russia. Harm Reduct J. 2009;6:17.

3. Green TC, Grau LE, Blinnikova KN, et al. Social and structural aspects of the overdose risk environment in St. Petersburg, Russia. Int J Drug Policy. May 2009;20(3):270-276.

4. Coffin P. Overdose: A Major Cause of Preventable Death in Central and Eastern Europe in Central Asia: Recommendations and Overview of the Situation in Latvia, Kyrgyzstan, Romania, Russia and Tajikistan. Vilnius, Lithuania: Eurasian Harm Reduction Network (EHRN);2008.

5. Liu Y, Bartlett N, Li L, Lv X, Zhang Y, Zhou W. Attitudes and knowledge about naloxone and overdose prevention among detained drug users in Ningbo, China. Substance abuse treatment, prevention, and policy. 2012;7:6.

6. Bartlett N, Xin D, Zhang H, Huang B. A qualitative evaluation of a peer-implemented overdose response pilot project in Gejiu, China. Int J Drug Policy. Jul 2011;22(4):301-305.

7. Strang J, Manning V, Mayet S, et al. Overdose training and take-home naloxone for opiate users: prospective cohort study of impact on knowledge and attitudes and subsequent management of overdoses. Addiction. Oct 2008;103(10):1648-1657.

8. Community-based opioid overdose prevention programs providing naloxone—United States, 2010. MMWR. Morbidity and mortality weekly report. Feb 17 2012;61(6):101-105.

9. Walley AY. Bystander overdose education and naloxone distribution in Massachusetts. Paper presented at: Role of Naloxone in Opioid Overdose Fatality Prevention2012; Silver Spring MD.

10. Sporer KA, Kral AH. Prescription naloxone: a novel approach to heroin overdose prevention. Ann Emerg Med. Feb 2007;49(2):172-177.

11. Doe-Simkins M, Walley AY, Epstein A, Moyer P. Saved by the nose: bystander-administered intranasal naloxone hydrochloride for opioid overdose. Am J Public Health. May 2009;99(5):788-791.

12. Piper TM, Stancliff S, Rudenstine S, et al. Evaluation of a naloxone distribution and administration program in New York City. Subst Use Misuse. 2008;43(7):858-870.

13. Enteen L, Bauer J, McLean R, et al. Overdose prevention and naloxone prescription for opioid users in San Francisco. Journal of urban health : bulletin of the New York Academy of Medicine. Dec 2010;87(6):931-941.

14. Maxwell S, Bigg D, Stanczykiewicz K, Carlberg-Racich S. Prescribing naloxone to actively injecting heroin users: a program to reduce heroin overdose deaths. J Addict Dis. 2006;25(3):89-96.

15. Paone D, Heller D, Olson C, Kerker B. Illicit drug use in New York City. NYC Vital Signs. In: Hygiene DoHaM, ed. Vol 9. New York2010:1-4.Coffin PO, Tracy M, Bucciarelli A, Ompad D, Vlahov D, Galea S. Identifying injection drug users at risk of nonfatal overdose. Acad Emerg Med. Jul 2007;14(7):616-623.