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Barbara W. Son

California State University, Los Angeles, bson@exchange.calstatela.edu

Carole South-Winter

University of South Dakota, carole.south-winter@usd.edu

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Cover Page Footnote

We are grateful for helpful comments from multiple referees on several versions of the paper.

HUMAN BEHAVIOR IMPACTS ON HEALTH CARE

Barbara W. Son, California State University, Los Angeles
Carole South-Winter, University of South Dakota

It is critical to understand human behavior in order to implement effective health-care policies for both developing and industrialized countries. Human behavior issues were studied in Ghana, with a developing economy, and South Korea, with a developed economy. From the survey research in Ghana in 2014, we learned that rural residents are heavily dependent on traditional health care. However, local community residents preferred to talk to medical doctors about their health care when accessible. We also looked into human behavior issues and the unique hospital culture in South Korea that contributed to the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak in 2015, incorporating human behavior into the SIR (susceptible-infected-recovered) model of infectious disease transmission. Moreover, we closely examined the impacts of human behavior and offered suggestions for the integration of human behavior in health-care policy.

Keywords: health care policy, human behavior impacts, culture of health, Ghana, South Korea

INTRODUCTION

It has been critical to understand human behavior in order to implement effective health-care policies for both developing and industrialized countries. Human behavior issues were studied in Ghana, with a developing economy, and South Korea, with a developed economy. Our study in both countries revealed how human behavior plays a central role in the maintenance of health and the prevention of disease.

To investigate how health-care opinion leaders exert influence on residents' behaviors, we carried out two surveys in Ghana in May 2014. With fewer facilities to deliver health care in the rural areas of Ghana, there are unique health-care providers not common in western medicine. People in rural and remote areas of Ghana often rely on traditional medicinal approaches. Traditional health care in Ghana includes chemical sellers, which are loosely regulated medication and herbal dispensaries, prayer camps, and voodoo priests or shrines (Adinkrah & Adhikari, 2014). We examined how traditional health-care providers gain opinion leadership in their communities, as well as their influence on individuals' attitudes within the community.

We also looked into human behavior issues and the unique hospital culture in South Korea that contributed to the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak in 2015. In South Korea, patients typically visit multiple hospitals and their family members traditionally help medical staff with the care of their loved ones (WPRO, 2015). We incorporated human behavior issues into the SIR (susceptible-infected-recovered) model of infectious disease transmission (Haran, 2009). Moreover, we closely examined human behavior

impacts and offered suggestions for the integration of human behavior in health-care policy. Our studies demonstrated that health-care opinion leadership and the SIR model can assess, measure, and facilitate behavior that will result in positive health outcomes in compromised countries.

INFLUENCE OF HEALTH-CARE OPINION LEADERSHIP ON HUMAN BEHAVIOR IN GHANA

Ghana has enjoyed one of Africa's most stable governments in addition to a promising economy, yet health care in Ghana has not kept pace. Many citizens have gone into a perpetual cycle of disease and poverty. The overwhelming majority (80%) of the population live on less than \$2 a day (United Nations Development Program, 2008). Many areas lack electricity, sanitation, and clean water. Only 32% of Ghanaians living in the upper east region have access to potable water (Atipoka, 2008). There are approximately 200 hospitals in Ghana and a handful of for-profit clinics, which provide less than 2% of health-care services (Yeboah et.al, 2014). Health-care access remains a challenge in Ghana, particularly in the rural regions. There are fewer physicians in rural areas to deliver health care (Apoya & Marriott, 2011).

Lack of medication to treat diagnosed diseases is responsible for the prevalence of traditional health providers such as chemical sellers, traditional healers, and prayer camps in rural and remote areas. There are over 1,000 pharmacy outlets, both retail and wholesale, and more than 8,000 chemical retail sellers. This indicates very small coverage of the country by retail pharmacies and hence, the heavy dependence on chemical sellers by those in rural settings. In over 60% of the cases, rural chemical sellers are first-line providers of medicines. There is no regulation of unlicensed chemical sellers and many medications are stored incorrectly and many are expired (Adinkrah & Adhikari, 2014).

Given the heavy dependence on chemical sellers by residents, our survey study examined how traditional health-care providers gain opinion leadership in their communities and their influence on residents' behaviors within the community. These health-care opinion leaders are those individuals with the ability to influence the attitudes or behavior of patients in an informal desired way with relative frequency.

A. Survey Study in Ghana

Background of survey study. Many low and middle income countries, such as Ghana, struggle to finance their health-care systems and are required to explore different options. This is a direct result of the systems being under-funded (Adinkrah & Adhikari, 2014). Access remains severely limited for the people of Ghana. Barriers to enrollment are the "high cost of premiums, distance to health facilities, place of residents, poor quality of care, timing of premium payments, and other behavioral and social factors" (Jehu-Appiah et al., 2014, p.158).

In 2011, a United States-based health-care system committed to complete a 10-clinic network in Ghana within three years, based on a hub and spoke model or micro clinics to meet the specific needs of individual communities. In January 2012, the first clinic in Cape Coast, Ghana, was completed and provided care to over 900 patients per week. The geographic survey locations were selected based on this commitment.

To investigate how health-care opinion leaders exert influence on residents’ behaviors, we carried out two surveys in Ghana. We adopted a sociometric survey method with three general questions: 1) who are the identified health-care opinion leaders in Ghana? 2) To what extent is there alignment between self-designating opinion and citizen-reported opinion leader identification? and 3) what is the extent and structure of social networks or likely coverage by opinion leaders? Two surveys were distributed and collected by student investigators during a faculty-led program to study health care in Ghana in May 2014. One survey was offered to individuals in various settings including remote areas of medical outreach, urban areas, and villages. The second survey was offered to those in a health-care setting, including clinics, midwives, voodoo communities, public health clinics, and chemical sellers. The community member survey selections were determined through research of medical treatment in Ghana and input from the hub and spoke model previously mentioned.

Limitations. The survey study was limited by the willingness of community residents and health-care providers to participate in the survey, access to community residents and health-care professionals, and appropriate translators in remote regions.

Survey methods. We collected surveys from community residents in three broad groups: urban, rural, and remote areas. Participants in remote and rural areas require a translator and reader. Many community residents in these areas, especially women, were illiterate and spoke a non-English dialect. Ghana is a multilingual country with approximately eighty languages and seventy tribal groups, each with its own distinct language. Surveys were anonymous and compiled after returning from Ghana. Participants were not identified or rewarded for completing the surveys. Of the respondents, 157 community members were surveyed, including 51 from urban cities, 65 from rural villages, and 41 from Kpanla, an isolated island. A second survey on self-designation was administered to 61 health-care providers to measure their health-care opinion leadership. There was a correlation between the two surveys.

Survey results and discussion. The results indicated a correlation between the two surveys and, as a result, particular health-care providers were identified as being the most ideal opinion leaders. However, there were significant variations between urban communities, rural communities, and the island of Kpanla. The general trend of the study, when moving from urban to rural to island, shows a steady decline in the selection of medical doctors and chemical shops, with a constant increase of dependence on family. The Ministry of Health reports that only 45% of rural households, compared to 92% of urban households, have access to a health facility (Ghana Statistical Service et al., 2015). We confirmed this finding in the survey sample. Our survey results are summarized in Table 1.

TABLE 1: THE HEALTHCARE PROVIDER THAT THE RESPONDENTS TALK TO MOST OFTEN

	Rank	Doctor	Chemical Shop	Family Member	Prayer Camp	Herbalist	Midwife	Shrine/Voodoo
Cities	1	23	19	6	3	0	0	0
	2	16	14	5	10	0	0	0
Rural Area	1	22	19	15	9	0	0	0
	2	18	12	16	8	2	2	0
Kpanla	1	15	4	14	3	5	0	0
	2	13	9	3	9	8	0	1

Both urban and rural residents prefer speaking to doctors and chemical sellers. Rural residents also greatly rely on family members. Furthermore, we found the dominant influence of opinion leadership in health-care attitudes and behaviors. The most striking feature was how health-care providers used opinion leadership in their communities and the degree to which an opinion leader influenced individuals' attitudes or overt behaviors within the community.

HUMAN BEHAVIOR ISSUES AND UNIQUE HOSPITAL CULTURE IN SOUTH KOREA

A. Influence of Human Behavior on MERS Transmission

We looked into human behavior issues and the unique hospital culture in South Korea that contributed to the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak in 2015. MERS, with a fatality rate of about thirty-eight percent, is a strong, deadly respiratory infection (Rockx et al., 2007). The initial MERS patient visited multiple crowded hospitals. South Korean patients typically go to multiple hospitals to ascertain the correct diagnosis and often use small hospitals to get a referral to bigger hospitals, since they seek better medical care at bigger hospitals. Even rural patients seek hospital beds in large famous hospitals in Seoul and wait in the crowded emergency rooms until they secure hospital beds.

Furthermore, emergency rooms are typically filled with patients' family, friends, and outside caregivers. In South Korea, patients' family members traditionally help medical staff with the care of their loved ones in multi-occupancy patient rooms (WPRO, 2015). These peculiarities in the Korean hospital culture sparked a large subsequent secondary spread. Super spreaders unleashed separate chains of infection as they moved to different hospitals, infecting their medical staff, fellow patients, and hospital visitors. One of the patients who contracted the virus from the initial patient spread his virus to over 70 people in the crowded emergency room in Seoul, where chances of close contact are high (Cowling et al., 2015). In the wake of the super-spreading MERS virus in hospitals, South Korean patients feared hospital infection and avoided visiting hospitals for even critical treatment (Kim, 2015).

B. Integration of Human Behavior into the SIR Model of Infectious Disease Transmission.

We incorporated human behavior issues into the SIR (susceptible-infected-recovered) model of infectious disease transmission (Haran, 2009). The SIR model assumes infected individuals transmit viruses to healthy individuals through contact or close proximity. The model describes the progress of an infectious disease epidemic from "S" (susceptible) to "I" (infected) and then to "R" (recovered). The SIR model, as shown in Figure 1, has three components: "S" (susceptible population), "I" (infected population), and "R" (recovered population).

Susceptible (S): Individuals who are susceptible to infection.

Infected (I): Individuals encounter infected individuals and become capable of transmitting the disease to those in the susceptible category.

Recovered (R): Individuals have recovered with immunity, have been placed in isolation, or have died. They are no longer able to transmit the infection to others.

As discussed in the preceding section, human behavior played a key role in the deadly outbreak of MERS in South Korea. Figure 1 displays the impact of human behavior on the progress of the MERS epidemic.

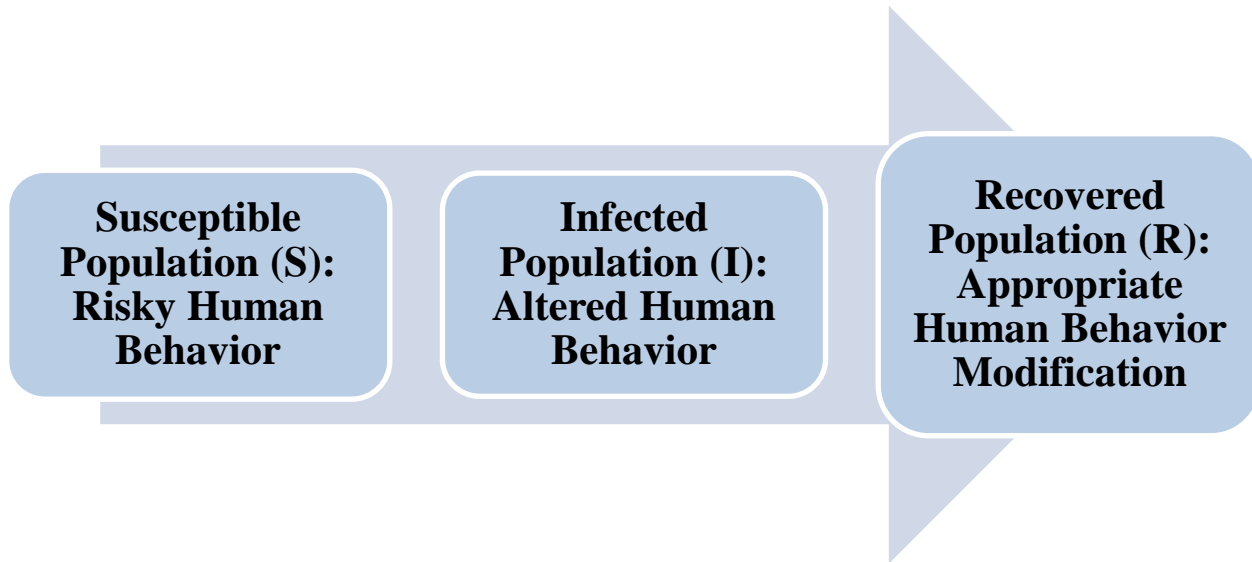


Figure 1. Human Behavior and the SIR Model: South Korea

Susceptible population: risky human behavior. The first component of the SIR model is susceptible population: risky human behavior. As hospital shopping is common in South Korea, the initial MERS patient visited four hospitals to find answers regarding his symptoms. Along the way, he spread his deadly virus to over 30 people who came into close contact with him. In addition, the initial patient did not fully disclose his travel to the Middle East to his doctors. Only when he was eventually referred to the Samsung Medical Center in Seoul, did his doctors discover his trip to the Middle East and gave him a correct diagnosis (Hui, Perlman, & Zumla, 2015).

Infected population: altered human behavior. The second component of the SIR model is infected population: altered human behavior. The Samsung Medical Center failed to assess the risk posed by the initial MERS patient in its crowded emergency room. The hospital did not place the initial MERS patient in well-ventilated hospital rooms, and further allowed its ambulance driver with MERS symptoms to continue to work, causing him to have contact with approximately 500 people (Park et al., 2015). The MERS virus in South Korea spread rapidly, infecting over 180 Koreans, resulting in over 30 deaths in the first month after it was first detected on May 20, 2015 (WHO, 2015). Since a MERS vaccine was not available, to prevent further MERS transmission, the South Korean government took steps to trace contacts and implement quarantine measures. In June 2015, over 2,800 individuals were quarantined in their home or in medical facilities (WHO, 2015).

The deadly MERS outbreak in South Korea has consequently altered people's behavior. Given the super-spreading events at the MERS-stricken hospitals, people avoided hospital visits,

preferring to purchase medicines at convenient stores. Even if they had to visit hospitals for critical treatment, they postponed hospital visits. As fears of MERS were growing, people increasingly stayed home and drastically reduced trips via public transportation. Meanwhile, demand for MERS protection products, such as masks and air purifiers, soared. The South Korean government pledged all out efforts to halt the further spread of MERS, while urging people to get back to their normal lives with slowing MERS cases (Kim, 2015).

South Korea also faced drastic changes in foreign travelers' behavior. The Korea Tourism Organization (KTO) reported an enormous 108,100 flight cancellations by foreigners on June 14, 2015, although there were no MERS infections experienced by foreigners in South Korea. To win back foreign tourists, the Ministry of Culture, Sports and Tourism decided to offer free MERS insurance policies to all foreign tourists. When foreign tourists were infected with the MERS virus in South Korea, MERS insurance fully covered their medical and traveling expenses. The MERS insurance policy coverage lasted three months from June 22 to September 21, 2015 (KMFA, 2015).

Recovered population: appropriate human behavior modification. The last component of the SIR model is Recovered population: appropriate human behavior modification. As we have indicated, risky human behavior played a key role in the spread of MERS. Improvement of infection control practices requires appropriate human behavior modification. In particular, changing health-care workers' behavior is a tough challenge (Pittet, 2004). To enforce appropriate human behavior modification, the South Korean government took a strong multidimensional approach including legal actions. As many MERS patients, including the super-spreaders in South Korea, were not forthright about their hospital shopping, a new MERS law was passed in the National Assembly on June 25, 2015. According to the KMHW's Press Release on June 26, 2015, under the MERS law, the public was compelled to be honest with health authorities. When MERS-infected patients gave false testimony to state investigators or refused to follow infection-control measures, they paid a fine of 20 million won (\$18,000) or faced two years of imprisonment. The new law also doubled the number of MERS infection-control officials and granted them greater authority to implement quarantine and infection-control measures.

To ease public fear by creating a safe environment for care, the KMHW recognized change in the hospital system through the National Safe Hospitals program was inevitable (KMHW, 2015). According to the KMHW's press release on June 12, 2015, medical personnel who treat pneumonia-suspected patients in National Safe Hospitals must wear complete protective gear at all times and thoroughly follow hygienic procedures to protect themselves from the virus. To ensure adequate public monitoring, the South Korean government and the Korean Hospital Association will also set up a joint monitoring team and will continuously monitor the full compliance of National Safe Hospitals (KMHW, 2015).

The South Korean government effectively adopted the recommendations of the South Korea-WHO MERS Joint Mission to halt the MERS transmission. Quarantine and the tracing and monitoring of all contacts with MERS-infected individuals in South Korea were maintained during the MERS outbreak. These actions ultimately led the government to bring the MERS outbreak under control (WHO, 2015). On December 23, 2015, the Korea Ministry of Health and

Welfare (KMHW) declared that the MERS outbreak was officially over according to WHO standards (KMHW, 2015).

As Table 2 indicates, South Korea experienced the largest MERS outbreak outside the Arabian Peninsula with 186 laboratory-confirmed infections and 36 deaths. There have been no new MERS-positive confirmed cases since July 4, 2015, and all five of the MERS-positive cases under treatment tested negative for MERS. In total, 16,693 individuals were released from quarantine (KMHW, 2015).

Table 2.

Status of MERS Cases in South Korea

Classification of Cases	Laboratory-Confirmed Cases	Discharged	Deaths	Under Treatment	Released from Quarantine
Total	186	145	36	5	16,693

Source: KMHW, 2015.

INTEGRATION OF HUMAN BEHAVIOR IN HEALTH-CARE POLICY

It is critical to understand human behavior in order to produce effective health-care policies for both developing and developed countries. From the survey research in Ghana, we found the dominant influence of opinion leadership in health-care attitudes and behaviors. Increasing partnerships between the health care opinion leaders and governments is vital to promote safe health-care practices. We also learned that rural residents are heavily dependent on traditional health care. Although rural chemical sellers are first-line providers of medicines, they sell incorrectly stored and expired medications. The Ghana Ministry of Health and the Ghanaian Pharmacy Council should seriously address the major underlying causes of its deepening health-care crisis.

Human behavior played a key role in the deadly outbreak of MERS in South Korea. Risky human behavior led to many secondary and tertiary MERS cases (Park et al., 2015). This then sparked widespread panic and consequently altered people's behavior. The South Korean government took an aggressive, multidimensional approach, including legal action, to enforce appropriate human behavior modification.

A closer examination of human behavior impacts on health care in Ghana and South Korea calls for the integration of human behavior in health-care policy. The identified vulnerabilities in their health-care systems suggest governments should actively implement human behavior-based strategies for a "culture of health" and prevent infectious diseases. Serious policy efforts should be directed towards cost-effective preventive measures and public health education.

CONCLUSION

Our studies can help to improve our understanding of the impact of human behavior, and thus, shed light on appropriate health interventions. Our research demonstrated that health-care opinion leadership and the human behavior-centered SIR model can assess, measure, and facilitate behavior that will result in positive health outcomes in compromised countries. Our survey results indicated the dominant influence of traditional health providers' strong opinion leadership in rural health care in Ghana. Using the paradigm of the SIR model of infectious disease transmission, we carefully examined how human behavior played a key role during the MERS outbreak in South Korea. This model strongly supports human behavior-centered interventions to successfully combat multidimensional infectious diseases. We have closely studied human behavior impacts and offered suggestions for the integration of human behavior in health-care policy.

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