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Original Research Article

Patients' over-visit phobia versus physician's over-prescription phobia

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ABSTRACT

Background: Hospital administrators conduct survey of patients to solicit their satisfactions and/or concerns for accreditation or renewal of license. For the first time in the literature, this article defines and illustrates the existence of patient's over-visit phobia and the physician's over-prescription phobia. These phobias pave way to formulate policy to increase hospital's efficiency.
Methods: The number, of times a patient visits the physician (with a visitation rate) and the number, of prescriptions written by a physician (with a prescription rate) are assumed to follow Poisson type probability patterns. This article, in a novel manner, untangles intricacies and inter-relations of these two phobias.
Results: An analysis of the Australian Health Survey data, using our model and methodology, estimates visit and prescription rate to be and respectively. The chance for patient's visit phobia and physician's prescription phobia is respectively 0.33 (with a reluctance level 2.16 to make additional visits) and 0.46 (with an avoidance level 3.17 to prescribe more medicines).
Conclusions: A few comments and suggestions are stated to save service time/cost for the sake of more hospital's efficiency. With a methodology in this article, level of over-visits by the patients and the level of over-prescriptions by the physicians are estimable to reduce the waste of hospital's resources.

Keywords: Mean residual life, Poisson distribution, Probability indices, Survival function

INTRODUCTION

The electronically advanced 21st century is still struggling with the serious issues, which quite stumbles the healthcare industry from becoming effective and efficient enterprise. The healthcare professionals (including physicians, nurses, insurance agencies, policy makers, administrators and most of all, the patients as customers) desperately desire evidence-based healthcare practice. A popular notion is "don't visit physician if you are not sick". Approximately 177,000 Americans visit the physician per annum without any symptom or suffering. Of course, the time a physician spends with the patient is a crucial factor in the discussion of refining the healthcare system. In general, a physician spends 13 to 16 minutes, while specialists like anesthesiologists, neurologists, or radiologists spend more than 25 minutes with the patient but specialists like dermatologists or ophthalmologists spend lesser than 12 minutes. Of course, the time translates into money. To reduce the healthcare cost, unnecessary visits to physician as well as unnecessary consumption of medicines play a vital role.

Bodenheimer et al, narrates a perilous journey through the health care system to refine it for a better efficiency.[1] If a patient's visit takes more than 23 minutes, a physician would spend 17 million hours over 40 million healthy people in USA per year. These startling facts alert healthcare analysts to learn from the collected data to refine the healthcare system to enable it to attain more efficiency. In this regard, this article develops a data analytic new approach and illustrates it using the Australian Health Survey of year 1977-1978. The main theme in this article is all about unnecessary over-visits to physician versus unneeded over-prescriptions of medicines.

To be specific, when a patient visits the physician's office more often than necessary, it is labelled here patient's over-visit phobia in this article. This phobia is a latent trait, not measurable but perhaps estimable from the data of a group of patients, if a suitable methodology exists. A search of the literature suggests the absence of a methodology to estimate and interpret the here patient's over-visit phobia, despite its importance to improve healthcare system. Likewise, if a physician over-prescribes unneeded medicines to a patient, it is also not measurable directly but can, perhaps, be identified from the data pattern and it is named physician's over-prescription phobia in this article. There is a need to formally define the phobias and develop a suitable data analytic methodology to extract pertinent evidence from the data to estimate and interpret both phobias. This is achieved in this article.

METHODS

In an ideal scenario, the physician functions with no phobia of over-prescribing unneeded medicines as much as the patient has no over-visit phobia of making unnecessary visits to physician. In such a scenario, let x≥0 be a random variable, denoting the number of visits to physician per annum made by a patient with a visit rate *λ>0*. Suppose that follows X a Poisson probability pattern. Likewise, let the random variable denote the number of prescribed medicines by the physician with a prescription rate θ>0 to a patient during his/her visit. Suppose that follows a Poisson probability pattern and it is independent of X. Then, note.

$$\Pr[X = x, Y = y | \lambda, \theta] = e^{-(\lambda+\theta)} \lambda^x \theta^y / x! y!]; \quad \lambda > 0, \theta > 0; x, y = 0,1,2,3,......,\infty. \qquad (1)$$

Shanmugam et al, enlist various ways of checking independence among random variables.[2] Note that the joint probability

$$\pi_1^{00} = \Pr[X = 0, Y = 0 | \lambda, \theta] = e^{-(\lambda+\theta)} = \Pr[X = 0 | \lambda] \Pr[Y = 0 | \theta], \qquad (2)$$

portrays the proportion of healthy people requiring no prescribed medicine and making no visit to the physician. Suppose of interest is the proportion of patients making just one visit and it is $\lambda e^{-\lambda}$. Hence, the jump rate from the proportion of healthy people requiring no medication is and it often increases. Likewise, the jump rate of prescribing one medication over none is θ and it often increases.

The conditional probability pattern of the visits for a given number of prescribed medicines is also Poisson with parameter λ. That is,

$$\Pr[X = x | Y = y] = \frac{\Pr[X = x, Y = y]}{\Pr[Y = y]} = \Pr[X = x | \lambda] = e^{-\lambda} \lambda^x / x!. \qquad (3)$$

Then, the conditional projection of the number of visits to the physician given a patient has received a y number of medications is

$$E[X = x | Y = y | \lambda, \theta] = \lambda \qquad (4)$$

with volatility

$$Var[X = x | Y = y | \lambda, \theta] = \lambda. \qquad (5)$$

Likewise, the conditional probability pattern of the number of prescribed medications for a given number of visits is also Poisson with parameter θ. That is,

$$\Pr[Y = y | X = x] = \frac{\Pr[X = x, Y = y]}{\Pr[X = x]} = \Pr[Y = y | \theta] = e^{-\theta} \theta^y / y!. \qquad (6)$$

Then, the conditional projection of the number of prescribed medications by the physician for a given number of visits by a patient is

$$E[Y = y | X = x | \lambda, \theta] = \theta \qquad (7)$$

with volatility

$$Var[Y = y | X = x | \lambda, \theta] = \theta \qquad (8)$$

Their correlation is zero, meaning no inter-dependency between the number of visits and the number of prescribed medications.

Marginally, the most probable number v, (because, it is the mode of Poisson frequency pattern) of visits by a patient to the physician is least integer greater than $[\lambda] - 1$. Hence, author define the patient's over-visit phobia as follows.

Definition 1

A patient has an over-visit phobia if s/he makes more than the most probable number $v = [\lambda]$ and it happens with a probability

$$Pa_{phobia} = \Pr[X \geq v | \lambda] = \Pr(\chi^2_{2vdf} \leq 2\lambda) \qquad (9)$$

using the relationship between the cumulative Poisson distribution and the chi-squared probability, where *df* denotes the degrees of freedom.

Likewise, marginally, the most probable number *m*, (because, it is the mode of the frequency pattern) of the prescribed medicines to a patient by the physician is the least integer greater than *(θ)*. Hence, author define the physician's over-prescription phobia as follows.

Definition 2

A physician has an over-prescription phobia if s/he prescribes more than the most probable number m=[θ] and it occurs with a probability

$$\begin{aligned} Ph_{phobia} &= \Pr[Y \geq m | \theta] \\ &= \Pr(\chi^2_{2mdf} \leq 2\theta) \end{aligned} \qquad (10)$$

using the relationship between the cumulative Poisson distribution and the chi-squared probability.

However, the existence of the patient's and/or physician's phobias, according to the data, would negate the prevalence of the ideal scenario, which was mentioned. The question is then how are they to be captured? This article devises a methodology and it follows.

The task amounts to dealing with their bivariate survival function (BSF) and it is:

$$\begin{aligned} &SF(X \geq v, Y \geq m | \lambda, \theta) \\ &= \left(\sum_{x \geq v}^{\infty} e^{-\lambda} \lambda^x / x!\right)\left(\sum_{y \geq m}^{\infty} e^{-\theta} \theta^y / y!\right) \\ &= \Pr(\chi^2_{2vdf} \leq 2\lambda) \Pr(\chi^2_{2mdf} \leq 2\theta) \end{aligned} \qquad (11)$$

because of the independence between the random variables X and Y. In other words, the survival function (11) is the likelihood of having both the patient's over-visit phobia and the physician's over-prescription phobia in the hospital system.

After noticing the patient's over-visits phobia in the data, we may wonder on whether a physician reacts with respect to prescribing the medicines. If so, how probable such a reaction ($\Re_{physician}$) might be? It is answerable using a definition, which is:

$$\begin{aligned} &\frac{1 - \Pr[X \leq v, Y \leq v]}{\Pr[X > v] + \Pr[Y > v]} \\ &= \frac{[1 - \Pr(\chi^2_{2vdf} > 2\lambda) \Pr(\chi^2_{2vdf} > 2\theta)]}{\Pr(\chi^2_{2vdf} \leq 2\lambda) + \Pr(\chi^2_{2vdf} \leq 2\theta)} \end{aligned} \qquad (12.a)$$

using an identity

$$\begin{aligned} &\Pr[X > a, Y > b] = 1 - \Pr[X > a] \\ &- \Pr[Y > b] + \Pr[X \leq a, Y \leq b]. \end{aligned}$$

connecting the quadrants of bivariate probability theory. Is the expression:

$\dfrac{1 - \Pr[X \leq v, Y \leq v]}{\Pr[X > v] + \Pr[Y > v]}$ in (12) a bona fide conditional probability? In other words, is $0 \leq \dfrac{1 - \Pr[X \leq v, Y \leq v]}{\Pr[X > v] + \Pr[Y > v]} \leq 1$? It is non-negative because $\Pr[X \leq v, Y \leq v] \leq 1$. Let $A = (X > v)$ and $B = (Y > v)$ be two events. Because $\Pr[A \cap B] \geq 0$, note that $\Pr(A) + \Pr(B) \geq \Pr[A \cup B]$,

which in turn suggests:

$\Pr[a] + \Pr[B] \geq 1 - \Pr[\bar{A} \cap \bar{B}]$ and

$$\Pr[X > v] + \Pr[Y > v] \geq 1 - \Pr[X \leq v, Y \leq v]$$

according to DeMorgan's probability laws. It then proves that expression (12) is the conditional probability $\Pr[Y > v | X > v]$ and it portrays the probability, $\Pr[\Re_{physician}]$ for the physician's reaction: $\Re_{physician}$ to make adjustment on the number of prescribed medicines due to the over-visit by the patient. Equivalently, the odds: $odds_{physician-reaction}$ for the physician's reaction after noting the patient's over-visit phobia is:

$$[1 - \Pr(\chi^2_{2vdf} > 2\lambda) \Pr(\chi^2_{2vdf} > 2\theta)] \qquad (12.b)$$

Versus

$$\begin{aligned} &[\Pr(\chi^2_{2vdf} \leq 2\lambda) + \Pr(\chi^2_{2vdf} \leq 2\theta) \\ &- \Pr(\chi^2_{2vdf} > 2\lambda) \Pr(\chi^2_{2vdf} > 2\theta)]. \end{aligned} \qquad (12.c)$$

Is there a reciprocal reaction: $\Re_{patient}$ on the part of the patient, after noticing the over-prescription by the physician? If so, how probable it is? The derivation is parallel to the one seen earlier for expression (12) and hence, only the expression is stated in (13) below. This echoes in the conditional probability (1.13) below since it is parallel to the above result in (1.12). After noticing the physician's over-prescribing phobia, the probability for the patient to react is:

$$\Pr[\Re_{patient}] = \Pr[X > m | Y > m] = \frac{1-\Pr[X \le m, Y \le m]}{\Pr[X > m] + \Pr[Y > m]} = \frac{[1-\Pr(\chi^2_{2mdf} > 2\lambda)\Pr(\chi^2_{2mdf} > 2\theta)]}{\Pr(\chi^2_{2mdf} \le 2\lambda) + \Pr(\chi^2_{2mdf} \le 2\theta)}. \quad (13.a)$$

Equivalently, the odds: for the patient's reaction after noting the physician's over-prescription phobia is:

$$[1-\Pr(\chi^2_{2mdf} > 2\lambda)\Pr(\chi^2_{2mdf} > 2\theta)] \quad (13.b)$$

Versus

$$[\Pr(\chi^2_{2mdf} \le 2\lambda) + \Pr(\chi^2_{2mdf} \le 2\theta) - \Pr(\chi^2_{2mdf} > 2\lambda)\Pr(\chi^2_{2mdf} > 2\theta)]. \quad (13.c)$$

Continuing the process of learning the data evidence about the phobias, the analysts often utilize the hazard rate (equivalently referred as frailty in the statistics literature) to extract the changing nature of the data pattern. Shanmugam recently demonstrated the use of bivariate hazard rate in a bivariate distribution with infrastructures among operative, natural, and no menopauses.[3] The joint bivariate hazard rate (BHR) is the product of their marginal hazard rates in the ideal scenario because of the independence between X and Y. That is,

$$HR(X = v, Y = m | \lambda, \theta) = \frac{\Pr(X = v, Y = m | \lambda, \theta)}{SF(X \ge v+1, Y \ge m+1 | \lambda, \theta)} = \frac{e^{-(\lambda+\theta)}\lambda^v \theta^m}{v!m!\Pr(\chi^2_{2[v+1]df} \le 2\lambda)\Pr(\chi^2_{2[m+1]df} \le 2\theta)} = (Shift_1) HR(X = v | \lambda) HR(Y = m | \theta) \quad (14)$$

where $Shift_1 = 1$ is the baseline number, suggesting the number of visits t0o physician and the number of prescribed medications are disconnected separate processes.

What else is unique to this ideal scenario? To explore this, author follow a line of thinking as follows in this scenario. Shanmugam showed that on how the queuing concepts and tools help to effectively manage hospitals when the patients are impatient.[4] In the current context, for a given threshold $v > 0$, the expected excessive visits to physician is

$$EEVisit_x = E[X = x - v | v, \lambda] = \frac{\sum_{i=v+1}^{\infty} SF(X \ge i | \lambda)}{SF(X \ge v | \lambda)} = \{\frac{1-\sum_{x=1}^{v-1}\Pr(\chi^2_{2xdf} \le 2\lambda)}{\Pr(\chi^2_{2vdf} \le 2\lambda)} - 1\} \quad (15)$$

which is called the mean residual life function in the statistics literature. The tail value at risk for making more visits (which is really a financial term to refer gain or loss in trading stocks over a period) in our context is

$$TVaR_v(X) = E[X | X \ge v, \lambda] = v + \frac{\sum_{x \ge v}^{\infty}(x-v)e^{-\lambda}\lambda^x / x!}{\Pr(\chi^2_{2vdf} \le 2\lambda)} = v - 1 + \frac{\lambda \Pr(\chi^2_{2[v-1]df} \le 2\lambda)}{\Pr(\chi^2_{2vdf} \le 2\lambda)}. \quad (16)$$

Similarly, for a given threshold $m > 0$ for the number of prescribed over-medications, the expected excessive medications in a single visit to physician is

$$EEMedications_y = E[Y = y - m | m, \theta] = \{\frac{1-\sum_{y=1}^{m-1}\Pr(\chi^2_{2ydf} \le 2\theta)}{\Pr(\chi^2_{2mdf} \le 2\theta)} - 1\}. \quad (17)$$

The tail value at risk for having more prescribed medications in our context is

$$TVaR_m(Y) = E[Y | Y \ge m, \theta] = m - 1 + \frac{\theta \Pr(\chi^2_{2[m-1]df} \le 2\theta)}{\Pr(\chi^2_{2mdf} \le 2\theta)}. \quad (18)$$

Note that the ratio, $\frac{Y}{X}$ denotes the random number of medications per single visit, while its inverse ratio, $\frac{X}{Y}$

denotes the random number of visits to physician for a single medication. However, statistically referring, both ratios are implicit of each other, as it will become apparent later in the article. Let $R = \Pr(\frac{Y}{X} > 1)$ and it is synonymous to bivariate reliability, $\Pr(Y > X)$ in the statistics literature. Bivariate probability distributions like (1) have been popularly employed in medical and health research. Shanmugam illustrated on how a probing of non-adherence to the prescribed medicines could be explained using a bivariate distribution with information nucleus clarifies.[5]

The importance of the maximum likelihood estimator (MLE) and uniformly minimum variance unbiased estimator (UMVUE) of the probability, R is well articulated by Kotz et al.[6] Both the MLE and UMVUE of R in (19) and (20) are a linear combination of cumulative chi-squared or F- distributions, respectively

$$\hat{R}_{mle} = \sum_{x \geq 0}^{\infty} \frac{e^{-\bar{x}} \bar{x}^{x} \Pr(\chi^2_{2[x+1]df} \leq 2\bar{y})}{x!} \qquad (19)$$

and

$$\tilde{R}_{umvue} = \sum_{x \geq 0}^{\min(n\bar{x}, n\bar{y}-1)} \frac{\binom{n\bar{X}}{x} (n-1)^{n\bar{X}-x} \Pr\{F_{2[x+1]df, 2[n\bar{Y}-x]df} \leq \frac{(n-1)(n\bar{Y}-x)}{(x+1)}\}}{n^{n\bar{X}}} \qquad (20)$$

Where, $\bar{X}$ and $\bar{Y}$ are sample means. Furthermore, when a situation is identified by:

$$\Pr(X > v+m) < \Pr(X > v)\Pr(X > m)$$

Prevails, there is a positive tendency for more visit to physician by a patient. When the situation is pointed out by:

$$\Pr(X > v+m) = \Pr(X > v)\Pr(X > m)$$

a patient makes only a necessary visit. Otherwise (that is $\Pr(X > v+m) > \Pr(X > v)\Pr(X > m)$,), there is a reluctance to visit the physician by a patient. In other words, the parameter

$$\delta_1 = \frac{\Pr(X > v+m)}{\Pr(X > v)\Pr(X > m)} = \frac{\Pr(\chi^2_{2[v+m]df} \leq 2\lambda)}{\Pr(\chi^2_{2vdf} \leq 2\lambda)\Pr(\chi^2_{2mdf} \leq 2\lambda)} \qquad (21)$$

would portray positive tendency, reluctance, or a necessity by the patient to visit the physician in this ideal scenario, depending on whether $\delta_1 < 1$, $\delta_1 > 1$, or $\delta_1 = 1$ respectively.

Likewise, the probability $S = \Pr(Y < X)$ portrays the likelihood of prescribing multiple medications in a single physician's visit by the patient. The maximum likelihood estimator (MLE) and uniformly minimum variance unbiased estimator (UMVUE) of the probability, $S = \Pr(Y < X)$ are a linear combination of cumulative chi-squared or F- distributions, respectively

$$\hat{S}_{mle} = \sum_{y \geq 0}^{\infty} \frac{e^{-\bar{y}} \bar{y}^{y} \Pr(\chi^2_{2[y+1]df} \leq 2\bar{x})}{y!} \qquad (22)$$

and

$$\tilde{S}_{umvue} = \sum_{y \geq 0}^{\min(n\bar{x}-1, n\bar{y})} \frac{\binom{n\bar{Y}}{y} (n-1)^{n\bar{Y}-y} \Pr\{F_{2[y+1]df, 2[n\bar{X}-y]df} \leq \frac{(n-1)(n\bar{X}-y)}{(y+1)}\}}{n^{n\bar{Y}}} \qquad (23)$$

Where, $\bar{X}$ and $\bar{Y}$ are sample means.

Furthermore, when a situation is identified by:

$$\Pr(Y > v+m) < \Pr(Y > m)\Pr(Y > v)$$

There is an over-prescription tendency by the physician to a patient in a single visit. When the situation is pointed out by:

$$\Pr(Y > m+v) = \Pr(Y > m)\Pr(Y > v)$$

The physicians prescribe just the necessary medications in a single visit by the patient. Otherwise (that is, $\Pr(Y > m+v) > \Pr(Y > m)\Pr(Y > v)$),

There is an avoidance of over-prescription by the physician during a visit by a patient. In other words, the parameter,

$$\gamma_1 = \frac{\Pr(Y > m+v)}{\Pr(Y > m)\Pr(Y > v)}$$

would capture over-prescription tendency, avoidance, or just prescribing necessary medications by the physician to a patient. In this scenario, note that

$$\gamma_1 = \frac{\Pr(\chi^2_{2[m+v]df} \le 2\theta)}{\Pr(\chi^2_{2mdf} \le 2\theta)\Pr(\chi^2_{2vdf} \le 2\theta)} \quad (24)$$

With all these new expressions in the statistics literature, we now proceed to apply them in the analysis of the Australian Health Survey of 1977-1978 in the next section.

Table 1: Cameron's data from Australian Health Survey of 5,194 individuals during 1977-1978.

$Y \rightarrow$ / $X \downarrow$	0	1	2	3	4	5	6	7	8	Sum	$\bar{y} \mid X = x$	$s^2_{y\mid X=x}$
0	907	67	55	44	20	9	2	3	0	1107	0.42	1.13
1	40	2566	135	108	77	35	13	5	0	2979	1.26	0.73
2	6	71	134	124	86	50	30	10	7	518	3.11	2.62
3	7	28	54	84	68	54	22	4	4	325	3.45	2.5
4	7	10	24	35	40	28	17	5	3	169	3.69	3.01
5	1	1	3	17	21	13	15	10	15	96	5.07	3.65
Sum	968	2743	405	412	312	189	99	37	29	5,194		
$\bar{x} \mid Y = y$	0.11	1.03	1.67	2.02	2.3	2.508	2.85	2.89	3.89			
$s^2_{x\mid Y=y}$	0.26	0.13	1.21	1.61	1.75	1.624	1.78	2.82	1.67			
$\hat{\lambda}_{mle} = 1.18$											$v = 2$	
$\hat{\theta}_{mle} = 1.55$											$m = 2$	

RESULTS

For illustration, consider Cameron et al, data on the demand of health care and health insurance in Australia.[7] In their data, note that X = # physician visits and Y = # medications prescribed among 5,194 randomly chosen for survey during 1977-1978 are analyzed and interpreted using the analytic expressions in Section 2.

The random sample size is n=5,194. The maximum likelihood estimator has a unique invariance property, which is that the maximum likelihood estimate (MLE) of a function is simply the function of the MLE. Author provoke this invariance property for the MLEs $\hat{\lambda}_{mle} = 1.183$ and $\hat{\theta}_{mle} = 1.553$ (which are the estimated visitation rate and prescription rate respectively). Note that *v=2* and *m=2* (which are the most frequent visitations and prescriptions respectively). Using (9), the estimated probability of the patient's over-visit phobia, according to the data in Table 1 and the expression (9), is

$$Pa_{phobia} = \Pr(\chi^2_{4df} \le 2.366) \approx 0.33$$

It means that about 33% of the sampled 5,194 patients have exhibited over-visit phobia.

Likewise, according to the expression (10) and the data in Table 1, the probability for a physician among those 5,194 physicians to have over-prescription phobia is

$$Ph_{phobia} = \Pr(\chi^2_{4df} \le 3.106) \approx 0.46$$

It means that about 46% of the sampled 5,194 physicians have practiced over-prescription phobia.

According to the expression (11), the proportion of 5,194 cases with both patient's over-visit phobia and physician's over-prescription phobia is 15.2 percent, which is not negligible. This is an important finding in the aim of refining healthcare sector and it would not have been possible without the new methodology in this article.

According to expressions (12.a through 12.c), when the patient exhibits a phobia of over-visit, the probability for a physician to react in the prescribing medicines is $\Pr[\Re_{physician}] \approx 0.807$. This is not a smaller proportion to ignore in the process of refining healthcare practices. In other words, the odds for any physician to react to the over-visit phobia by a patient is four to one meaning that for every single physician not reacting, there are four physicians reacting in the prescription of medicines.

Likewise, according to the expressions (13.a through 13.c), when the physician exhibits a phobia of over-prescription, the probability for a patient to react in the visit to the physician is equally the same $\Pr[\Re_{patient}] \approx 0.807$ because $v = m = 2$ in this data and it could be different if $v \neq m$. There is a symmetric reciprocity among the patients towards the physicians as it happened in the other direction. In other words, the odds for any patient to react to the over-prescription phobia by a physician is also four to one meaning that for every single patient not reacting, there are four patients reacting in the visit to the physician.

The patient's visit to the physician as well as the event of prescribing medicines attest to the existence of hazard to healthy living. According to the expression (14), the bivariate hazard level in the population background of 5,194 is 88.2 percent, which is a significant amount.

According to the expression (15), the expected excessive visits to physician is one and the expected excessive prescriptions to the patient is just zero due to the expression (17). According to the expression (16), the total value at risk for the visit to the physician is 3.47 and the total value at risk for the prescription to the patient is 3.66 due to the expression (18). These risks are not too small to ignore, and such a finding would have been not possible without the derived expressions in this article. According to the expression (21), the visit related parameter is $\delta_1 = 2.16$, which indicates a clear reluctance among the patients to make additional visits. According to the expression (24), the prescription related parameter is $\gamma_1 = 3.17$, which indicates a clear avoidance level by the physicians to prescribe more medicines.

DISCUSSION

This article has constructed new, novel and viable approach and data analytic methodology to analyze and interpret health survey data. This innovative approach defines the data-based patient's over-visit phobia as well as physician's over-prescription phobia when they exist in a hospital or healthcare clinics. Analytic expressions are derived to estimate each phobia separately. The inter-connections between these phobias are developed, estimated and interpreted for the Australian Health Survey.

Expressions for making two indices to check whether there is a reluctance for the patient to make more visit to the physician and whether there is an avoidance for the physician to write extra prescription.

These breakthrough ideas and results have helped to identify the physician's prescription phobia and the patient's visit phobia as they are exhibited in the Australian Health Survey.

Future research work could focus on extracting real reasons for the emergence of patient's or physician's phobia and it would help to achieve making healthcare practice more cost or time efficient and effective.

It appears that nonmedical use of prescription or over-the-counter medications might be significant. It suggests that a thorough analysis may be worthwhile about the proportion of patients' community using other than those indicated in the prescription. Such an abuse of medications is a worldwide issue. Lessenger et al, provided an account of a various abuses of prescription and over-the-counter medications.[8] An increase of over prescriptions is noticed even among the children's treatment as well as described in Setlik et al.[9] Furthermore, author point out that there are illicit uses and diversions of prescription stimulant medication as reported in McCabe et al.[10] A further study is necessary to identify the incidences and prevalence of factors associated with the over prescription of drugs among the college students.

Derlet et al, asserted a fact that frequent overcrowding is a causal factor to the inefficiency of the U.S. emergency departments.[11] A causal factor for over prescriptions is traceable to the patient's frequent visits, ac-cording to several directors of the academic, county, and private hospital emergency departments in both urban and rural settings. Overcrowding results with more waiting times for patients might be an obstacle for better healthcare system, and it is possibly increasing the risk of adverse medications as well.

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