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## Articles

ATHENS INSTITUTE FOR EDUCATION AND RESEARCH
A World Association of Academics and Researchers
8 Valaoritou Str., Kolonaki, 10671 Athens, Greece.
Tel.: 210-36.34.210 Fax: 210-36.34.209
Email: info@atiner.gr URL: www.atiner.gr
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# Mission

ATINER is a ***World Non-Profit Association*** of Academics and Researchers based in Athens. ATINER is an independent **Association** with a **Mission** to become a forum where Academics and Researchers from all over the world can meet in Athens, exchange ideas on their research and discuss future developments in their disciplines, **as well as engage with professionals from other fields**. Athens was chosen because of its long history of academic gatherings, which go back thousands of years to *Plato's Academy* and *Aristotle's Lyceum*. Both these historic places are within walking distance from ATINER's downtown offices. Since antiquity, Athens was an open city. In the words of Pericles, **Athens*"...is open to the world, we never expel a foreigner from learning or seeing".*** ("Pericles' Funeral Oration", in Thucydides, *The History of the Peloponnesian War).* It is ATINER's **mission** to revive the glory of Ancient Athens by inviting the World Academic Community to the city, to learn from each other in an environment of freedom and respect for other people's opinions and beliefs. After all, the free expression of one's opinion formed the basis for the development of democracy, and Athens was its cradle. As it turned out, the Golden Age of Athens was in fact, the Golden Age of the Western Civilization. *Education* and *(Re)searching* for the 'truth' are the pillars of any free (democratic) society. This is the reason why *Education* and *Research* are the two core words in ATINER's name.

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# President's Message

All ATINER"s publications including the e-journals are open access without any costs (submission, processing, publishing, open access paid by authors, open access paid by readers etc) and are independent of the presentations made at any of the many small events (conferences, symposiums, forums, colloquiums, courses, roundtable discussions) organized by ATINER throughout the year. The intellectual property rights of the submitted papers remain with the author.

Before you submit, please make sure your paper meets some basic academic standards, which include proper English. Some articles will be selected from the numerous papers that have been presented at the various annual international academic conferences organized by the different divisions and units of the Athens Institute for Education and Research.

The plethora of papers presented every year will enable the editorial board of each journal to select the best ones, and in so doing, to produce a quality academic journal. In addition to papers presented, ATINER encourages the independent submission of papers to be evaluated for publication.

The current issue of the Athens Journal of Health and Medical Sciences (AJH) is the third issue of the sixth volume (2019). The reader will notice some changes compared with the previous volumes, which I hope is an improvement.

Gregory T. Papanikos, President
Athens Institute for Education and Research

# Athens Institute for Education and Research

*A World Association of Academics and Researchers*

**19th Annual International Conference on Health Economics, Management & Policy, 22-25 June 2020, Athens, Greece**

The Health Economics & Management Unit of ATINER will hold its **19th Annual International Conference on Health Economics, Management & Policy, 22-25 June 2020, Athens, Greece s**ponsored by the Athens Journal of Health and Medical Sciences. The aim of the conference is to bring together academics, researchers and professionals in health economics, management and policy. You may participate as stream leader, presenter of one paper, chair of a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2020/FORM-HEA.doc).

**Academic Members Responsible for the Conference**

- **Dr. Paul Contoyannis**, Head, Health Economics & Management Unit, ATINER & Associate Professor, McMaster University, Canada.
- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Division, ATINER & Assistant Professor, School of Nursing, Johns Hopkins University, USA.

**Important Dates**

- Abstract Submission: **19 November 2019**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **25 Mav 2020**

**Social and Educational Program**

The Social Program Emphasizes the Educational Aspect of the Academic Meetings of Atiner.

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**Conference Fees**

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**4-7 May 2020, Athens, Greece**

The Medicine Unit of ATINER is organizing its **8th Annual International Conference on Health & Medical Sciences, 4-7 May 2020, Athens, Greece** sponsored by the Athens Journal of Health and Medical Sciences. The aim of the conference is to bring together academics and researchers from all areas of health sciences, medical sciences and related disciplines. You may participate as stream leader, presenter of one paper, chair a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2019/FORM-HSC.doc).

**Important Dates**

- Abstract Submission: **1 October 2019**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **6 April 2020**

**Academic Member Responsible for the Conference**

- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Research Division, ATINER & Assistant Professor, School of Nursing, Johns Hopkins University, USA.
- **Dr. Carol Anne Chamley**, Head, Nursing Research Unit & Associate Professor, School of Health and Social Care, London South Bank University UK.
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- **Dr. Ketan Ruparelia,** Head, Pharmaceutical Research Unit, ATINER & Research Fellow and Part-time Lecturer, De Montfort University, U.K.

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# "*Poverty is our Biggest Enemy*": Canadian Nursing Students' International Learning Experiences (ILEs)

*By Hannah Ashwood-Smith*[*]*, Lorelei Newton*[†] *& Renate Gibbs*[‡]

*International Learning Experiences (ILEs) have been a cornerstone of global health education for nursing programs throughout the world. Camosun College's Nursing Department (Victoria, BC, Canada) has conducted numerous ILEs in many developed and developing countries for over a decade with only anecdotal evidence to support these rich yet challenging international placements. Thus, the principle objectives of this research aimed to explore the impact of study abroad placements on students' global health knowledge acquisition, and personal and professional growth, in addition to understanding the important perspectives of the host countries. The methodology combined qualitative and quantitative components and employed a global health framework. The data collection tools included focus group discussions, global health themed critical reflections, a survey, and a structured questionnaire. An interpretive description approach guided the analysis. The results revealed the complexity of the students' personal and professional journey as they incorporated global health concepts into their novice practice. Furthermore, health promotion was a critical dimension of the data illuminating student's enhanced knowledge levels of principles of upstream thinking and effective health education strategies. Cultural competence as a key learning outcome fostered complex ethical discussions supporting the concept of cultural comportment. It is hoped that these research findings, coupled with recommendations for best practice, will help inform the debate on the merits and challenges of ILEs, ensuring that vital concepts of global health knowledge and cultural competence are deeply embedded into future international nursing placements.*

**Keywords:** *Nursing students, Global health, Cultural competence, Personal and professional growth, International Learning Experiences*

## Introduction

Canada is a multi-cultural society embracing over 200 ethnic groups (Statistics Canada 2011). According to the National Household Survey, one in five people living in Canada is foreign-born representing 21% of the population, the highest of all the G8 countries (Statistics Canada 2011). Four percent of Canadians have an Aboriginal identity. Furthermore, the Canadian Nursing Association (CNA 2018) has adopted a new position statement promoting cultural competence stating all nurses have an obligation to strive for culturally competent care. For the purposes of this project, cultural competence is defined as "the ability of nurses to self-reflect on their own cultural values and how these impact the way they provide care" (CNA 2018). Therefore, it is increasingly important that nursing programs adapt curricula to reflect cultural minority's diverse health needs. Developing a cohort of culturally competent nursing graduates with a deeper awareness of global health principles will promote high quality nursing care for all Canadians (CNA 2018).

[*]Faculty, Camosun College, Canada.
[†]Faculty, Camosun College, Canada.
[‡]Faculty, Camosun College, Canada.

The Camosun College Nursing Department, Victoria, BC, Canada has offered international clinical field school experiences for Canadian student nurses in the Baccalaureate of Nursing (BSN) program for over a decade. No formal evaluation has been performed, but anecdotal evidence and student testimonials have reflected positively on these international learning experiences (ILEs). To this end, we embarked on a project to examine the impact of ILEs on students and host country institutions.

## Literature Review

A number of studies have published the merits of International Learning Experiences (ILEs) or exchange programs for nursing students (Button et al. 2005, Frisch 1990, Greatrex-White 2007, Kulbok et al. 2012, Zorn et al. 1995) highlighting the importance of these unique opportunities to enhance nursing students' personal and professional growth (Greatrex-White 2007, Lee 2004). These invaluable international placements provide prospects to develop cultural competence (e.g., Campinha-Bacote 2011, DeSalles Turner 2007, Kokko 2011, Ruddock and Campesino 2002). Numerous studies report that healthcare students express a desire to gain deeper knowledge of other cultures and wish to experience a different health care system (Bohman and Borglin 2014, Burgess et al. 2014, Gower et al. 2016, Holmes et al. 2012, Kelleher et al. 2016, Kent-Wilkinson et al. 2015, Keogh and Russel-Roberts 2009, Owen et al. 2013, Wehbi 2009). Students would like a chance to improve upon their nursing knowledge (Bohman and Borglin 2014, Holmes et al. 2012, Gower et al. 2016, Kumwenda et al. 2014), learning from low-income countries, and expressed a craving to contribute towards health issues in order to make a palpable difference (Burgess et al. 2014, Gower et al. 2016, Kumwenda et al. 2014, Reimer-Kirkham et al. 2009, Wehbi 2009).

Recent literature reviews explore factors in North America and Europe which influence healthcare students' decisions to pursue ILEs (Brown et al. 2016, Kent-Wilkinson et al. 2015). Findings suggest that prior travel opportunities and volunteer experiences, coupled with family support, fuelled commitment for some students to participate in studies abroad (Burgess et al. 2014, Gower et al. 2016, Kent-Wilkinson et al. 2015, Keogh and Russel-Roberts 2009, Owen et al. 2013). Challenges for students are identified as inadequate funds, potential lost wages and family considerations (Bohman and Borglin 2014, Kelleher et al. 2016, Kent-Wilkinson et al. 2015, Morgan 2012). One survey indicated that 54% of Canadian nursing schools incorporate international placements into their curricula (DeLong 2015) speaking to the need for well planned ILEs which truly enhance students' evolution. Financial barriers seem to be the overarching deterrent for nursing schools and/or students considering international placement options (Kelleher et al. 2016).

Global literature reveals a dearth of data exploring the host country's perceptions of these ILEs (DeLong 2015, Underwood et al. 2016). Furthermore, students' knowledge acquisition on core global health concepts have rarely been studied in detail, although past findings support the notion that ILEs can

have a positive influence on students' cognitive development (Button et al. 2005, Zorn et al. 1995, Frisch 1990). There have been some concerns raised by faculty that students returning from these ILEs are inadequately prepared clinically for subsequent placements, lacking certain necessary psychomotor skills based on Canadian nursing standards.

## Methodology

### *Ethics*

Ethical approval for the study was obtained in writing from the Camosun College Research Ethics Board; New Zealand and the Philippines institutions were approached for written consent to conduct the study within their hospital and community settings. Host country questionnaires were distributed and collected through a confidential process each week. Written informed consent was acquired from all Canadian nursing students and verbal informed consent was obtained from host country staff nurses prior to administration of confidential questionnaires. Data was stored in secure files with names removed from the critical reflections prior to data analysis. Focus group discussions were conducted by a faculty member who did not accompany students and had no involvement with any student evaluations. Informed consent was obtained from the nursing students for each focus group (pre and post departure).

### *Design*

A combination of qualitative and quantitative data collection techniques were employed using an adapted version of Riner's (2011) framework. Focus group discussions (FGDs) (n=4), global health themed critical reflections (CRs) (n=32), surveys (n=12) and a structured questionnaire (n=62) were used to address four study objectives examining host countries perspectives of the ILEs, and the Canadian nursing students' motivating factors, and personal and professional growth, with a strong emphasis on global health concepts.

### *Sample*

Student participants ranged in age from 20 to 34 years old with mean age of 24. There were 22 students in total; 16 went to the ILE in the Philippines (seven first year and nine second year students) and six students attended the New Zealand ILE (all second-year nursing students). All nursing students consented to participate in at least one aspect of the research project.

Host country nurses (n=62) took part and were purposively selected after working with Camosun College nursing students; 41 responded to the questionnaire from the Philippines and 21 from New Zealand. 70% of the host country nurses surveyed were unit staff with 13% nurse educators, 9% senior nurse managers, 7% outpost nurses and 1% other.

*Study Setting*

The Philippines

The Filipino ILE was located centrally in a large local hospital which served impoverished populations with limited medical coverage. Camosun College nursing students learned to provide direct support and advocacy across the life span while caring for patients on a number of units**.** This setting provided all levels of care including male and female surgery, operating rooms, general medicine, pediatric and adult emergency services as well as pediatric and obstetrical in-patient services. A smaller neurological stroke unit, and pediatric, neonatal and adult intensive care units were also selected to assist students in meeting their learning outcomes.

New Zealand

The New Zealand ILE was located on the North Island of New Zealand. Camosun College nursing students learned about divergent health systems working in several settings: a large tertiary referral hospital, Whanau Care Services and Pacific Support Services. These services link up with individual patients and their families to provide direct support and advocacy for the Maori and Pacific Island populations. Community experiences gave students an opportunity to work under supervision in the Ora Toa Health Services. Reflecting the cultural diversity of New Zealand, this range of sites and services provided unique learning experiences for students to care for patients with poorer health outcomes than the general population.

Student Preparation

All students were required to attend a full day cultural workshop hosted by Camosun's International department prior to departure. Additionally, several orientation sessions were planned by educators focusing on each country's political climate, unique health systems, and priority diseases with a specific focus on basic treatments and nursing care not previously covered by their curriculum. A simulated learning experience was conducted, ensuring students could perform comprehensive neonatal and maternal assessments. Several health promotion activities were designed for the group going to the Philippines, covering pediatric dehydration and dengue fever, including patient assessment, treatments, preventative aspects, and how to teach families the importance of, and ingredients for, homemade oral rehydration therapy. A simulated learning experience was arranged during the first week of the practicum for the New Zealand student group. This included patient assessments, clinical decision-making and the documentation expected in the host healthcare facilities.

*Research Objectives*

Four research objectives were explored as follows:

1. What are the host country participant's perceptions regarding the benefits and challenges of the ILE?
2. What are the key motivating factors for students pursuing the ILE?
3. How do ILEs impact students' global health knowledge acquisition?
4. What is the impact of the ILE on students' personal and professional growth?

Although the study involved a wider focus, this paper addresses the outcomes related to the unique host country's perspectives and the benefits and challenges experienced by students in the context of global health knowledge acquisition. Their personal and professional growth is explored which inevitably covers their complex and often challenging journey towards cultural competence.

*Data Collection Techniques*

Multiple methods were employed to answer the study objectives which included quantitative instruments: a structured questionnaire for host country nurses and an on-line survey for nursing students. Qualitative instruments included focus group discussions and themed critical reflections for nursing students. Data was collected before and after the ILE.

Questionnaire

A structured questionnaire was designed and administered to respondent host country nursing staff (n=62) working with the Canadian nursing students. Respondents ranked their satisfaction levels working with the students as per the following categories: Very Successful/Quite successful/Average/ Unsuccessful/Very unsuccessful/Unable to comment. Closed questions regarding factors that contributed positively and negatively to their experience were employed, in addition to several open-ended questions: "What has been the biggest lesson learned from hosting the Canadian nursing students?" and "How can we improve this experience from your perspective?". Data was entered into Microsoft Excel and Fluid Survey for analysis.

Survey

A survey was delivered on-line to all nursing students three months after completion of their practicum with a core focus on elements of Riner's (2011) framework (Table 1) designed to assess their global health knowledge acquisition. Respondents were asked to self-rate their competency levels on a series of topics: teaching and learning, cultural awareness, patient advocacy, and critical thinking.

The nursing students' self-rated competencies regarding cultural awareness, psychomotor skills and global health knowledge acquisition were obtained via an electronic survey, pre and post departure focus group discussions and themed critical reflections (with a minimum of two per student) during their five-week practicum abroad.

**Table 1.** *Riner's (2011) Adapted Global Health Framework*

| |
|---|
| Applies principles of public health to populations |
| Implements principles of teaching and learning that address the health of populations at risk |
| Gains deeper understanding of tropical/infectious disease processes |
| Develops cultural competencies for working with underserved populations |
| Identifies cultural differences in the provision of health care resources |
| Provides culturally competent/sensitive health care |

Focus group discussions (FGDs)

Four FGDs were held with the nursing students: two prior to their departure and two three months after their return to Canada. Topic guides were developed with an initial focus on motivating factors for choosing the ILE, foundational public health knowledge, level of preparedness for the unique experience, and the student's expectations for personal and professional growth. Sample questions from the pre FGD topic guide include: "What do you think will be your biggest challenge?" and "How do you think culture influences your practice?".

The post FGD topic guide differed slightly as the aim was to ascertain global health knowledge acquisition with a specific focus on the social determinants of health (SDOH), in addition to ethical dimensions for studying abroad. Sample questions from the post FGD topic guide included: "How did you apply the principles of public health to an at-risk population?" and "Can you identify any upstream public health strategies?". In addition, students were asked to "Describe any ethical dilemmas or situations you encountered" and "Are there any cultural considerations that will enhance your Canadian practice?".

Critical reflections (CRs)

Some studies have emphasized the importance of CR as a means of enhancing nursing students' cultural awareness (Riner 2011, Torsvik and Hedlund 2008, Ruddock and DeSalles Turner 2007), helping them to synthesize different aspects of nursing care and ensuring greater depth to their learning (Keogh and Russel-Roberts 2009).

Students completed a minimum of two themed CRs three weeks apart during the ILE experience (n=32). The themes for the CRs were structured around the eleven SDOH which, loosely defined are factors that influence population/community health. These include: income, employment, education, healthy child development, physical environments, coping skills, access to health services, healthy behaviors, biology/genetics, gender and culture (Government of Canada 2018). In addition, students were prompted to consider the impact of

infectious or communicable diseases on their patient's health status; however, most students selected a lens of culture, poverty, or resource allocation to reflect upon their clinical experience.

*Analysis*

Quantitative data was collected through a Fluid Survey (FS) platform and analysed using descriptive statistics to ascertain measures of frequency, central tendency and variation. Analysis was completed by the research team. Qualitative data analysis was guided by an interpretive description approach (Thorne 2016). Interpretive description is a method that addresses the complexity arising out of nursing practice research and supports the excavation of subsequent convoluted and diverse data. Analysis was multi-layered with author generated groupings of broad themes that emerged from our individual readings of the qualitative data. We further coded and refined the themes for discussion. The main emerging themes are presented below. Triangulation of methodology as listed above helped to ensure more validity and rigor to the study findings, which augmented the credibility of the study.

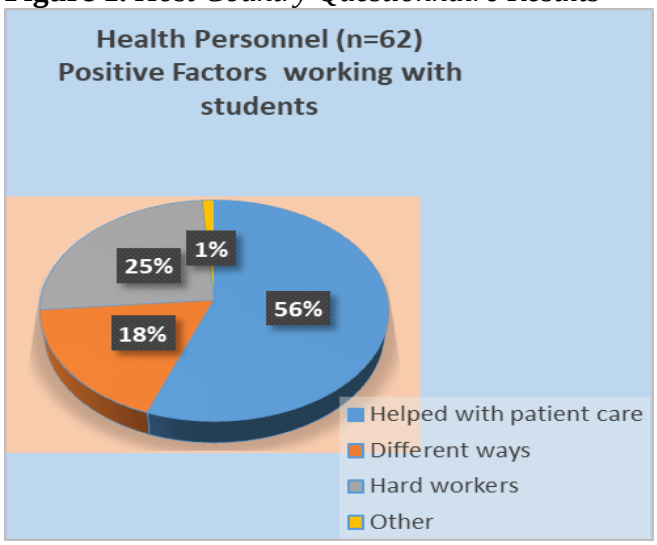
## Results

Rich data emerged from this study revealing the value of including host country staff more intentionally in the initial study design. Important in-country feedback from nursing staff was distinctly positive but also served to highlight several disparities related to language and cultural barriers, and the divergent scope of nursing practice. The Canadian students' data demonstrated a deeper understanding of the SDOH and their impact on vulnerable population's morbidity and mortality. Cultural comportment and the ethics of nursing abroad were identified as dominant themes with poverty, inequity of healthcare resource allocation, and cultural differences recognized as multifactorial issues. Health promotion was a critical dimension revealing students' enhanced knowledge levels regarding upstream thinking and effective health education strategies; specifically related to dengue fever, diarrheal disease, lung disease (asthma, pediatric community acquired pneumonia, tuberculosis), cardiac disease and diabetes. The results are presented according to the four study objectives as follows:

*Objective 1: Host Country's Perceptions*

The majority of health personnel from both countries (68%) stated that the ILE was "very successful"; while 32% felt it was "quite successful". Figure 1 summarizes the benefits host staff experienced. Generally, they were impressed with the Canadian students' "humility, willingness to adapt to new situations, patience, hard work, keen assessment skills and kindness".

**Figure 1.** *Host Country Questionnaire Results*




Many staff on the pediatric units were pleased with the students' willingness to engage in hands-on care and their ability to embrace their role as teachers for vulnerable families. One nurse in charge of a general pediatric ward explained:

> "They have helped a lot in the pediatric general ward, taking vital signs, monitoring patients, and the teaching and learning classes on oral rehydration were very informative!".

When asked specifically about factors that impeded this ILE, although 75% of staff surveyed had no negative factors to convey, 9% stated that communication and language barriers (in the Philippines) were the most significant challenges and this, coupled with a relatively short placement, impacted students' ability to optimize learning.

> "They make contributions however there are limits in labor and delivery as responses should be quick thus putting more hindrance on what students can do as they are still in orientation phase".

The different scope of practice was mentioned by numerous ward staff:

> "We are hesitant to initiate certain things because this might not be practised in your country".

Students from both countries also commented on the different scope of the nurse and how this affected their ability to perform nursing care. In the Philippines there was one nurse responsible for obtaining vital signs, and another nurse solely responsible for medication administration. Canadian students were not allowed to give medications due to the difference in medication policies and procedures. In New Zealand, second-year student nurses also noted a difference between the training programs and length of training. Groups in both countries found these adjustments in practice eye opening. Most students were

impressed with the ingenuity of the host country staff as illustrated by the following quotations:

> "Filipino nurses have mastered providing care with next to no resources". (CR)

and

> "Sometimes as a nurse it is the littlest things that can make the biggest impact". (CR)

Other students struggled with the roles and relationships they encountered:

> "Nurses here don't question the doctors" (CR)

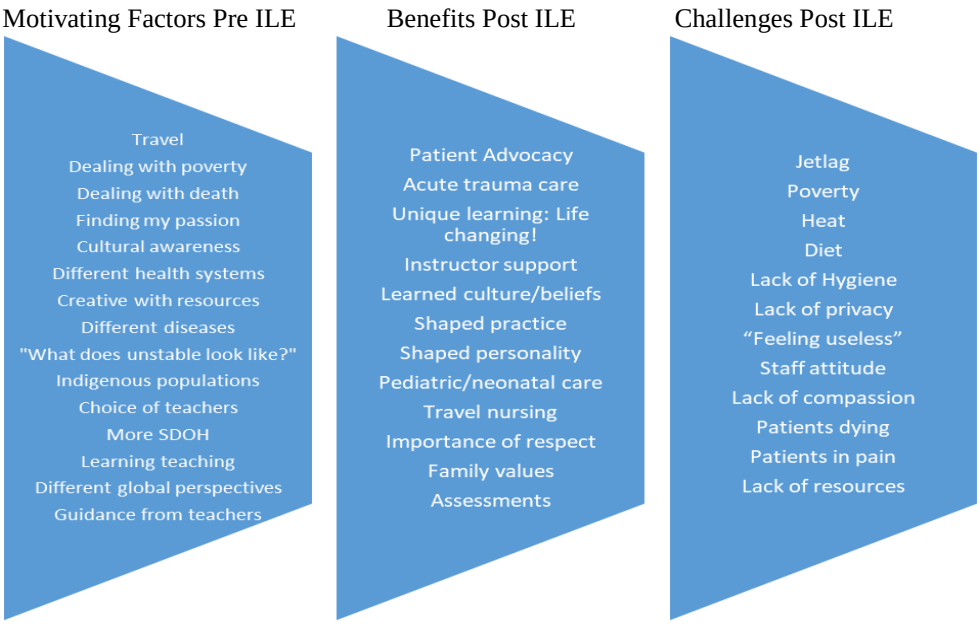
with another student writing:

> "Doctors were very understanding, but their scope of practice is very different… strange things are done, intubation when they don't need to intubate". (CR)

*Objective 2: Students' Motivating Factors*

Students identified a multitude of factors that both motivated their involvement in the ILE and challenged them to move beyond their comfort zone personally and professionally as caregivers. Figure 2 and Table 2 outline a summary of the key findings.

**Figure 2.** *Summary of Student Results*



Students' challenges

As outlined above, a central concern for students attending ILEs is inadequate funds (Kent-Wilkinson et al. 2015). For this ILE experience, a greater number of students (n=16) participated in the lower cost ILE in the Philippines, compared to New Zealand (n=6). Although the cost played a role in their selection, an equally important consideration for many students was the opportunity to work in a developing country rather than a developed country, which would provide them with a different world view. The majority of students applied for scholarships or bursary funds to help support their programme. During both ILEs, several students discussed multiple family considerations as a part of their learning context; however, this was not commented on in the Pre or Post FGDs.

**Table 2.** *Students' Motivational Factors*

| |
|---|
| "Cultural competence, the biggest thing I can be is be open minded and not judgmental". |
| "I wanted to be able to experience a different culture. Everyone looks at the world differently, culture affects the way you see the world". |
| "In no way did I think I was going to save the world, I walked into this, I said this is my time, I wanted to experience travel nursing, but not be fully responsible for it all. I'm going to do this, and with instructors". |
| "I went for an opportunity to travel, I wanted the culture shock. I'm so caged and protected. I was ready to see anything that can happen, even the condition of the hospital, seeing how they function in the best way – how they function with lack of resources". |
| "We did priority assessments and head to toe assessments…we practised it and learned it so well and it's stayed with me". |
| "People there are acutely ill, there are so many things we could do-there is such a need". |

Students also made several statements regarding concerns for personal safety, stress and reactions to divergent cultures. For example,

> "I found that it was taxing to be aware and alert all the time…that things could have gone the other way. At times we had to advocate ourselves". (FGD)

Some students expressed concerns regarding language, communication and cultural barriers which impacted their ability to perform nursing care. Students who learned a few basic words in the local language felt this helped break down communication barriers and eased the rapport with their patients and host nurses. Instructor observations concurred with the student findings, noting enhanced relationships with those students who took the initiative to learn simple words in Tagalog or observe Pacific Island customs.

Students reported feeling upset by the extreme poverty, the profound changes in their own diet, and identified many personal challenges, namely lack of privacy and basic comforts related to their crowded living conditions. In some cases, students expressed "feeling useless" and felt confused by their

perception of a "lack of compassion" demonstrated by some host nurses during nursing care of dying patients. Due to these complex factors, students expressed the need for a richer, more in-depth and culturally appropriate preparation. As one student explained:

> "I would have liked a lot more context - this is what would have been more helpful". (FGD)

Some of the more seasoned students with travel experience benefited from their own initiative to enhance their overall preparation:

> "I did a lot of research about the country ahead of time…always be aware of what is around you, don't be naïve about that". (FGD)

*Objective 3: Students' Global Health Knowledge*

Riner's (2011) adapted framework was incorporated to ascertain global health knowledge acquisition. Pre-departure few students could identify one SDOH, in contrast in-country CRs revealed a much richer knowledge with most students freely journaling about witnessing ten out of 11 SDOH including poverty, lack of hygiene, social supports, literacy, income, political/social climates, resource allocation, culture, overcrowding and unjust access to care. They witnessed SDOH in action every day.

> "Be prepared for the poverty. I was prepared for poverty but not for that type of poverty!". (FGD)

In comparison, anecdotal evidence suggests that very few students who did not participate in the ILE (that is, those who stayed in Canada) discussed SDOH in their critical reflections.

Students in New Zealand reported on their work with the Mauri and Pacific Island populations in Ora Tora clinics, which included addressing respiratory diseases, wound care and teaching diabetic patients' dietary advice to control unstable blood sugars.

Many students reflected on the inequity of health care resource allocation:

> "I was frustrated and saddened to see how the system works here for the poorest populations". (CR)

> "Most of the poor families could not afford many of the drugs, scans, X-rays and MRIs which is a major barrier to providing good health care". (CR)

> "During my first week I was feeling overwhelmed by the poverty I was seeing in the streets and in the hospital. I did not think there would be children sleeping in cardboard boxes in the streets". (CR)

It was clear that all nursing students in both host countries felt that teaching at risk populations was a highlight of their trip (CRs) and there was an undercurrent of profound student learning through this teaching process (CRs, FGDs). Pre-departure orientation focused on teaching students important elements of vector control strategies (i.e., daytime biting mosquito, importance of wearing long sleeves and importance of diminishing stagnant water sources to decrease risk of dengue) and how to teach mothers to make their own oral rehydration solution (WHO 2007) to tackle childhood dehydration and diarrheal disease, which students implemented on the pediatric and dengue units in hospital and with urban and rural scavenger families in the community.

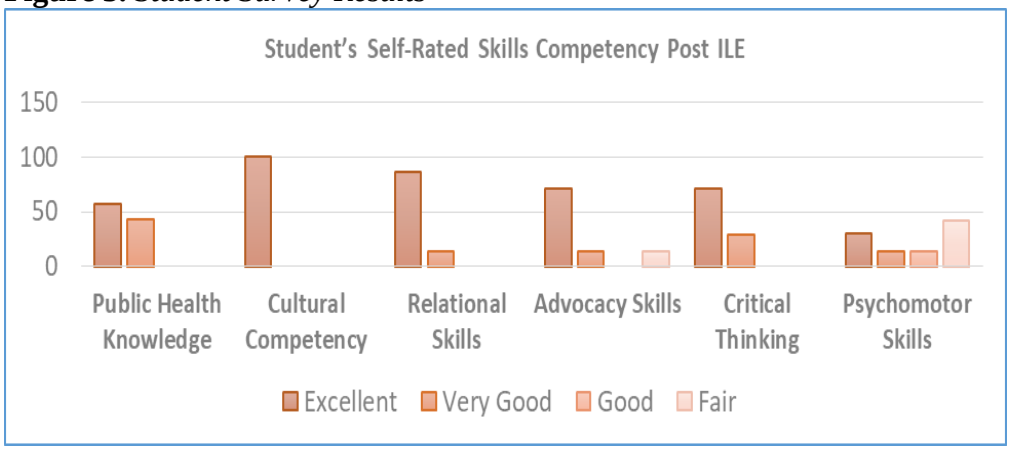
> "One of the profound experiences I had was with a young mum down in ER (with her baby). She was dealing with diarrheal disease and we had learned the recipe for oral rehydration solution. She spoke really good English. I said I'm going to teach you how to prevent this in the future, and this is how you stop it, and I want you to go home and teach all your friends- everyone you know, you can do good in the world". (FGD)

Prior to their many teaching sessions students tried, with the help of a local translator, to determine existing knowledge levels of the families, and were surprised to discover that in some very rural Filipino communities cultural beliefs exist associating witchcraft with Dengue fever. Many students perceived health promotion to impoverished populations as more critical due to the urgency of preventing imminent mortality versus distant morbidity: For example, helping local communities understand principles of vector control to prevent Hemorrhagic Dengue Fever was viewed as more vital than teaching Canadian school children smart drink choices to prevent diabetes in later life.

The nursing students working in the Philippines described caring for patients with dengue fever, Tuberculosis, community-acquired pneumonia and pediatric diarrheal disease and recognized these as important infectious diseases affecting vulnerable populations. Additionally, they described challenges influencing the chain of disease transmission for example: lack of running water, soap, and medical supplies.

An interesting study finding was that 100% of students rated their cultural competency as "excellent" upon return to Canada. They rated their critical thinking skills, advocacy skills and relational practice skills as "very good". They were less generous rating their public health knowledge. Many felt they had not had enough opportunity to practise psychomotor skills during their overseas placement, resulting in a "fair" rating. Figure 3 outlines students' self-rated competencies.

**Figure 3.** *Student Survey Results*




The Canadian students, many of whom came from affluent areas, found witnessing abject poverty uncomfortable and overwhelming. Despite observing these tough circumstances, which included the extreme lack of life saving resources, all students expressed gratitude for this life-changing opportunity by the end of their intense placement.

> "I felt fortunate to participate in global nursing to expand my nursing knowledge of health ethics". (CR)

> "I felt very inspired by the scavenger community experience-seeing what makes a sustainable healthy community!". (CR)

> "This was an intense learning experience that challenged me both as a person and as a nursing student. It enhanced my empathic nature, gave me curiosity to learn about global health issues, improved my communication skills and helped me grow physically, emotionally and ethically as an individual. I loved every minute of it!". (CR)

*Objective 4: Student Personal and Professional Growth*

Overall, and notwithstanding the challenges they encountered, all students reported tremendous personal and professional growth during this international experience. Data from FGDs and CRs, coupled with researcher observation, highlighted how the ILE prompted a juncture that could be seen as the beginning of a multifaceted and individual journey towards cultural competence. These findings are congruent with previous research (e.g., DeLong 2015, Montenery et al. 2013, Button et al. 2005).

Attributes central to the concept of cultural competency are: cultural awareness; cultural sensitivity; cultural knowledge and cultural skills (Cai 2016). These attributes provide a frame for examining students' personal and professional growth over the course of the ILE and will be explored further in the discussion.

Cultural awareness

Nursing students are exposed, through multiple formal and informal learning processes over the course of nursing school, to the concept of cultural awareness; that is, the recognition that different cultural attributes influence health (CNA 2018). Prior to their departure, the nursing students were confident in their awareness of cultural diversity and their cultural competence in general (FGD). Certainly, they had already been presented with multiple opportunities in the curriculum to experience different cultures that extended beyond definitions limited to ethnicity (Blanchet Garneau and Pepin 2015); however, the ILE provided incredible depth to the learning they had acquired thus far.

> "It has been very important for me to always take a step back and try to understand some of the cultural values before judging actions that I may normally consider confusing". (CR)

> "This was such a huge opportunity to understand how social determinants of health impact families through culture". (CR)

> "There is a language barrier but body language and tone speak volumes". (CR)

Cultural sensitivity

Cultural sensitivity is an "appreciation, respect and comfort" for and with the cultural diversity of patients and clients (Cai 2016). Building on their emerging sense of cultural awareness, the students began to recognize their own cultural values and became more sensitive to the multiple perspectives of what healthcare is and means. For the majority of the students, this was unexpected and akin to what Jenkins et al. (2011) describe as "nursing shock". While the impact of the initial jarring exposure did seem to dissipate, as Jenkins et al. also reflect, the experience seemed to be more of a process of being "sensitized" to alternate interpretations of taken-for-granted ideals in a Canadian context and understanding that those customs are not necessarily the norm or even available elsewhere.

> "My initial feelings were disbelief and shock!" [that things were not done as in Canada]. (CR)

> "This young man (with a blunt trauma head injury) needed a CT scan and was not receiving it due to his family having to allocate funds to pay-they were [the equivalent of seven Canadian dollars] short…it is likely this young man died due to his injuries…". (CR)

Building on cultural awareness, cultural sensitivity refers to the idea that "both appreciation and respect are based on feeling comfortable within cultural diversity" (Cai 2016: 270). Understandably, there were differences in the degree of initial sensitization experienced by students from the Philippines versus New Zealand, where the hospital setting did not differ substantially from a Canadian setting. Many students in the Philippines talked about the importance of "*getting comfortable with the uncomfortable*" (FGD), which can be seen as a critical step in cultural sensitivity. (FGD) Many examples in the final CR demonstrated less

judgment of local belief systems and more acceptance of the differences they observed in patient care.

> "Being able to work in the Ora Toa clinic (New Zealand) has shown me that in order to improve the health of patients in the community, more preventative health care must be provided, rather than treating diseases when they occur!". (CR)

> "One of the biggest learning outcomes for me is that I will never be protected from culture shock…and that open-mindedness and respect is not equivalent to intercultural competence". (CR)

Cultural knowledge

Cultural knowledge is described by Cai (2016) as striving for a comprehensive educational foundation regarding a particular culture. Students recognize this in terms of the unique culture of their particular field school but also in terms of the culture of nursing within the overarching culture.

> "It has become apparent to me that we may have things to teach each other as nurses". (CR)

> "It is important to realize that resource allocation is not always better in Canada, [we] can be towards the other end of the spectrum with overuse and misuse of services". (CR)

Cultural skills, or the practise of incorporating culturally relevant assessments into nursing care (Cai 2016), seemed to be highlighted in the students' discussions and reflections of the varied and diverse issues they brought forward as ethical challenges.

> "It has been ethically challenging at times [in the Philippines]. I realize I am a visitor to the country and I found it conflicting to understand where that boundary may lie: being respectful of culture and traditional ways of caring for Filipino patients…". (CR)

> "In class, we learned about the SDOH and the role they play in health of an individual but this real-life experience put those factors into perspective". (CR)

> "While the baby was in intensive care unit, the mom just left him there, neglected…the inequities of the system made me think that she might not be able to care for all her children, or even one, because of her economic status and complete lack of resources". (FGD)

Students realized the importance of cultural skills in practice, that their scope of nursing involved far more than merely performing set tasks.

> "I realize more than ever that the care of a nurse is far more than just task oriented; it is about connecting with your patient and being fully present". (CR)

> "I realize there must be a balance between advocating for the patient in a respectful manner and stepping aside, but at this point in my training I feel that I have not fully grasped this yet". (CR)

In particular, as the students worked through ethical considerations, they came to realize that recognizing contradictions can be seen as an important aspect of self-reflection of their own cultural competence.

> "I have not been talking about these experiences with others, not sure how much I could tell them-my family wondering how could it all be negative? My travel afterwards was talked about more…". (CR)

> "I felt guilt coming from [a developed] country…and I did not want the patient…to feel I was judging them on the way they lived". (CR)

> "This was harsh but what I learned here can't be learned anywhere else and I will use this experience in positive ways". (FGD)

All respondents echoed this sentiment:

> "The trip did an amazing job of not only solidifying our knowledge but also pushing us out of our boundaries and challenging our beliefs". (FS)

## Discussion

### *Host Countries' Perceptions "Canadian Students Have Heart"*

Collaboration with the host country nursing staff was a critical, yet surprisingly often overlooked, research consideration. Kokko (2011) conducted a systematic literature review of seven empirical studies describing nursing students' studies abroad with a focus on cultural competence, yet none of these studies included the perceptions of their hosts. However, global host partner perspectives were the focus of one well designed qualitative study in the Dominican Republic (Underwood et al. 2016: 357) where engagement and collaboration of the host institutes provided a well needed "platform from which to intentionally dialogue with host partners in order to gain their context specific insights". The importance of this shared insight cannot be overstated. Host staff's perceptions stemming from this research helped to establish a more equal partnership. Although most staff in both countries surveyed were very pleased with the Canadian nursing students' compassion, flexibility and desire to help, local staff were able to provide insight into the divergent scope of nursing practice between countries, the importance of a more profound cultural orientation to the high intensity areas, and the need for these exchanges to be longer for more meaningful learning to occur. Kokko asserts that for the development *process* required to gain true cultural competence, longer exchanges are necessary. This is supported by other researchers whose analysis of the length of exchanges ranged from eight days to 21 days total (Browne and

Fetherston 2018). This five-week study exceeded these shorter exchanges considerably yet host country staff rightly felt it was still an insufficient length of time for the students to understand the rich complex culture and therefore limited their ability to experience a profound cultural shift.

There is the perception that the interconnections made with host countries with a North American Health Care programme can have ongoing benefits. One can argue that globalization and the interrelationship of local and global contexts can create beneficial opportunities for students and their teachers to contribute to their hosts in international placements. Although further research is needed to critically examine contributions made to the host countries, the desire to contribute and altruism remain strong motivating factors (Gower et al. 2016, Burgess et al. 2014, Kumwenda et al. 2014, Reimer-Kirkham et al. 2009, Wehbi 2009).

If study abroad programmes are developed with effort and expense, to build alliances and partnerships across cultures with their host countries, the financial burden for students should also be addressed to allow greater access to study abroad programmes. Given that inadequate funds can be a primary deterrent for many students, one initiative may include implementing a program that offers greater access to funding specifically to support students considering study abroad including scholarships, bursaries or loans with generous terms of repayment.

*Students' Motivating Factors "I Went for the Opportunity to Travel-Experience Culture Shock!"*

While ILEs can create valuable learning opportunities for nursing students studying abroad, there is a danger that students choose to pursue these culturally diverse nursing placements for their "exotic" and "adventurous" elements rather than the pursuit of global health knowledge, professional growth and cultural competence. The motivation to study abroad for some students seemed disconnected from the stated learning outcomes for the course. As identified in other studies "cultural tourism" can be a dangerous motivating factor (Ramsden as cited in Racine and Perron 2012). This complex balance between providing a culturally rich and safe environment for young (often inexperienced) students, versus the opportunity of an adventure tour and the real potential for helicopter epidemiology (Jamrozik 2006) proves the key to the overall success of ILEs.

Students' responses concurred with literature regarding personal safety fears, in addition to the stressors they experienced through exposure to wide-ranging cultural differences (Kent-Wilkinson et al. 2015, Kelleher et al. 2016, Morgan 2012, Ruddock and DeSalles Turner 2007, Tyagi et al. 2006).

While such international experiences can create valuable learning opportunities, students also report concerns about the physical and emotional challenges (Gower et al. 2016, Tyagi et al. 2006). Our results concur with these findings where students voiced a tangible need for better preparation to work in resource poor settings, and the importance of personal resilience during the ILE (FGD). Lack of supplies, lack of cleanliness, inability to perform hand hygiene

were listed among physical limitations. This finding was not unique to our study (Gower et al. 2016, Racine and Perron 2012, Tyagi et al. 2006).

A second issue worthy of consideration is the impact that student participants exert on their peers upon return, and the influence on nursing programs in general as they may ultimately draw upon their cultural journey and overseas nursing experience. Indeed, one can argue that these participants will potentially influence others long after they graduate and contribute positively to their local health care system to increase awareness and improve the cultural sensitivity in their profession. The underlying notion that those study abroad participants can be better positioned to shape their practice with a sense of cultural safety and a higher degree of cultural competence is an area that requires further study.

Recognizing the inherent value to the individual student participant and to the overall quality of health care programs, one also needs to reflect on the challenges that may deter future participants or derail future ILEs. In the case of Camosun College, the initiatives to mount a study abroad program in both 2017 and 2018 were cancelled due to the insufficient enrollment, and difficulty recruiting educators with pertinent global health experience. Given the identified deterrents such as inadequate funds and the impact on students' and faculty's family and work responsibilities, the question of how healthcare departments can better support interested parties is raised. Effective promotion of study abroad opportunities must not only address the motivating factors, but the important deterrents need to be considered in a thoughtful and clear fashion, both for students and faculty members.

*Global Health Knowledge: "Poverty is our Biggest Enemy"*

Many students are motivated to study abroad for a multitude of reasons as previously discussed in this paper. One criticism of ILEs described by our research and by other studies (Racine and Perron 2012) is that if not managed professionally with a rich cultural and global health lens, overseas placements run the risk of becoming an exciting form of cultural tourism, and may therefore miss vital, unique and rich learning opportunities. The inclusion of an adapted version of Riner's (2011) framework into this study design coupled with other important global health concepts (including tropical diseases, SDOH, and health promotion) helped us gain a richer understanding of the value of these ILEs from a global health perspective.

The importance of the students' CRs as a valuable research tool is evident and this was found equally important in other studies (Ruddock and DeSalles Turner 2007). It was often after challenging shifts that students were able to explore their beliefs, values, judgments and underlying knowledge around complex patient care issues through these intense journal entries that served as important data sources but more importantly helped students process some of their difficult nursing experiences. Many of the core SDOH which they admitted to not adequately considering in Canada became apparent as they confronted abject

poverty, lack of hospital supplies, and poorly educated families with sick children.

Students' self rated competencies of their global health knowledge and cultural competency showed an improvement following their international placement. Interesting to note however that their very high self rating of cultural competency often did not align with the researcher's personal observations. At times a few students appeared judgmental and held an air of superiority. Racine and Perron (2012) explore similar findings. The true depth of this learning may not become apparent until a later time in the students' careers as they gain maturity, experience and better insight into their experience. It would be important to survey the students several years after their ILE, something our study did not consider, but has been highlighted by research done by Kokko (2011: 681) where "nurturing after graduation" was recommended to sustain cultural growth.

There was an undercurrent of intense student learning through their teaching process. Teaching at risk populations was a highlight in the majority of students' CRs (25/32). Although patient education is an important part of their Canadian nursing curricula and learning outcomes, students seemed to place more value on this role and expressed pride in this element of their nursing practice. It was evident that students' knowledge of infectious diseases and the impact of the SDOH was enhanced through a combination of taught lectures by Canadian instructors prior to and during the practicum, through their weekly critical reflections, and by the complexity of patients experiencing a multitude of infectious diseases students do not often witness in their routine Canadian nursing training. For example, students' recognition that early detection of the signs and symptoms of dengue fever and subsequent prompt treatment has the potential to reduce patients' case fatality rates to less than one percent (WHO 2019) was transformative.

### *Students' Personal and Professional Growth: "Getting Comfortable with the Uncomfortable"*

Participating in an ILE has a profound impact on the professional and personal growth of students (e.g., Button et al. 2005, Lee 2004). Our results demonstrate that such growth can be framed within the concept of cultural competence, which can also be viewed as a gradual "developed capacity of nurses to provide safe and quality healthcare to clients with different cultural backgrounds" (Cai 2016). That is, cultural competence is a continuous lifelong dynamic process requiring an emphasis on perpetual development and explicit focus of cultural awareness, cultural sensitivity, cultural knowledge, and cultural skills (Cai 2016). As cultural competence is considered a requisite entry-to-practice ability for Canadian nurses (CNA 2018), the notion of supporting cultural competence in nursing students and novice nurses requires further attention. This is no small task as it necessitates that we "become comfortable with the uncomfortable".

Cultural competence, particularly cultural skills, were highlighted in the student nurses' discussions regarding ethical challenges. Benner et al. (2010) argue that nursing ethics has consistently been taught well across nursing education programs. Further theorizing of ethical comportment has proved a useful construct in this area (Day and Benner 2002, Benner et al. 2008). Ethical comportment is the ability to demonstrate "appropriate use of knowledge, skills of care and relations, and communication with patients and colleagues" (Benner et al. 2010). Extending this definition, cultural comportment can be seen as an educational opportunity at the nexus of nursing ethics and cultural competence.

The challenge is not only to create opportunities along this journey for nursing students (and faculty) to explicitly focus on the dynamic nature of cultural competence, but to also integrate the central attributes outlined above into everyday practice. Viewing cultural comportment as an avenue to support and role model cultural competence may provide nursing students (and faculty) with the confidence necessary to sustain and embed this process in a way that will inform their nursing practice across an entire career. Including cultural competence within ethics discussions, and further supplementing those discussions within the context of ethical comportment, will assist the promotion of a life-long curiosity in this regard. ILEs can be seen as a disruptive pedagogical technique that will focus nursing students on the importance and value of cultural competence, and cultural comportment, both abroad and at home.

## Limitations

The primary sampling technique was based on convenience and thus, the group consisted of students who were financially able to participate. In this way, the group may not be representative of overall nursing student population. As well, the data was collected over a short time frame, providing a snapshot of the ILEs offered at that time. International placement sites will vary across time, depending on student interest and faculty experience and availability. The snapshot of the ILEs examined only considered short term learning outcomes; a longitudinal study is recommended to examine sustained impact for students as often the most important learning is not actualized immediately upon return. There are also concerns that the host country nurses may only provide positive feedback with little critique via the questionnaires due to cultural etiquette, language barriers and a desire not to offend their guests.

## Conclusion

In summary, the study findings identify that host country staff benefited significantly from collaborating with our ILE students and it was important to include their opinions into the study design. The Canadian student participants developed a deeper awareness of the host culture coupled with a better

understanding of the key SDOH in both settings. The students revealed exponential growth both personally and professionally as they embarked on a challenging journey on the road to cultural competence and cultural comportment. This paper puts forth new suggestions for future ILE practices and areas worthy of further exploration. It is hoped that findings from this research will inform the global debate not only on the value and importance of ILEs, but on ways to ensure cultural competence is embedded into nursing practise from graduation with a sustained and richer global health focus.

## Recommendations

- Apply a post colonial lens when constructing learning activities for nursing students attending ILEs with the intention of supporting the inclusion of host country perspectives.
- Prepare students and faculty intentionally, with a focus on the importance of an in-depth cultural workshop from a health perspective with clearer objectives that relate to the SDOH, tropical medicine, cultural competence and cultural comportment – designed explicitly to move beyond cultural tourism.
- Develop a comprehensive orientation and evaluation toolkit for both instructors and students, which includes a clear global health framework with related learning outcomes.
- Ensure a formative evaluation and debriefing across the entire ILE, addressing immediate concerns (including post traumatic distress) with follow up upon return to Canada.
- Embed explicit nursing ethics discussions and frameworks to consolidate ethical dimensions of practice, which support the acquisition of cultural competency.
- Assess impact of the intentional critical reflections on students' journey to cultural competence through the lens of personal and professional growth.
- Develop a comprehensive psychomotor skills-workshop upon returning from a low-income country is warranted.
- Provide simulated learning experiences addressing both assessment skills and global health concepts to prepare no only students attending ILEs, but those who participated in domestic placements.
- Examine the long-term impact of ILEs on students' cultural competence journey post-graduation.

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# Development of Multiprofessional Simulation-based Education in South Ostrobothnia, Finland

*By Mari Salminen-Tuomaala*[*]

*Continuous multiprofessional development and networking are essential elements of health and social care practice today. This paper gathers together the results gained so far of a regional research and development project and discusses their application and implications for future. The aims of the project were to create a network-like simulated learning environment, to develop multiprofessional simulation education for medical students and for students representing two levels of nursing education and to create a multiprofessional simulation-based coaching programme for health and social care professionals in small and medium-sized enterprises. The project partners were two educational institutions and a Central Hospital in Finland. The first sub-project involved an online survey at the turn of 2016 and 2017, whose purpose was to describe nursing and medical staff's (n=125) knowledge of simulated learning and their experiences about the usefulness of simulation-based education. Quantitative data was analysed using SPSS Statistics for Windows 24 and qualitative data using inductive content analysis. Another online survey was conducted as part of the second sub-project in 2017 to study nurse and practical nurse students' experiences (n=21) of joint simulation training. The results were analysed using SPSS. The third sub-project, which aims at the development of a new simulation coaching project for health and social care staff in small and medium-sized enterprises, also involved a survey conducted in 2017 to study staff's learning needs (n=125). The results of the three surveys confirmed that both nursing and medical staff, students and professionals working in small and medium-sized enterprises find multiprofessional simulation-based learning effective and useful in promoting networking and the exchange of knowledge, skills and support. This paper also discusses the practical applications of the project results.*

**Keywords:** *Development, Multiprofessional collaboration, Network, Simulation-based education*

## Introduction

This article describes the development of multi-professional simulation-based education in South Ostrobothnia, a region with a population of 200,000 in western Finland. The work is being carried out within the framework of a research and development project for the years 2016-2020. This paper gathers together the results gained so far and discusses their application and implications for future.

The aims of the project are threefold: 1) creation of a network-like simulated learning environment; 2) development of multiprofessional simulation education for medical students and for students representing two levels of nursing education and 3) creation of a multiprofessional simulation-based coaching programme for health and social care professionals in small and medium-sized enterprises.

The regional project partners are South Ostrobothnia Hospital District, Seinäjoki University of Applied Sciences and Seinäjoki Vocational Education Centre. The Hospital District provides specialized medical services for the population of 18 municipalities in western Finland. Most of the services are

[*] Senior Lecturer, Seinäjoki University of Applied Sciences, Finland.

concentrated in the central hospital, but some psychiatric services are available across the region. The Hospital District works in close collaboration with primary health care and social services (Etelä-Pohjanmaan Sairaanhoitopiiri 2019). The second partner, The University of Applied Sciences is a multidisciplinary institution of higher education, which currently offers 19 Bachelor and 8 Master degree programmes. The number of full-time students is 4,800. The School of Health Care and Social Work of the University offers degree programmes in nursing, public health nursing, physiotherapy, elderly care and social work (*SeAMK-About us* 2019).The third partner, the Vocational Education Centre, offers 23 upper secondary-level vocational qualifications in various fields of study for 4,500 students. The students of social and health care are trained to become practical nurses and emergency medical technicians. (Sedu 2019).

Based on recent research, the article first discusses multiprofessional networking, collaboration and simulation learning to provide a background for the project results. Following that, three sub-projects marked A-C are described in separate sections. Each section contains a description of the methodology, results and practical application of a sub-project. The article ends with a discussion and conclusions.

## Literature Review

This article discusses the development of competence, multiprofessional collaboration and networking in health and social work education and practice, carried out using simulation-based pedagogy. Smooth collaboration between the various professionals responsible for client or patient care has been found to affect the recipients' experience of the care quality positively (Beaubien and Baker 2004). Also in a wider context, the importance of interdisciplinary and multiprofessional collaboration (combining knowledge and skills to reach common objectives) has been found to be on the increase in modern societies (Grigg et al. 2003, Holland 2006, Katajamäki 2010).

Genuine multiprofessional collaboration means that professionals with different educational backgrounds and work roles work together and develop their work based on mutual respect and appreciation (Drinka and Clark 2000). In today's society, multiprofessional collaboration can take the form of dialogue, in which participants gather knowledge and perspectives, build networks and cross borders together (Isoherranen et al. 2008). The collaboration is not possible without clear but flexible coordination and allocation of roles and responsibilities. It has also been said that multiprofessional collaboration is about participation, competence and sharing of responsibility and power in decision-making. These attributes are both the aim and prerequisites for successful collaboration (Vuokila-Oikkonen 2002).

Networks, another important concept in this article, have been compared to a series of knots linked to each other. These knots can be material or immaterial, and formal or informal structures (Castells 2000). A network can consist of individual actors working as partners seeking to reach both individual and collective

objectives (De Man 2004, Provan and Kenis 2008). In an optimal situation, the participants have equally valuable roles as parts of the network, in which they communicate openly and complement each other (Linnamaa and Sotarauta 2000, Valkokari et al. 2008). To succeed, networking organizations should be guided by the principles of participatory action, uniform practices and open access to information. In an educational institution, for example, this would mean that both managers, teaching staff and various experts employed in the organization actively contribute to the development of the work (Karjalainen et al. 2016).

Successful networking is characterized by joint development efforts, creative solutions and agility (Kuure and Lidman 2012). It enables sharing of knowledge and competence between organizations. Committing oneself to networking entails long-term planning and allocation of resources, but networks can also result in more functional allocation of responsibilities and use of resources. In fact, a more effective use of resources can be the incentive underpinning networking activities (Ståhle and Laento 2000, Vesalainen 2002). In a well-functioning network, collaboration is intensive and dynamic, and the partners commonly share values and practices (Ståhle and Laento 2000). Such collaboration can help manage complex phenomena in a rapidly changing environment (Linnamaa and Sotarauta 2000).

The third essential concept in this article is simulation-based education. In simulation-based education, an effort is made to create a near-authentic learning environment and context based on the participants' aims and learning needs. The experience is immersive – learners can feel that they are part of the environment. Simulation-based learning is also action-based (Hansen and Bratt 2015) and it can help build a bridge between theory and practice. Simulation-based education can be used to develop both generic and specific competencies.

There is evidence that simulation can be effective in practicing team work, interaction and collaboration skills, as well as clinical care situations. Simulation and other action-based methods been found to suit both students and professionals participating in continuing education programmes, and they can be useful in enhancing nurse-physician collaboration and mutual appreciation (McPherson et al. 2001, Baker et al. 2006). Simulation-based learning has even been found to improve such complex skills and attributes as problem-solving, emotional intelligence and situational sensitivity (Duff 2013, Forneris et al. 2015) and it can increase participants' confidence levels (Cooper et al. 2012, March et al. 2014). All these improvements can be expected to improve care quality and patient and client (Issenberg et al. 2005, Duff 2013, Jeffries 2015, Forneris et al. 2015).

Finally, a few observations should be made from the perspective of continuous development of competence in the health and social sector. It is likely that care providers will be expected to possess an increasingly complex set of skills and knowledge in future (Holli and Saloranta 2016). This is necessary for example to respond to the needs of the older population, who will mostly likely suffer from multiple health and social problems or dysfunction (ICN 2012). In Finland, where budgets for education have become tighter, educational institutions are struggling to meet the demands placed by the new competence

requirements in curricula and by the need to intensify collaboration with practice. In addition, the universities of applied sciences in particular have been assigned the mission of creating and developing attractive learning, research and innovation environments, which also meet the needs of professionals in practice (Ministry of Education and Culture 2014). Providers of education are expected to anticipate constantly changing client needs and to develop new practices, services and pathways of studies, while taking into account the perspective of employment policy. The work can only become possible with help of open dialogue and reciprocal sharing of knowledge and skills between education and practice (Mäkimattila 2014, Research and Innovation Council 2014). At best, this can result in building of bridges and creation of new forms of collaboration (Salminen-Tuomaala 2015, Salminen-Tuomaala and Jaskari 2017). It has been suggested that the aim should be to cross the boundaries between organizations and disciplines, not only locally, but also nationally and internationally (Järviniemi 2012).

## The Three Sub-projects

This chapter describes three separately conducted sub-projects within the overall research and development project still underway (2016-2020) in South Ostrobothnia, Finland. Each section contains the methodology and results of the respective sub-projects. The more detailed survey results for each sub-project have been described in earlier articles (Salminen-Tuomaala et al. 2017, Salminen-Tuomaala and Jaskari 2017, Salminen-Tuomaala et al. 2018, Salminen-Tuomaala et al. 2019 forthcoming)

### *Sub-project A: Hospital Staff Survey on Simulation-based Learning and Environment*

#### Methodology

This sub-project involved an Internet-based (Webropol) survey conducted with medical and nursing staff of the regional Hospital District. The aim of the project was to gain an overview of the staff's knowledge and experiences regarding simulation-based learning and simulated environments. The underpinning idea was to gather user-oriented knowledge that could be used to develop the teaching. The questionnaire, used to collect data at the turn of the years 2016 and 2017, consisted of both quantitative and qualitative items. SPSS for Windows 24 was employed to analyse the quantitative data, and inductive content analysis was used to examine the responses to the qualitative material.

#### Results

The results are based on a response rate of 28% (n=125). The majority of the respondents rated their knowledge of simulation as a method either moderate (women 31%, men 39%) or quite weak (women 26%, men 34%). Somewhat

surprisingly, the nursing staff members, who were past 50, were more confident about their knowledge levels compared to the colleagues in their thirties (p=.001; Kruskall-Wallis test). It must be noted that simulation-based pedagogy had not been used at the time of the older age group's initial education.

The same observation was made as regards knowledge of simulated learning environments. Again, the older age group reported higher self-ratings (p=.001). The greatest group in both men (42%) and women (38%) found their knowledge as moderate, but there was a statistically nearly significant difference (p=.077) between male and female respondents, with women rating their knowledge as higher.

It was also discovered that both doctors and nurses would appreciate simulation-based learning opportunities to practice the management of various clinical situations, that is theoretical and practical competences, communication, counselling and collaboration with other professional groups. On one hand, the respondents stressed to importance to practise acute situations, in which smooth collaboration between professionals is called for. On the other hand, they also mentioned recurring challenging situations. These can, for example, involve demanding patient or family counselling (education). According to the respondents, simulations can be used to practise teamwork and management skills and they can be helpful in looking into the roles of managers and employees. Simulation-based learning would also be an excellent way of orienting newcomers (Salminen-Tuomaala et al. 2017).

Practical application of the results

Besides providing information about what teaching contents should be included in the future simulation-based training programmes, the survey facilitated decision-making on the learning environments. It was concluded that, as far as possible, the partners should share their virtual and simulated learning environments. Using each other's concrete simulation facilities as well as virtual learning environments will create a network, which facilitates knowledge sharing and combining. Procurement of similar simulators through common bid processes can also create additional synergy among the partners. Currently the University of Applied Sciences can offer facilities for simulating scenarios typical of emergency clinics, intensive care units or common wards, whereas the Vocational Education Centre offers opportunities for practicing prehospital emergency services, including the ambulance context. The third partner, the Central Hospital, has simulation learning facilities for trauma, operating room and labour room scenarios. Future improvements involve creating a bank of actors, that is experts by experience available for roles of clients and patients.

*Sub-project B: Joint Simulation Training for Two Student Groups*

Practical arrangements

This sub-project is associated with the aim of the overall project to provide joint simulation education for medical students and for students that represent

two levels of nursing education. Up until know, the training experiment has been conducted once with two different groups of nursing students representing the University of Applied Sciences and the Vocational Education Centre. The students, who are close to their graduation, specialise in acute nursing (University) and prehospital emergency care (Vocational Education Centre). Four expert lecturers, two from both educational institutions, are responsible for planning and implementing the simulation training.

The joint simulation training takes place during two days. The scenarios involve the care of trauma patients at the site of the incident, in the ambulance, at the emergency clinic and in the intensive care unit. Critical learning contents involve patient assessment using the ABCDE approach, teamwork, effective communication and medical consultation to ensure a safe care pathway.

Methodology

An online survey was conducted in 2017 to study nurse and practical nurse students' (n=21) experiences of the joint simulation training. The questionnaire consisted of Likert-type items and three open questions. The results were analysed using SPSS for Windows. As there was only a limited number of short responses to the open questions, they were not analysed, but used as a support to the statistical data.

Results

Both nurse and practical nurse students found the joint simulation training useful. The action-based scenarios especially facilitated their teamwork and communication skills, and increased their understanding of the rights and limitations involved in different nursing roles (Salminen-Tuomaala and Jaskari 2017).

Practical application of the results

The observation has been made that communication between different groups of nursing has become clearer. In addition, since the simulation training, students remember to repeat orally what patient medication has been administered. The next joint simulation-based learning for students will be arranged in autumn 2019. In the future, the project team is planning to involve medical students in the simulated sessions.

*Sub-project C: Creation of a Multiprofessional Simulation Coaching Concept for SME Staff in Health and Social Services*

Project background and aims

This sub-project involves small and medium-sized enterprises or SMEs, whose staff numbers range from a few to 250 and whose maximum net turnover remains under 50 million euro (European Commission 2014). In recent years, many local and regional actors have become increasingly aware of the challenges faced by SMEs in the health and social sector. They have great difficulty in competing with major chains and in keeping up with the new technological

solutions, changing practices and the structural change of health and social services in Finland. Both the client population and care providers are ageing at a rapid pace, and lack of trained professionals has become a problem in many regions.

This sub-project, carried out in 2017-2019 and funded by the European Social Fund, is an attempt to respond to these concerns and to local and regional staff's practical and theoretical learning needs. The project aims at improving the quality of training by tailoring it to the specific needs of the participants. Much of the project impact relies on local and regional networking and on sharing interdisciplinary knowledge. The aim is that the coaching programme will produce permanent new practices and forms of collaboration, also between the Hospital District and the educational institutions. Improved staff competence in SMEs is likely to make the enterprises more attractive to clients and new employees. It can also increase client safety, occupational safety and, in the long run, result in better health and social services.

## Methodology

This sub-project uses an instrument based on a systematic literature review and a preliminary assessment of learning needs conducted at the SMEs in spring 2017. This questionnaire, which contains both quantitative (n=44) and qualitative (n=4) items, was first used to assess staff learning needs in SMEs. The same instrument will be used to evaluate the effectiveness of the interventions at the end of the project.

Twenty SMEs operating in the health and social work sector (child protection, mental health, care of old people) took part in the study. The data was collected from staff members (n=125) late in 2017 using Internet-based software and analysed by SPSS for Windows 23 and by inductive content analysis. The majority (83%) of the respondents in these enterprises were women, and most of them (90%) had a vocational qualification or a higher education degree in nursing or related area. Practical nurses formed the greatest occupational group (47%), and 22% of the respondents worked in a managerial position.

## Results

The survey obtained a high response rate (96%). Respondents reported various theoretical and practical learning needs. Some of the needs were individual, while others (multiprofessional collaboration, company development, networking) were more strongly associated with the development of the enterprise and the working community. Respondents were confident about their ability to recognise client needs and support clients' psychosocial and physical ability to function. Despite this, they reported a need to develop their interaction and client counselling skills. Other learning needs involved the management of acute situations, coping with aggressive behaviour and the use of digital tools and information technology. The more detailed results have been described in articles published recently (Salminen-Tuomaala et al. 2018, Salminen-Tuomaala et al. 2019 forthcoming).

Practical application of the results

An innovative simulation coaching concept based on participants' needs evolved as a result of this sub-study. For the first time in Finland, social and healthcare staff of SMEs gathered together for interactive, action-based and concrete learning sessions, especially suitable for professionals with long a work history.

In practical terms, the coaching consists of workshops and collaborative full-scale simulations involving manikins, simulation video equipment and sometimes teachers (coaches) acting the part of a demanding patient or client. The coaching takes partly place in project partners' facilities, partly in the enterprises' own facilities, according to their specific needs. This means that the simulation coaches must carefully study each context and set of learning needs before planning and implementing any contents. The aim for the future is to encourage participant involvement in planning the scenarios.

The participants form a multiprofessional, interdisciplinary group, which enables benchmarking and peer mentoring or sharing knowledge and experiences. The coaches are teachers working in pairs and they may represent the same or different fields of expertise.

As an example of concrete learning needs: Within the framework of the simulation coaching, participants have an opportunity to learn to use and test new technology in their own work environment. Simulations can be used to learn general technical skills or to learn about health and welfare technologies that support clients' self-care.

## Discussion

The main idea in the ongoing research and development project described in this paper is to bring together educational institutions, small and medium-sized enterprises and the central hospital under the shared goal of better collaboration, communication and new kind of education using state-of-the art simulation and ICT technology. The project aims at the exchange of knowledge and support between students, teachers and care providers and between overlapping and related disciplines.

The development of multiprofessional simulation-based education has proceeded at a brisk pace over the past few years, as a result of close collaboration between motivated individuals engaged in the development activities at the Central Hospital, the Vocational Education Centre and the University of Applied Sciences. The experiences have been positive; the joint simulation-based training sessions have been found to benefit nurse and practical nurse students, as they provide an opportunity to practise multiprofessional collaboration before graduation and to become aware of the various roles and responsibilities in nursing. The recently created network of simulated learning environments has been an economically and practically wise decision, which has increased synergy among all concerned parties by giving them an access to various environments.

The similar manikins in these environments, for example, make it easy and safe for learners to practice in a new setting.

The possibility to practice in a simulated environment is important because many hospitals take in a smaller number of nurse and practical nurse students for clinical practice periods than in previous years. The same challenge has been mentioned in earlier research as well (Rossetti et al. 2014, Murray et al. 2008). The near-genuine simulated scenarios and concrete learning environments are a feasible alternative to clinical practice (Hravnak et al. 2007, Brown J. 2008, Brown A. 2015). Secondly, it could be said that simulation-based learning has one advantage over clinical practice; it provides an opportunity to practise ethically and socially demanding situations. The same observation has been made by Braude et al. (2015).

Finally, both participants and teachers agree that the simulation coaching concept developed for staff in SMES is an effective and useful way of learning. Motola et al. (2013) have also stressed usefulness of creating simulated scenarios based on the target organization's needs and expectations. To sum up the new, unique elements in the coaching programme: 1) planning and implementation based on SMEs' individual learning needs; participants' involvement in planning, implementation and evaluation; 2) alternating individually tailored simulation sessions in the company's facilities with joint simulation sessions for all participants in project partners' facilities; 3) coaching in the genuine company context; 4) teachers working in pairs; multiprofessional coaching given by lecturers of nursing and social work and 5) a new kind of learning experience and pathway, which starts with the learner's and company's current situation.

## Limitations

In this three-fold project, the results of the first and the second sub-project can be best applied outside the context of the project. These two sub-projects had adequate sample sizes and response rates, and appropriate research approach and methods. Pre-testing of the questionnaire further improved the external validity of these sub-studies. The Internet-based software was also pre-tested and found suitable for the purpose. The results of the first sub-project can be utilised to develop multiprofessional simulation training in various healthcare organizations regionally, nationally and internationally. The third sub-project, conducted with SMEs, had a very high response rate (96%), and the results can be generalized to similar national and international enterprises interested in simulation-based training for their staff. In contrast, the results of the second sub-project (the training experiment with nursing students), cannot be much generalized beyond this particular group due to the limited sample size and number of responses. These results can only be considered indicative of how to proceed in the further development of joint training sessions for nursing and medical students in the region described. However, the combination of the three sub-projects provides an overall picture of important themes in the development of multiprofessional simulation-based training.

## Conclusion

Multiprofessional simulation-based learning and coaching are an effective way of developing clinical competences, collaboration and networking in health and social work education and practice. Simulation-based coaching is seen to promote professional growth, because it helps the participants become aware of their personal development needs in various situations. It is also possible to develop dialogic leadership, empathy and understanding of another person through the simulation scenarios.

A well-functioning network may offer a possibility to develop professional contacts and to identify opportunities for useful partnerships. Networking is a good way to expand knowledge by taking advantage of the viewpoints and experience of others. It may help professionals to remain on top of trends and developments in health care and social work. The multiprofessional network can function as a good resource. Sharing of knowledge between professionals and organizations is useful for both the professionals and their clients. It can improve the quality of care, client safety and occupational safety.

Multiprofessional simulation-based coaching is an attractive and effective way to learn problem-solving, emotional intelligence, situational sensitivity and teamwork skills. The simulation coaching can be even seen as an excellent opportunity for benchmarking and collaborative development of new ideas and solutions. It can improve decision-making in day-to-day management tasks.

It is essential for the new simulation coaching concept that the simulation scenarios are based on the target organization's needs. The participants' involvement is useful in planning, implementation and evaluation of the simulation coaching process. The quality of training will be better when it's tailored to the specific needs of the participants and arranged in the genuine company contexts. Thus, simulation-based coaching provides an opportunity to take account to the participants' current learning needs and goals and the organization's context as a genuine environment.

Multiprofessional simulation-based coaching is an innovative learning pathway, which starts with the learner's and company's current situation. Thus, the simulation coaches, teachers, must study each organization context before planning any contents and prepare for simulation carefully. Simulation-based coaching demands a lot of situational sensitivity from the coaches too.

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# The Impact of an Educational Program on Enhancing Knowledge towards Drug Addiction among Health Care Providers in Saudi Arabia

*By Najla J. Alhraiwil[*], Razan A. AlYoussef[†], Nora K. AlShlash[‡], Samar A. Amer[§], Nashwa M. Radwan[**], Ali M. Al Hazmi[††], Walid A. Al-Shroby[‡‡], Fahad A. AlAmri[§§]*

*Drug addiction is a major preventable and treatable problem. One important way of reducing drug abuse is through provision of effective and accurate information about drug addiction to health care providers (HCPs) to enable them to detect suspected cases earlier and provide them with the help they need. This study aimed to assess health care providers' knowledge related to drug addiction and availability of related national health services and the impact of an educational program intervention on the perceived knowledge. An interventional longitudinal study was conducted in Saudi Arabia between 10 Dec. 2017 and 4 Jan. 2018. The study included 383 participants HCPs aged 20-60 years old. They were randomly selected using a stratified sampling technique out of 143,517 HCPs who attended an educational program organized by the General Directorate for Clinical Education, Ministry of Health, in collaboration with the National Committee for Narcotics Control. A pre-designed questionnaire was used to collect data from the participants before and after attending the program. The study recorded a relatively good baseline level of knowledge about drug addiction among participating HCPs (average knowledge score 9.54±3.7 out of 13) with no significant difference between genders, occupations or education levels. At the same time, the study reported a fair level of knowledge regarding available national health services for drug addiction (Nebras). After the educational program, the drug addiction knowledge score improved from 9.54±3.7 to 11.15±2.9 with a statistically significant difference (mean difference 2.7±1.3, t=2.83, P=.01). Morover, the knowledge score about the available national service (Nebras) showed also a statistically significant improvement (mean difference 54.1±15.6, range: 7-93, P=.00). Although many HCPs lack formal training regarding drug addiction, providing them with a short educational intervention can be effective, and has the potential to improve service utilization.*

**Keywords:** *Drug addiction, Educational program, Health care providers, Knowledge, Saudi Arabia*

## Introduction

The full impact and societal cost of drug abuse and addiction are considerable; however, there are a number of useful indicators that can give us insight into its true impact. Such measures include monitoring of reported adverse health effects,

[*]Public Health Specialist, Head, Ministry of Health, Kingdom of Saudi Arabia.
[†]Health Education Specialist, Ministry of Health, Kingdom of Saudi Arabia.
[‡]Health Promotion Specialist, Ministry of Health, Kingdom of Saudi Arabia.
[§]Associate Professor, Public Health Consultant, Ministry of Health, Kingdom of Saudi Arabia/ Zagazig University, Egypt/ Royal College of General Practitioners, UK.
[**]Associate Professor, Public Health Consultant, Ministry of Health, Kingdom of Saudi Arabia/ Tanta University, Egypt.
[††]Associate Professor, King Saud University, Kingdom of Saudi Arabia.
[‡‡]Lecturer, Public Health Consultant, Ministry of Health, Kingdom of Saudi Arabia/Beni-Suef University, Egypt.
[§§]Family Physician, Director General, Ministry of Health, Saudi Arabia.

which in turn may be used to estimate the financial cost of treatment for drug addiction and associated disorders, as well as providing a qualitative measure of premature mortality and morbidity (Wallace and Kohatsu 2007). Besides costs that arise from lost productivity of the affected individual as well as family members or caregivers, potential crimes committed to sustain the addictive habit, and the provision of rehabilitative social welfare programs, the severity of the increased risk of contracting human immune deficiency virus (HIV) associated with intravenous drug use (Cassens 1992) and the consequent public health concern this poses cannot be understated. Overall, according to the World Health Organization, the global burden of disease attributable to alcohol and illicit drug use is 5.4% of the total burden of disease (World Health Organization 2010).

In the Arab world in general, and Islamic countries in particular, possession of any kind of addictive substance is illegal, and alcohol and substance use are forbidden. Even in those Arab countries where alcohol is tolerated, the strong societal stigma surrounding substance use is a major impediment to those wishing to seek help for addiction, and from a health service perspective, it constitutes a barrier to reporting, early detection and treatment. Thankfully, part of the new vision for Saudi Arabia includes a commitment to a more accepting and supportive community and a willingness to openly address previously stigmatized issues. Consequently, the National Committee for Narcotics Control (NCNC) established "Nebras": a free health service that provides advice and support for people struggling with drug addiction and their families in Saudi Arabia, as well as operating a hotline where drug addicts reported completely private and confidential in order to avail them of the specialized help that they need (National Center for Narcotics Control 2018).

One important way of reducing the use of drugs among adolescents is through providing them with reliable, accessible, and well-presented information on the subject. Providing people with accurate information on any health-related matter affords them the ability to make informed decisions in that regard (Wright and Pearl 2000). An essential prerequisite for the creation of any such materials is the assessment of existing health-related knowledge among the intended target population, as this facilitates the formulation of effective preventive programs (McBride 2003).

It is essential, therefore, that the health professionals who are sought out as a source of advice about health issues in general, and drug addiction issues in particular, are themselves knowledgeable about the risk factors, warning signs, and social, psychiatric, and medical sequelae of drug addiction, as well as being aware of the available services to whom they can refer their patients or concerned family members (US Department of Health and Human Services 2016). Only a handful of studies on drug addiction awareness among the Saudi population have been published, none of which have focused on the perspective of Health Care Providers (HCPs).

This study aimed to assess health care providers' knowledge related to drug addiction and availability of related national health services and the impact of an educational program intervention on the perceived knowledge.

## Methodology

A prospective longitudinal interventional study was conducted in Saudi Arabia on various healthcare providers between 10 December 2017 and 4 January 2018 to assess their pre- and post-knowledge towards drug addiction via questionnaire before and after an educational program.

### *Study Population*

In brief, the educational program consisted of a train-the-trainer format for selected coordinators from each region, followed by didactic lectures conducted by these trainers in their regions along with dissemination of supporting educational handouts. It targeted 70% of Ministry of Health (MoH) employees from all 20 health regions in Saudi Arabia, including employees of all specialties (medical and non-medical) and all nationalities, from regional health affairs directorates, hospitals, and primary health care centres. The study included 383 participants (288 males and 95 females) aged 20-60 years old. They were randomly selected by using a stratified sampling technique out of 143,517 HCPs who attended the educational program organized by the General Directorate for Clinical Education, MoH, in collaboration with the NCNC. The sample was first stratified according to the Saudi 20 health regions and then the subjects were randomly collected from each region. The calculated sample size was 300 by using epi-info program and it was hypothesized that the knowledge prior to attending the educational program was about 40%, and this was expected to increase to about 70% after completion of the program with a 95% confidence interval and 80% power. The final sample size was adjusted for expected attrition rate (20%), therefore, the final sample size was equal to 360.

### *The Study Instrument*

A comprehensive self-report questionnaire was designed to collect data from the participants pre and 3-weeks post attending the educational program. The questionnaire was distributed to 500 HCPs before and after their participation in the educational program and the response rate was 76.60% (Four regions were excluded from the study as they did not return the questionnaire). The total sample was 383 participants. The questionnaire was provided to the program delivery team to be reviewed for content relevance and comprehensiveness, and further reviewed by a panel of public health experts for content validity, accuracy, and clarity of different items, which included:

1. Socio-demographic data including age, sex, occupation, education, nationality, region.
2. Data about participants' knowledge regarding signs and negative health consequences of drug addiction, as well as their awareness about the NCNC Program, Nebras, and its free telephone hotline.

3. A knowledge score was developed giving each correct item one point and zero points for each incorrect one. The total score for each participant's knowledge about drug addiction (0-13 points) and the Nebras service (0-4 points), as well the mean change in knowledge score, were calculated pre- and post-training.

*Ethical Considerations*

Ethical approval for the study was granted from the Institutional Review Board at King Fahad Medical City, Riyadh, Saudi Arabia through the relevant MoH health authorities. Consent was obtained from each participating HCP after explaining the nature and benefit of participation.

*Statistical Analysis*

Data entry and analysis was performed using the Statistical Package for Social Sciences (SPSS, version 16). Mean, median, the percentage of change and ranges were used for quantitative data summarization, while for their analysis; Paired -t-test and Wilcoxon signed rank test were used. Numbers (frequency) and percentage were used for qualitative data summarization. MC-Nemar and Fisher exact test were used to analyze statistical significance. Differences were considered statistically significant when the p-value was less than .05.

## Results

Concerning the geographic distribution of the participating HCPs, four out of the total twenty health care regions in the Kingdom were excluded as their questionnaire response rate was zero. The highest response rate was from Najran region (10.44%) followed by the Northern Borders region and Riyadh region (9.92% and 9.40%, respectively). Nearly half (45.16%) of the participants in the training program work in hospitals, while 28.72% work in regional Health Affairs General Directorates and 26.10% work in PHCs. A possible explanation for the higher response rate among HCPs working in hospitals compared to primary health centers may be the relatively higher work load of HCPs in primary care preventing their participation (Table 1).

Table 1 presents the socio-demographic characteristics of the participating HCPs. About half (48.56%) of them were aged 30-40 years old, and about three quarters were males with technical occupations who were university educated (78,85%, 75.20% and 73.10%, respectively).

**Table 1.** *Socio-Demographic Characteristics among Studied Health Care Providers*

| Characteristics | Number (N=383) | Percent (%) |
|---|---|---|
| Age groups: | | |
| 20-30 | 81 | 21.15 |
| 30-40 | 186 | 48.56 |
| 40-50 | 98 | 25.59 |
| 50-60 | 18 | 4.70 |
| Sex: | | |
| Female | 95 | 24.80 |
| Male | 288 | 75.20 |
| Occupation: | | |
| Administrative | 81 | 21.15 |
| Technical | 302 | 78.85 |
| Education:* | | |
| Intermediate | 4 | 1.04 |
| Secondary | 64 | 16.71 |
| Undergraduate | 280 | 73.10 |
| Postgraduate | 26 | 6.78 |
| Work location: | | |
| Regional health affairs | 110 | 28.72 |
| Hospitals | 173 | 45.16 |
| PHC centers | 100 | 26.10 |

*Missing data=9.

Improvement of knowledge levels regarding negative health consequences of drug addiction was shown in Table 2. Psychological disorders and behavioral disorders were the most commonly known negative health consequences reported by more than ninety percent of HCPs (98.62% and 90.86%, respectively). Statistically significant differences were recorded regarding all negative health consequences before and after the educational program ($p<.05$).

**Table 2.** *Pre- and Post-Program Knowledge Regarding Negative Health Consequences of Drug Addiction*

| Negative Health Consequences | Pre-program N=383 | Post-program N=383 | P-value |
|---|---|---|---|
| | N (%) | N (%) | |
| **Cardiovascular disease** | 198 (51.7) | 226 (59.01) | .00 |
| **Gastrointestinal disease** | 175 (45.69) | 254 (66.32) | .00 |
| **Liver cirrhosis** | 221 (57.7) | 274 (71.54) | .001 |
| **Psychological disorder** | 336 (87.73) | 358 (98.62) | .01 |
| **Behavioral disorder** | 318 (83.03) | 348 (90.86) | .02 |
| **Involvement in crimes** | 301 (78.6) | 320 (83.55) | .00 |

Table 3 shows that more than ninety percent (respectively 91.38%, 90.86% and 91.91%) of the studied HCPs recorded post-program knowledge about drug addiction signs concerning continual absence from home, behavioral changes and physical body signs. Improvement in knowledge levels after the program

regarding all items of drug addiction signs was evident with statistically significant differences (P<.05).

**Table 3.** *Pre- and Post-Program Knowledge Regarding Drug Addiction Signs*

| Drug Addiction Signs | Pre-program N=383 | Post-program N=383 | P-value |
|---|---|---|---|
| | N (%) | N (%) | |
| **Sleep problems** | 289 (77.81) | 324 (84.6) | .05 |
| **Neglecting religious rituals** | 305 (77.81) | 336 (87.73) | .003 |
| **Continual absence from home** | 301 (78.59) | 350 (91.38) | .00 |
| **Behavioral changes** | 312 (81.46) | 348 (90.86) | .02 |
| **Financial troubles** | 295 (77.02) | 342 (89.3) | .00 |
| **Physical body signs** | 290 (75.72) | 352 (91.91) | .00 |
| **Neglecting general appearance** | 295(77.02) | 334 (87.21) | .00 |

Pre- and post-program knowledge of the studied HCPs regarding Nebras program is presented in Table 4. It is evident from the table that before the educational program, more than half of the participating HCPs did not know about the availability of the government health service for drug addicts nor the availability of a hotline for informing about drug addicts (57.96% and 65.01%, respectively). This was compared to more than three quarters of them who recorded positive knowledge regarding the same items after the educational program (89.89% and 78.72%, respectively) (P<.05).

**Table 4.** *Pre and Post-Program Knowledge Concerning Nebras Program*

| Knowledge | Pre-program N=383 | Post-program N=376 | P-value |
|---|---|---|---|
| ***There is a national program for drug addiction*** | | | |
| | N (%) | N (%) | |
| **No** | 3 (0.78) | 0.0 (0) | .00 |
| **Yes** | 158 (41.25) | 338 (89.89) | .00 |
| **I don't know** | 222 (57.96) | 38 (10.11) | .00 |
| ***There is a free drug addiction hotline*** | | | |
| **No** | 6 (1.57) | 3 (0.79) | .89 |
| **Yes** | 128 (33.42) | 296 (78.72) | .00 |
| **I don't know** | 249 (65.01) | 77 (20.48) | .09 |
| ***If yes, do you know the name of the program that provides it?*** | | | |
| **No** | 3 (2.34) ®[1] | 42 (14.19) ®[2] | .03 |
| **Yes** | 125 (97.66) | 254 (85.81) | .05 |
| ***Able to correctly name the program*** | | | |
| **No** | 94 (75.2) ®[3] | 194 (79.18) ®[4] | .08 |
| **Yes** | 31 (24.8) | 60 (24.49) | |

®1: n= 128, ®2: n= 296, ®3: n = 125, ®[4] n = 254

The number of participants who reported that they know the name of the program, that provides the drug addiction hotline, doubled after attending the educational activity (P<.05); however, only (24%) out of these participants –who

thought they knew the name of the program– were able to recall the correct name (Nebras) after attending the educational program.

The knowledge score regarding drug addiction among studied HCPs changed from 9.54±3.7 to 11.15±2.9 after the program with a statistically significant difference (mean difference=2.7±1.3, t=2.83, P=.01). While the mean difference in the knowledge score for Nebras was 54.1%±15.6%, range 7%-93%.

## Discussion

In Saudi Arabia, as with other Arab communities, denial and shame constitute the biggest barriers to increased awareness of drug abuse and addiction; nonetheless, given the dire consequences of inaction, we cannot allow this to stand in the way of effective prevention, support, and rehabilitation for those affected. The first step in breaking the social stigma that prevents people getting help is to bring this dialogue into the public domain, and to do this effectively, we need to form a clear and directed health message (National Academies of Sciences, Engineering, and Medicine 2016). Before this can be done, it is imperative to establish an accurate and reliable measure of people's existing levels of knowledge. Fortunately, in recent years a number of studies have been conducted that investigated these factors in defined target populations in Saudi Arabia. Among the recently published studies about drug addiction in Saudi Arabia, is one that aimed to measure the prevalence of drug abuse among athletes (Al Ghobain et al. 2016), which was closely preceded by a study to assess the knowledge and the prevalence of drug use among high school students in Jazan (Siddiqui and Salim 2016). Another study measured the perceptions and prevalence of drug use among medical students in Riyadh (Al-Haqwi 2010).

The current study, tackling the issue of HCPs awareness of drug addiction in Saudi Arabia for the first time, found that the level of knowledge among studied HCPs regarding negative consequences and signs of drug addiction was relatively good. This level improved further after the educational program.

Our study showed that psychological and social disorders were the most commonly known negative health consequences reported by more than ninety percent of HCPs followed by potential involvement in crimes. After the educational program this knowledge increased on average by 10%, compared to an increase of 20% for knowledge about medical negative health consequences. This may be explained by the difference in knowledge score between the technical and administrative participants (P=.03), and the fact that psychosocial effects can be easily detected while other negative medical health consequences (cardiovascular, liver, and gastrointestinal) required a specific medical background. Happell, Carta and Pinikahana (2002) also reported an adequate level of knowledge among technical staff about the negative medical outcomes associated with drug use.

Most of the participants in this study (>90%) recorded good knowledge regarding drug addiction signs and symptoms – in particular physical body signs, behavioral changes, personality changes, and dramatic changes in habits

and/or priorities. Conversely, there was a low level of awareness (58.22% and 65.01%) among studied HCPs about the existence of a national body (Nebras) and the availability of a free drug addiction hotline to support drug addicts and their families. Encouragingly, the knowledge score improved significantly in both domains after the educational program.

At baseline, there was no statistical difference in knowledge regarding drug addiction among male and female HCPs (P=.67). Moreover, it is interesting to note that after the educational program, improvement of knowledge regarding drug addiction was found to be higher among female HCPs (47%) than male ones (44%), while improvement of knowledge regarding the national project (Nebras) was found to be higher among male HCPs (57.9%) than female ones (44.3%) (P<.05). One might surmise from this that women were more interested in the theoretical information while men were more interested in practical solutions, proposing taking gender differences into consideration when designing health educational interventions (Al-Khashan et al. 2012).

Unlike previous studies conducted among adolescents (Siddiqui and Salim 2016, Ahmed et al. 2002, Haddad et al. 2010), no significant association was found between age and level of knowledge either for drug addiction or the service provided among HCPs. This discrepancy may be because during mid- to late-adolescence, young people rely more on their peer groups in forming their opinions (Nebhinani et al. 2013, Haddad et al. 2010) and learning new information, as well as being overall more active socially compared to adult HCPs.

Significantly, this is the first national study in Saudi Arabia assessing the knowledge of HCPs regarding drug addiction, setting the ground for future research. The key limitation of this study is the absence of a control group of HCPs that had not been exposed to the educational program. Therefore, the possibility that other factors, not related to the educational programs, could have affected the results, cannot be excluded. Yet, the findings are generalizable to the study's target population.

## Recommendations

Future educational programs may consider using a multi-model approach with an increased focus on the available national services for drug addiction as well as making sure to target all members of the health care team, both medical and non-medical. A valuable area for future research would be assessing the knowledge and attitude of HCPs towards drug addicted patients and what procedures should be followed.

## Conclusion

In general, this study found a good existing level of knowledge among HCPs about drug addiction, and a lower but still fair level of knowledge regarding the availability of national services for drug addicts and their families in Saudi

Arabia. Although many HCPs lack formal training regarding drug addiction, we have demonstrated that providing them with a short educational intervention can be effective, and we believe that their increased awareness will allow them to recognize the signs and symptoms of drug addiction among patients in their clinics and proactively engage with them to encourage them to find help and thereby directly improve service utilization.

## Conflict of Interest

The authors of this study certify that they have no conflict of interests in the subject matter or materials discussed in this manuscript.

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# Supply and Demand Drug Shortage Causes: Patient-centric Business Model and its Application

*By Raimonda Bubliene[*], Aurelija Burinskiene[†]*

*In this study, the authors have investigated supply and demand drug shortage causes and highlighted the collaborative business model in solving drug shortages. The aim of this research is to build a collaborative business model helping to investigate how to deal with drug shortages. The authors have included employee and patient relationship into collaborative business model. Following the analysis of the evolution of the term "business model", it is noted that the evolution of the term is closely linked to the development of B2(B2B) (McGlinchey and Toews 2017). In scientific literature there are mentioned more than 50 elements of the concept structure of the business model. In the study authors provided patient-centric business model and selected 9 main structure elements connected to the areas of key resources, key activities, and value system. The study consists of three parts. In the first one, the paper discloses the concept of a business model and the evolution of business models. In the second part, address the importance of links between distribution channel partners to solve drug shortage causes in distribution channel. The legal regulation provided in a good practice of supply of medicine in the chain and the right of the patients were highlighted to access to the goods and services. In the third part, the application of business model scenario in the pharma sector that might guarantee high level of protection of human health is presented. Herein several medical distribution channel scenarios are compared and their influence on drug shortage is presented. The research study is based on time horizon and event tree analysis.*

**Keywords:** *Demand, Drug shortage, Employees, Patients' Rights, Supply*

## Introduction

Adler et al. (2011) in Harvard Business Review promoted collaborative enterprise build-up as best organizational form. It promotes shared purpose as social responsibility outlined by sociologist Max Weber. In particular, shared purpose articulates the position of enterprise towards suppliers, competitors and patient's society – it means unique labor force partnership for day-to-day process improvement. Collaborative purpose is defined as best service quality to customers delivery, i.e., it is what every employee is trying to do providing contribution to society.

Shortages of drugs put patients at risk to get most efficient health improvement. The study of US case (MediMedia 2011) that drug shortages are affected by supply and demand cases, which are pointed among 7 major problems destroying patients' welfare. Hence, it is important to ensure the rights of patients and patients' accessibility to health care, right of access to preventive health care and the right to benefit from medical treatment. As well, patients must be accorded qualified health care and patient's rights law is intended to secure good medical practice. Each of the national health systems of the EU countries manifests quite different realities with respect to patients' rights.

[*]PhD Student/Lecturer, Mykolas Romeris University/Vilnius Gediminas Technical University, Lithuania.
[†]Associated Professor, Vilnius Gediminas Technical University, Lithuania.

Pharmaceutical supply chain differs from traditional supply chain by environment and complexity. The attention is also drawn to the fact that pharmaceutical supply chain combats slowed growth and industry pressures. Pharmaceuticals enterprises must embrace demand-chain thinking and cloud-enabled solutions to become more flexible and able to share data in real-time with partners, from producers, to specialized distributors and retailers. All these factors are compelling pharma businesses to rethink their supply chains and IT strategies and develop more collaborative business models that enable flexibility, speed, and compliance.

The study also extends research in the area. The study in year 2017 presented by Settanni et al. (2017) have promoted patient-centric delivery model, which has not been getting attention from academia until now but is important for the topic of drug shortage.

The study consists of three parts. The first part is dedicated to the concept of a business model – the operating model, which results the lowest possible the number of shortages. The evolution analysis of the term "business model" is observed and defined that the time evolution is closely related to collaboration revolution. The second part of the paper represents distribution channel as the system which meets patients needs. It addresses the importance of links between distribution channel partners to solve drug shortages in business and legal perspective. Finally, the authors presented the application of models in the pharma sector that might guarantee high level of protection of human health. Several distribution channel scenarios are presented here and their impact to shortage reduction. The research results showed the tendencies of application of smaller scale distribution channel and collaborative enterprises business models suggesting the future research directions in solving drug shortages.

## Literature Review

### *Shortage Causes*

On 2011 US agency has reported drug shortages crises and identified that 13% of causes are coming from supply and demand problems. The study of US case (MediMedia 2011) that drug shortages are affected by supply and demand cases, which are pointed among 7 major problems destroying patients' welfare. These are as follows: production difficulties, the unavailability of raw material, recalls, business and economic issues, regulatory issues, supply activity related issues and disasters.

Supply side

Disruption could be met in the supply of raw material. The shortages are painful when single supplier delays supply of raw material or cancels production and these actions affects many drug producers. Even the drug is produced by several producers, the raw material they buy from single seller (producer).

Disruption of supply in this case will negatively affect all producers, which are manufacturing final product (i.e., drug) (Kleindorfer and Saad 2005).

Many producers of drugs are importing raw components from India, China and Europe. If some of these abroad suppliers has supply problems (Newman 2016) such as political, economic, historical (Coomber et al. 2016), environmental, etc., these could lead to shortage. The delays in supply of raw material leads to production overcrowded after the raw material is arrived. Economic reasons could lead producers to reduce level of inventory for low-revenue drugs or decide to discontinue production. There are some cases when producers take from the market drugs because they are giving low profits or the consumption is higher the capability of producer.

Demand side

The judge increase in demand could also lead to shortage, even if demand overcome production capacity. Producers usually use the same equipment to produce many drugs. So, they are not capable to rise production of single item without influencing shortage of others. In those cases, necessary to buy more equipment or contract other producers for production services. Such action requests time and temporally there is lag between supply fall period and finished production buildup in outsourced plants. Here are very important good ordering practices. To build them data accuracy and timeliness, transport and communication system efficiency is needed [for example, data about historical usage of product (Moreau 2017), access to inventory levels and reporting on hourly basis concerning freights and stocks must be foreseen (Hou et al. 2010)]. Even it is difficult to predict and be ready for daily shortage (Lopez et al. 2019), good planning (Sen et al. 2016) and reason-causes analysis (Simonsen et al. 2016) could help to reduce the number of shortage cases or to minimize the time period of shortfall.

*Collaborative Enterprises – New Business Model*

The concept of business model started to be used sufficiently. It is analyzed in the literature for innovation management, management, e-business, and enterprise strategy themes. Authors are still debating and offer different definitions of the business model. Most often, the business model is characterized as the creation of values for the client (i.e., patient). It describes how the company creates value for the customer. In addition, the business model reflects the business logic of the company, which shows what enterprise offers to its customers (i.e., patients), what is its relationship with its partners. The business model is as well as the way in which the enterprise can sustain itself.

Since the mid-1990, the increase in technology, especially in the value of information technology, has started to become an interest by scientists presenting its role in the concept of business model. Moreover, over the years, business models have become increasingly sophisticated and got high attention.

The literature analysis showed that more than 50 structural elements of a business model are met in the concept of the business model (Osterwalder and

Pigneur 2002). Slywotzky (1995) proposed the broken-down pillars in the concept of business model, which are "what", "who", "how" and "how much". These four pillars allow to express the company offer to clients "what" (product innovation, value proposition, value blocks), "who" it targets (channels, mechanisms, relationship), "how" this can be realized (resources, activities, etc.) and "how much" can be earned by doing it (revenue streams, pricing mechanism, auction, pay-peruse, yield management, costs structure). These pillars consist of sub-sections and these sub-sections from structural elements.

In theory and practice, the business model is used to identify key business aspects: organizational structure (Alt and Zimmermann 2010), sales (demand forecasting) practices and business processes. Shafer et al. (2005) examined the concept of the business model and identified 42 structure elements of business model. A bit later, in 2012, Krumeich et al. (2012) counted more than 54 structural elements mentioned. Krumeich et al. (2012) criticizes the large number of elements of the structure, arguing that it is difficult to understand how all elements could be combined into unified system. These authors also mention that other authors who offer elements for the business model structure do not provide the guidelines for the formation of integrated business model system (Krumeich et al. 2012). Business models were mainly considered for internal purposes. An extension to external persons e.g., investors, was partially proposed (Shafer et al. 2005).

When carrying out the study, the authors selected 9 structural elements suitable for drugs distribution enterprises, where targeted customers are patients. On pillar level "what", "how much" pillars are not included into proposed business model as study is not concentrating on products innovation and financial assets. Other pillars "who" and "how" are included into the business model. The pillar "how" is presented on two axes, as infrastructure management must cover all elements linked with the configuration of activities and resources between the enterprise and its distribution channel partners in order to create value and reach patients. The authors of this paper fill the gap and provides business model elements for pharmaceutical supply chain enterprises. Below are elements selected for the business model:

- Channels – different channels could be selected for communication with customers (i.e., patients): off-line or on-line channels such as face-to-face or social media. There are also possible to use various types of channels: own channels and partner's channels or indirect channels and direct channels as well (McGill 2018).
- Mechanisms – scientists agree that the primary functions of business model are value creation and value capture. In general, there are four mechanisms such as value proposition and value targeting (generating value to patients through their willingness to pay), and value appropriation and value delivery (affecting business value through transactions' price and costs) (Biloshapka and Osiyevskyy 2018). Shortly, it could be treated as supply and demand matching mechanism working for pharmaceutical supply chain needs.
- Relationship – the relationships enterprise has with customers (i.e., patients) heavily impact their customer experience. It is product delivery in best way to

the customers. Relationship could be tailored in many variants, like self-service, dedicated assistance, automated service, etc. (McGill 2018).

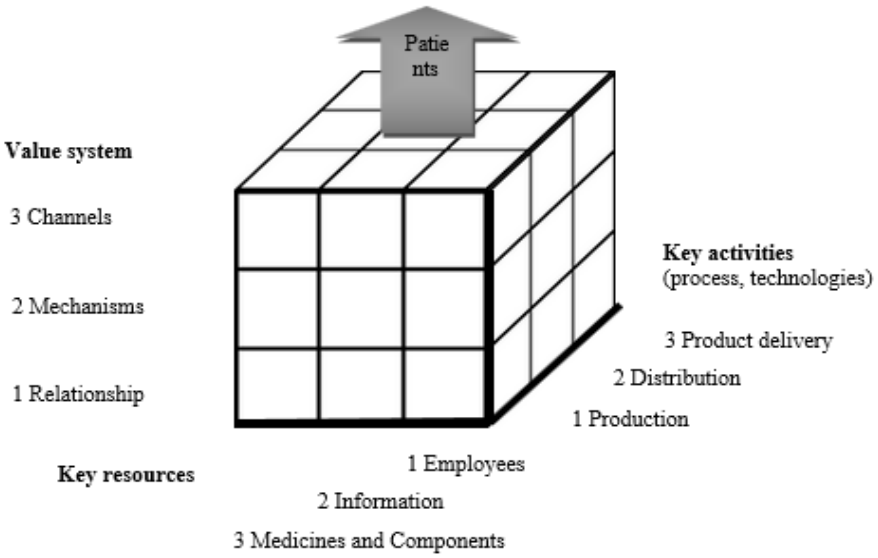
- Employees – depends from the size of the company, but employees support organizational efficiencies (Armenakis and Bedeian 1999).
- Information – the enterprise must lever the data it possesses to information that can be used rapidly to facilitate knowledge creation and map effectively the complex many-to-many relationships existing between them (Alexopoulos and Theodoulidis 2003).
- Medicines and components – social aspect of health care business model is medicine and components. These are used to highlight exceptional specifics (Sabatier et al. 2017).
- Production – additive production growth is 34,9% in 2013 and current market volume of machinery and services of additive production is estimated at 3.7 billion euros. There are seven production steps: design and planning, material processing, machine preparation, physical production, post-processing, administration, and sales and quality (Schröder et al. 2015).
- Distribution is substantial logistics activity. It usually pertains the management of the material stream from production through a distribution channel to the end customer (Chapman et al. 2002).
- Product delivery is highlighted in health care and customer service topics and considered as a part of business model (Hwang and Christensen 2008). That is why the authors have included this element to proposed business model.

Gordijn and Akkermans (2001) propose a conceptual business model construction steps starting from actors, value exchanges, value activities, and value objects, and use these elements to model networked constellations of enterprises to end-consumers by separating creation, distribution, and consumption of things to economic value. The authors of this paper proposed to connect business model elements for drug distribution enterprises to the single system (Figure 1).

There are three axes: key activities, key resources and value system. Key activities support production, distribution, and product delivery processes. Key resources, like raw material, finished products placed to stock, information and employees are important in delivering activities. Employees and information are to support for material flow. All together have relational and transactional links and are integrated into value system, which delivers results to patient.

Each company has its own operations business model. The definition of business model covers: (1) the set of activities; (2) the set of departments (internal and external ones) executing activities; (3) the set of physical transactions between departments and human relationships among the managers of departments (as supervisors and/or connectors of departments); (4) the governance of control mechanisms implemented in departments and links between organizational units. In general, business model presents linkages between such systems: the system of activities, the system of resources, and the system of relationships between parties.

**Figure 1.** *Patient-centric Business Model with Elements for Drugs Demand and Supply Case*

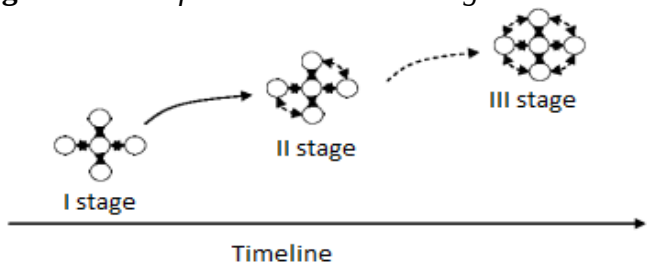



*Source*: Authors' estimations.

*Evolution of Business Model*

Business model may be changed over time period because of new business landscape. Transformation from existing business model to one, which respect society, requires behavior change (Figure 2). This change will need competencies inside the company, also, the presence of relations among the managers of departments, which are linking new business model between activities of each department, helps for behavioral change. Business model elements then could be replaced with another element or splitted i.e., separated into new business model elements.

**Figure 2.** *Transformation Process Stages to Collaborative Enterprises Model*




*Source*: Authors' estimations.

First stage represents low collaboration and integration between distribution channel partners. Second stage is intermediate period where strategic actions are lunched to reach higher collaboration and integration level. And third stage shows intensive collaboration and integration in distribution channel with focus of these strategic actions to patient needs. This stage allows to share demand related data intensively.

Changes in the business models seem to have significant changes in the global competitive environment. Changes in relationship linkages between parties or their units affect the output of distribution channel activity. Business model improvement setup involves updates of relationship linkages among firms and require transformational behavior to reach impact of the setup. Business model evolution shows dramatical changing since the 1933s:

- Standalone organization is mention around the 1933s. The framework depicts the business as system containing cause and effect relationships (Baden-Fuller and Haefliger 2013).
- Function driven organization is visible from 1937, especially then decentralized functions of company were switched to centralized strategic functions. Herein also static and dynamic view to the functions exists (Demil and Lecocq 2010).
- Process driven production and operations (1958) have been instituted to serve the diversity of demand with respect to time and place. According the author McGrath (2010) two core components constitute business model: the basic "unit of business", which is what customers pay for, and "key metrics" of process for delivering competitive performance.
- Network organization is evident from 1980. The business model was developed to point out the competitive advantages. Outsourcing of many support functions such as distribution were fully or partly implemented under this time period. The role of specialized distributors has increased during this time period.
- Finally, collaborative enterprise model is highlighted in literature from 2010. It represents system with intensive relationships between entities.

It becomes necessary to search solutions that enable the strengthening business model of pharma enterprise. Collaboration is seen both from a resource-based and knowledge-based perspective. The most common motive for collaborative relations is the positive effect on shortage reduction. Below is presented the evolution of business models (Table 1).

The step from the "classical" B2B approach to the new multi-tier B2(B2B) concept requires the development of all activities centrally designed and therefore communications between various entities. Business needs real cooperation, more than minimal collaboration and compliance. Collaborative purpose – not the expression of enterprise but is the delivery of service for citizens, like the guidelines for every employee in the company to do the best activity. It is the description of efforts expected in all levels of company: from top managers and their provided business strategy, to unique all employees' partnership, and further down to teams of the departments and their efforts on process improvement.

Value Compass suggests starting discussion on new model, i.e. employees-to-patient model development, as the system of activities and system of relations between parties (Adler et al. 2011) to outline employees and patient's relationship. It can reinforce the degree of protection of patients' rights and can be a tool to ensure patients' rights realization.

**Table 1.** *The Evolution of Business Models*

| Direction | Business models | Drugs supply case |
|---|---|---|
| Standalone organization (1933) | Business reference model is concentrating on organizational and functional aspects of main business activities inside the organization. | Cameroon example. The roads during the rainy seasons do not satisfy required conditions. This causes increasing delays and difficulties getting drugs' deliveries to the most of places (Pharmalink 2011). |
| Function driven organization (1937) | Activities are implemented in departments and requires coordination among departments. | Tanzania epidemic case in 2009 with the implementation of treatment stock tracking system (Leiras et al. 2014) could be an example. |
| Process driven organization (1958) | Activities are implemented according service or product flow to customers. | Benin example. Here distribution channels are leveraging on Coca-Cola distribution chain. This chain is available in every village and at the right condition for the end users and has strong tracking system implemented in remote access, which mitigates the risk to miss drugs in areas. |
| Network model (1980) | This cross-functional and cross-firm model developed to aiming to integrate the key business processes. | Pharmaceutical firms started to use logistics service providers, which give lower distribution costs in delivering products to end users. Their system holds permanent buffer stock at warehouses, and respond to the needs of patients in periphery, also improves organization access to drugs (Pharmalink 2011). |
| Collaborative enterprises model (2011) | The model is client centric and covers collaborative functions, which are implemented in processes of functioning subsystems. Model covers the alignment of large system (collaborating firms) processes, which interconnect employees of many sub-systems. | Stocking of the widest possible range of pharmaceuticals, easy access of inventory via partners, integrated production and efficient distribution system, guaranteeing frequent and timely deliveries to pharmacies (Kanavos et al. 2011). Wide shift to the model is foreseen in 2030. |

*Source*: Authors' estimations.

Value Compass, which guides to the main direction, suggests recognizing the challenge given and expecting from every employee the responsibility to meet it every day. To shift these aspects, knowledge of organizational behavior, industrial organizations, and transaction cost theory is needed.

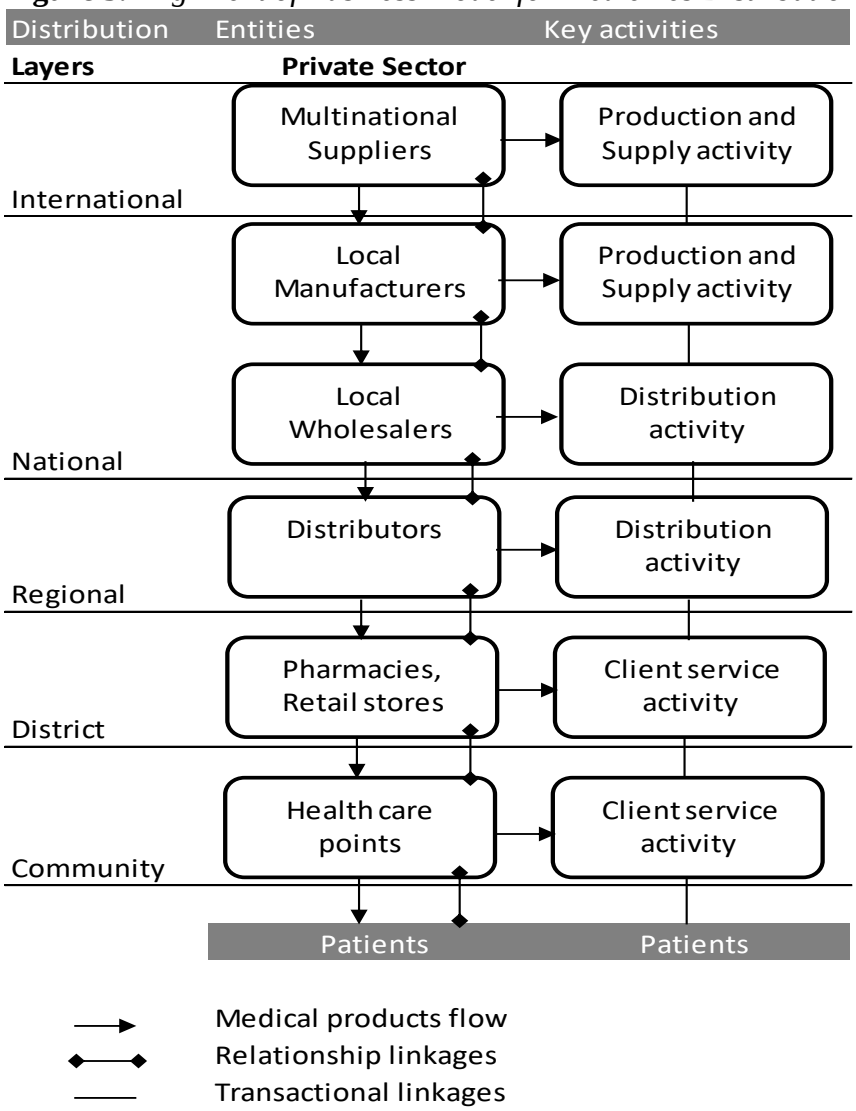
Organization is the set of units, which performs key activity. The key activities performed by company and its partners are considered as the part of business model. Transactions are supplemented among activities and represent the second linkage in business model. The result of transactions is products (i.e., medicines) flow to the patients.

## Distribution System to Meet Patients Needs

*Distribution System*

Distribution channel operates as system, which needs to focus on patients needs. The system in differentiated volume vice. In large scale manufacturing supply case production and consumption are co-located. Examples include regenerative cell-based therapies in healthcare and other cases. In smaller scale manufacturing supply case production is located close to the point of use. New changes are evident in medicines distribution: from tradition channels, which contain large scale production, resulting inflexibility and low inventory situations, to modern channels, which respond to individual consumer demand signals requiring delivery to a specific location of consumer choice (i.e., pick up point), rather than far away healthcare locations.

**Figure 3.** *Alignment of Business Model for Medicines Distribution*




*Source*: Authors' estimations.

Figure 3 presents the presentation of business model for medicines distribution. Based on discussion on business model, companies have relational and transactional linkages, which are integrated into unique distribution system delivering results to patients (Figure 3).

Local wholesalers buy and sell on their name and take over the full collection risk towards our customers. Regional distributors could handle pure fee service, in which all services are performed on the seller's name. For collaborative enterprise the common purpose to serve patients must become the daily routine for humans performing different functions and employed at various levels of organizations to overcome new challenge together. In particular, to align large system of collaborating enterprises, and their processes, interconnecting employees in the system (i.e., the organizational structure units).

*Motivation to Use Recent Business Model: Legal Aspects towards Patients*

Drug shortage has negative impact on patients' accessibility to the medicine and medical treatment. The role of drugs storage takes significant place and impact to safeguard the access to the medicine. There are variety of factors influencing the storage and supply of the drugs.

The importance to ensure the rights of patients the accessibility to health care, right of access to preventive health care and the right to benefit from medical treatment depends on national health system, and supply, storage chains. Patients must be accorded by qualified health care and patient's rights law is intended to secure good medical practice and access, supply and storage to medicinal products. Each of the national health systems of the EU countries manifests quite different realities with respect to patients' rights and legal regulation to ensure the appropriate defense of patients' rights.

The distribution and supply are an important part of the quality that ensures that the quality of medicines is maintained at all stages of the distribution channel, from the place of manufacture to the pharmacy or the person authorized to supply medicinal products to the customers. There are specific European Union (EU) law regulations that defines the principles and good practice for the medical products distribution. European Union Member State's follow with requirements and authorized institutions organize and coordinate the supply of the state population with the basic medicinal products, regulate and ensure by legal and organizational measures uninterrupted supply to the pharmacies of the country of the quality, safe, effective, basic medicinal products.

At the EU law regulation level for wholesale distribution, authorized holders of medicinal products obliged to follow the European Commission Guidelines on Good Distribution Practice of medicinal products for human (GDP) (2013). GDP (2013) are based on Article 84 and Article 85b (3) of Directive on the Community code relating to medicinal products for human use (2001). Revised were published in order to consider recent advances in practices for appropriate storage and distribution of medicinal products in the European Union. Hence "the new requirements introduced by Directive Community code relating to medicinal products for human use, as regards the prevention of the entry into the legal

distribution channel of falsified medicinal products (2011), that amending Directive on the Community code relating to medicinal products for human use (2001)".

Article 81 of Directive on the Community code relating to medicinal products for human use (2001) states "that the holder of a marketing authorization for a medicinal product and the distributors of the said medicinal product actually placed on the market in a Member State shall, within the limits of their responsibilities, ensure appropriate and continued supplies of that medicinal product to pharmacies and persons authorized to supply medicinal products so that the needs of patients in the Member State in question are covered".

Wholesale distribution of medicinal products is an activity involving the procurement, holding, supply or export of medicinal products, unless such action carried out for the purpose of selling or dispensing medicinal products to the public or patients. GDP (2013) prescribe, "procurement as a receipt or purchase, and therefore the purchase and sale of medicinal products without requiring them to be received and stored is a wholesale distribution activity requiring a license". It also does not matter where the distributor is established (in specific parts of the customs territory, such as free zones or free warehouses) and operates (stores, supplies or exports) the requirements to have a wholesale distribution authorization and to operate are applied to the distributor.

As an example, might be taken persons who deal with the mediation of medicinal products and drugs on the territory of the Republic of Lithuania, who have their place of residence and place of work and contact persons in accordance of the Republic of Lithuania Law on Pharmacy (2006), are registered by indicating them at the list of suppliers. All suppliers must act in accordance with the relevant requirements of the GDP (2013).

The requirements for the quality system, personnel, premises and equipment, documentation, operations performed (for the selection and validation of suppliers, for the assessment of recipients, the acceptance, storage, stock management, supply, including transportation), for handling complaints, suspected counterfeits, returns and cancellations, contractual activities, internal audits, implemented by the authorization holder of wholesale distribution specified at GDP (2013). The legal act defines "the quality management principle of all critical stages and significant changes to be identified, justified and, where appropriate, validated". Wholesale distributors must maintain a quality system setting out responsibilities, processes and risk management principles in relation to their activities and wholesale distributors must ensure they supply medicinal products only to persons who are themselves in possession of a wholesale distribution authorization or who are authorized or entitled to supply medicinal products to the public.

Recommendation provided by the GDP (2013) is to follow of the ICH Guideline Q9 on Quality Risk Management (QRM) (2006) for quality risk management, as recommended by the International Conference on the Harmonization of Technical Requirements for the Registration of Medicinal Products for Human Use. QRM (2006) defines "principles and examples of tools for quality risk management that can be used to various aspects of pharmaceutical quality". These aspects include development, manufacturing, distribution, and the

inspection and submission/review processes throughout the lifecycle of drug substances, drug (medicinal) products, biological and biotechnological products all the chains of supply.

Good Distribution Practice certificates are issued by the EU Member State authorities, which reveals that the evaluation of wholesale distribution authorization holder corresponding with the requirements. The data of pharmaceutical wholesale distribution authorizations with following procedure established by the European Commission, Good Distribution Practice certificates and the non-compliance with requirements for each EU Member State indicated in the Eudra-GMDP database of the European Medicines Agency. EU law legislation uniform and harmonize law, as well provide common standards for EU Member States.

*Patients' Right Protection in the Context of EU Anti-Discrimination Law*

Patient's rights are protected in the field of European Union antidiscrimination law. The supply and storage of the drugs influences the access to the goods and services.

The law of regulation of patients under the influence of modern globalization in any country appears to be very significant from the point of view of local and international policy. There is the difference between legal regulation and protection against discrimination in the EU level and separate legal regulation of each Member State.

The Member States of the EU are required to ensure that the national legislation must comply with the requirements of anti-discrimination law and to make all changes of the national legal regulation that are needed. With the provisions of the anti-discrimination law, all patients living in the European Union could benefit from effective legal protection against the discrimination, irrespective of their nationality to the access to the goods and services with the extension to the medicine and drugs.

The progress of EU equality law in the last years developed from a market right to a social and after that to fundamental right. Non-discrimination legislation provide two legal acts promoting equality in sense to access to goods and services including healthcare and access to the drugs. Under EU law, protection from discrimination in the field of access to the supply of goods and services, including housing, applies to the ground of race under the Racial Equality Directive (2000), and to the ground of sex under the Gender Goods and Services Directive (2004).

Racial Equality Directive (2000) introduced prohibition of discrimination based on race or ethnicity in the context of employment, but also in accessing the welfare system and social security, as well as goods and services. It prohibits the following forms of discrimination: direct and indirect discrimination, harassment and instructions to discriminate. This was a significant expansion of the scope of non-discrimination law under EU law. In 2004, the Gender Goods and Services Directive (2004) extended the scope of discrimination to the area of goods and services. The difference between protected areas and grounds of anti-discrimination law cause the different level of protection. Gender Goods and Services Directive (2004) gives more precision to prohibition of discrimination,

stating that it relates to all goods and services which are available to the public irrespective of the person concerned as regards both the public and private sectors, including public bodies, and which are offered outside the area of private and family life and the transactions carried out in this context. Although healthcare is covered specifically under the Racial Equality Directive, it may also fall under the scope of services, particularly where this is private healthcare. In this sense, the Court of Justice of the European Union (CJEU) has interpreted services in the context of free movement of services to cover healthcare that is provided in return for remuneration by a profit-making body. Unfulfilled demand of patients means abuse of their rights to get proper health treatment.

*Link between Business Model and Supply and Demand Shortage Causes*

The review of the literature dedicated to supply and demand shortage shows the links to research areas mentioned as elements in the business model. Just-in-time (JIT) production has received a great deal of attention in the past two decades, due to aim to reduce lead time in the process. Ouyang et al. (2007) study develops an integrated inventory model assuming vendor-buyer relationships, which jointly determines lead time and the frequency of deliveries. Yang and Pan (2004) have studied the effect of lead time reduction. Yang and Pan (2004) offered integrated inventory model.

Rodado et al. (2017) proposed mathematical model with product mixing that considers shortage with one-month time period. Hidayat et al. (2012) investigated controllable buyer's lead time that can be shortened in product delivery by adding costs. Tayal et al. (2015) consider shortages as lost sales. They have stated that suppliers must pay for delays and compensate the losses for retailer. In addition, presented inventory model is tested with respect to various mechanisms parameters in concern to the number of warehouses and products. Jaggi et al. (2016) consider inventory system where cycle begins with shortage due to the lack of information.

There are some studies dedicated to information sharing and channel alignment. Ferrer and Ketzenberg (2004) acquire information sharing. They developed model to evaluate the impact of information sharing and supplier lead time on manufacturing costs. The model formulated with an infinite horizon. By using Markov decision process, they proved that the value of short lead times increases for products with higher complexity.

Huang et al. (2017) study considers linkages in two-echelon supply chain with multiple suppliers, with which information sharing is essential for shortage reduction and successive sales (i.e., demand) increase. Also, McCullen and Towill (2002) have studied information aspects in three-echelon supply chain. They pointed information transparency, lead time and time delays. Lee et al. (1997) point supply shortage and channel alignment also importance of information factor meaning demand and supply signal processing. Xiao and Shi (2016) focus on supply and demand and study the strategy of dual channel having potential shortage. All these aspects leads to shortage reduction and are important for traditional and pharmaceutical supply chains.

In addition, some studies incorporate product specific attributes. Duong et al. (2015) study replenishment strategy with complex objective to minimize expiration rate with a given shortage rate. The inventory level, outdated quantity and shortage quantity are calculated according demand function. Where demand function represents the original product demand and the substitutable demand. Gan et al. (2017) provided channel analysis and assumed the demand as time dependent deterministic function for short life cycle products pattern.

There are studies including both production and distribution aspects. Memari et al. (2015) are minimizing the costs of production, distribution, holding and shortage costs representing out of stock situations. They have built the model which determines the green economic production quantity (GEPQ) and product shortages at dealers. Hidayat et al. (2012) highlights production aspect in shortage studies and assumes that during a production cycle the supplier produces a product and distribute it to the buyer facing a stochastic demand condition. In all above-mentioned studies demand is treated as a function of unique product.

Chien et al. (2018) proposed model performs better than existing approach in minimizing the capacity cost loss of shortage for smart production. It is new working mechanism matching demand and supply and is suitable for advanced cases.

Grey et al. (2005) argument the idea that spot markets serve as a channel for suppliers as capacity and for buyers to address periodic shortages in relationship-based supply chains. Also, Dolgui et al. (2018) observed that disruption of production capacity causes both product shortage and write-offs. The reliability of a multi-stage supply chain is evaluated as the probability that demand, and therefore enough product supply, can be met in multiple stations of transit within the time appropriate time frame. Herein, Dolgui et al. (2018) incorporated human factors in ripple effect analysis.

The most of these aspects are used for traditional supply chain. Pharmaceutical supply chain is more complex by environment and supply chain, which in most cases involves specialized distributors. Many of these situations are presented in drug supply cases under Table 2. Also, pharmaceutical supply chain is described as system with many risks leading to the growing problem of drug shortages. In addition, demand-driven supply has to be aligned for large scale and smaller scale manufacturing supply case production.

**Table 2.** *The Studies Reflecting Research Areas, Matching the Structural Elements of Business Model*

| | |
|---|---|
| **Channels** | Gan et al. (2017); Lee et al. (1997); Xiao and Shi (2016) |
| **Mechanisms** | Chien et al. (2018); Tayal et al. (2015) |
| **Relationship** | Grey et al. (2005); Ouyang et al. (2007) |
| **Employees** | Awad et al. (2016); Dolgui et al. (2018) |
| **Information** | Ferrer and Ketzenberg (2004); Huang et al. (2017); Jaggi et al. (2016); McCullen and Towill (2002) |
| **Medicines and Components** | Awad et al. (2016); Rodado et al. (2017) |
| **Production** | Chien et al. (2018); Hidayat et al. (2012); Memari et al. (2015) |
| **Distribution** | Duong et al. (2015); Memari et al. (2015) |
| **Product Delivery** | Hidayat et al. (2012); Volland et al. (2017) |

It is not easy to figure out the reasons of drug shortage. Awad et al. (2016) stated that the root causes of products' shortages are complicated and involve many factors at the different nodes of the supply chain, including manufacturing issues, regulatory and legislative issues, supply and demand issues. In their study they identified the effect of manufacturing-related issues on drug shortages, the effect of distribution, the effect of supply and demand imbalance on drug shortages. They have also incorporated new category addressing human factor or behavior as a contributing factor to drug shortages. Their study results show:

- Regulatory and legislative processes were found the most contributing cause to shortages.
- Distribution (activity) factor was also identified as a contributor to the shortages.
- Human (resource) factor was also perceived as a significant contributing factor to drug shortages.

Authors identified that production (activity) issues were not significantly related to drug shortages in countries where production system is less risky due to such reasons. First, pharmaceutical production companies do not distribute medications directly to hospitals and health care facilities, this is done by specialized distributors. Second, raw materials are mainly purchased from international suppliers in enough quantities and reliable deliveries. Substitutes of the raw materials can be easily found in the international markets with prompt delivery if needed.

The study of Awad et al. (2016) did not incorporated information and products (resources) but these ones are evident from other studies presented. In addition, Volland et al. (2017) pointed the scheduling as supply constrain in hospital product delivery (activity).

The studies dedicated to shortage problem solving shows the link between research areas and business model. In most of the cases demand is incorporated as function of sales and presented on unique product level. And supply, which corresponds demand, must be prompt and work on the basis of shortened lead time, when it helps to reduce shortage. Shortage could be presented as imbalance between demand and supply, and is caused by production, distribution and products delivery (i.e., all these activities together meets value chain) issues where human factors and information sharing are important especially for complex products. To solve these causes various channels, mechanisms and relationship are analyzed in many studies. As pharmaceutical supply chain is very complex, all these aspects are incorporated in patient-centric business model. The main condition for the proper functioning of business model is collaborative enterprise. As business is becoming more complex, evolution of business model is important towards more collaborative enterprises supporting further progress, like smart production. Not many studies point the aspects such systems face to achieve zero shortage, so, these are expected in the future.

## Research

### *Methodology*

As drug shortages are affected by supply and demand cases, pointed among major problems destroying patients' welfare, the research will be given to the improvement of drugs availability and the minimization of delays in drugs supply. The sequence of actions is important in distribution channel and could be analyzed from collaborative enterprises model perspective.

Many authors studied time constrain in distribution channel and delivered tools, demonstrating time metrics. Value Stream Mapping is one of the tools, which identifies time metrics such as lead time, value-added time, cycle time, and takt time (Lacerda et al. 2015). Dinis-Carvalho et al. (2015) proposed Waste identification diagram, which overcomes some of limitations of Value Stream Mapping and integrates the material flow and throughput time. It comprises two time constrains: time at workstations, and time for transportation activity. Rivera and Chen (2007) developed Cost-time profile, which represents cost and time investment important for production system. Cuatrecasas-Arbos et al. (2011) suggested Operation-time chart, which provides information on production and covers waiting time, and lead time. Time gap in distribution channel is the main constrain influencing delays or drug shortage cases.

The research purpose – to evaluate reasons of shortage. The aim of business collaboration is to take advantage of law of great numbers that helps better meet patients demand.

In the research authors are analyzing order lead time and reaction time to undeliveries. Automatization of order picking, and shipping process helps to reduce average order processing time. But it could be other factors disturbing order processing, like insufficient inventory level issues, etc. Usually, order processing time is 2 business days: the first business day – for order picking and the second business day – for order shipping.

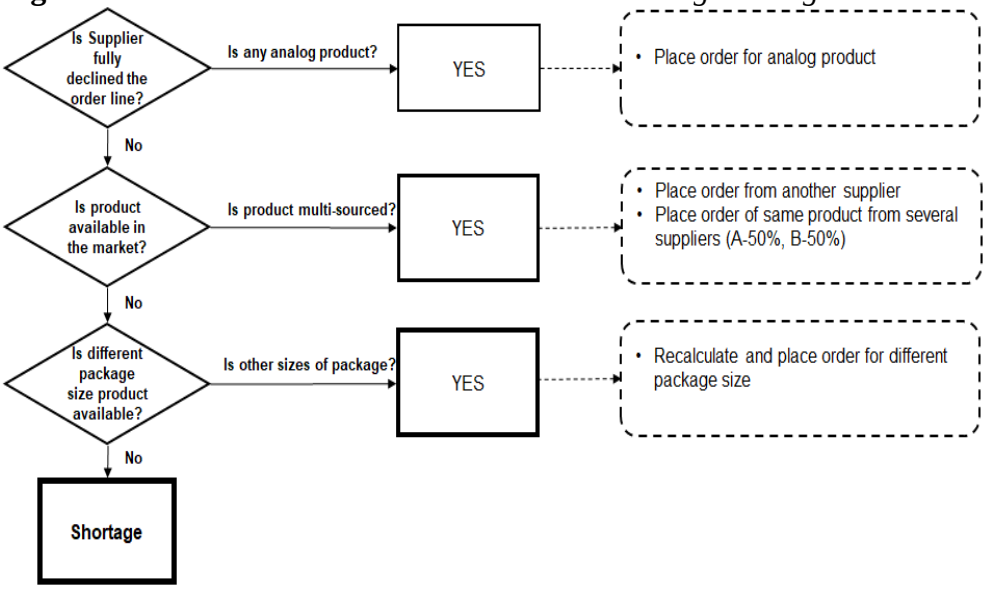
The information about declined or partly declined Purchase order could be provided as soon as information become clear but not later than one business daytime interval. Parties could agree that if purchase order will not be 100% fulfilled, the supplier is responding to Purchase Order under the conditions agreed between Parties by sending Purchase Order Respond message (ORDRSP) containing information on Purchase order Line (item) level. These relationships are important aspects of business collaboration, as they interconnect sub-systems functioning based on information sharing. Automated electronic messages trigger new order generation event in the system, which sends the information to alternative supplier, for analog product, or different package item (Figure 4).

### *Event Tree Analysis (ETA)*

The authors have taken historical data which show the shortage appearance: time series of shortage days, time series of order processing days and time series of order delivery days. Here authors have analyzed supply and demand causes.

The identification of shortage reasons starts with the set of initiating events. An initial event is an event that creates the negative result that could lead to other events (intermediate events), and then finally is the outcome, which is mentioned above. Each initiating event leads to another event and continuing through this path.

**Figure 4.** *Event Tree and Actions Taken to Avoid Drug Shortage*




*Source*: Authors' estimations.

Steps to be taken to perform event tree analysis:

- Identify the event scenarios: Perform a system assessment to find failures scenarios within the system.
- Identify the initiating event: Use analysis to define initiating event.
- Identify intermediate events: Identify intermediate events.
- Build the event tree diagram.
- Recommend corrective actions: Minimize negative output by developing actions or alternatives.

The information about event provided timely stimulates the number of equally probable alternatives to be chosen to minimize the negative outcome. The selection decision is done immediately without time gaps and increases the opportunity overcome shortage case if selected alternatives has successful output reached by applying collaborative enterprises model.

*Time Horizon Formulation*

Distribution channel operates as system, which is driven by the sales (demand) of pharmacy to clients (i.e., patients). Pharmacy accumulates sales (demand needs) during the day places the order to distributor, and requests to bring it in 48 hours. At the end of the day, pharmacy has products available: if

drugs are in stock, pharmacy continues serving clients. Orders arriving after the deadline could lead to shortage case.

Timelines are often used tool to represent the order of events. The timeline can be used to visualize durations and time gaps between events or overlaps of events. Timelines can use scale representing time. This scale is linear and dependent on the events in the row. It is suiting the subject and data and is multi-period in which single period intervals are represented gradually.

In multiperiod situation, necessary to define time horizon – *t*. The pharmacy places order on the day *t-2*. Distributor starts order processing in *t-1* and ships it on the day *t*. What happens if distributor has no stock to process the order? If order delivery is not present at the evening of day *t*, when on the next day *t+1* pharmacy places the new order with delivery day *t+3*. Finally, the order is arrived on *t+3*, and clients are served on *t+4*. The interval between *t+1* and *t+4* represents shortage period. This is the key point in rolling order processing situation. Authors presented case study which represents how collaborating enterprises could reach 6 days timeline instead of initial one with 7 days.

*Framework*

Each timeline has n number of order days, *n* number of delivery days, and *n* number of drugs availability days. Framework includes timeline with integrated ETA, actions taken to avoid drug shortage (placed under ETA), and system result analysis on the third day (stated in timeline scenario II referred in Figure 5). On the third day ETA is processed to avoid suppliers' failure case (mentioned in the event tree under initial event). System results are estimated by setting up "if-if" analysis approach to estimate availability of drugs. The research question – to define how the reduction of time period (i.e., move from 7 days timeline to 6 days timeline) effects the shortage reduction. The historical data of products is used to define the amount of order (i.e., order size). The order size is placed to be delivered in lead time frames. The lead time is defined is period from order placement to order delivery and is specific attribute of each unique product and is agreed with supplier on yearly basis. If the product is not delivered (i.e., undeliveries are fixed) by any reasons, the company must take new actions to serve its customers (i.e., patients). Reaction time is the time which is required for company to define steps to solve the shortage problem. Such period could be up to 4 days.

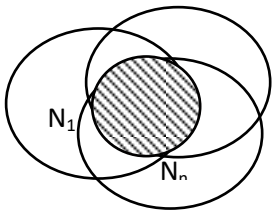
*Case Study*

The study case is provided to reach research purpose. The study covers one-month period (i.e., February) in the year 2019 and the analysis of 235 products behavior. All analyzed 235 products are commercial goods listed in the assortment as non-prescription drugs (medical products – products for eyes, hart, nerve, fish oil, vitamins, urine and hygienic products). Data is collected on above mentioned products from pharmacies, selling all mentioned products to customers.

Shortage is calculated as sum of order lines (not delivered by supplier to pharmacies) which is divided from total number of order lines placed by all pharmacies.

The data was collected from pharma enterprise database. The enterprise is located in the Eastern part of Lithuania and has pharmacies in such regions: Vilnius, Ukmerge, Jonava, Utena, Radviliskis, Visaginas and Kedainiai region. Assortment placed under the 50 pharmacies ($N_1 \ldots N_{50}$, when n=50) is slightly different due to the size of the pharmacy, but the authors have identified 235 assortment products being common in all 50 pharmacies.

**Figure 5.** *Assortment Selection*




*Source*: Authors' estimations.

This paper is aimed to evaluate and establish the problem application intensity. The selected products (as presented in Figure 5) meet the common assortment criteria among region pharmacies.

## Findings/Results

Timeline is very important aspect in order processing, as shorter it is as better for the clients (i.e., patients). In Figure 6 is presented the two timelines (longer one (I) and shorter one (II)). Both timelines have the shortage period, which length depends on scenarios:

I. Scenario represents shortage period i.e., interval between *t+1* and *t+4*.

In first scenario parties (supplier and pharmacy) are following standard process: pharmacy is waiting for supplier delivery and only if drugs delivery is not appearing the action are taken to avoid drug shortage and new order is placed (following the steps presented in Figure 4).

II. Scenario represents shortage period i.e., interval between *t+1* and *t+3*.

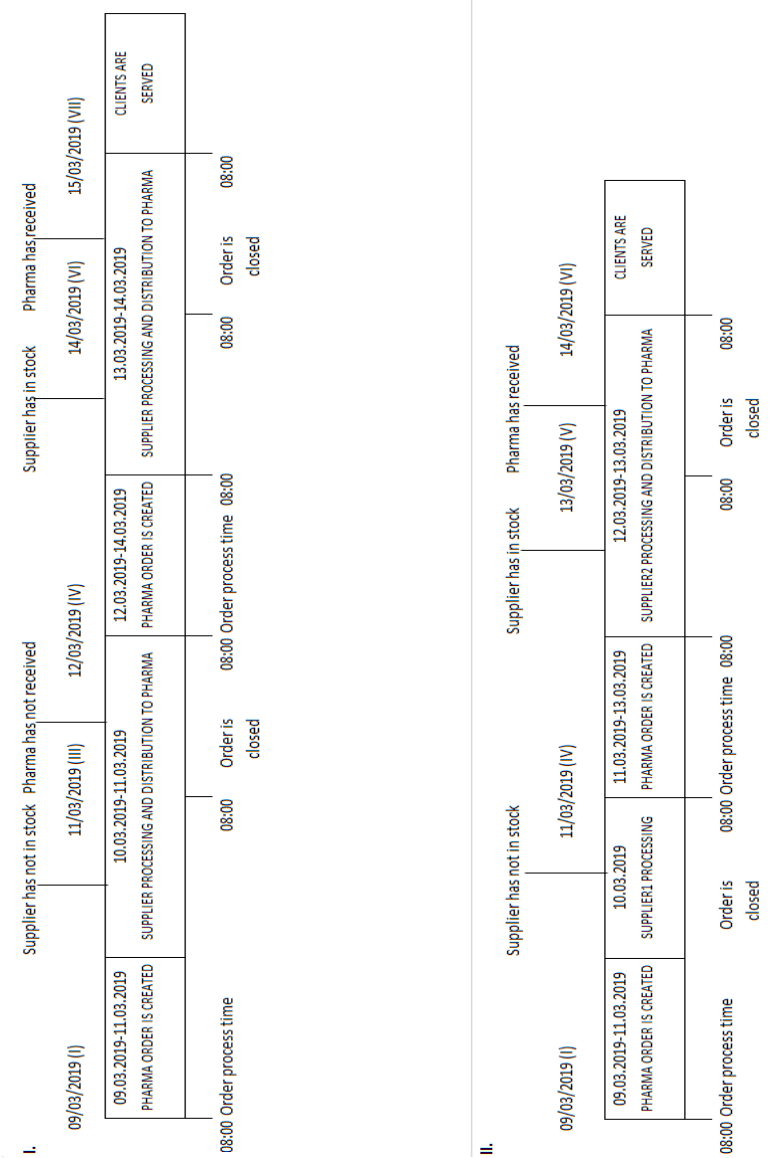
In case study bellow order processing time is 48 hours: the first 24 hours are given for order picking and the second 24 hours are for order shipping.

In second scenario supplier has responsibility to provide the information in advance about fully unfulfilled or partly unfulfilled order as soon as information become clear but not later than 24 hours. In this case pharmacy takes actions to avoid drug shortage one day earlier and placing new order is (following the

steps presented in Figure 4). This second scenario shows the outcome of timeliness information sharing and higher level of collaboration between supplier and pharmacy. Authors also tried to measure what impact the actions taken in the second scenario has on shortage reduction.

By applying event tree analysis, authors selected undelivery cases which represents supplier failures and lasts from several days to certain period or repeats.

**Figure 6.** *Timeline in Order Processing (I. 7 Days Timeline; II. 6 Days Timeline)*




The lead time of deliveries (as specified in Table 3) varies for high demand, middle demand and low demand products selected for case study according Pareto rule.

**Table 3.** *Lead Time Parameters*

| | **Lead time distribution by duration** | | | |
|---|---|---|---|---|
| **Products by demand** | **1 day** | **2 days** | **3 days** | **More than 3 days** |
| High demand products (A) | 54% | 0 | 35% | 11% |
| Mid demand products (B) | 58% | 26% | 11% | 5% |
| Low demand products (C) | 66% | 27% | 5% | 1% |

*Source*: Authors' estimations.

Most of deliveries are on Wednesday and Friday and the most of shortage is on Tuesday and Saturday. This is suggesting insights to revise suppliers' timetable and slightly reschedule delivery days. The highest shortage is for new products, as supply of these is not balanced nor from order timetable schedule, nor from supplier performance. That is why supply do not match the demand in most of cases when shortage appears.

In part of pharmacies which did not receive delivery from supplier product shortage could be 100% and in other part of pharmacies, which have the buffer stock the shortage will not appear. Moller's Junior, 45 psc., Carbon 300 mg, 20 tab., Magnis+B6 complex N30, A+E 30 tab., and Super Validol 60 mg, 10 tab. have the same shortage trend at the beginning of month, and it is twice lower than in Humer 150 ml case or Super Validol case at the second part of the month. Statistically the constant number of pharmacies having indicated drug shortages, when reason of the shortage is supplier failure according ETA.

There is also systematic shortage which increases at 19th day (Tuesday) of the month for products having the shortage (following are evident in Figure 7). Moreover, supplier could revise delivery schedules from producer as at the same time various pharmacies struggle with high level of shortage if they do not have buffer for above mentioned products.

Authors have investigated that long timeline is directly linked with shortage cases. From lead time parameters analysis, we could see that for shortage reduction shorter timeline is the priority. The highest issue is on weekend as there are no deliveries from suppliers. In case the supplier is delivering less than ordered, new order is placed with one day time slot.

All analyzed 235 products are commercial goods (i.e., Super Validol, Magnis+B6, Moller, Humer, A+E, etc.). From Table 4 we could see that high demand products have 3.5 orders generated a week than such figure must be around 5 times. Average lead time is also quite long 9.4 days and supplier performance – 98%, which is not good to have less than 100% for high demand products (A). In opposite, low demand products have average lead time 2.1 days. For some B products the lead time is up to 73 days. Long lead time appearance one of the factors leading to shortage increase. New products are lack of alignment and due to that faces shortage appearance (the statistics of shortage cases is summarized in Table 5).

**Figure 7.** *Shortage Trendline for Various Products*

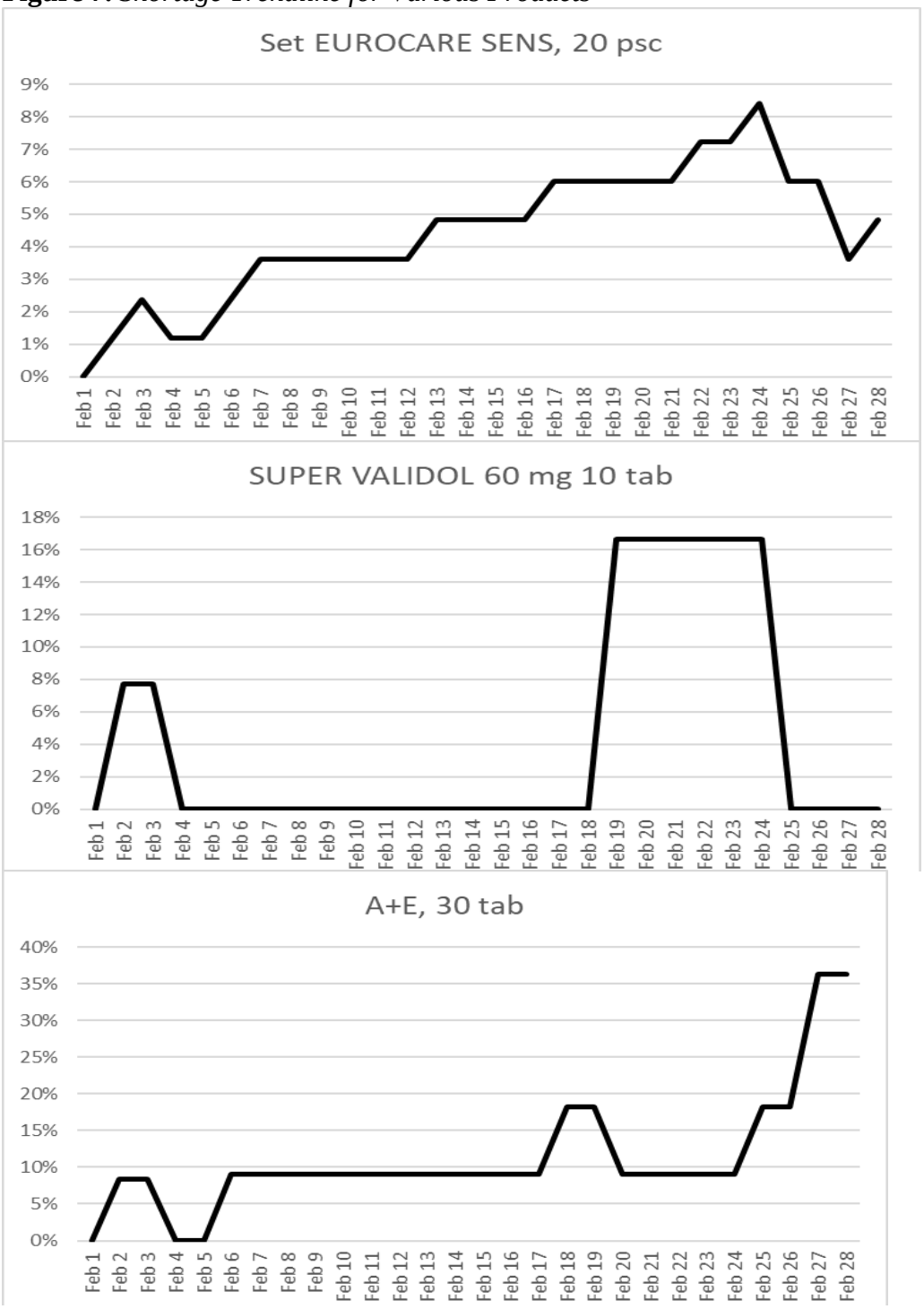


**Table 4.** *Products Factual Parameters*

| Products by demand | Number of products | Generated orders a week (historical data) | Average lead time (from order day to delivery day) | Supplier reliability (quantity delivered vs quantity ordered) (historical data) |
|---|---|---|---|---|
| High demand products (A) | 14 | 3.5 | 9.4 days | 98% |
| Mid demand products (B) | 90 | 4.2 | 4.3 days | 100% |
| Low demand products (C) | 121 | 1.2 | 2.1 days | 96% |
| New products (D) | 9 | 1 | 28 days | 80% |
| **Grand Total** | **235** | **2.48** | **10.95** | **97%** |

Herein – undeliveries is opposite to supplier reliability. Undeliveries for A product is 2%, for C products – 4%, and for D products – 20%. Finally, total undeliveries for 235 products is 3% (Table 4).

As supplier performance is not 100%, order processing reduction by one day gives higher availability of stock upfront supplier's failure. This result might be explained by more frequent respond to demand.

Mainly orders are placed on morning and delivery is at the mid-day and shortage is fixed on the evening, – one day is required for responsiveness (reaction-time).

**Table 5.** *Shortage size Statistics*

| Summary of statistics | Minimum | Maximum | Mean | Standard deviation |
|---|---|---|---|---|
| Shortage size | 0 | 33% | 0.015 | 0.034 |

*Source*: Authors' estimations.

Linear regression was delivered to revise if products delivery is linked with shortage reduction. The study is delivered for the first week of the month and represented by weekdays. These results also confirm the importance of supplier delivery on weekday basis (Table 6). It also shows that shortage occurrence has higher correlation coefficient in the first part of week (i.e., at the beginning of cycle).

**Table 6.** *Linear Regression Parameters*

| | Weekday | | | | |
|---|---|---|---|---|---|
| **Regression parameters** | ***Monday*** | ***Tuesday*** | ***Wednesday*** | ***Thursday*** | ***Friday*** |
| $R^2$ | 0.532 | 0.613 | 0.498 | 0.482 | 0.476 |
| Intercept | 0.22 | 0.18 | 0.23 | 0.22 | 0.20 |
| Slope | 0.78 | 0.82 | 0.77 | 0.78 | 0.80 |
| Equation | $0.22+0.78x_t$ | $0.18+0.82x_t$ | $0.23+0.77x_t$ | $0.22+0.78x_t$ | $0.2+0.8x_t$ |

*Notes*: $sh_t$: a shortage of period *t*; $x_t$: delivery on time of period *t*.
*Source*: Authors' estimations.

Table 7 represents the impact of delivery on shortage reduction for Tuesday shortage cases.

**Table 7.** *Regression Results for Equation*

| **Observations** | **235** | **Adjusted $R^2$** | **0.653** |
|---|---|---|---|
| Sum of weights | 235 | MSE | 0.084 |
| DF | 233 | RMSE | 0.291 |
| $R^2$ | 0.658 | MAPE | 13.70 |

*Source*: Authors' estimations.

Below is the equation where delivery timeline directly linked with shortage:

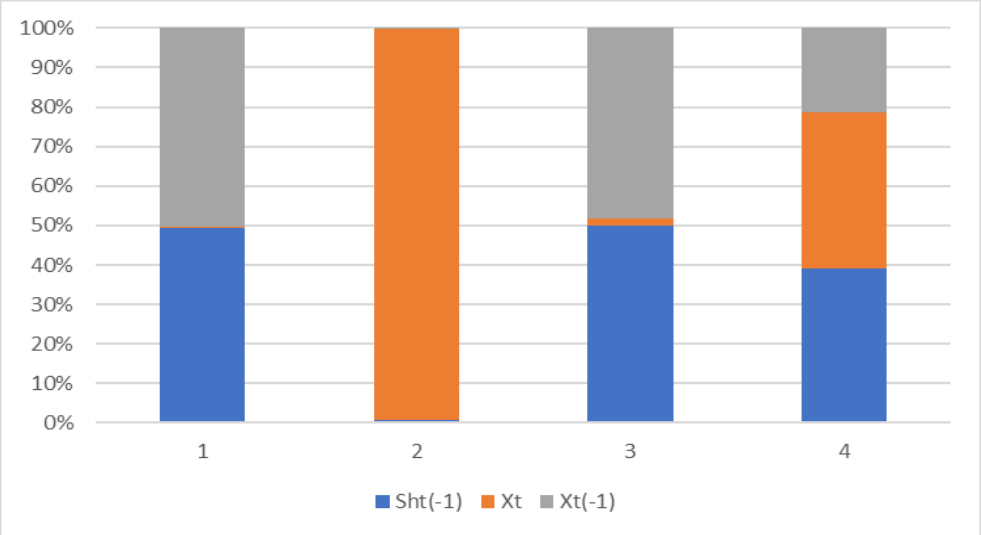
$$sh_t = 0.1152 + 0.3265\ sh_{t(-1)} + 0.8168\ x_t - 0.2752\ x_{t(-1)} \quad (1)$$
$$(4.1442)\quad (5.5005)\qquad (19.574)\qquad (-4.2356)$$

where $x_t$ represents the first scenario of delivery timeline and $x_{t(-1)}$ represents the second scenario of delivery timeline.

Figure 8 shows that if shortage appeares a day before, then there is the probability of 33.65% that it will occur on the next day. The equation (1) shows that on the day of shortage probability of delivery is 81.67%. That means that those deliveries come at the end of a day not at the beginning thereof. If delivery occurs it diminishes probability on shortage next day by 27.52%.

Authors have investigated that delivery timeline is directly linked with shortage cases. The reduction of timeline would help to generate more orders a week and delivery could be processed one day earlier following the actions mentioned under ETA, would have positive effect on shortage reduction.

**Figure 8.** *Regression Variables Variants Decomposition*




If there is no stock of product, when shortage appears and where is no demand on these days. Part of these shortage cases are linked to supply issues, which negatively affects representation of product demand. Presented equation shows that delivery is directly linked with shortage reduction but in order to avoid repeatable shortage cases, supply actions have to be unfront the demand days. The provided solution formulation could be treated as framework

incorporating various aspects: time horizon and event tree analysis (ETA) for the reduction of shortage cases.

## Discussion

Not all supply and demand cases, which are pointed among 7 major problems destroying patients' welfare, such as follows: production difficulties, the unavailability of raw material, recalls, business and economic issues, regulatory issues, supply activity related issues and disasters, are covered in the paper. The authors have concentrated on demand-driven supply and supply constrains such as resources, lead time and their alignment.

Under the study case the authors presented the the equation where delivery timeline directly linked with shortage. The regression method used in case study serves well then the effect of regressor manifests itself after more one one cycle (period). The decomposition of regression variables variants shows the effect of lead time shortening to shortage reduction, as the probability of delivery on the day of shortage is higher then 80%. The timeline solution is valuable as it shows the probability to have shortage on the next day after delivery as well. This is because the delivery is too small, supplier delivery service level is week and the pharmacy shelfs are not filled up with products.

The timeline solution formulation is delivered taking into account the actions sequence and making choice between ETA alternatives. Moreover, the proposed framework presented in the the paper is not limited. It could be used to promote collaborative actions and allows the comparison of collaboration level between distribution channel partners (suppliers and pharmacies). The possible application of framework showed that the quantitative evaluation could be used to compare scenarios and it could be handled by single or multiple decision makers. The developed framework also could be useful for authors, which analyse drug shortage reduction cases under collaborative enterprise conditions.

## Conclusion

Pharmaceutical supply chains are complex and facing new challenges. The studies are focus on traditional supply chain aspects and there are not many studies which place patient into the center position. To fill the gap authors constructed patient-centric business model for pharmaceutical supply chain enterprises and provided studies given to shortage avoidance problem which match the structural elements of business model.

Two main pillars are used for new business model development: pillar "who" targets channels, mechanisms, and relationship; and pillar "how" is specified as the system of resources and the system of activities, that is this pillar is presented on two axes. Finally, authors presented empirical study

where examined the application aspects of business model for drugs and opportunities to minimize shortage.

The case study shows that lead time parameters must be revised for high demand products as they strongly correspond to the sales function. Opposite to high demand products, low demand products have shorter lead time parameters in presented case study. Also, supply chain for new products has to be tightened up, as in the most of cases supply constrains are critical for shortage avoidance: the reliability of suppliers is low, average lead time is long and the number of orders placed a week is very small.

The study showed that if shortage appeared a day before, then is the probability of 33.65% that it will occur on the next day. The equation shows that on the day of shortage probability of delivery is 81.67%. That means that those deliveries come at the end of a day not at the beginning thereof. If delivery occurs it diminishes probability on shortage next day by 27.52%. The empirical part of the study proves that time-period reduction could help to reach reduction of drug shortages. Performed empirical assessment showed that the suggested framework can be applied for drug shortage reduction.

The findings suggest the future research directions. The study results also give insights on necessity to have more frequent deliveries for high demand products, as now mid demand products have more frequent deliveries then high demand ones. The action to be taken for supplier timetable revision aiming to increase the number of deliveries and reduce shortage at the beginning of cycle; also, other supply and demand cases.

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