4-2019

# Why Patients Do Not Always Follow Doctor's Advice: Systems Approach Explains Empirical Observation

Griselda Acosta
*The University of Texas at El Paso*, gvacosta@miners.utep.edu

Eric Smith
esmith2@utep.edu

Vladik Kreinovich
*The University of Texas at El Paso*, vladik@utep.edu

Comments:

Technical Report: UTEP-CS-19-41

# Why Patients
# Do Not Always Follow Doctor's Advice:
# Systems Approach Explains
# Empirical Observation

Griselda Acosta[1], Eric Smith[2], and Vladik Kreinovich[3]
[1]Department of Electrical and Computer Engineering
[2]Department of Industrial, Manufacturing, and
Systems Engineering
[3]Department of Computer Science
University of Texas at El Paso
500 W. University
El Paso, TX 79968, USA
gvacosta@miners.utep.edu, esmith2@utep.edu, vladik@utep.edu

**Abstract**

Empirical studies show that when a medical doctor prescribes a medicine, only two third of the patients fill the prescription, and of this filling-prescription group, only half follow the doctor's instructions when taking the medicine. In this paper, we show that a general systems approach – namely, abstracting from the specifics of this situation – helps explain these empirical observations. We also mention that systems approach can not only explains this problem, it can also help solve it – i.e., it can help increase the patients' adherence to the doctors' recommendations.

## 1  Formulation of the Problem

**Empirical observation.** A recent study [5, 6] shows that among all the patients who get a prescription from a medical doctor:

- approximately one third of the patients do not fill their prescription at all,

- one third of the patients fill the prescription, but do not exactly follow the doctor's instructions about dosage and times, and

- only the remaining one third of the patients does exactly what the doctor suggested.

Researchers tried to explain this somewhat unexpected observation; see, e.g., [2, 4, 6]. However, all these explanations have been mostly qualitative. So far, to the best of our knowledge, there has been no convincing quantitative explanation.

**What we do in this paper.** In this paper, we show that the above empirical observation can be quantitatively explained if we abstract away from medical and social details and reformulate this problem on the general systems level.

# 2 Our Explanation

**Possible reactions to a doctor's recommendation.** When a patient gets some recommendation from the doctor, the patient does not necessarily believe that these recommendations are correct – otherwise, he/she would obediently follow this recommendation. In general, there are three possible options:

- the first option is that the patient is confident that the doctor's recommendation is correct,

- the second option is that the patient is confident that the doctor's recommendation is not correct, and

- the third option is that the patient is not sure whether the doctor's recommendation is correct or not.

**How these reactions affect the patient's behavior.** If a patient is confident that the doctor's recommendation is correct, then this patient will obediently follow this recommendation. In particular, this patient will fill the doctor's prescription and take the corresponding medicine at the prescribed times and at the prescribed dosage.

If the patient is confident that the doctor's recommendation is not correct, this patient will not even bother to fill the doctor's prescription.

In the third case, when the patient is not sure whether the doctor's recommendation is correct, a reasonable idea – unless the patient goes to a second doctor for a second opinion – is to follow some part of the doctor's recommendation. In this case, the patient fills the prescription but follows only part of the doctor's instructions about taking this medicine, e.g.:

- takes only half-dose each time or

- takes it only once a day when the doctor recommended to take it twice a day, etc.

**The resulting frequencies with which patients exhibit different reactions to the doctor's recommendation.** The above analysis shows that, depending on the patient's reaction, we will observe exactly the three types of behavior that the above empirical study observed. Thus, the frequencies

with which we observe three different behaviors are exactly the frequencies with which the patients show one of the above three reactions to a doctor's recommendation:

- approximately one third of the patients are confident that the doctor's recommendation is correct;

- about one third of the patients are confident that the doctor's recommendation is not correct, and

- the remaining one third of the patients are not sure whether the doctor's recommendation is correct or not.

Hence, to explain the above empirical observation, we need to explain the frequencies of different patient's reactions to the doctor's recommendation.

**Frequencies explained.** The vast majority of patients are not trained in medicine. Thus, they have no reasonable way to decide whether they should trust the doctor's recommendation or not. As a result, they face the problem of selecting one of the three alternatives – i.e., one of the three possible reactions to a doctor's recommendation – without having any information that would help them select one of these three alternatives.

Such a situation of selection under complete uncertainty is well known. A usual way to solve it – known as *Laplace Indeterminacy Principle* – is to conclude that since we have no reason to assign different probabilities to different alternatives, a reasonable idea is to assign the exact same probability to all these alternatives; see, e.g., [3] and references therein.

In our case, there are three alternatives, so we assign the exact same probability $p$ to each of these three alternatives. Since the probabilities of selecting one of the alternatives must add up to 1, we thus conclude that $p + p + p = 1$, i.e., that $p = 1/3$. So, we predict that the patient will select each of three alternative reactions – and thus, the corresponding behavior – in exactly $1/3$ of the cases. This is exactly what the empirical study observed.

Thus, we have indeed explained the observed frequencies of different medicine adherence behavior.

**Need to go beyond explanations.** Explanations are nice, but it is desirable not just to explain the fact that patients do not follow the doctors' recommendation, but to come up with ways to increase their adherence to these recommendations. In this, systems approach can also help; see, e.g., [1]. Specifically, systems approach helps in developing tools that help the patients understand the reasoning behind the doctors' recommendations and thus, increase the percentage of patients who follow these recommendations.

# Acknowledgments

# References

[1] B. Dantu and E. Smith, "Diagnostic modeling for medical decision making", In: T. Doolen and E. Van Aken (eds.), *Proceedings of the 2011 Industrial Engineering Research Conference*, Reno, Nevada, May 21–25, 2011.

[2] J. Groopman, *How Doctors Think*, Houghton Mifflin Co., New York, 2007.

[3] E. T. Jaynes and G. L. Bretthorst, *Probability Theory: The Logic of Science*, Cambridge University Press, Cambridge, UK, 2003.

[4] A. Morabia, "Last stand or burgeoning rebellion against evidence-based medicine? A book review of [2]", *Preventive Medicie*, 2007, Vol. 45, pp. 491–494.

[5] J. B. Peterson, *12 Rules for Life: An Antidote to Chaos*, Random House Canada, Toronto, Canada, 2018.

[6] R. Tamblyn, E. Tewodros, A. Huang, N. Winslade, and P. Doran, "The incidence and determinants of primary nonadherence with prescribed medication in primary care: a cohort study", *Annals of Internal Medicine*, 2014, Vol. 160, pp. 441–450.