4-15-2014

Breast Cancer in Vietnam: Pamphlets as a Teaching Tool

Fantine Giap
Southern Methodist University, giapfantine@gmail.com

Breast Cancer in Vietnam: Pamphlets as a Teaching Tool

Journal article to be published:

Applying epidemic models of infective disease to understand the spread of information within a hospital

April 15, 2014

Engaged Learning Program
Fantine Giap
Southern Methodist University

Applying epidemic models of infective disease to understand the spread of information within a hospital

Fantine Giap and Thomas Carr
Department of Mathematics, Southern Methodist University

Abstract

Using the theoretical basis of simple epidemic models, we will examine how information can spread through a population. Specifically, the acquisition of new information (i.e. through pamphlets, physicians, health education programs) will be made analogous to that of an infection. The paper will include: 1) the relevance of epidemic modeling for a social contact application 2) a discussion of the possible models and their implications for conceptualizing information spread 3) the findings from a pilot study conducted with breast cancer patients in a hospital in Vietnam. With our exploration of this application, we hope to supplement intervention programs seeking to improve health education of patients with defined parameters to consider and a method of collecting empirical data concerning contact transmission.

Introduction

Cancer Prevalence in Vietnam

Although cancer is prevalent in Vietnam, its public significance has a low priority in comparison to other diseases. Cancer ranks in the top three diseases of Vietnam but many other diseases such as diarrhea and respiratory infections afflict a larger percentage of the Vietnamese population. Because of the immediacy of these conditions, the importance of cancer is reduced. The low priority of cancer is reflected by the shortage of treatment centers and lack of general health knowledge. Despite its lower priority, cancer still impacts a significant portion of the population.[1] Although cancer incidences are not as high in Vietnam in comparison to international statistics, there have been over 150,000 new cancer cases and 75,000 cancer related deaths as of 2008.[8] Lower cancer incidences may also result from the low report of cases due to the limited quality of statistics, which may contribute to establishing the low priority of cancer.

Breast cancer is frequent in Vietnamese females. In Hanoi alone, the capital of Vietnam, 30 women in every 100,000 are affected by breast cancer. Breast cancer incidences are also not homogeneous across the country - the north has a higher breast cancer incidence rate than that of the south. Regardless, many women in Vietnam are susceptible to breast cancer, but there are barriers to their access of regular screenings, preventative care, as well as treatment. This could be due to several factors such as the lack of awareness, education, and resources, as well as the clash between traditional Vietnamese medicine and westernized medicine. Lack of educational awareness about breast cancer lends itself to issues in early preventative care, as well as in lack of understanding treatment and diagnosis.

Health Education Programs in Vietnam

In terms of heightening awareness of cancer knowledge, the burden of informing patients is created, a responsibility that requires dedicated effort and time. Ideally, medical staff would be the best source of primary information for patients. However, considering the patient load that physicians and medical staff already have scheduled, extra time dedicated solely to answering questions and explaining information in depth is practically not an option. For example, Hospital K in Hanoi admits 4,000 patients for examinations and over 3,000 inpatients, operating at 172% capacity ("Hospital K"). As of 2012, Vietnam public hospitals have operated at 118% capacity on average ("Hospital K"). Due to lack of time and resources, therefore, asking medical staff to further educate patients will not be a practical solution in the near future.

Organizations and parties external to the hospitals have thus tried to address this issue of awareness. In developing countries such as Vietnam, health education has reportedly been a "fundamental tool in the promotion of health and prevention of disease" (Nutbeam 260). Although previous attempts in the mid-twentieth century neglected to consider socioeconomic and cultural conditions of their target population, recent school-based education programs have focused on the "social context of behavioural decisions" (Nutbeam 260). In a randomized controlled study conducted in a rural Vietnamese community, it was determined that health education that was "interactive and participatory" was beneficial for community leaders in increasing their likelihood to spread health literacy to their community members (L. Hien et al 355). Participants in this study reported that more references for self-study and visual aids are helpful in improving health literacy (L. Hien et al 360, 362). Educational programs are only a local part of the larger scheme to improve health knowledge, however. The overarching need for public policy and media publicity for a more global change stands strong. Nevertheless, the actions of health education programs promote health literacy and self-efficacy, initiating the grassroots movements to improve patients' medical understanding.

While awareness and health literacy need to be addressed in populations outside of the immediate hospital environment, patients already affected by cancer most directly in need of information concerning their current affected health. Increase in health literacy has been related to greater self-efficacy, positive attitudes, and positive behavior changes, improving health outcomes (Baker 879). Thus, focused and sustainable health education programs aim to help patients understand their condition on a deeper level and alleviate unanswered fears about their diagnoses, treatments, and lifestyle choices.

Theoretical Models in Health Psychology

Theoretical models in health psychology have traditionally been used to explain changes in health behavior. For example, the Theory of Reasoned Behavior reasons that a person's attitudes and subjective norms affect his behavioral intention, which in turn influences his behavior. Much research, however, has favored a bi-directional rather than a unidirectional relationship between these variables. Accordingly, the Mental Models approach states that beliefs and behavior can be reciprocally related in consistent and predictable ways, because people will act to reduce dissonance. Both of these models provide a simple cause and effect model for individuals who seek to understand the motives and resulting health behavior of patients. These abstract concepts provide a framework in which health psychologists can devise intervention programs.

The Transtheoretical Model of Behavior Change draws on the stages and processes people go through in order to bring about successful long-term change. This stage-based model allows researchers to categorize people based on their awareness, intent, and behavior. In this manner, successful attitude and behavior change at each stage depends on appropriate intervention for that stage. These distinct stages include:

Table 1. Stages of the Transtheoretical Model of Behavior Change

Stage	*Description*
Pre-contemplation	No intention of behavior and no personal awareness of issue
Contemplation	Personal awareness of issue, but no commitment of action
Preparation	Intend to change behavior but have yet to start
Action	Modification of behavior
Maintenance	Work to prevent relapse and consolidate gains

These three models are commonly used to describe people in different modes of behavior and behavioral intention. Statistics are used to derive significance between groups and thus make conclusions about health behavior. The implications of these conclusions are then used to advise individuals creating successful health intervention programs.

Relevance of Epidemic Modeling

While the theoretical models proposed by health psychology research provide simple relationships that can be easily empiricized, at best they describe linear relationships between variables. The relationships between people and others in their environment, those that influence their attitudes and beliefs, are quantified by statistically significant data and correlations. A person's change in behavior is analyzed as an individual data point in a range of others during observations or experiments such that parameters (i.e. time) are controlled, as in cross-sectional and longitudinal studies. Thus, extrapolations on future behavior are limited to knowledge of observed and recorded behavior, within the strict confines of the experimental set up.

In this way, epidemic modeling can be used to reveal nuances in the relationships between different minded people within a given population. It can also provide a dynamic system through which extrapolations could be closely fitted to the complex relationships between people in different "stages". Specifically, we can apply the models of infectious disease spread to this case by equating viral infection to information spread between individuals. By analyzing potential models (i.e. SEIS, SEIR) and the role of each variable within each model, we can attempt to quantify more detailed information on how the introduction of new ideas or beliefs can affect a population.

The particular example of patients within a Vietnamese hospital lends itself for a practical application of this conceptualization. As mentioned above, cancer patients are a good target for health education programs, especially those who abide in developing countries where

prevention information and resources during treatment are relatively scarce. Typical breast cancer patients reside in the hospitals for long periods of time (the duration of their treatment) due to their socioeconomic status and geographic distance from home. Also, besides their phones, these patients have little access to social media, including internet, television, and radio. They wait in hospital beds that hold an average of five people, with four to six beds per room and multiple open rooms per ward. Thus, a population of patients in this kind of public hospital can be relatively well-defined, and new information is confined between person to person. Under these assumptions, we can begin to formulate the questions we must ask in order to gather empirical data for each parameter in the epidemic models.

Discussion of Applied Epidemic Models

Units

Table 2 (below) describes how the parameters of the information "disease" model are derived from the epidemic disease model.

Table 2. Comparison of the SEIR Disease Model to the Proposed Model

Variable	*SEIR Disease Model*	*SEIR Information Model [Proposed]*
Beta	The parameter controlling how often a susceptible-infected contact results in a new exposure	The parameter controlling how often a person who did not have the pamphlet speaks to someone who has the pamphlet (or vice versa)
Gamma	The rate an infected recovers and moves into the resistant phase	The rate at which a person who has received the pamphlet begins practicing the behavior change. The rate at which a person forgets about the info, stops telling or asking others about the info, or resists the info
Sigma	The rate at which an exposed person becomes infective.	The rate at which a person who is in the hospital until he/she gets the pamphlet
Mu	The natural birth/mortality rate (this is unrelated to disease). This models a population of a constant size	The rate at which a person enters/ finishes treatment/ leaves the hospital
Susceptible	The fraction of susceptible individuals; those able to contract disease	The fraction of patients who are in the hospital and have not yet received the health pamphlet
Exposed	The fraction of exposed individuals; those who have become infected but are not yet infectious	The fraction of patients who are in the hospital and have a baseline understanding of some beneficial health behavior (i.e. have received information from other mediums in the past, but not from the health pamphlet)
Infected	The fraction of infective individuals; those able to transmit disease	The fraction of patients who are in the hospital and have received the health pamphlet
Recovered	The fraction of recovered individuals; those who have become immune	The fraction of patients who are in the hospital and have forgotten, or stop telling/asking others about the info in the pamphlet.
Days	Controls how long the model will run	Days since the education program has been in place

In terms of finding evidence for the epidemic model, the following questions could be asked to determine the values of the parameters. We note that these questions are far from all inclusive of psychological, social, and cultural aspects that are needed to fully understand the implications, but they represent a few of the types of questions that could be used in a survey.

Table 3. Empirical Data to Gather for each Parameter

Variable	*SEIR Disease Model*	*SEIR Information Model*
Beta (β)	Contact rate from S → I $\beta = (\gamma R_o) / N$	From patients: 1. The number of people a patient contacts 2. The frequency at which this patient contacts these people
Gamma (γ)	Rate at which infected recovers	From patients: Average time it takes for patients to forget or stop telling people about the information they learned
Sigma (σ)	The rate at which an exposed person becomes infective	From patients: Ave time it will take for the pamphlet to reach a person in a hospital OR Average time it will take for a person with the pamphlet to tell someone else
Mu (μ)	birth rate / death rate	From hospital administration: 1. The number of new [breast cancer] patients that check in per day 2. The number of [breast cancer] patients that check out per day? * Check out = totally finish treatment
Total Population (N)	total population	From hospital administration: The total number of [breast cancer] patients in the hospital
Susceptible (S)	The fraction of susceptible individuals	The fraction of patients who are in the hospital and have not yet received the health pamphlet
Exposed (E)	The fraction of exposed individuals; those who have become infected but are not yet infectious	The fraction of patients who are in the hospital and have a baseline understanding of some beneficial health behavior (i.e. have received information from other mediums in the past, but not from the health pamphlet)
Infected (I)	The fraction of infective individuals; those able to transmit disease	The fraction of patients who are in the hospital and have received the health pamphlet
Recovered (R)	The fraction of recovered individuals; those who have become immune	The fraction of patients who are in the hospital and have forgotten, or stop telling/asking others about the info in the pamphlet.
Days	Controls how long the model will run	Days since the education program has been in place

SEIR Model

$$\begin{aligned}
\frac{dS}{dt} &= \mu(N-S) - \beta\frac{SI}{N} \\
\frac{dE}{dt} &= \beta\frac{SI}{N} - (\mu+\sigma)E \\
\frac{dI}{dt} &= \sigma E + (\mu+\gamma)I \\
\frac{dR}{dt} &= \gamma I - \mu R + \nu S \\
N &= S + E + I + R
\end{aligned}$$

This model seems to fit the best with the model of information spread, considering the prevalent theories of health psychology. The total population (N) of patients within a hospital is divided into four groups of people (S, E, I, R) based on their susceptibility to new information and their ability to retain and use this information. The assumption associated with the exposed population (E) is that there are patients who get the new information but do not share this with others. It is also possible that the individuals within the exposed population for some reason cannot share this information with others (i.e. forgetters, are uncomfortable talking, shy, mute, etc) and therefore do not use the information they have. Also, the recovered population (R) has patients who did tell others or change their own behavior because of the new information, but for some reason (i.e. forgetting) stopped.

The change in rate at which the patient population is susceptible to these hypothetical new ideas (dS/dt) is characterized by how many patients enter the hospital in a day (μN), how many patients leave the hospital in a day before they have gotten the new information (μS), and how many people who have not gotten the new information talk to patients who have gotten the new information (β SI/N).

The change in rate at which the patient population is exposed to the new ideas (dE/dt) is characterized by the addition of the β SI/N term, but the subtraction of the μE and σE terms. The μE term describes how many people leave the hospital after they have gotten the new information but have yet to tell others about this information or change their behavior as a result of this new information. The σE term describes how many people begin telling others or change their behavior in the time period between the initial moment of information learning and telling others.

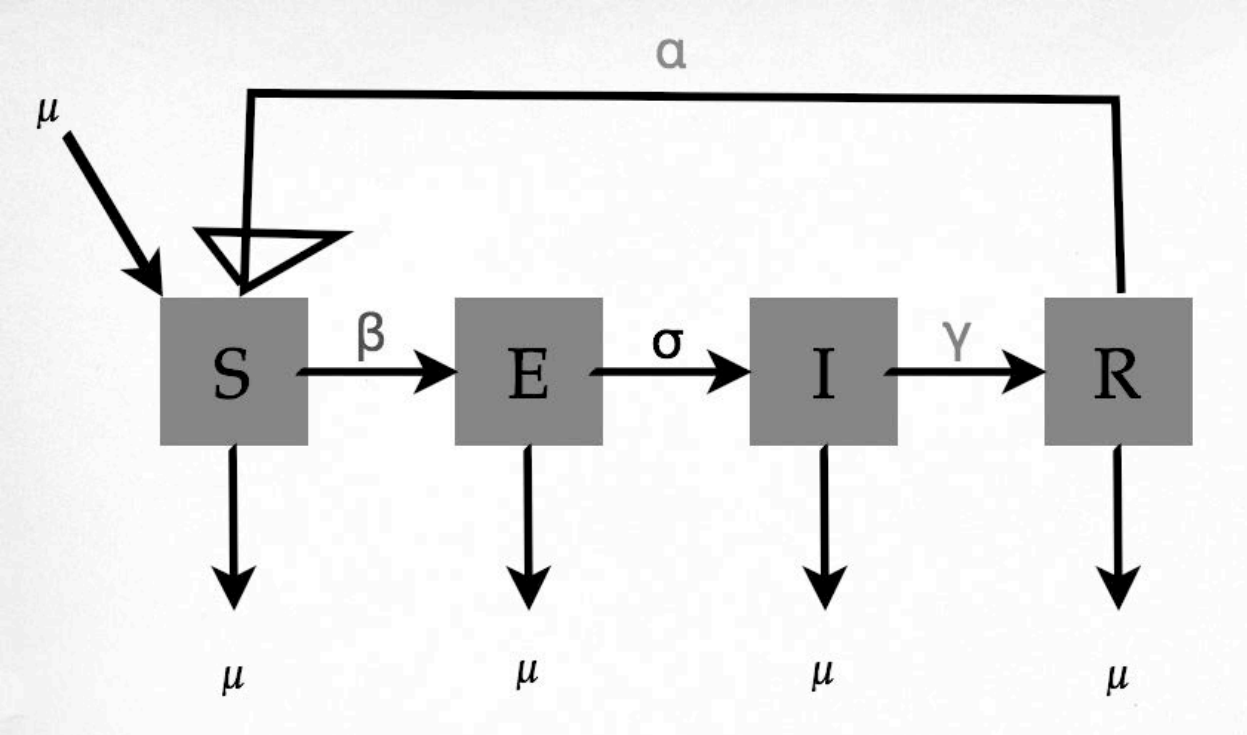
The change in rate at which the infected population spreads these ideas (dI/dt) is characterized by an addition of the σE term, as well as addition of μI and subtraction of ɣI. The μI term describes the number of patients who come in knowing about the new information already, without the intervention of a health education program. The ɣI term describes the number of patients who have gotten the information and no longer are telling others about it.

The change in rate at which the recovered population discontinues sharing the new information (dR/dt) is characterized by the addition of ɣI, as well as the subtraction of μR and addition of vS.

The μR term describes the number of patients who have stopped telling others bout the information they learned and left the hospital (i.e. finished treatment).

Thus, in totality the SEIR model describes the movement of a patient population from different stages in sharing and understanding the new information they may receive from the health education programs initially and the patients they are surrounded by throughout their stay at the hospital.

Figure 1. SEIR Model



Some assumptions are made by this model. In cancer treatment centers in Vietnam, the majority of the patients receiving chemotherapy or radiation therapy treatment live within the hospital for most of the day, if not overnight. Thus, the estimations for the populations (N, S, E, I, R) are more representative of the actual population within the hospital, which has little exposure to the surrounding neighborhood or city of people. In this, we assume that recovered individuals (R) are permanently immune; people who have changed behavior keep those new behaviors but do not ever share their knowledge.

In terms of parameters, we also make some assumptions. There are equal birth and death rates (only one μ), so we assume that the rate at which people enter and leave the hospital are the same. This simplifies our calculations and the model itself, but including birth and death rates if they differ would be advised for further study. We also assume that the contact transmission (β) rate is constant, and is therefore not a function of time, which is a possibility outlined by the SEIR model.

Also, patients sit multiple people to a hospital bed, multiple hospital beds per room. Patients tend to be in high contact with other patients, but little contact with medical physicians or staff. Patient contact with families is also minimal, unless they can afford travel. Patients have little

access to social media while in the hospital: TV, radio, printed media (newspaper, magazines, etc), internet sources. Thus, interaction is assumed to be mostly contained within the patient population, which seems to be reasonable. Moreover, we assume that patients who are in the hospital are currently receiving treatment. That is, the information that they are learning is relevant to their personal health, and thus all the patients find some baseline imperative to understand the information.

Finally, the largest assumption made is that infection is equivalent to receiving the new information verbally, and that the physical medium through which the new information is shared (i.e. pamphlet) is not simply passed around without verbal communication so that the interaction stays between person to person.

Other Models

There are other possible epidemic models that can be used to model the spread of new health information. In a SEIS model, there is no recovered population. Thus, people do not “recover” (i.e. stop tellings others forever); instead, they can stop tellings others but re-enter the susceptible class (i.e. they forgot the information, but can be re-taught). This assumes that there are never patients who do not share information. In an SIRS model, we would assume that there is no latent period in which people, upon obtaining the new information, immediately share with others. In an SIS model, we would assume that there are no recovery or exposed classes, so not only is there no latent period, but there is also no part of the population who will forever discontinue sharing health information. In choosing to use a SEIR model over a SIR model, for conceptualization purposes, a SEIR model is used to explore the implications of an exposed class.

Pilot Study: Quantifying the Contact Transmission Parameter (β)

Background

By modeling, researchers are given specific parameters to manipulate and test empirically, as well as extrapolate from. Contrary to the purpose of understanding viral infections, the purpose of using an epidemic model to conceptualize the spread of information is to understand how to change the parameters in order to create an epidemic. In terms of its implications for education programs, an epidemic would determine success because then all of the patients will have been infected with new information provided by the programs. This can easily be visualized by R_o, which is the basic reproduction ratio in a closed population (in a traditional epidemic model). If R_o is less than one, the disease (spread of information) dies off, but if R_o is greater than one, the disease will be endemic and possibly epidemic. Thus, we seek to increase the R_o, where:

$R_o = (\beta N) / \gamma$

There are several ways to increase R_o. We can aim to decrease gamma (γ), which is the rate of removal of infectives; increase beta (β), which is the infectious rate rate; or increase the effective N, which would essentially mean we would need to increase the initial susceptible population.

We decided to analyze only the contact transmission parameter β in our pilot study because of its direct relevance to understanding how new information is transmitted between an "infected" person and a "susceptible" person. This information alone is relevant for those seeking to develop health education programs and attempting to understand who patients talk to and how often they do. R_o is also defined as the expected number of infectious contacts made by an infective (Springer). Rearranging the equation for R_o, we can solve for β:

$\beta = (\gamma R_o) / N$

Previous studies and analyses aimed at understanding social contact in terms of dynamic systems also deem that the probability of transmission is based on the duration of contact between susceptible and infected such that the longer the contact, the greater the probability of transmission (Hens, LeGresley, Stehlé, Wallings). However, these studies attempt to quantify evidence of contact through personal diaries, computer simulations, and self-report, all in regard to actual disease.The difference between disease spread and information spread is that exact spatial distance is not a significant factor in whether the information is spread from person to person, as people could be across the room and still spread information. This is unlike in disease spread, in which proximity matters much more. Also, the spread of information more intentional than is the spread of disease, and thus the means of collecting empirical data must reflect some of this behavioral difference. While personal diaries could have also been a viable method of recording data, questionnaires allowed for faster self-reporting, given the circumstances of the hospital. Patients in developing countries often do not have phones or other means of tracking them down for follow up, making revisits practically more difficult.

Hypotheses

1. Our method of collecting data (questionnaire) will allow us to estimate the average number of people that a patient talks to generally and specifically about their cancer condition.
2. We will be able to determine an average frequency at which patients talk to different individuals in their social networks.
3. We will be able to estimate β for the population.

Methodology

Sample Population

The population consists of breast cancer patients in Vietnamese hospitals, specifically, K3 Hospital in Hanoi, Vietnam. This population of patients is affected by the detriments of being at a hospital operating at over capacity - lack of medical resources, patient attention, and patient-physician time. They are typically of lower socioeconomic status and are generally receptive to new information and questions. There were 23 participants in the sample. While we recognize that these patients were not randomly selected from a list of all the breast cancer patients available, we were subject to the availability of the patients who were waiting to receive treatment for the day. Also, we note that a physician was in charge of recruiting patients from the busy hospital wards, and we are appreciative of her time and ability to find her patients. We did not screen for age, education level, religious affiliation, or other cultural factors.

Questionnaire

Questions to assess the contact transmission parameter, β, were developed (see Appendix 1 for the English version of the questionnaire). The purpose of asking questions 1 and 2 were to compare the patients' overall frequency of communication with those in their social networks (family, friends, acquaintenances, authority figures) with their specific communication of their current health condition (i.e. pains, emotions, information regarding their cancer treatment and symptoms) to these people. While they may be likely to share any information, we deemed it necessary to distinguish between any information and specific material concerning their condition, which could be possibly difficult to discuss.

Procedure

The head oncologists referred us to our patient population. Patients were brought one at a time into an empty office. A translator was present to relay the information between the participant and the surveyor. The participant was asked for consent (informed consent is at the top of the questionnaire) and her confidentiality was explained to her. The questions were read aloud to the participant and the participant answered. The participant's answers were recorded on the printed questionnaires. After the 10 minute survey, the patient was given reasonable compensation (an Ensure powder can).

Results

1. Our method of collecting data (questionnaire) *did not reliably* allow us to estimate the average number of people that a patient talks to generally and specifically about their cancer condition.

While all patients were able to count their spouses, children, nurses, and doctors, for some of the patients defining how many relatives, friends, and fellow patients they talk to proved to be difficult. While inherently the difficulty in quantifying all of the people in a person's life is understandable, without a clear number it is impossible to assume what "a lot" means to different people. Participant bias in reporting must be noted in all of the responses that require participants to guess how many people they talk to. It seemed that the further away the patient's social contacts were in terms of social network (immediate family versus relatives, and friends), the less prevalent in their immediate life (nurses and doctors versus relatives and friends), and

the greater number of possible people within the category (immediate family versus relatives and relatives), and the less able patients were to give a numerical response. Despite the proximity and relevance of the other patients to the participant, the ambiguity of defining the number of other patients a given participant talks to seems to explain why the total number of ambiguous responses (descriptive and no response) is almost half (48%).

Table 4. Percent Confirmation of Patients' Relationships

Patient's contact	*Numerical Responses*	*Descriptive Responses*	*No Responses*
Spouse	23 (100%)	0 (0%)	0 (0%)
Children	23 (100%)	0 (0%)	0 (0%)
Relatives	6 (26%)	3 (13%)	14 (61%)
Close friends	9 (39%)	4 (17%)	10 (43%)
Other patients	12 (52%)	4 (17%)	7 (30%)
Nurses	23 (100%)	0 (0%)	0 (0%)
Doctors	23 (100%)	0 (0%)	0 (0%)

2. We *were* able to determine an average frequency at which patients, within the sample, talk to different individuals in their social networks.

Table 5 (below) describes the frequency in contact between a participant and others, graded on a Likert scale of 1 to 5, where:

Table 5. Coding of the Frequency Responses

Response on Questionnaire	Grade
Every day	1
A few times a week	2
Monthly	3
Less than monthly	4
Never	5

Table 6 (below) shows the average contact frequencies of the 23 participants, by type of information shared:

Table 6. Comparison of Contact Frequencies between Contacts and Information

Patient's contact	*General information discussed*	*Specific information discussed about patient's cancer condition*
Spouse	2.0	2.1
Children	1.2	1.4
Relatives	2.2	2.2
Close friends	1.3	1.4
Other patients	1.1	1.0
Nurses	1.2	1.3
Doctors	1.8	1.9

Because of the small sample size in relation to the population and the method of participant recruitment, finding confidence intervals to describe the statistical significance between general and specific information shared would not be practical information. However, the pilot study does show interesting potential differences in frequencies between the contacts and between the information types. Our assumption that patients do not talk to people outside of the hospital environment frequently is undermined by the data, since patients seem to talk to their families and relatives almost as often as other patients and nurses. However, it seems as though patients talk to other patients the most frequently. Also, participants talked slightly less frequently about specific information in regards to their condition, except when they are communicating with other patients. This (1.0 versus 1.1) positively denotes that patients will share information regarding their cancer condition and treatment with those around them, something that would still allow for the proposed epidemic model to be relevant.

3. We *were not* able to estimate β for the population.

Because we do not have a reliable estimation for the number of people that the participants communicated with, it is difficult to estimate β for the population.

Conclusion

Although Vietnam has historically been a developing country, it currently has the second largest growing economy and thus is on the rise for improvement in many public sectors, including health care. Improving conditions of breast cancer patients in Vietnam includes improving health care knowledge. While physicians work to provide their patients with the best of their limited resources, we need to create solutions that involve other members of patients' social networks. As aforementioned, the patients would directly benefit from the information presented to them. Also, the medical team would benefit from the pamphlet or other health education program by referring patients to it, if necessary, alleviating the time needed to answer simple questions. Health organizations will benefit from the model developed in order to evaluate their methods of increasing awareness of health and cancer.

The epidemic model outlines aspects of information spread that can be beneficial for those looking to improve the spread of health literacy and awareness. While the pilot study provided a possible method of collecting empirical data, more research needs to completed in order to develop more reliable methods of collecting contact information, as well as analyze the other parameters in a SEIR model. We believe that the results of the study on the contact transmission provide some evidence that the application of an SEIR model would be relevant to a medically underserved community and hope that further research will elucidate the relationship between disease spread and information spread.

References

4. Anh PTH, and Nguyen BD: The Situation with Cancer Control in Vietnam. *Japanese Journal of Clinical Oncology* 2001, 92-97.
5. Baker DW: The Meaning and the Measure of Health Literacy. *Journal of General Internal Medicine* 2006, 21, 878-83.
6. Funk S, Gilad E, Watkins C, and Jansen VA: The Spread of Awareness and Its Impact on Epidemic Outbreaks. *PNAS* 2009, 106:16, 6872-877.
7. Giap, HB: Breast Cancers and Public Hospitals in Vietnam. Telephone interview on 11 Feb 2012.
8. Gordon S, Bernadett M, Evans D, Shapiro NB, and Dang L: Vietnamese Culture: Influences and Implications for Health Care. *Molina Healthcare*. The Molina Institute for Cultural Competency. Web.
9. Hospital K Opens New Cancer Unit. *Vietnam News*. Viet Nam News, 20 Aug 2012.
10. Hens N, Goeyvaerts N, Aerts M, et al: Mining social mixing patterns for infectious disease models based on a two-day population survey in Belgium. *BMC Infectious Diseases 2009*, 9:5.
11. In Vietnam, Alongside Progress, a Battle for Life. *International Atomic Energy Agency (IAEA): Women in Science: Balancing the Equation*. Division of Public Information, 23 Jul 2008. Web.
12. Jemal A, Bray F, Center MM, Ferlay J, Ward E, and Forman D: Global Cancer Statistics. *CA: A Cancer Journal for Clinicians* 2011, 61:2, 69-90.
13. Kitchovitch S, and Lio P: Community Structure in Social Networks: Applications for Epidemiological Modeling. *PLoS ONE* 2011, 6:7, 1-17.
14. LeGresley SE, Del Valle SY., Hyman JM: Quantifying how social mixing patterns after disease transmission. In *computationalsocialscience.org*.
15. Le H, Thu T, Takano T, Seino K, Ohnishi M, and Nakamura K: Effectiveness of a Capacity-building Program for Community Leaders in a Healthy Living Environment: A Randomized Community-based Intervention in Rural Vietnam. *Health Promotion International* 2008, 23:4, 354-64.
16. Mikolajczyk RT, Kretzschmar M: Collecting social contact data in the context of disease transmission: Prospective and retrospective study designs. *Social Networks* 2008, 30:2, 127-135.
17. Musallam N, Coleman P, Nowak A. Understanding the Spread of Malignant Conflict: A Dynamical Systems Perspective. Presented at the 22nd Annual Association of Conflict Management Conference 2009.
18. Nguyen H: The Principal- Agent Problems in Health Care: Evidence from Prescribing Patterns of Private Providers in Vietnam. *Health Policy and Planning* 2011, 26, 153-62.
19. Nutbeam D: Health Literacy as a Public Health Goal: A Challenge for Contemporary Health Education and Communication Strategies into the 21st Century. *Health Promotion International* 2000, 15:3, 259-67.
20. Ogunjimi B, Hens N, Goeyvaerts N, et al: Using empirical social data to model person to person infectious disease transmission: An illustration for varicella. *Mathematical Biosciences* 2009, 218:2, 80-87.
21. Stehlé J, Voirin N, Barrat A, et al: Simulation of an SEIR infectious disease model on the dynamic contact network of conference attendees. *BMC Medicine* 2011, 9:87.
22. Tran T, Dung VTM, Neu I, and Dibley MJ: Comparative Quality of Private and Public Health Services in Rural Vietnam. Diss. Oxford University, 2005. Abstract.
23. Wallinga J, Edmunds WJ, Kretzschmar M: Perspective: human contact patterns and the spread of airborne infectious diseases. *Trends in Microbiology* 1999, 7:9, 372-377.

Appendices

1. Questionnaire [English]

Questionnaire

I am a college student in the Department of Math at Southern Methodist University. I am conducting a research study to study whether health informational pamphlets will help patients understand their cancer and health.

I am recruiting subjects to answer 10 questions in a survey which will take approximately 5 minutes.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, it will not affect your treatment/care**.** The results of the research may be published, but your name will not be used.

If you have any questions concerning this research study, you may call Fantine Giap at +1 (858) 531-0433 and giapfantine@gmail.com.

1. How often do you talk to...

family	**spouse/ significant other**	every day	a few times a week	monthly	less than monthly
	children (# = _____)	every day	a few times a week	monthly	less than monthly
	relatives (# = _____)	every day	a few times a week	monthly	less than monthly
close friends		every day	a few times a week	monthly	less than monthly
other patients		every day	a few times a week	monthly	less than monthly
nurses/medical staff		every day	a few times a week	monthly	less than monthly
doctor		every day	a few times a week	monthly	less than monthly

2. How often do you talk to _____ about your cancer condition and treatment?

family	**spouse/ significant other**	every day	a few times a week	monthly	less than monthly
	children (# = _____)	every day	a few times a week	monthly	less than monthly
	relatives (# = _____)	every day	a few times a week	monthly	less than monthly
close friends		every day	a few times a week	monthly	less than monthly
other patients		every day	a few times a week	monthly	less than monthly
nurses/medical staff		every day	a few times a week	monthly	less than monthly
doctor		every day	a few times a week	monthly	less than monthly

3. Do you or have you talked to your doctor and or nurse about your questions about maintaining your health during treatment?
   a. Yes
   b. No

4. Do you think you would ask or have you asked other patients about how to maintain your health during treatment?
   a. Yes
   b. No

2. Questionnaire [Vietnamese]

Bảng câu hỏi

Tôi là một sinh viên đại học trong bộ của toán học ở miền Southern Methodist University. Tôi là tiến hành một nghiên cứu nghiên cứu để nghiên cứu xem liệu sức khỏe thông tin pamphlets sẽ giúp bệnh nhân ung thư của họ hiểu và sức khỏe.

Tôi là tuyển dụng đối tượng để trả lời 10 câu hỏi trong một cuộc khảo sát mà sẽ khoảng 5 phút.

Tham gia trong nghiên cứu này là tự nguyện. Nếu anh chỉ có một lựa chọn để tham gia hoặc rút từ nghiên cứu vào bất cứ lúc nào, nó sẽ không ảnh hưởng đến việc điều trị - quan tâm. Các kết quả của nghiên cứu có thể có được công bố, nhưng tên của bạn sẽ không được dùng.

Nếu bạn có bất kỳ câu hỏi về nghiên cứu này nghiên cứu, cô có thể gọi Fantine Giáp ở 1 (858) 531-0433 và giapfantine@gmail.com .

---

1. Có hay nói chuyện với ...

gia đình	**vợ/chồng** **khác đáng kể**	hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
	trẻ em (# = _____)	hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
	họ hàng (# = _____)	hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
bạn thân		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
những bệnh nhân khác		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
y tá/nhân viên y tế		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
bác sĩ		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng

2. Có hay nói chuyện với _____ về tình trạng bệnh ung thư của bạn và điều trị?

gia đình	**vợ/chồng** **khác đáng kể**	hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
	trẻ em (# = _____)	hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
	họ hàng (# = _____)	hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
bạn thân		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
những bệnh nhân khác		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
y tá/nhân viên y tế		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng
bác sĩ		hàng ngày	trong tuần	hàng tháng	ít hơn hàng tháng

3. Hay đã nói chuyện với bác sĩ của bạn và hoặc y tá về các câu hỏi về việc duy trì sức khỏe của bạn trong điều trị?
   a. Có
   b. Không

4. Làm bạn nghĩ bạn sẽ hỏi hay đã yêu cầu những bệnh nhân khác về việc làm thế nào để duy trì sức khỏe của bạn trong điều trị?
   a. Có
   b. Không