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## Short Communication

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Urban Policies and Health In Developing Countries: The Case of Maputo (Mozambique) and Cochabamba (Bolivia)

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ABSTRACT

Urban planning and related policies can contribute to improvement in health. Recent epidemiological and quantitative Health Impact Assessment (HIA) studies in Europe and North America suggest that a change from passive (car) to active transportation (cycling, walking) and public transport in daily life could improve health. HIA studies are still largely lacking in low and middle-income countries. We conducted a scoping study to evaluate the availability of data to conduct quantitative HIA in two cities from two low-income countries. We collected information through interviews with different local agents, from the National Institute of Statistics and by conducting field work to identify the built environment and mobility characteristics in the respective cities. Conducting a quantitative HIA in Maputo (Mozambique) is currently not possible, mainly because there is no appropriate data on mortality, road traffic accidents and physical activity of the general population. However, in Cochabamba (Bolivia) it might be possible when the mobility plan will be available (currently under development), in which data on traffic flows, mobility surveys and transport modal shares will become available. The current paper describes two examples of the opportunities and difficulties to conduct quantitative HIA in low- and middle-income countries, highlighting the limited availability of data (quantitatively and qualitatively) on transport and urban planning and health outcomes.

KEYWORDS: Urban; Transport; Development; Health impact assessment.

INTRODUCTION

Urban planning and related policies can contribute to improvement in health. Recent epidemiological and quantitative Health Impact Assessment (HIA) studies in high income countries suggest that a change from passive (car) to active transportation (cycling, walking) and public transport in daily life limit chronic disease, and reduce air pollution emissions, including greenhouse gasses, have been recommended. Transportation and planning policies that promote active travel by walking and cycling can contribute to these goals, potentially yielding further co-benefits. Little is known, however, about the interconnections among effects of policies considered, including potential unintended consequences.
OBJECTIVES AND METHODS

We review available literature regarding health impacts from policies that encourage active travel in the context of developing health impact assessment (HIA) could improve health through mechanisms such as an increase in physical activity and social contacts and a reduction in stress and pollution levels. However, there is a large gap between urban planners and public health researchers, resulting in that new research findings are not implemented in urban policies. Amongst others, this may be because the tools for active transportation are fairly new and need to be further calibrated for new situations.

The transport sector represents a significant contributor to greenhouse gases, heat islands, and noise and air pollution. The introduction of more efficient cars and reducing vehicular travel are essential components of climate change mitigation policies across the world. Shifting the population towards active modes of transportation (e.g. cycling, walking) represents a particularly promising strategy with a high potential of public health co-benefits. Such change may result in a sustained increase in physical activity in the population – a major requirement to abate the obesity epidemic. Other potential benefits include improvements in environmental quality indicators such as ambient air pollution and noise, as well as in the social environment (social capital) and quality of urban life, and related health impacts. However, depending on local conditions and policies, these strategies may also result in adverse health effects as inhalation of air pollutants may increase among those physically active along traffic arteries and traffic accident rates may increase.

There are now holistic frameworks and related tools for policy makers available to evaluate the expected health impacts of active transportation in European cities. The conduct of such quantitative HIA relies on data availability and a large number of assumptions. Whereas in high income countries this data may be available, this may not be the case in low- and middle-income countries, where only one HIA has been conducted. Cities in low- and middle-income countries provide great opportunities to conduct quantitative HIA and implement the findings because of the rapid and often unplanned urban expansion, the limited transport planning and the health related consequences. Furthermore, in such countries levels of physical inactivity are rapidly increasing and traffic accidents represent an important health and economic burden. We are therefore evaluating if we could expand the work conducted in European countries to other large low- and middle-income countries with fast growing cities. We also aim to evaluate the health impact of new urban policies planned in these growing cities. Particularly, we performed a feasibility study in two cities of two countries of Africa and Latin-America, respectively, with a low Gross National Product (GNP) but with perspectives of rapid economic, demographic and urban growth. In this regard, the two selected cities, Maputo (Mozambique) and Cochabamba (Bolivia), which have been rapidly expanding in the last decades, are expected to continue their expansion in the coming years, facing important urban and transport challenges. Additionally, we selected these two countries and cities because of their political stability and because there are two well-developed health research platforms established which facilitated the contact with local stakeholders and the implementation of the study. In this paper, we aim to provide a framework and description of the current situation regarding urban planning and transport management in these two cities and the potentiality to conduct a quantitative HIA study in relation to changes in urban transport policies.

METHODS

The screening process was focused on identifying data sources, indicators, policy descriptions and stakeholder perspectives in each city. A special effort was made to identify input data to conduct a quantitative HIA of urban and transport planning. Data on urban and transport policies, sociodemographic characteristics of the population, transport records (modal share and modal use), traffic safety, air pollution levels, and mortality and morbidity rates were collected. In order to identify data sources and collect this information stakeholders of the respective cities were selected and interviewed, including politicians and technicians of the municipality and different governmental departments, non-governmental organizations (NGOs), foundations, international cooperation organisms, and local university researchers. Part of the information was also obtained from the National Institute of Statistics of the respective countries. Finally, in order to have a perception of the built environment and mobility in the studied cities, and in order to capture the reality described by the stakeholders, we also conducted field work using the different modes of public transport (bus, taxi, bike, ferry, etc.) around the different neighbourhoods of both cities. The field work did not follow a well-structured methodology as we did not aim to collect formal data, which in principle should be available through other sources.

MAPUTO (MOZAMBIQUE)

Maputo city is the capital of Mozambique, a country in the southeastern coast of Africa. Together with two other cities (Matola and Boane) and a district (Marracuene), Maputo city belongs to the Great Maputo area, which in total has a population of 2.2 million inhabitants, expected to increase to 3.7 million by 2035. While Maputo city is the political and industrial center of Mozambique, residential and industrial development has spread to Marracuene, Boane and, especially, Matola. Maputo has a dualistic urban structure: a center that follows the classical European design (densified, with tall buildings and following a grid pattern) and the surroundings, which are expanding and are characterized by a low-densified structure, with low buildings and fewer services available. Furthermore, some services (e.g. education and health), are better provided in Greater Maputo, particularly in Maputo city, than in other districts of the country. This is one of the main causes of the increase of the number of inhabitants in the area, which has translated into a huge num-
ber of daily person trips (3.1 million) within the Great Maputo area but also from other surrounding areas to Great Maputo.\(^{12}\)

**Transport Systems in Maputo**

Maputo city and its surroundings count on a public transport system that currently cannot absorb all commuters moving everyday within the city and from the outskirts to the city center. In the last few years Mozambique has started to import used cars, mainly from Japan, and the number of people using this private transport is increasing every year (in 2035 the number of cars is expected to increase 1.5 times compared to the number of cars in 2012\(^{12}\)), which causes severe traffic jams and worsens the mobility in the area. In the next sentences we briefly explain each existing transport system in Great Maputo.

**Bus system:** Transporte Públicos de Maputo (TPM) is the state-owned company of bus service in Maputo. It owns around 350 buses but only 140 are operated daily in Greater Maputo as of 2013.\(^{12}\) Furthermore, according to TPM, since 2010 the number of bus passengers has decreased from 80.000 to 30.000, likely related with the loss in the quality of service (associated with the old buses and the poor maintenance) and a reduction in the service (associated with the traffic jams that reduce the number of trips per route and the bus speed) (Figure 1). It is, however, the cheapest transport system.

**Mini bus system:** Most commuters in Maputo use private minibuses called “chapas 100” because they are faster than buses and reach certain parts of the city that buses do not. However, “chapas 100” are more expensive and operate following the “fill and go” system, which causes long queues of passengers in the terminals (Figure 2). Additionally, commuters can stop “chapas 100” anywhere along the route (no regulated stops exist), a system that worsens traffic jams and safety, especially at peak hours. A great part of “chapas 100” fleet is poorly maintained, and many are involved in road traffic accidents. Because of the high demand of transport in Great Maputo, since few years ago a new version of “chapas 100”, known as “my loves”, is also circulating. These are pick-up trucks that work following the same system as “chapas 100”, but the insecurity for commuters is greater due to the design of the vehicle (without cabin to protect the passengers), which makes people hug each other to avoid falling from the truck. Taxis are also available but represent a very small percentage compared to “chapas 100” and “my loves”.

**Train system:** Train service in Maputo is very limited. Although the number of passengers has increased from 0.45 million in 2007 to 1.26 million in 2011 the number of trains circulating everyday has not increased, which causes overcrowding of the trains and increase in the risk of road traffic accidents. There are four lines, three of which have two trains in each direction circulating every day, covering between 69 and 88 kilometres respectively. The fourth line has four trains covering 20 kilometres and running every day in each direction.

**Ferry:** Ferry service connects Maputo and the district of Katembe, located at the other side of the bay. The service is schedule every ten minutes, although the timings are relative. This service reduces the number of cars circulating in the highway connecting the two areas, but is more expensive than the toll located in the highway.

**Cars:** As previously said, in the last years Mozambique has started to import mainly used cars (they are cheaper, but more polluting, noisy and unsafe than new cars). More and more people are choosing this transport option every year (mainly because the public transport options are not competitive, efficient, safe and fast), causing severe traffic jams at peak hours. Additionally, there are few parking areas in the city and cars often park on the sidewalks.

**Walking and cycling:** Despite that between 2010 and 2011 the government gave credits to buy bicycles and motorbikes, the use of the bicycles is very limited, mainly because commuters feel that it is dangerous due to the number of cars circulating, and also because there are not infrastructures to ride and park the bike. Most of the time sidewalks in Maputo are wide, but these are in a bad condition, often with big holes and mostly occupied by cars (Figure 1); for people with physical disabilities the access is even more difficult.

The Government of Mozambique requested the Government of Japan for assistance in formulating a “Comprehensive Urban Transport MasterPlan for the Greater Maputo” with...
the aim to improve mobility in the city now and in the coming 20 years, when the number of daily person trips is expected to double.\textsuperscript{12} The master plan was published in 2014 and considers three scenarios. The first would continue with the same land use and mobility pattern, whereas the other two propose a new distribution of land uses (and services) and the introduction of a Bus Rapid Transit (BRT) system and a Light Railway Transit (LRT) system connecting Maputo and Matola, among others.\textsuperscript{12} However, this plan does not take into account the implementation of bike lanes and improvements of sidewalks, but the city council is planning, through other projects, to improve mobility of bikes and pedestrians.

**Conducting HIA in Maputo**

With the current information available (see Table 1), it is not possible to conduct a quantitative HIA in Maputo. Although information on the types of transport used is available\textsuperscript{25}, data on traffic injuries and mortality data is poor. For instance, there are around 11 different mortality databases in the country, and one person can be registered in none or in several of these databases, which are impossible to combine. Furthermore, the number of deaths occurring at the hospitals is very low (12%). A study conducted by the World Health Organization (WHO) during the first semester of 2014 could only quantify deaths related to road traffic accidents based on dead people arriving at the Central Hospital of Maputo. However, many road traffic accident deaths are not registered because the family of the dead removes the body even before the ambulance or the police reach the point where the accident occurred. Information on traffic injuries (type of lesion, types of transport involved, age and sex of the injured person, etc) is even scarcer, though the Health Ministry of the Mozambican Government is starting a pilot project to collect this information. Finally, information on the levels of physical activity of the general population is neither available in the country. It is also interesting to highlight that although traffic is a major problem in the capital of Mozambique in terms of air quality, another important source of pollution is the household cooking system, as many people still use charcoal and wood as fuel. This is important to take into account if HIA is conducted in the future in the city of Maputo.

**COCHABAMBA (BOLIVIA)**

Cochabamba is located in the valley of Cochabamba in the centre of Bolivia, at 2500 m above sea level, and is the fourth largest city in the country. In 2012, there were 918,000 inhabitants, but the whole metropolitan area, which also includes the cities of Sacaba, Tiquipaya, Colcapirhua, Quillacollo, Vinto y SipeSipe, had around 1.5 million inhabitants.\textsuperscript{13} In two decades the population has increased a 150%, which has lead to a rapid and unplanned urbanization process (following an horizontal expansion) that has carried serious social and environmental challenges in the whole metropolitan area, including problems related to air pollution and mobility.\textsuperscript{14} A recent diagnostic on the urban development of the metropolitan area of Cochabamba highlighted mobility as a critical issue to be solved by the authorities, with an unsustainable public transport system and an increasing process of motorization.\textsuperscript{15} Until now the metropolitan area did not have a comprehensive plan on urban mobility, neither statistics on traffic flows, mobility surveys, transport modal shares nor any other updated statistics on the sector.\textsuperscript{16} Currently, this plan is being elaborated and will be finished soon.

**Transport Systems in Cochabamba**

Public transport, together with walking, is the most used transport system in Cochabamba. However, the private transport (including motorcycles) has substantially increased in the last years, and in parallel, the quality of public transport continues to decline.\textsuperscript{17} In the next lines we briefly explain each existing transport system in Cochabamba.

**Public transport: buses, mini-bus and taxis:** Cochabamba does not have an integrated public transport system, partly because of the strength of a number of private transport unions that do

<table>
<thead>
<tr>
<th></th>
<th>Maputo (Mozambique)</th>
<th>Cochabamba (Bolivia)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility plan</td>
<td>Available but not yet implemented (sources: JICA and municipality)</td>
<td>Currently under development (sources: Swiss contact, BID and municipality)</td>
</tr>
<tr>
<td>Sociodemographic characteristics (gender, age)</td>
<td>Partially available (low quality) (sources: NIS)</td>
<td>Available (sources: NIS)</td>
</tr>
<tr>
<td>Mortality data</td>
<td>Data available is not appropriate (only ( \leq )12% of the total deaths are registered) (sources: WHO, Ministry of Health)</td>
<td>Data available for the metropolitan area of Cochabamba (sources: NIS)</td>
</tr>
<tr>
<td>Health outcomes data and traffic injuries</td>
<td>There is currently a project to register better the number of accidents, injuries and the mortality rates (within and outside the hospital). No information on when this data will be available (sources: Ministry of Health)</td>
<td>Data available for the metropolitan area of Cochabamba (sources: NIS)</td>
</tr>
<tr>
<td>Air pollution &amp; noise</td>
<td>Very limited information (sources: Universidad Eduardo Mondlane)</td>
<td>Data available on air pollution (( \text{NO}_2 ), ( \text{SO}_2 ), ( \text{O}<em>3 ), ( \text{CO} ), ( \text{PM}</em>{10} )) and noise exists (sources: municipality)</td>
</tr>
<tr>
<td>Modal share (commuting)</td>
<td>Data available in the mobility plan (sources: JICA, TPM)</td>
<td>Data will be available in the urban development and mobility plan (sources: BID)</td>
</tr>
<tr>
<td>Physical activity</td>
<td>There is not information on general physical activity among the population</td>
<td>We have information on physical activity for the whole country (sources: NIS)</td>
</tr>
</tbody>
</table>


Table 1: Data sources available in Maputo and Cochabamba to conduct quantitative health impact assessment.
not want to lose the control of their businesses. The regular bus lines (owned and managed by the local authority) have official stops along the route. However, mini-buses, also called “trufis” and “taxi-trufis” (taxi cars that follow a fixed route with multiple passengers in a trip) are the most common public transport system in Cochabamba. These “trufis” and “taxi-trifis” are owned by private entrepreneurs, and follow the “fill and go” system, without fixed public transport stops. Also, “trufis” commonly carry more people than what is allowed, increasing the insecurity of passengers. The number of “trufis” in Cochabamba is substantial (mainly because the government does not regulate the number of “trufis” licences), with at least 60 lines operating. Due to the system followed (“fill and go”) they are a major source of traffic jams in the city. Common taxis are also available in Cochabamba.

**Cars:** Bolivia has now a new law that regulates the import of old cars in order to fight air pollution, a serious problem in the country, and particularly in big cities like La Paz and Cochabamba. However, the motorized fleet has substantially increased in the last years.14 Every day the city runs into serious traffic jams, especially in the city centre, despite there is a norm that regulates the entry of cars according to the car license plate number. The low quality and safety of the public transport system is another factor that has promoted the increase of the use of cars in the city. Also, and as it is occurring in other developing countries, car ownership is a sign of belonging to a higher socioeconomic status, which increases the interest to have one’s own car.

**Walking and cycling:** The city of Cochabamba has two bike lanes known as “ciclovías”. One of them is located in the north-east side of the city and surrounds Alalay lagoon (Figure 3). The other is small stretch located in the west part of the city. However, these bike lanes are mostly used as a recreative activity rather than as a useful infrastructure to move along the city. Moreover, the use of the bike as a common mode of transport has declined in the last years because of the nonexistent exclusive infrastructure and insecurity in the road (related to road traffic accidents and crime), despite optimal geographical and climatic conditions for its use.

Sidewalks in Cochabamba are in a reasonable condition; cars do not generally park on them and they are clean and clearly identified. Although in specific spots these are adapted for disabled people, most of them need to be revised in order to facilitate their use. Additionally, there are very few pedestrian streets in the city. Despite the reasonable condition of the sidewalks in Cochabamba, most car drivers do not respect crosswalks and pedestrians have important problems to cross-busy streets (Figure 4).

![Figure 3: Ciclovía (bikelane) in Cochabamba, Bolivia.](image)

Both the municipality of Cochabamba and the metropolitan area are currently developing their respective mobility plans, which are supposed to be finished by the end of 2015. The initiative “Ciudades emergentes y sostenibles” (Emerging and sustainable cities) has already provided some guidelines expected to be followed by these plans in relation to mobility but also to urban planning: potentiate a more compact city and mix-use of land, urban distribution of goods in accordance with urban planning strategies, road traffic and parking control measures for the use of private vehicles, optimization of investments for expansion and maintenance of the road network, the support to pedestrians and the use of bike, creation of an integrated public transport system, etc.14

**Conducting HIA in Cochabamba**

With the current information available (see Table 1) it should be possible to conduct a HIA in Cochabamba as soon the mobility plan will be available. Data on traffic injuries and mortality data is available, and from this primary information other data needed to conduct qualitative HIA can be derived. Information on the levels of physical activity of the general population is available at country level, obtained through health surveys conducted by the government. Cochabamba has one of the oldest air quality surveillance networks in Latin America (started in 2001), with continuous air quality records, which provided the information needed to conduct HIA in relation to air pollutants exposure.15

**DISCUSSION**

In both Maputo and Cochabamba a rapid population...
growth with poor urban and transport planning has resulted in a decline in public transport and in a rapid increase in private cars, with limited possibilities for walking and cycling. Minibus system is providing most of the mobility services in these cities. Both cities are also following the developments that has been seen in many rapid expanding cities in low- and middle-income countries. The current situation is likely to result in a large burden of disease, based on epidemiologic and HIA studies conducted in high income countries.2-5

Data to Conduct HIA

The rapid expansion of cities in low- and middle-income countries provides a unique opportunity for quantitative HIA researchers but also for other stakeholders interested in urban and transport planning (Table 2). However, to conduct quantitative HIA studies several data from different data sources is needed, and these are generally lacking in such countries. Although the feasibility of conducting HIA in low- and middle-income countries will depend on each specific country and city, a greater effort is needed to routinely collect basic demographic (e.g. population size, sex, age, births, deaths, socio-economic status) and health (e.g. diseases and death causes) data, as well as information on environmental exposures (e.g. air pollution) and on transport (e.g. modal use) to be able to make informed decisions in many fields (public health, urban design, mobility, etc). Also, exposure-response functions (e.g. for physical activity, air pollution) available in high income countries may not be appropriate for low- and middle-income countries. Therefore, epidemiological evidence is needed for these countries, as the current knowledge base is often poor or non-existent.

Urban and Transport Planning and Health in Developing Countries

Further studies are needed to evaluate the burden of disease related to future transport scenarios in cities from low- and middle-income countries. However, implication of policy makers to introduce the health perspective and HIA results in urban and transport decision making processes should be reinforced. Also, urban and transport policies should be addressed from a global perspective (i.e. metropolitan area), and not only at a municipality level, and should have continuity in order to have a real impact on people’s quality of life. In low- and middle income countries these policies are usually supported from NGOs, international cooperation agencies and foundations, which should be able to identify the necessities of the city, policy makers, local authorities and population, and to help with technical support, more than monetary assistance, to provide recommendations and interventions. Although it is not the aim of the present study to provide recommendations of implementations that cities from low- and middle-income countries should conduct, we here provide a few general actions that, according to previous experiences in high-income countries and according to mobility plans conducted in some of these cities could help to achieve the aims of having efficient and cost effective transport systems to stimulate economic development and innovation while producing the lowest burden on health (Table 3) and preventing the dependency from motorized vehicles.

These interventions, which should be contemplated in urban and mobility plans in order to have them all integrated and well-coordinated, include, from the urban point of view, the promotion of mixed-land use (including a higher number of green and open public spaces) and high-density development with decentralized populations and services. From the mobility point of view, public transport needs to be reorganized and well-regulated in order to improve the service and the mobility itself. Also, the development of mass transit systems, such Bus Rapid Transit (BRT), would improve the service and reduce the number of private cars (in the case of Maputo, for instance, the existing train lines are an opportunity to provide a good service from the outskirts of the city towards its different areas). Improving sidewalks and increasing the number of areas exclusive for pedestrians are also important actions that need to be implemented, as well as a good regulation of parking areas in order to avoid cars on sidewalks and to facilitate the creation of car-free areas, as well as mobility itself. The promotion of bike use, with i.e. safe bike-lanes, is also a key aspect, as it is a cheap and sustainable mode of transport, and it is an interesting option for those with fewer economic resources.

CONCLUSION

In low- and middle-income countries the pace of urban-
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Table 3: Possible health effects of transport modes.

<table>
<thead>
<tr>
<th>Transport Mode</th>
<th>Negative Effects</th>
<th>Positive Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public transport</td>
<td>Low quality and unregulated public transport can increase the number of traffic injuries.</td>
<td>Reduction of air and noise pollution; reduction of road traffic injuries (if it is well regulated and the quality of the service is good); increase of physical activity levels.</td>
</tr>
<tr>
<td>Cars and motorbikes</td>
<td>Increase of air and noise pollution; increase of road traffic injuries; reduction of physical activity levels.</td>
<td></td>
</tr>
<tr>
<td>Walking and cycling</td>
<td>Low quality infrastructures and regulations can increase road traffic injuries.</td>
<td>Increase of physical activity levels; reduction of air and noise pollution.</td>
</tr>
</tbody>
</table>

This project was funded by the CERCA Institutes Integration Program (SUMA 2013) [promoted and managed by the Secretariat for Universities and Research of the Ministry Economy and Knowledge of the Government of Catalonia (SUR), the Agency for Management of University and Research Grants (AGAUR) and the CERCA Institute]. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. We would like to thank to all the stakeholders and organizations willing to collaborate and provide information.

ACKNOWLEDGMENTS

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AUTHOR’S CONTRIBUTIONS

M.N, A.P. and M.G conceived and designed the study; M.N.M, S.T. and F.T. contributed obtaining the data; D.R.R. and M.G. analyzed the data; M.G. wrote the paper, with the collaboration of all authors, especially of D.R.R.

CONFLICTS OF INTEREST DECLARATION

The authors declare no competing financial interest.

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Non-Communicable Diseases: A Major Problem Worldwide

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Non-Communicable Diseases (NCDs) are a worldwide major problem. NCDs are accounted for over 36 million deaths each year and highly prevalent in low- and middle-income countries. It is estimated that 16 million people die prematurely before reaching the age of 70. It is also the leading cause of hospital admission and premature deaths. NCD comprises diabetes, asthma, hypertension, heart attacks, cancer, obesity, depression etc. Some of the major NCDs such as diabetes, hypertension, dyslipidemia are attributed to unhealthy lifestyle behaviours. Four prominent risk factors namely smoking, physical inactivity, alcohol and unhealthy diet have been found to be associated with NCD deaths. Tables 1 and 2 show worldwide mortality in 2012 based on the 4 main non-communicable diseases and total, premature NCD and preventable risk factors relating to deaths respectively.

<table>
<thead>
<tr>
<th>Non-Communicable Diseases</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Diseases</td>
<td>17.5 million</td>
</tr>
<tr>
<td>Cancer</td>
<td>8.20 million</td>
</tr>
<tr>
<td>Respiratory Diseases</td>
<td>4 million</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.5 million</td>
</tr>
</tbody>
</table>

*Mortality and risk factors Data based on year 2012

| Overall NCD mortality              | 38 million deaths (out of 56 million deaths globally) |
| Premature NCD mortality            | 48% of NCD deaths before age 70 (in low- and middle-income countries) |
| Preventable risk factors           | 80% of premature heart disease, stroke and diabetes can be prevented |

REASONS NON-COMMUNICABLE DISEASES ON THE RISE

Numerous efforts have been taken to tackle NCDs. For example in diabetes, health awareness campaigns with regards to diet, physical activity, education and health policies have been implemented. Although some awareness have been created, it is hardly successful. The awareness through education is important in preventing NCDs. According to a study done by Snyder on the effectiveness of health communication campaigns, it was noted that if the awareness were to focus on the objective which is to reduce the prevalence or incidence of the disease, it may not necessarily lead to behavioural changes and would be better to focus on the aims of behavioural changes.

It has been shown in many studies that NCDs such as diabetes and risk factors are inversely associated with education and low education is not a hindrance to behavioural lifestyle changes. The knowledge of the progression and symptomatology of the disease as well as the awareness and management of the disease and the risk factors such as diabetes and hypertension that could be prevented by lifestyle changes are still lacking among the general population. This was noted in a diabetes prevention program in Finland (FIN-D2D) where awareness of diabetes and its risk factors were raised and which resulted in lifestyle changes as well as health behaviour and early facilitation of diagnosis and management of type II diabetes. However, the
findings were limited to self-reported questionnaires and misclassification which cannot be ruled out.

However, on the other extreme spectrum, especially in the urban population where the general knowledge of the disease is far better than the rural population, the disease is on the rise. Some urban people are less critical in their behaviour and attitude and pay less attention. Some studies have been done to focus on the knowledge, attitude and practices in some populations. For example, a study of hypertension in Gandhinagar, Gujarat has shown subjects having good knowledge of the disorder but are poor in their attitude and practice.9,10

Similarly a study in Nepal on cardiovascular health, among those with satisfactory knowledge, only a small percentage had highly satisfactory attitude and satisfactory/highly satisfactory practices.9 This is one of the issues why NCD is difficult to tackle. When these people are eventually diagnosed with NCD(s), they are aware of the contributing factors to these diseases but it may be too late as the disease may have developed for quite some time before diagnosis.

The preparation and amount of food at home is one of the contributing factors to obesity and NCDs. The person who prepares the food has no knowledge of what type of healthy food to prepare. Most of the time, the amount of food prepared in a family is usually in excess. The excess is usually either refrigerated or consumed later rather than discarded.

People also tend to spend more time in the office and in front of their computers. Most of the work nowadays involves paper work, report writing, emailing etc. and these make them less active and it is not good for health. These are few reasons why people get obese these days. A systematic review and meta-analysis study by Kivimaki et al showed that people who spend long working hours have higher risk of getting coronary heart disease and stroke.12

People tend to focus more on their work/job and pay less attention to exercise or physical activity. The priority placed on routine work is one of the reasons why people tend to take exercise less seriously. The lack of proper place or lack of facilities for physical activity is also one of the reasons why people find it hard to do physical activity. Apart from this, there are issues of lack of time due to family commitments which they need to address.

Smoking and consumption of alcohol are well-known contributors to NCDs.13 Ignorance on the risk of smoking and alcohol consumption are high as the effects can be observed over the years of exposure. The labelling of the cigarette package with pictures showing the consequences of smoking has not been successful as people still continue to smoke. There is also a new alternative trend of smoking called e-cigarettes (vaping) which is equally or more detrimental to health compared to conservative tobacco smoking. Schweitzer et al has shown that nicotine and nicotine-free e-cigarette solutions have damaging effects on the lungs.14 Despite knowing the consequences, people still ignore the warning and continue to vape.

In terms of prevention of NCDs, according to a worldwide study, physical inactivity can contribute to 6-10% of NCDs such as type II diabetes, coronary heart disease, breast and colon cancers.15 Improving on physical activity can help to reduce the NCDs as well as increase life expectancy. No one can argue that physical activity is indeed important in order to prevent NCDs as highlighted in this study as well as in others. To achieve this, the individual need to take his/her own initiative to ensure that the physical activity is taken seriously. Healthcare professionals can only advice but in the end, it is the general public that need to take the initiative. The government/municipal councils should build more parks in the residential areas so that the public can engage in physical activity regardless of urban or rural areas.

With regards to smoking, the government has two choices; ban or increase cigarettes prices in order to reduce smoking among the general public. However, banning tobacco is not possible as it has been a source of income for many countries through implementation of taxes. Due to the availability and affordability of e-cigarettes, more people are switching to vaping. The government should ban e-cigarettes as it could cause more harm than the conventional smoking.

More effort is needed for the government to control the sales of carbonated drinks in the market. Although this is hard to implement, the least the government could do is to instruct the relevant companies to reduce the sugar level in the cans before selling them to the consumers. The government should also stop giving licences to new fast food chains to be set up. Currently, there are many available fast food outlets which provide unhealthy food.

More awareness on NCDs should be made available either in the media or via campaigns. The campaigns should be continuously highlighted as usually done in cinemas, television, social media etc. and not for a short period of time. The government and Ministry of Health should from time to time organize and carry out awareness campaigns at the community level and hospital/clinics to create awareness so that the public knows that
the government is very concerned about their health.

Each clinic or hospital should have a wellness or NCD clinic with one dedicated nurse attached to it. Most of the time, doctors do not have much time to spend on providing detailed information and to educate the patients on lifestyles as well as for the patients to seek further advice or ask more questions. In order to treat a patient successfully, there is a need to know the patient’s medical history, social history and the difficulties the patient is facing. By setting up a dedicated clinic for this purpose, the patients will be able to spend more time with health care professionals to ask more questions and to seek advice as well as for monitoring purposes.

The school education system should also place the importance of implementing subjects related to nutrition and health. The curriculum needs to be updated from time to time to cater for the country’s needs. It is vital that school children are taught early so that they are aware of it. Most of the time, children are influenced by their parents. If the parents have no proper awareness, the children may follow their parents footsteps.

CONCLUSION

Preventing NCDs is not an easy task. A lot of effort need to be taken to address the issue. The government and the public need to seriously pay more attention and take necessary action so that NCDs can be reduced. The role of government is important and it requires good leadership as well as policy development and implementation.

Apart from that, there is a need to incorporate all strategies in order to prevent NCDs. For example, there are some successful community intervention programs for diabetes such as Kerala Diabetes Intervention Studies, Da Qing Diabetes Prevention Study, Finnish Diabetes Prevention Study (DPS), which incorporated various strategies such as peer support, lifestyle changes/modification (diet, physical activity), education sessions, health education booklet etc.

Most of the premature deaths are due to NCDs that are preventable. If the public is still apathetic to their actions, the NCDs will increase and the government will have to spend more money on the treatment, resources and the country suffers from the loss of productivity. Before it is too late, appropriate actions are required and all the contributing factors to NCDs need to be addressed. It is vital for the community/public to take charge of their own health and not place the responsibility solely on the care of healthcare providers. The public also need to be aware that NCDs kill and action needs to be taken before they develop the condition(s).

The nine global targets for prevention and control of NCDs set by WHO: reducing alcohol consumption, increasing physical activity, reducing salt/sodium intake, reducing the use of tobacco, containing hypertension, slowing down the rise of diabetes and obesity, improving the treatment coverage for prevention of heart attacks and strokes, access to basic technologies and essential medicines, as well as reducing 25% of premature deaths of the four major NCDs by 2025, are realistic and achievable.

FUTURE DIRECTION

To reduce the burden of NCDs, the government needs to play an active role not only to implement policies but also to ensure that the strategies are fully implemented and monitored. At the lower level, there is a need to ensure that the intervention program is tailor made accordingly to individual needs. Each health clinic/health centre should have a wellness centre dedicated to NCDs to provide counseling and also to monitor progress. The needs of each individual are different from one another. As such there is a need to customize the intervention package according to individual needs.

Further to the management of existing population with NCDs, the government, particularly the Ministry of Health should focus on the prevention of NCDs by targeting the high risk groups. Apart from that, Ministry of Health and Nutrition Society should endorse a recommended standardized nutritional menu with proper nutritional standards to enable the public to use it as a dietary guide.

Awareness, attitude and practice are the most important contributing factors for NCDs. The strategies need to focus on those who are unaware of the NCDs and on those who are aware but with poor attitude and practice and should focus on individual or group needs rather than focus on the general group.

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Economic Evidence Regarding Alcohol Price Elasticities and Price Responses by Heavy Drinkers, Binge Drinkers, and Alcohol-Related Harms: Summary of Results for Meta-Analysis, Systematic Reviews, and Natural Experiments in Alcohol Policy

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ABSTRACT

Numerous economic studies examine effects of alcohol price and tax changes on drinking, drinking patterns and alcohol-related harms. The consensus view is that prices are an effective instrument for addressing issues of heavy drinking, binge drinking, and adverse outcomes associated with alcohol. In a series of published studies, I present evidence that this view is overly optimistic, and results for alcohol prices are more varied, complex, or nuanced. This paper provides a brief overview of main results in eight studies. Alcohol tax and price interventions have selective, rather than broad, impacts on sub-populations, drinking patterns, and alcohol-related harms.

KEYWORDS: Alcohol policy; Alcohol prices; Health effects.

INTRODUCTION

Economic theory predicts that consumer demand for products and services responds to changes in real prices or real income, holding other key variables constant (e.g., prices of substitutes, prices of complements, product availability, product promotion, etc.). Theory predicts neither the magnitude of price response by individuals nor exact patterns of responses across groups of individuals. It is not sensible to claim that all individuals respond in the same manner or to the same degree for a tax-induced change in alcohol prices. Establishing the magnitude of price response for individuals and groups requires statistical evidence, possibly based on several different methodologies. These simple observations have been lost in on-going discussions and debate over the role of prices and taxes as alcohol policy instruments. Instead, what is usually reported is something along the following line - “economic studies have demonstrated that increased alcohol taxes and prices are related to reductions in alcohol use and related problems”[1][p108]; and there is “...strong evidence that increasing alcohol taxes reduces alcohol-related harm”[2][p1]. Statements such as these are often based on aggregate econometric studies that fail to account for individual or group responses to price changes. Magnitude and patterns of response are neglected as necessary details for alcohol policy. Further, there is a seeming lack of attention to issues of publication biases in reporting of results. Finally, evidence from “natural experiments” in alcohol policy has been neglected as a basis for public policies.
Meta-analysis and Publication Bias in Price Elasticity Estimates

In a series of published reviews, I examine evidence related to alcohol prices, taxes, and patterns of change for both drinking outcomes and alcohol-related harms. Three of my papers use meta-analysis. My analysis adjust aggregate econometric results for several statistical problems, including heteroskedasticity, statistical outliers, lack of independence among multiple estimates, and publication bias. Publication bias is the basic problem that researchers are prone to report statistical results that support pre-conceived notions of publishability, including “correct” signs, statistical significance, and larger (more price elastic) values. The existence of publication bias in both medical and economics literatures are widely recognized, and several techniques are available for detecting its existence and correcting for bias. Publication bias also is associated with selectivity in discussion of statistical results. In Nelson, I correct for publication bias in 114 primary studies that estimate the price elasticity of beer. I conclude that in regression models that correct for selection bias and heterogeneity the average beer price elasticity is about -0.20, which is less elastic by 50% compared to values commonly used in alcohol tax policy simulations. A second meta-analysis reports average price and income elasticity estimates for beer, wine, and spirits. My sample of primary studies exceeds substantially those employed in prior work along similar lines, e.g., compared to Wagenaar et al, there are 135 studies that were not included in their analysis. Correcting for publication bias, I conclude that cumulative price elasticity estimates are about 28% smaller in absolute value for beer; 29% smaller for wine; and 28% smaller for spirits. The total price elasticity for alcohol, however, is virtually unchanged (-0.48 compared to a consensus value of -0.50). A key component also for simulation studies is recognition that “affordability” depends critically on changes in real incomes and associated income elasticities. Results for income elasticities also are reported.

Heavy-drinking and Binge Drinking by Sub-populations: Systematic Reviews for Prices and Taxes in Individual Survey Studies

The consumption of alcohol by some individuals creates external costs for others in the form of drink-driving accidents, crime, violence, family strife, and other physical, financial, and psychological costs. Reducing alcohol demand by increasing alcohol prices might therefore alleviate some of these costs, although as suggested above the magnitude of response has been overstated. More generally, given heterogeneous drinking patterns, addressing alcohol problems through price increases requires that heavy drinkers, abusive drinkers, and other critical sub-populations respond to price changes, and arguably their response should be as large or larger than those who responsibly use alcohol. In a series of three published papers using a systematic-review methodology, I examine robustness of price-tax results for heavy-drinking adults and young adults, gender-related differences, and binge-drinking by adults, young adults, and youth. In Nelson, I examine 19 individual-based survey studies for prices and heavy drinking by adults and nine studies of prices and cirrhosis mortality. Only two of 19 heavy-drinking studies find a statistically significant and substantial negative price response, and only two of nine mortality studies find a negative price response. In Nelson, I focus on gender-related differences in price responses. Fifteen survey studies are reviewed for drinking and heavy-drinking by adults and eight studies are reviewed for young adults, ages 18-26 years. I report that adult men are less responsive to price compared to women, and heavy drinking by young adults, regardless of gender, is not easily dissuaded by higher prices. Finally, in my third paper, I review results for binge drinking contained in 56 econometric studies, five natural experiments, and six field studies. The results are not robust-null or mixed results are found in more than half of the studies. I conclude that “the body of evidence indicates that binge drinkers are not highly responsive to increased prices”. I also demonstrate that literature-search techniques used in other systematic reviews and meta-analyses are biased, and fail to detect or locate numerous economic studies.

Natural Experiments in Alcohol Policy: Surveys of Results for Drinking and Alcohol-Related Harms

Natural experiments are an important alternative to observational and econometric studies. Indeed, Babor et al argue that “studies of what happens when there is a change provide the most valuable evidence on the effects of alcohol policy.” Past reviews such as Elder et al and Wagenaar et al include only two or three studies based on natural experiments for alcohol prices and taxes. Two recent papers, published jointly with Amy McNall, provide summaries of this methodology for drinking and alcohol-related harms. In Nelson, we examine 29 primary studies for natural experiments in price or tax policy for five countries—Denmark, Finland, Hong Kong, Sweden, and Switzerland. Primary studies cover a variety of drinking outcomes and sub-populations, and in general such a diversity of results and methods is not amenable to meta-analysis. We conclude that there is “a lack of consistent results for consumption with a general finding that alcohol tax interventions had selective, rather than broad, impacts on sub-populations and drinking patterns.” In our second study, we examine 69 outcomes for five categories of alcohol-related harms, including mortality and hospitalizations; assaults and other crime; drink-driving; intoxication; and survey-indexes for alcohol dependency. Nine countries are included: Australia, Denmark, Finland, Hong Kong, Iceland, Russia, Sweden, Switzerland, and United States. We find that most policy-induced changes in taxes and prices had highly selective effects on harms, with Finland and Russia as possible outliers for mortality.

DISCUSSION

Taken together, analysis and reviews reported here demonstrate...
mixed results for alcohol prices and taxes, including policy-driven natural experiments. This contrasts sharply with arguments presented elsewhere that a broad or population-level increase in alcohol taxes or prices is the most cost-effective or consistent alcohol-policy intervention.16 Our critical analysis and reviews indicate that changes in alcohol prices do not have the same effect on all sub-populations or on all alcohol-related harms. Rather, effects and magnitudes are more selective and nuanced, and depend importantly on the sub-population or harm, social norms, and possibly other variables. Economic models for tax-policy require accurate price parameter estimates, especially for heavy and abusive drinkers.22 If abusive drinking and alcohol harms are not responsive to prices or depend importantly on particular circumstances—as evidence reviewed here suggests—then more targeted approaches to alcohol control are to be preferred.

ACKNOWLEDGEMENTS

The author acknowledges past research support received from the International Alliance for Responsible Drinking (IARD), Washington, DC, USA, a not-for-profit organization sponsored by major producers of alcohol beverages. No support was received in conjunction with this communication. The paper presents the work product, viewpoints, and conclusions solely of the author. Views expressed are not necessarily those of IARD or any of IARD’s sponsoring companies.

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Implementation of Value Stream Mapping for Waste Elimination in Public Sectors: A Case Study at Emam Sajjad Clinic, Rasht, Iran

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ABSTRACT

Introduction: In the competitive world, it is necessary to be aware of all tools and knowledge as well as to learn the correct use of tools and techniques of lean manufacturing. The lean manufacturing concepts are always trying to achieve the lowest loss and highest efficiency in production planning. In this production mode which now operates in manufacturing sectors, the value stream map is currently applied as one of the most efficient tools. Value stream map has also been recently used as a method of planning in the service sectors in particular in the health and emergency.

Method: This research work aims to use the value stream map in a public emergency sector in an Iranian hospital. At the beginning, data have been collected through timing followed by drawing the current flow map in emergency conditions. Improving suggestions and removing unnecessary activities have been proposed considering the lean manufacturing concepts. The proposed map, targeting to the future improvement, has also been presented and data analysis was done using the well-known software of “EASYFIT.” Standard normal test has been utilized to check the existing difference between current and future stream maps in terms of waiting and processing times.

Results: The current and suggested stream maps have been simulated using “ARENA” and comparing results revealed that the improvement of 6.336 minutes and 77.76 seconds have been achieved in waiting and processing times, respectively. Using standard normal test also showed that there are significant differences between average waiting and processing times over the current and future stream maps.

Discussion: Since, comparing the results shows statistical improvement on average waiting and processing times on the current and future stream maps, it can be concluded that using value stream map technique is capable to improve service quality in medical centers.

KEYWORDS: Value-stream map; Lean manufacturing; Simulation; Hospital care system; Emergency response.

ABBREVIATIONS: MRI: Magnetic Resonance Imaging; EMS: Environmental Management System.

INTRODUCTION

In order to stay at today’s healthy and successful competition, if we are not better than any of our global competitors, we should at least be as well as them. Lean thinking, as the antithesis of Muda, provides some techniques in which the value creation activities can run in required time and prevent additional activities. Basically, lean thinking is called Lean because of providing ways in which the lowest rate of (manpower, equipment, time and space) will be used and the most will be accomplished.¹ In fact, lean production was one of the new viewpoints proposed after mass production. Lean Manufacturing is a philosophy and approach that seeks
to remove and eliminate any additional process of preparation of raw materials to manufacturing and ultimately selling that does not create extra value. In this regard, one of the most important tools is known as value stream mapping. Discussions of lean and other methods of manufacturing are knot up with automotive industry. In Indeed, with attention to comprehensive concepts of lean production and its goals and flexibility, it can be certainly concluded that this method is by no means unique to a particular organization, so it can be run on all systems.\(^2\)\(^3\)

For implementation of lean manufacturing, many tools are highly proposed while one of the most important ones is the value stream mapping. The value stream map includes two maps of the current situation and the future situation. Current situation map provides an image of the entire production process (including the activities of creating and not-creating value) for managers and executives and the future situation map develops a clear path for implementing lean system on intended system, to be able to apply lean concepts for running the program, continuously and consistently rather than doing lean operation in an irregular and unplanned process.\(^4\) According to learning lean production techniques abilities in manufacturing sectors which are rarely applied in service sectors, in the present paper, the value stream map technique is utilized for 227 patients in the Public and Emergency Departments. Using ARENA simulation software for testing differences in the comparison, every process including patients arrival to the clinic and getting out of will be examined. Following that, a map will be drawn according to the current situation and enhanced value stream map will be drawn regarding to suggestions for improvement. At the final step, results of both the maps will be statistically compared.

*Muda* is a Japanese word means waste. It is any human activity that consumes resources but creates no value. There are many types of wastes, commonly known as septet wastes. In fact, *Muda* is everywhere, but fortunately there is an effective antidote for that and that is Lean or better to say Lean thinking. This method is called Lean in brief because of the lowest antidote for that and that is Lean or better to say Lean thinking. This method is called Lean in brief because of the lowest

In order to detect defects and waste and non-valuable activities, Satish Tyagi\(^8\) developed his value stream map and added steps in the current situation maps gas turbine to eliminate wastes in walking process, questions to determine the root causes of problems was asked from experts and future plan was prepared after providing the wastes. At the same time, DT Matte\(^9\) used a 12-stage framework for drawing the current map and identifying weaknesses and drew the future map using the proposed guidelines. Results indicated that there was no complete inventory in units and there were significant differences in cycle time and overall time which the system provides a lean production expectation.

In the field of software engineering at Sweden Sony Ericsson Company, Numan Bin Ali et al\(^10\) evaluated the simulation by value stream map for software development. That was a very useful way to overcome significant limitations on the use of simulation especially insightful discussion.

Rajeev Chadha et al\(^11\) made a study to prepare a model for the integration of queuing and lean methods to improve dynamic performance, the Indian SD hospitals, emergency health care system evaluates a dynamic system models and re-designs the process by value stream mapping to eliminate non-valuable activities to achieve timely service. Robert James Carfolio et al\(^12\) investigated the removal of useless parts of a process in lung hospital lobotomy operation. At the beginning of their research, they divided all patients into groups of 300 lobotomy patients. After drawing and analyzing the current map, many unnecessary removed from operation and arrival time to the operating room and mortality rate has been improved. In another study which focuses on hospital outpatient departments, Richard Miller et al\(^13\) had a survey collecting relevant data through observation and questionnaire for applying the lean tools for some unique health issues in developing countries. Analyzing the lack of planning and what was found following five-whys resulted to clarify the current plan for the main driver of losses in patient flow system. Applying the proposed corrections revealed that the average waiting time for patients and the labor productivity have been improved.

Emily Lee et al\(^14\) provided a learning structure on how to make a value stream map in a hospital magnetic resonance imaging (MRI). Drawing value stream map and proposing solutions, which were following a general understanding of the needs and expectations, showed a clear improvement over different periods.

Dickson et al\(^15\) evaluated the implementation of lean principles in the Emergency Department and published results in their research work. They run the lean implementation with
the purpose of promoting employees and customers’ satisfaction by required tools such as Kaizen and also value stream mapping. Results showed that the organized lean is appropriate to the environment which made some desired improvements. According to the articles mentioned and various studies that were raised in the spheres of production and services, it is obvious that the use of value stream map in services sphere, is mostly in the health section. This may be on because of this increased risk-taking and interconnected relation with the health and lives of human beings. In the present research, the main aim is to use value stream map tools in order to identify and eliminate waste in a medical ward and provide ways for being better.

METHODOLOGY

In this section, the proposed procedure is defined including four steps of data collection, drawing value stream map, simulation process and analyzing as shown in Figure 1. For each step, the transactions with the other steps are also defined using more detailed process followed and following to the others. The relationships between the proposed steps are also illustrated by arrows. In brief, more detailed information is provided by observation and time measuring following data collection. The stream map in the current situation is drawn for using in simulation step. In this step, the current map is simulated and analyzed. In the next step, weaknesses are identified and suggestions are given for improvements. The future map will be drawn according to solutions derived by analyzing the current problems. This map is consequently analyzed in simulation step followed by investigating outputs and comparing the results of both current and future value stream maps.

One of the most important steps must be conducted in such kinds of this research work is data gathering. Since, the improving techniques should also been compared by waiting time, observation and interview methods of data gathering have been applied to collect data. In order to use data by simulation software, the common software of EASYFIT has been utilized to determine data distributions. Collected data for each process analyzed by the above software and the most appropriate distribution function targeting the highest ranking for the intended data has been selected. Then the current map has also been drawn according to observation and personal interview following the use of simulation software of ARENA. Simulation results analyzed in terms of strengths and weaknesses points of the process and showed that there are some recommended notes for improving the process. In order to compare results and validate the proposed improving hints, the future stream map has also been drawn and the simulation results statistically analyzed.

Current Situation Value Stream Map

The procedure and improving notes have been applied in a case study of hospital in the Northern Iranian city of Rasht. This is located on the Namjoo Street of Rasht City, the capital of Gilan Province. All medical activities are operated under the official contracts with health insurance companies but non-insurance patients are also visited paying more money. The selected clinic includes various specialized fields including general (emergency), radiology and more. In some specific buildings, there are a variety of parts separated in weekdays and work in different hourly shifts of morning and evening. The emergency part of clinics includes two sectors of nursing sector (first aid) and public medical sector. The average number of 250 to 350 patients daily refer to the public buildings Environmental Management System (EMS). Since, the value stream map tool is a try and error tool namely paper and pencil method, the current value stream map has been drawn by visiting the entry and exit track of the emergency patients as well as the procedures that each patient should spend over the process. Both spending and waiting times are also collected for each process done at the research scope. It is obvious that the drawn stream map is literally retrieved from the real situations of emergency without involvement of personal logic and advises. An overall view of the value stream map articulated by software has been drawn as below.

Analysis of the Current Situation Map

Observing the process and patient flow activities which have been summarized as current situation stream map revealed that there are many problems and different wastes over the process. Problems have been classified regarding to the defined septet

![Figure 1: The proposed procedure to improve hospital care system.](image-url)
wastes and tabulated in Table 1. As it can be observed, any problem in the clinic, which has been selected as case study is related to its own corresponding waste. (Figure 2)

Proposed Improvements Solutions

After identifying all wastes over the various clinical processes, some solutions for waste elimination and improving notes for current situations can be proposed at this stage. They should be proposed according to lean production principles followed as below:

- Reduction on waiting times at reception and nursing is required and possible.

<table>
<thead>
<tr>
<th>Type of wastes</th>
<th>Observed problems</th>
</tr>
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| Waste of over production | • Getting additional information from patients on admission sector  
• Paper work roles (patients who come just for nursing affairs, in addition to filling in the form, specify the type of insurance they receive from accepting sheet.) |
| Waste of additional motions | • Unnecessary trips of receptionist and nurses  
• Unnecessary form filling out.  
• Inappropriate nursing rest period.  
• Incorrect ordering work stations.  
• No board, sheet or brochure to introduce the specialties of the clinic divided day and hour separately.  
• The lack of a telephone answering systems and IVR. |
| Waste of unnecessary inventory and lack of essentials | • Frequent and redundant questions from patients.  
• Rework in returning patients to the doctor to know the way of taking the drugs.  
• Back to doctor in order to eliminate duplication errors in the insurance.  
• The lack of a properly arranging for women nursing.  
• Lack of Elevator and problems for patient transport. |
| Losses resulting from defective production | • Waste time and delays due to faulty during use of some medical equipment and crash them.  
• Waiting time to fill out the form at the reception.  
• Waiting time for receiving bills and lack of POS.  
• Waiting time while using medical affairs and entering the patient to the clinic because of gender segregation of patient and doctor.  
• Waiting time in nursing.  
• Waiting time to show the drug to the doctor when the receptionist is busy.  
• Waiting time due to carelessness of receptionist the waiting time due to absence of doctor in clinic and unnecessary Attendance in the area and negligence of receptionist from notifying the doctor. |
| Waste, resulting from the long waiting time. | • A mismatch between jobs and workers (no proper use of the operator, and lack of motivation)  
• Irregularities in the stations  
• The lack of patient’s accurate awareness of the number of waiting patients and in some cases, facing with high volume of patients  
• Lack of sufficient attention to the prioritization of patients to determine the severity of sickness |

Table 1: Identification and classification of septet wastes.
improve waiting time in particular when there is no same gender doctor available at the time.

- Other fixes in waiting time are also proposed.
  - A payment object system (POS) can improve operators’ accuracy at the desk where receptionists involve for payment activities.
  - Getting less information from patients is useful for improving waiting time.
  - All forms include many parts of required data collection. Review proposed forms and remove unnecessary items are highly recommended.
  - Paper work can be omitted from the process.
  - Remove unnecessary references from the reception to the nursing section. Some of papers can be substituted by electronic procedures.
  - Lack of proper workstation setup.
  - According to the concepts of 5S which are usually mixed with value stream map technique, improving suggestions are to determine the right workstation and using a guidance tableau in front of the entrance part of patient admission located at emergency room.
  - Lack of a proper accountability system and IVR telephone
    - Establishing an answering machine system and IVR to respond and fix problems caused by the lack of basic information would be useful for decreasing waiting time.
  - Omitting dual referring to doctors for showing drugs and receiving instructions.
    - About 50% of the patients, return to the doctor just for showing drugs and receive prescription. If they justify at the pharmacy when taking the drugs, there is no need to return to doctor.
  - Elimination of human errors.

Using the Poka-yoke tool in each section will improve process and minimize unintentional errors.

- Transmission from nursing section to the doctors.
  - If nurses are much careful in relevant part, a lot of unnecessary referrals to doctors will be prevented.
  - Matching more between jobs and working.
    - By using five-why technique, the root of some problems will be identified and operator compliance with their jobs will be decreased. In fact, when there is no motivation or energy to do things errors increase and accuracy reduces over the procedures.
  - Getting exact information about the number of patients.
    - Installing an electronic sign at the emergency room can improve the aware of waiting patients for the doctor and nursing affairs and provide an approximate plan for the admission to the emergency.
  - More attention to prioritize patients according to the severity.
    - Lack of time, the bustle of reception and lack of the necessary commitment are generally included over the procedures. In order to eliminate them and patient severity recognition, installing health care electronic cards and job-workers matching system are recommended.

Improved Value Stream Map

According to the proposed solutions and apply some important solutions, the current value stream map can be redesigned and its results can be compared. The improved value stream map has been redesigned shown in Figure 3.

METHODOLOGY VALIDATION

Since, it is necessary to validate the proposed methodology; simulation technique is utilized to compare the current and future
stream maps indexes followed by statistical test.

Simulation

Both value stream maps including the current and future have been simulated for 30 days using the software of ARENA according to the sample of 227 patients and results are tabulated in Table 2. According to other results derived from simulation, it can be concluded that the maximum waiting time and maximum queue length are strongly related to the reception section. It seems that there is a bottleneck in the above mentioned section. Comparing selected criteria revealed that the average occupation time at the reception is the maximum amount of 36.588 minutes.

Comparing the results of improved stream map simulation with ones of current stream value map revealed that the maximum waiting time is related to the nursing section with a median of about 6.426 minutes and the maximum length of the queue, the queues in medical offices with an average of 15.42 minutes. To understand the improvement of the value stream map simulation more accurately, more comparing results are also tabulated in Table 3.

As shown in Table 3, the average waiting time has been improved as much as 6.336 minutes. This improvement is very significant because it recognizes the right suggestions. In fact, by reducing the processing time and zero waiting time for about 60 percent of patients, waiting time for a large part of the remaining patients is reduced and in most cases comes to zero.

Statistical Data Analysis

In order to make a statistical test to compare the average waiting and processing times, the well-known test of standard normal test (Z-test) is used due to the large number of samples. In this case, comparison is made for two different samples with different variations. So, hypothesis test for waiting time is done as below in which $\mu_1$ and $\mu_2$ are average waiting times of the current

---

**Table 2:** Simulation results for current and future value stream maps.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Current Value Stream Map</th>
<th>Future Value Stream Map</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing time per person (VA Time) (min)</td>
<td>8.256 0.6294 52.308</td>
<td>6.96 0.00 60.984</td>
</tr>
<tr>
<td>Waiting time (min)</td>
<td>12.840 0.00 112.548</td>
<td>6.504 0.00 106.380</td>
</tr>
<tr>
<td>Total time (Total Time) (min)</td>
<td>21.096 1.8876 128.136</td>
<td>13.488 0.00 135.834</td>
</tr>
<tr>
<td>Number of patients entered to system</td>
<td>11356 ----- -----</td>
<td>11214 ----- -----</td>
</tr>
<tr>
<td>Number of patients exited from system</td>
<td>11346 ----- -----</td>
<td>11211 ----- -----</td>
</tr>
<tr>
<td>The number of patients at any given moment (WIP)</td>
<td>5.547 0 28</td>
<td>3.500 0 16</td>
</tr>
</tbody>
</table>

---

**Figure 3:** Proposed (Future) value stream map.
and future stream maps, respectively.

\[ H_0: \mu_1 = \mu_2 = 0 \]
\[ H_1: \mu_1 - \mu_2 > 0 \]

Sample size is \( n_1 = n_2 = 227 \) and the null hypothesis is that the waiting times for both current and future stream maps are equal while the competitive one is that the average waiting time for the future map is smaller than the current map. Confidence interval (CI) is considered as 95% and computation results show that the average and standard deviations for waiting time are calculated as below:

\[ \bar{x}_1 = 6.678414, \bar{x}_2 = 2.123348, S_1 = 6.631757, S_2 = 5.983956, \]
\[ \alpha = 95\%, Z_{\alpha/2} = 1.645 \]

So, the statistical measure is now calculated as below:

\[ z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} = \frac{6.678414 - 2.123348}{\sqrt{\frac{(6.631757)^2}{227} + \frac{(5.983956)^2}{227}}} = 4.555 \]
\[ = 7.6851 \]

Since, the statistical measure is more than critical value \( (Z_{\alpha/2} = 1.645) \), the null hypothesis is rejected and it is concluded that waiting times for the current and future maps are significantly different as well as the future stream map will reduce the average waiting time.

The above test can be also utilized for processing time. Hypothesis test for processing time is as below in which \( \mu_1 \) and \( \mu_2 \) are average processing times of the current and future stream maps, respectively.

\[ H_0: \mu_1 = \mu_2 = 0 \]
\[ H_1: \mu_1 - \mu_2 > 0 \]

Considering confidence interval of 95%, computation results for processing time, while the sample size is \( n_1 = n_2 = 227 \), are as below:

\[ \bar{x}_1 = 6.678414, \bar{x}_2 = 2.123348, S_1 = 6.631757, S_2 = 5.983956, \]
\[ \alpha = 95\%, Z_{\alpha/2} = 1.645 \]

So, the statistical measure is now calculated as below:

\[ z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} = \frac{7.8237 - 6.2995}{\sqrt{\frac{(8.24754)^2}{227} + \frac{(8.47736)^2}{227}}} = 1.5242 \]
\[ = 1.942 \]

Since, the statistical measure is more than critical value \( (Z_{\alpha/2} = 1.645) \), the null hypothesis is rejected and it is concluded that the processing times for the current and future maps are significantly different as well as the future stream map will reduce the average processing time.

**DISCUSSION**

Because of the importance of paying more attention to the healthy services, the concepts of lean manufacturing principles have been applied to reduce waste and improve the overall look in a polyclinic. For this purpose, some specific examples of patients and all relevant processes from patients entering and out-going from a clinic in Iran have been investigated using the well-known technique of value stream map. For individual processes through observation and timing, the necessary data were collected and the current value stream map was drawn. In many sectors, weaknesses appeared and wastes identified from the procedures. Some improving notes have been proposed to eliminate waste and anticipated problems. At the next step, the improved value stream map was drawn and both the stream maps using ARENA software were simulated. In the emergency room, results showed that the suggested solutions made improvements of 6.336 and 1.296 minutes in waiting time and processing time, respectively. Statistical analysis utilizing standard normal test also shows that there is a significant difference between waiting time and processing time for the current and future stream maps.

**CONCLUSION**

In brief, results showed that the existing strategies and suggestions are capable to improve health care system in emergency room. So, the value stream map can be used as an efficient tool in service sections as well as manufacturing systems. Since, the proposed solutions may not be applied in different hospitals or situations, future researches are recommended to focus on prioritizing the solutions using ranking techniques such as analytical hierarchy procedure.
CONFLICTS OF INTEREST

No funding or financial support from fellowship, scholarship or any sponsors have been gained by author. Therefore, authors declare that there are no conflicts of interest regarding the publication of this article.

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The Role of Familismo and Acculturation as Moderators of the Association Between Family Conflict and Substance Abuse on Latino Adult Males

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ABSTRACT

Background: The significant research gap on Latino adults who completed substance abuse treatment (SAT) impacts the provision of substance use prevention and treatment for this population. Given the need for culturally-appropriate SAT for Latinos, research that examines the role of cultural constructs and acculturation in relation to substance use behavior is warranted.

Objective: Based on the social control theory, the purpose of the present study is to examine the role of Familismo and acculturation on the association between history of family conflict and years of substance abuse on Latino males in recovery from substance use disorders.

Methods: A total of 117 Latino male participants (M age=37, 54% non-US born with a mean length of stay of 19 years in the US) who completed SAT from facilities located in the metropolitan area of Chicago completed self-report measures. A multiple moderation model using the PROCESS macro was employed to examine the moderating effect of Familismo on the association between family conflict and years of substance abuse at different levels of acculturation (i.e., cultural orientation). Generational status (i.e., immigrant, US born) and age are used as covariates.

Results: Results from the multiple moderation analysis show a significant three-way interaction (family conflict x Familismo x acculturation), indicating that participants with Latino and bicultural orientation who endorse average to high levels of Familismo have fewer years of substance abuse compared to those with US mainstream culture orientation and low Familismo.

Discussion: Findings illustrate the need for SAT that assesses for family conflict and integrates cultural aspects to reduce substance use behavior on Latino males.

KEYWORDS: Latino males; Family conflict; Familismo; Acculturation; Substance abuse treatment.

ABBREVIATIONS: SAT: Substance Abuse Treatment; ASI: Addiction Severity Index; BAS: Bidimensional Acculturation Scale; PAS: Psychological Acculturation Scale; ORS: Office of Research Services; OH: Oxford House.

INTRODUCTION

Disparities in substance abuse rates and substance abuse treatment (SAT) utilization among Latinos remain significant. National data report binge alcohol use for Latino adults was 24.1% with higher number of drinks consumed for Latinos than other non-Hispanic racial or ethnic groups. The same trend is observed among Latino men age 26-49, where 7.5% of them engaged in illicit drug use in the past month. Despite the percentage of Latinos who needed treatment in the last year (9.9%) is not significantly different from their non-Latino counterparts (9.2%), Latinos are less likely than other ethnic groups to receive substance abuse treatment (SAT) (9.7% vs. 10.2% respectively), less likely to complete SAT (odds ratio (OR)=.82; 95% confidence interval (CI) .68, .99), and more likely to experience substance use-related risk...
behaviors than their European American counterparts.8

As the Latino population increases,7 the need to identify factors that contribute to better SAT outcomes increases as well.1011 The limited literature in SAT utilization suggests that Latinos are less satisfied with treatment8 and report high rates of unmet needs (98.60% for alcohol and 90.61% for drug abuse).13 Existing SAT programs may overlook unique needs that are important for Latinos in recovery from substance use.3,14,15 Despite calls for the incorporation of cultural aspects at all different stages of substance use prevention and treatment,1 research on cultural constructs in relation to substance use behavior remains neglected.

In the Latino culture, family is the social core where cultural values and social conventions are transmitted through social learning.16 The social control theory17 posits that strong bonds with close and extended family members promote responsible behavior and discourage individuals from engaging in substance use behavior.18 However, Latinos with history of family conflict may contend with considerable strain that is associated with increased substance abuse rates.19,21 Among Latinos, males are seven times more likely to have a chronic drinking problem22 and have higher use of illicit substances than women.23 Taken together, given that family is the first and most influential institution that provides support against environmental hardships,24 research is needed to investigate the role of cultural values in reducing substance use behavior on Latino males.15,25

FAMILY CONFLICT

Empirical studies consistently suggest that family promotes a safe environment where individuals learn self-regulation and socioemotional skills.20 Research also suggests the link between families characterized by hostility and poor nurturing and substance abuse.21 Individuals with a history of family conflict are more likely to engage in alcohol and substance abuse,28,29 and have higher alcohol and drug relapse.30 The limited literature on Latino families suggest that family conflict is associated with an increased risk of anxiety and distress31 that may lead Latinos to engage in substance use behavior as a coping mechanism. A recent study conducted on 446 Latino adults who completed SAT found that reduced family conflict led to decrease substance use behavior pre- and post-treatment.32 These findings support the need for research on cultural factors that contribute to reduce substance use behavior.

FAMILISMO AND ACCULTURATION

Familismo remains as a fundamental cultural value for most Latinos.33 Main aspects of this cultural construct are feelings of mutual obligation, reciprocity, and solidarity towards one’s family members.34 While Familismo has been found to reduce substance abuse, protect against environmental factors, and negative mental health outcomes,7 it has been noted that these family dynamics are dysfunctional it can increase the risk for using alcohol and drugs.19,35 However, endorsement of familismo in Latinos may fluctuate as a result of the acculturation.21,34,36 Through a comparative cognitive exercise expressed through language or attitudes, individuals shape their perception of the world, others, and self by adopting characteristics of the mainstream culture and retain or relinquish traits of their traditional background.37 Although acculturation has been studied in relation to substance abuse outcomes on Latina/o adolescents,38,39 there are no studies that have examined the interaction between Familismo and acculturation in a clinical sample of Latino adult males who completed SAT.

THE PRESENT STUDY

The examination of cultural constructs at different levels of acculturation is needed to understand key cultural aspects that inform culturally-appropriate, evidence-based substance use prevention and treatment for Latinos.3,40,41 The current study explores the association between history of family conflict and years of substance abuse in a sample of Latino adult males who recently completed SAT. Specifically, we hypothesize that, acknowledging the role of Familismo in promoting social control,17,18 the path from history of family conflict to years of substance abuse is reduced by the moderator Familismo. As adherence to cultural values varies at participants’ level of acculturation, we also hypothesize that Familismo moderates the aforementioned association at different levels of acculturation (Figure 1). Generational status (i.e., immigrant vs. US born) and age are used as covariates. Findings from the present study will shed light on the role of Familismo and cultural orientation in reducing substance use behavior among Latino males who recently completed SAT.

METHODS

Participants

Participants for this study were recruited from substance abuse treatment facilities and community-based organizations located in the metropolitan area of Chicago. The criteria for participation were 1) identified as Latina/o, and 2) either having successfully participated in a substance abuse treatment program or having remained abstinent from alcohol and/or illicit substances. For the present study, Latino males who completed baseline assessment were included in the analysis. There were 117 Latino male participants (M_age=37 years; SD±10.3 years). More than half of
the participants immigrated from Puerto Rico, Mexico and other Central American countries (54%), with a mean length of stay of 19 years (SD±13.87 years) in the United States.

Setting and Procedure

The present study was approved and monitored by the Institutional Review Board of DePaul’s Office of Research Services (ORS). Recruitment of participants took place from fall 2009 to spring 2012 for a larger National Institutes of Health (NIH) funded study aimed to examine recovery homes for Latinos in recovery from substance abuse.42,43 A cadre of bilingual/bicultural recruiters and research assistants collaborated in the outreach, recruitment and assessment of Latina/o participants. Research assistants utilized Internet search engines (i.e., Google, Yahoo) and state wide databases of health services and mental health providers to generate a list of substance treatment programs, hospitals, and community-based agencies servicing Latinos. The outreach strategy consisted of contacting these sites via phone and email to introduce the study. A team of Oxford House alumni, two of them Latinos, worked to establish ties with staff and potential participants at various treatment centers. Recruiters provided information on community-based recovery home options, described the nature of the study to potential participants, and facilitated the interview process. All participants were given an explanation about the nature, purpose and goals of the study before signing consent forms. Participants were interviewed in their language of preference (i.e., English or Spanish). Interviews took place at treatment facilities, a private location within an Oxford House, or at DePaul University’s Center for Community Research. After completing the interview, participants received $30 as a compensation for their participation.

Measures

Demographics: A demographic questionnaire was used to collect participants’ age, gender, place of birth, treatment setting, and country of origin. Participants were asked to report their place of birth and were assigned either to the immigrant or US born group. We determine to place Puerto Ricans who were born in the island in the immigrant group despite being US citizens by birth. Our rationale is that Puerto Ricans, who were born in the island endorse traditional cultural values and norms similar by birth. Our rationale is that Puerto Ricans, who were born in the island in the immigrant group despite being US citizens by birth.

Family conflict: The addiction severity index (ASI), 5th Edition44 assesses problems during the individual’s lifetime and during the 30 days prior to the interview in seven areas: alcohol use, drug use, illegal activity, interpersonal and family relations, medical problems, employment, and psychiatric problems. English and Spanish versions of the ASI were used, depending on participants’ stated language preference. The 5th Edition of the ASI has been used with Latino participants in several large studies and yielded strong psychometric properties.14,45,46 The Spanish translation was back translated and pilot tested prior to undergoing a validation study.47 Correlations for the test-retest reliability of the English and Spanish versions of the ASI range from .80 to .90. For the present study, a composite of family conflict lifetime was derived from items measuring conflict with father, mother, sibling, spouse/significant other, and children. An example of these items is the following: “have you had significant periods in your life which you have experienced serious problems with your father?” Participants responded no=0, yes=1, or N/A=not applicable. A composite was created by obtaining the sum of “yes” answers divided by the sum of “yes” and “no” answers; the N/A answers were not included in the composite as some of these relationships many not apply to them. In addition, the mean years of substance abuse was computed using the mean of alcohol use to intoxication, heroin, cocaine, marijuana, and amphetamines lifetime. High scores indicate greater problem severity.

Acculturation: A composite of acculturation was computed using the scores from the Non-Hispanic and Hispanic subscales of the Bidimensional Acculturation Scale (BAS)48; and the mean score from the Psychological Acculturation Scale (PAS).49 The Non-Hispanic subscale was reversed as to have both composite scores following the same direction. Mean scores from the Hispanic and non-Hispanic subscales of the BAS as well as the mean of the PAS were standardized (converted into z-scores) to resolve the discrepancy created by the use of different Likert scales. Below there is psychometric data on the measures used for the composite of acculturation.

The bidimensional acculturation scale for hispanics (BAS)48: The BAS is a 24-item, 4-point Likert-type (1=low or not well to 4=high or very well) self-report measure of English and Spanish use as a proxy for acculturation. Three subscales measure language use, linguistic proficiency, and use of electronic media subscales in both Spanish and English. An item sample of the language subscale includes “how often do you speak English?”. The Hispanic and Non-Hispanic domain scores are derived from the total scale, where scores higher than 2.5 suggest high acculturation. Good to high internal consistency (α=.81-.97) and high correlation with other behavioral measures of acculturation, such as generation in the US and proportion of life spent in the US are reported.48

The psychological acculturation scale (PAS)49: The PAS is a 10-item, 9-point Likert-type scale (1=only with Latinos to 9=only with Anglos) self-report measure that assesses sense of attachment to and belonging within the US and Hispanic/Latino cultures. An item sample includes “with what group of people do you feel you share most of our beliefs and values?”. A mean total score is derived from the scale, where a score of 5 indicates bicultural orientation. Both the English and Spanish versions of the PAS have good internal consistency (α=.90 and .83) and correlate with language and cultural preferences, along with percentage of life spent in the US and measures of cultural values.50 The PAS has been used with a sample of Mexican Americans, Central Americans, and South Ameri-
cans and has been found to be correlated with both the proportion of life spent in the US and measures of cultural values.  

**Familismo:** The Familismo scale is an 18-item, 10-point Likert-type (1 = strongly disagree to 10 = strongly agree) measure that assesses aspects of Latino familial values. Four subscales (familial support, familial interconnectedness, familial honor, and subjugation of self to family) measure adherence to Familismo values. An item sample of the familial interconnectedness subscale includes “a person should cherish the time spent with his or her relatives”. A total score was derived from the sum of the item responses, with high scores demonstrating endorsement of Familismo. Good internal consistency (α=.83) and validity (i.e., correlations with measures of acculturation, generation in the US, and proportion of life spent in the US) was reported with a sample of Latino adults.

**RESULTS**

Preliminary analysis, using pairwise deletion to address the issue of missing data, were conducted to determine descriptive statistics. The final sample used for the model analysis was 117 participants (n=54 US born, n=63 non-US born), with a mean age of 37 years. Bivariate correlation analysis was conducted between history of family conflict and years of substance use to determine directionality and strength of the hypothesized association. Results from the correlation analysis indicate that family conflict was positively correlated with years of substance use (r=.23, p<.05), and negatively correlated with age (r=-.33, p<.01). Familismo was positively correlated with years of substance use (r=.20, p<.05). Being born in the US was positively correlated with acculturation or affiliation to the US mainstream culture (r=.74, p<.01) and negatively correlated with age (r=-.20, p<.05). Acculturation, in turn, was negatively correlated with age (r=-.28, p<.01). Means, standard deviations, and intercorrelations for all study variables are presented in Table 1.

A moderated regression was employed using the PROCESS macro for SPSS to test (a) the effects of history of family conflict and Familismo in predicting years of substance abuse after controlling for country of origin (Model 1), and (b) a multiple moderation model (Model 3) such that the relationship between family conflict and substance abuse was moderated by Familismo at different levels of acculturation. The PROCESS macro, a path analysis approach that estimates moderation models using an ordinary least squares regression, has the ability to generate the conditional effects and produces a table of estimated values of the outcome at different values of the predictor and moderator. Interaction plots were utilized to illustrate the contribution of Familismo to years of substance use at different levels of Acculturation (i.e., Latino orientation, bicultural orientation, US mainstream culture orientation).

First, a moderation model was used to test the role of Familismo as moderator of the association between history of family conflict and years of substance abuse at different levels of Familismo. Generational status and age were included as covariates. Results showed that history of family conflict predicted years of substance abuse (b=30.49, SE=13.19, p=.02). Moderation was supported, as the cross-product term of family conflict and Familismo was significant for years of substance abuse (b=4.57, SE=1.71, t=2.67, p<.01). ∆R²=.055, F(1,111)=7.13, p<.01. Note that the beta coefficients are unstandardized. The PROCESS macro produced the conditional effect of family conflict on years of substance abuse at values of the moderator Familismo. For Latino males who endorsed low Familismo scores (-1SD=6.56), history of family conflict was not related to years of substance abuse. Participants who endorse average (M=7.63), and high Familismo scores (+1SD=8.70), history of family conflict significantly interacted with Familismo to predict fewer years of substance abuse. The conditional effects of history of family conflict on years of substance were stronger in magnitude and significance for participants who endorse high values of Familismo (effect=-9.27, p<.001) compared to those who endorse average levels of Familismo (effect=-4.39, p=.02). The Johnson-Neyman regions of significance indicated that the moderation was significant.

Then, a multiple moderation analysis was tested to examine Familismo as moderator of the association between history of family conflict and years of substance abuse at different levels of acculturation (i.e., cultural orientation). The proposed hypothesis was supported as the result from the multiple moderation model testing the conditional effect of the interaction family conflict and Familismo at different levels of acculturation was significant (b=6.36, t=2.17), ∆R²=.042, F(1,107)=4.71, p=.03.

<table>
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<th>Measure</th>
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<td>--</td>
<td>--</td>
<td>--</td>
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Table 1: Correlations, means, and standard deviations for the study variables.
The PROCESS macro generated the conditional effect of history of family conflict X Familismo interaction on years of substance abuse at different levels of acculturation. For participants with low acculturation (i.e., Latino orientation) and bicultural orientation, a reduction in years of substance abuse and history of family conflict was significant at average (M=7.64) and high values (+1SD=8.70) of Familismo (Figure 2). Specifically, the conditional effect of history of family conflict on years of substance abuse is stronger in magnitude and significance for Latino males with Latino orientation who endorse high values of Familismo (effect=-13.76, \( p<.001 \)) than those endorsing average values of Familismo (effect=-5.43, \( p=.03 \)) (Figure 3). The same pattern is observed among Latino males with bicultural orientation, where conditional effects are stronger magnitude and significance for participants who endorse high values of Familismo (effect=-7.76, \( p=.003 \)) than those with average levels of Familismo (effect=-4.08, \( p=.02 \)) (Figure 4).

**DISCUSSION**

The primary purpose of the present study was to explore the moderating role of Familismo and acculturation in the association of history of family conflict with years of substance abuse in a sample of US Latino males, who completed SAT. First, we tested a moderation model where the path from history of family conflict to years of substance abuse varied at different levels of Familismo. Second, we tested a multiple moderation model to evaluate the moderating role of Familismo in the association of history of family conflict with years of substance abuse at different levels of acculturation (i.e., cultural orientation). Results from the moderation and multiple moderation models support the proposed hypotheses and illustrate the mechanism through which cultural orientation and Familismo moderate substance use behavior on Latino males.

First, the findings from the moderation analysis indicated that the association between history of family conflict and years of substance abuse decreased as participants endorsed average to high values of Familismo, after controlling for age and generational status (i.e., immigrant, US born). Results from the multiple moderation analysis indicate that, among participants with Latino and bicultural orientation, the conditional effect
of the interaction between history of family conflict and years of substance abuse decreases at average and high values of the moderator Familismo. Specifically, the conditional effect of history of family conflict on years of substance abuse was stronger in magnitude and significance for participants with Latino and bicultural orientation who endorse high Familismo as compared to those with Latino and bicultural orientation who endorse average Familismo.

The most significant contribution of the present study are the findings illustrating the interaction between higher-order constructs (i.e., Familismo) and cultural orientation in decreasing substance use behavior on Latino males who completed SAT. These results expand on previous research on family conflict and substance abuse among Latino adolescents and Latino adults who completed SAT by including Familismo and cultural orientation as moderators of the above association. Results from the present study also support the social control theory in that high endorsement of Familismo may promote strong ties with family members, promoting behavior that is coherent with Latino values.

Lastly, results from the present study are partially supported by acculturation studies that found endorsement of Latino orientation to be a protective factor for substance abuse. It appears intuitive that participants with Latino orientation (including those with bicultural orientation) are likely to endorse higher values of Familismo, a traditional value that shapes and it is influenced by social conventions. It is plausible that participants with strong Latino orientation and high endorsement of Familismo would engage in cognitive dissonance, which refers to the stress perceived by an individual who is conflicted with two or more contradictory beliefs or values. Cultural values may generate distress proportional to the degree to which the value is endorsed by the individual. In other words, participants with strong Latino orientation are more likely to reduce the dissonance generated by family conflict through the endorsement of thoughts promoting family loyalty and support. The same mechanism, but to a lesser extent, was observed on participants with bicultural orientation. Of note, although most participants’ responses on the Familismo scale fall around the mean (M=7.63 on a 1 to 10 Likert scale; SD=1.07), cognitive dissonance appeared to increase on participants as a function of their cultural orientation. That being said, it is plausible that individuals holding on to traditional values (i.e., Familismo) are less likely to endorse culturally conflicting perceptions or values. On the contrary, participants who are less affiliated to the Latino culture and more affiliated to the US mainstream culture may endure more cognitive dissonance as they endorse conflicting values.

LIMITATIONS

The findings from the present study should be viewed in consideration of the following limitations. First, the small sample precluded us from using other variables of interest in the analyses. Second, data was collected from a mostly male alcohol and drug user sample and thus, gender comparisons could not be made. Third, although generational status was used as a covariate, further studies should explore generational differences in the association between family conflict and substance abuse. Fourth, other sources of conflict or distress (i.e., trauma) that may contribute to increased substance use behavior needs be examined. Fifth, the cross-sectional nature of the study did not allow for establishing causal inferences. Lastly, most participants were from Puerto Rican and Mexican background, which may limit generalization of findings to other Latino subcultures.

In order to develop sustainable and effective SAT programs, more research is needed to understand the underlying process through which cultural constructs promote reduced substance use behavior on Latinos. Specifically, substance use models that include cultural constructs and acculturation are needed to inform and develop culturally-tailored substance use prevention and treatment for Latino subgroups. From a community-centered approach, the use of values that are part of the Latino culture not only increases the odds of treatment adherence and completion, but it also empowers communities. In this vein, Latinos in recovery from substance abuse disorders may benefit from community-based recovery programs that utilize community assets. Our findings suggest that screening and assessing substance use should be complemented with the assessment of family conflict, cultural orientation, and key cultural constructs (i.e., Familismo, collectivism). The information gathered at pre- and post-treatment may be used for research as well as to inform SAT providers on important aspects to address in their clients’ aftercare plan. These results provide researchers, substance use counselors, and policy makers with a better understanding of the mechanisms through which Familismo and cultural orientation reduce substance abuse. In sum, our findings suggest that incorporating cultural aspects into treatment and in follow-up assessment may help in the prevention and treatment of substance use behavior on Latino males.

ACKNOWLEDGMENTS

The authors appreciate the financial support from the National Institute on Alcohol Abuse and Alcoholism (NIAAA grant numbers AA12218 and AA16973). We also appreciate the revolving loan funds and support provided by the Illinois Department of Alcohol and Substance Abuse.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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