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Childhood Immunization Coverage and Challenges: United States vs. Latin America

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Introduction:

All countries are classified, for analytical purposes, into three broad classifications, based off a country's economic condition.[1]. The World Economic Situation and Prospects (WESP) is responsible for these classifications. The gross national income per capita (GNI) is the measurement used to classify a county's economy: as developed, in transition or developing. The United States is an example of a country that is considered developed, while the countries of Central America are all considered developing.[1] This classification system is useful; however, it may not provide great insight into the health of a nation's population. Good health of a country's population directly effects its economy due to increase in productivity.[2] One of the ways a country can help decrease illnesses is by implementing childhood vaccination programs.

In 1974 the World Health Organization (WHO) realized the importance of vaccinations and established the Expanded Program on Immunization (EPI); with the goal of making vaccinations readily available for children worldwide. In 1977, the Pan American Health Organization (PAHO) established its own EPI for the region.[3] This region includes North America, Central America, Caribbean and South America. The first six targeted vaccine preventable diseases (VPDs) were diphtheria, whooping cough, tetanus, measles, poliomyelitis and tuberculosis.[3] These VPDs were prioritized based on their overall threat to public health and the ability to prevent them.[4] In 1984 the EPI created the first standardized vaccination schedule which recommended the following four vaccines against six diseases: tuberculosis (BCG), diphtheria, tetanus, and pertussis (DPT vaccine), measles (MMR) and poliomyelitis (IPV).[5] The DPT and polio vaccines both have a three-dose series, while the MMR vaccine is a two-dose series. Overtime changes have been made to vaccination schedules and new vaccinations have been recommended. In 2011 the Global Vaccine Action Plan (GVAP) was launched by the

immunization community to help set forward a plan to prevent VPDs through 2020. Overall the EPI in the Americas has been a major success.[6]

Since the implantation of the EPI in the Americas in the 1970s the immunization coverage has increased from 50% to 80%. The Americas have also become the first region, worldwide, to eliminate poliomyelitis.[6] In 2015 and 2016 this region was declared free of measles, rubella, congenital rubella syndrome and in 2017, neonatal tetatnus.[6] The initiative of PAHO has immensely contributed to the decrease in childhood morbidity and mortality due to VPDs. With that being said there is still more work that needs to be done in this region.

The PAHO still must tackle many challenges that hinder its ability to vaccinate all children in this region. These challenges include vaccine hesitancy, access to vaccinations, inadequate health care practices and cost.[6] The Americas still remains one of the most inequitable regions in the world and there are still millions of people that are unable to access health services.[7] Vaccine hesitancy which is defined by the WHO as a "delay in acceptance or refusal of vaccines despite availability of vaccination services", has become such a problem that the WHO has declared it as a top ten global health threat.[8] Countries in this region must also make sure that their health care providers are up to date on information related to vaccines. This includes vaccine contraindications and vaccination schedules as well as ensuring their patients are educated on vaccines. These challenges, if not addressed can lead to lower childhood vaccination rates which can leave a population more susceptible to VPDs.

Due to the recent short-comings of childhood vaccination rates, prevalence of VPDs in the Americas are on the rise. Herd immunity is a societal benefit that occurs when a large portion of the population is immune to a disease which protects people who are not immune.[2] When immunization coverage for a VPD falls below are certain percentage, herd immunity is more

likely to fail. This was recently observed when MMR coverage fell in the United States which allowed for measles to find its way back to the US after being declared eliminated in 2000.[8] It is important to address barriers that prevent children from receiving vaccines so that solutions can be implemented accordingly.

The goal of this paper is to analyze how the developing region of Latin America, with a focus on Central America, fairs in comparison to the United States regarding childhood immunizations against the six original VPDs. Furthermore, this paper will analyze the recent drop in immunization coverage in Pan America and some of the barriers these countries face which hinder their abilities to vaccinate all children. Lastly, probable solutions will be explored to address some of the challenges these countries face in implementing childhood vaccines.

Background:

Immunization Rates

Every year the WHO/PAHO release a summary of vaccination information of all the countries they monitor. The most recent summary is the 2018 comprehensive family immunization brochure which analyzes the immunization coverage of 2017. The WHO has a recommended vaccine schedule that they put out and update consistently as a guideline that each country can use as a reference.[9] DTP3 immunization coverage is often use as a measurement tool to gage how well a country is doing in regard to vaccinations, the goal is at least 90% coverage. Vaccinations against all of the original six VPDs are recommended to be started by the age of one, MMR vaccine can be started at nine or twelve months. Therefore, all the data on these vaccinations are of children one-year-old and younger.

In the United States the percent of coverage in 2017 for DTP3, MMR1, and IPV1 was 95%, 92%, and 97% respectively.[10] There is no data on the BCG vaccine because it is not

recommended in the United States. In Central America DTP3 coverage was 90% or above in Honduras, Nicaragua, and Costa Rica and lower than 90% in Belize, El Salvador, Guatemala and Panama.[10] MMR1 coverage was 85% and 86% in El Salvador and Guatemala respectively, while the other countries achieved coverage of 90% or higher. El Salvador had an IPV1 coverage of 82% while all of the remaining Central American countries achieved 88% or better percentage. BCG vaccine coverage was 90% or better in all Central American countries except El Salvador and Guatemala, 83% and 81% respectively.[10]

Challenges: Vaccine Hesitancy

Recently, in the region of Pan America an overall drop in DTP3 coverage has been observed. The PAHO has reported that coverage fell from 91% in 2016 to 88% in 2017, indicating that almost 1.8 million children under the age of one did not receive their complete vaccination. One of the factors thought to contribute to this is vaccine hesitancy (VH). VH can be thought of as a problem that falls on a spectrum, which on one side comprises people who fully accept the importance of vaccinations to the other side of outright refusers and everyone else falls in between.[11] In the US Immunization rates are good but there has been an increase in unvaccinated children under the age of two.[12] One of the factors that has contributed to VH, especially in the US, is the spread of false information. A catalyst for vaccine misinformation to spread happened when a British doctor, Andrew Wakefield, published an article linking the MMR vaccine to autism, which was later retracted.[12] Not only that instance but also prominent influencers from actor Jim Carey to the President of the United States, Donald Trump, has expressed misguided concern about the safety of vaccinations. This kind of false information has contributed to the public's confusion about vaccine safety.[12]

With social media having the outreach it has it makes it easier for falsified information to spread, unchecked. It was found that VH parents were more likely to be influenced by false vaccine information found online.[8,12] There is not much data about the impact of VH in Central America. However, with the increase availability of internet in the region there has been informal reports of growing anti-vaccine attitudes amongst people in parts of Latin America.[13] Overall the PAHO has found that in Latin America vaccines are viewed as a public good and a political priority.[13]

Challenges: Access

Despite increased access to health care in the Americas, there is still huge access inequalities. These inequalities can be due to many reasons such as wealth distribution, geographical barriers, and lack of health care services. Between 2014-2015 it was estimated that 1.2 million deaths could have been prevented in the Pan American region if health systems were more accessible.[14] In the Americas 30% of the population still do not have access to health care because of financial reasons, while 21% do not have access because of geographical barriers.[7] It is reported that 20% of children, under the age of one, who have DTP coverage lower than 80%, come from countries in the region that are in the lower income quartile.[15]

Access to health care services at a subnational level presents as an ongoing challenge in the US as well as Central America. In the United States and in Panama, it is estimated that access to physicians in urban areas is 80 percentage points higher than in rural areas.[14] The United States has 86% of their population covered by health insurance but they have the biggest discrepancy between coverage in regard to the wealthiest and the poorest of households.[14] However, only 1.9% of households in the US reported access barriers as the reason for lacking health care services.[14] While countries like Guatemala attribute differences in vaccine coverage,

at a municipality level, to longer clinic distances and availability of vaccines.[16] Due to the discrepancies in health services at the subnational level, many countries in the region have DTP3 coverage rates way lower than what they are reporting nationally.[10]

Challenges: Health care Providers

Health care providers play a pivotal role in ensuring patients receive vaccinations. Not only do health care providers administer vaccinations, it is their responsibility to also educate the populous on the importance of vaccinations. It is imperative that patients trust their providers so that they comply with what is recommended. However, health care providers sometimes fail to provide understandable information on vaccines.

With the rise in vaccine hesitancy, especially in the United States, it is important practitioners build a trusting relationship with their community, making the population more inclined to follow their medical advice. In the United States trust in institutionalized medicine is low and the relationship between provider and parent is changing.[12] Parents are now getting used to a shared-decision-making model with their pediatrician which can lead to problems.[12] One observational study compared the approach a provider used, regarding vaccinations, as "presumptive" (i.e., "Johnny has some shots today") or "participatory" (i.e., "What do you think about Johnny's shots today?"). The results showed that when a provider used the participatory approach, parents were more likely to resist the vaccination reccomendations.[12] There is little data on parent and provider relationships in Central America, however, studies in Guatemala and Panama show an overall patient/parent satisfaction and a positive attitude toward vaccinations.[13,16]

Health care provider's practices are not always up to acceptable standards, which can lead to missed opportunities for vaccination (MOV). MOV can be defined as an instance when a

child is eligible for vaccination during a visit but does not receive one. One of the reasons for MOV is because a provider fails to remind the parent that their child is due for a vaccination. Two studies done in New York and Denver showed that 82.2% and 80%, respectively, of vaccine eligible visits resulted in MOV.[11] In the Denver study they found that 29% of the MOV was due to providers lack of vaccination recommendation.[11] It is estimated that around 89% of all unvaccinated children could have been vaccinated if they received the proper recommendations and education on said vaccine.[11]

In Central America health provider's practices and protocols present a serious problem, especially in poor areas, leading to a decrease in immunization coverage.[17] A recent study that aimed to analyze MOV in Central America, found that there was a reluctance to administer vaccines due to false contraindications and inadequate knowledge of the vaccination schedule.[17] Physicians in this region self-reported knowledge of vaccine contraindications, however, were still hesitant to administer vaccines when the vaccination was not contraindicated.[17] Furthermore, this study indicated that providers may not be paying attention to vaccination records which may lead to MOV.[17] In Guatemala, patients reported lack of knowledge regarding immunization services.[16] This shows that failure of health providers to educate patients on vaccines being administered as well as vaccination schedules can lead to parents becoming confused and uncertain about their child's next vaccination.[17] In Panama, it was discovered that a high percentage of MOV were due to false contraindications.[13]

Challenges: Cost

The cost of any good must be weighed against the benefits, and that is especially true for vaccinations. It is globally accepted that administering vaccines improve population health which leads to economic gains, through illnesses adverted as well as increased productivity.[2,6]

Developed countries have an easier time implementing new vaccinations because of their increased wealth, which allows for more resources to help compare the cost and benefits of vaccinations. It has been shown that in developing countries, vaccine implementation can generate a return on investment of 16 times the cost.[18] Furthermore, research shows that for every US dollar invested in childhood vaccination will produce a net return of 44 US dollars.[19] However, implementing new vaccines still remains a challenge for developing countries.

Developing countries that are in the lowest income brackets have additional resources from outside sources that developing countries in middle income brackets do not qualify for.[1,19] The countries of Central America do not qualify for these external resources so funding for new vaccines can be hard to acquire.[19] Prices of new vaccines are especially high, but tend to lower over time, so middle income countries usually have a delay in implementing them, regardless of the long-term return on investment.[20] Vaccines do not have a set return on investment that translates equally between countries because each VPD affects a nation differently based on overall disease burden.[18] This presents as a challenge to developing Central American countries because they lack data on the disease burden for a lot of VPDs.[21] This makes it hard to compare the cost of an illness to the cost and benefit of implementing a new vaccine.

Methods:

A literature search was conducted using PubMed, World Health Organization database and the CDC to gather information on vaccines and immunization coverage in Latin America, and in the United States. Key words included, “immunization coverage”, “vaccines in the Americas”, “vaccine preventable diseases”, “vaccine hesitancy”, “country classifications” and “childhood vaccinations”. Parameters for the inclusion of articles included, full length articles,

relative data within the last ten years and in English. A total of 22 articles, editorials and journals were used to conduct this literature review.

Discussion:

Categorizing countries based on their economies may give insight into the wealth of a country but does wealthier mean better health? The goal of this paper was to examine the health regarding childhood immunizations in the United States compared to Latin American countries, with a focus on Central America. Furthermore, with a recent drop in childhood immunization coverage in the Pan American region, this paper analyzed barriers that these countries face in vaccinating all of their children.

Despite being the only developed country in the Pan American region, the United States does not rank at the top in immunization coverage for any of the VPDs that were analyzed. Updated standards and results regarding the first dose of a polio vaccination found that the United States ranked fourth out of the eight countries that were investigated. The US ranked fifth in MMR1 immunization coverage in comparison to the countries of Central America. Lastly, the United States ranked third for DTP3 coverage. It is important to note that all seven of the Central American countries still administer BCG vaccine. However, because the US does not have a high risk of childhood tuberculosis, they no longer have to include the BCG vaccine in their childhood immunization recommendations. Pertaining to immunization coverage, this literature review suggests that one cannot assume that developed countries fair better than poorer countries. With this, the US and Latin America face barriers that impede their abilities to vaccinate all children.

Vaccine hesitancy is now considered one of the biggest threats to global health. This paper found that this phenomenon affects countries differently. The limited data in Latin America indicates there is a strong support for childhood vaccinations; on the contrary the US

struggles in the deterrence of VH. In the United States the phenomenon of "fake news" is especially prevalent due to the influence of social media. Social media allows for information to spread faster than ever before, making it impossible to reliably fact check the resources that are out there. Additionally, prominent public figures within the US have questioned the safety of vaccines, with some even recommending more holistic approaches.

The United States is now paying the price for vaccine hesitancy with the recent measles outbreak throughout the nation. According to the CDC, as of July 18, 2019, there has been 1148 reported cases of measles throughout 30 states. While in Central America there has not been one reported case of measles. However, it is important to note that some countries in Central America have lower MMR coverage than the US, so one may be confused as to why there is not any measle breakouts in that region? It is thought that either there has been missed reporting on possible measle cases or there is just a lower coverage rate needed to achieve heard immunity.[17] Access to vaccinations is another barrier that decreases immunization coverage.

The United states has made headway in ensuring that more people are covered due to the Affordable Care Act (ACA), allowing more people to be insured. This legislation made it possible for millions of people to gain access to health services that were not accessible before. However, health service disparities still exist between the rich and the poor in the United States. Inequalities in accessing health services is also observed in Central America.

The US and countries of Central America have more health care providers in urban settings than rural areas. This affects developing countries more because they have less resources, meaning fewer personal vehicles and less access to public transportation. The consequences of this was observed in Guatemala which showed in areas where there were longer distances to the clinic meant lower immunization coverage.[16] The analyzed literature and research suggests that

geographical barriers do not seem to have as big as an impact on immunization coverage in the US. Both the region of Central America and the United States can improve their health care provider's practices, regarding vaccines.

In Central America and in the US, health care providers contribute to the problem of MOV. In Central America MOV were attributed to providers believing in false contraindications, even though they reported that they were knowledgeable regarding vaccines. In the United States one study showed that providers just out right forgot to tell the patient that they were due for a vaccination.

In the US, parents play an integral role in the decision making regarding the vaccination of their children. In part, this is due to providers allowing parents to interject by using "participatory" language instead of being "presumptive". This type of problem is less prevalent in Central America due to the overall strong and positive attitudes towards childhood vaccinations. Both the US and Central America need to ensure that patients are receiving the vaccine related education that is necessary. By doing so, it will reduce the risks and rates of miscommunications and, in turn, lower occurrence of MOV.

If done correctly, vaccine implementation has a positive impact on generating a net return in investment. Both the United States and Central American countries benefit monetarily from investing in vaccines. These countries see a net return on investment because of decreased costs from VPD related illnesses as well as gains in economic productivity. The research indicates that lower and middle-income countries benefit the most from the implementation of childhood vaccinations. However, challenges still exist in these countries because of the cost of new vaccines are high. Middle-income countries, like the ones that comprise Central America, struggle to introduce new vaccines because of funding. Developing countries must make sure

that they have estimated the overall disease burden before the implementation of the vaccine for a specific VPD. This will ensure that an overall benefit from introducing a new vaccine will be observed.

Challenges still lie ahead in ensuring higher childhood immunization coverage for these countries. However, many solutions are being explored to tackle these barriers. Recently, in the United States, the president of the American Academy of Pediatrics, Kyle Yasuda, reached out to Facebook, Google and Pinterest regarding the spread of vaccine misinformation.[8] In doing so Facebook has already announced that it will be removing pages and posts that promote an anti-vaccine rhetoric.[8] This is very important because it will help stop the spread of false information in the US, as well in developing countries where more people are gaining access to the internet.

The Global Vaccine Action Plan is another initiative that has been put into place to ensure childhood vaccinations get the attention it needs and deserves. This initiative is making sure that each country is held accountable in vaccinating its youth. Every year there is an assessment released to show how countries are doing on a global scale.[22] This initiative is important because it allows countries to see targets that they should aim for and guidelines they can follow that can aid in improving their childhood immunization programs. The GVAP is great for developing countries so they can see the data and change current programs accordingly.

Data is very important in helping effectively integrating vaccines. Surveillance programs must be implemented and updated to better track VPDs.[4] A country cannot successfully introduce new vaccines or change vaccination policies without knowing the effects VPDs are having on its' population.[4] Surveillance programs are also important in tracking breakouts so populations that are effected can be contained, like seen in the recent measles outbreak in the US.

Central American countries would benefit from updating surveillance programs to better track information on VPDs so they can allocate their limited resources accordingly.

Conclusion

Vaccines are a cost-effective method to help promote the health of a nation. It cannot be presumed that a developed country has higher standards in health services when compared to that of a developing country. This literature review indicates that in terms of immunization coverage, the US does not rank superior when compared to the developing countries of Central America. Both the United States and Latin America face challenges that impedes childhood vaccinations. These problems include vaccine hesitancy, access to health services, health care provider complacency and cost. Negative attitudes towards vaccines seem to present the US with its biggest challenge regarding childhood vaccines. While more resource driven barriers effect developing countries, in terms of decreased immunization coverage. Fortunately, initiatives are being implemented and research is being conducted in order to tackle these challenges. It is imperative to keep prioritizing childhood vaccines so that countries around the world, whether developed or developing, can reap the benefits of immunizations.

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