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MANAGEMENT OF HAV IN COUNTRIES UNDER CONFLICT: PALESTINIAN CASE AS A COST – CONSEQUENCES ANALYSIS

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Abstract

It is known that Hepatitis A is not a dangerous virus if individuals are infected by in early age, while it may be of high risk if individuals are infected after that, specially when there is a positive improvement in the hygiene around, that to say as hygiene gets more clean and health the probability of being infected in early age gets lower, which imply that individual may be under risk in future, Occupied Palestinian Territory (oPT) demonstrates a downward incidence rate of HAV up to the year 2002, when in this year a reverse trend commenced to instigate. This turning point re-opened the discussion on the feasibility, and efficiency, of introducing a vaccination programs against HAV, as this new trend was associated with a severe deterioration in the hygiene and all related socioeconomic conditions, the study aims to introduce an economic analysis of the most affordable, and economically-efficient, alternative to be adopted to manage HAV in the oPT. Based on cost-consequences analysis conducted from the societal perspective, the results show that an incremental strategy can serve well the Palestinian case; and we can say that A national strategy to incorporate HAV vaccine in the vaccination programs of the Ministry of Health according to a justified scope of priorities and coverage will assist in the process to prevent and control Hepatitis A through vaccination and improving the overall health conditions of the society.

ملخص

من المعروف أن مرض الالتهاب الكبدي الوبائي أ ليس من الأمراض الخطيرة إذا ما كان الأفراد الذين تعرضوا للإصابة في سن صغيرة، لكن خطورته تزداد إذا حدثت الإصابة فيما بعد مرحلة الطفولة. فإذا ما كانت الظروف الصحية جيدة في المرحلة العمرية الأولى قلت إمكانية الإصابة بذلك المرض بينما تزداد قابليته للإصابة بذلك المرض في المستقبل. وقد كانت معدلات الإصابة بالالتهاب الكبدي الوبائي أ منخفضة في الأراضي الفلسطينية المحتلة حتى عام 2002، ثم بدأ المرض ينتشر بعد ذلك التاريخ. وأدى ذلك الانتشار إلى بدء الحديث عن جدوى تقديم برنامج للتطعيم ضد مرض الالتهاب الكبدي الوبائي وفاعلية هذا البرنامج حيث صاحبت تلك الفترة تدهور خطير في الظروف الصحية وكذا كافة الظروف الاجتماعية والاقتصادية. وتهدف الدراسة ذات العلاقة إلى تقديم تحليل اقتصادي عن البديل الأقل تلكفة والأكثر كفاءة من الناحية الاقتصادية للتعامل مع مرض الالتهاب الكبدي الوبائي أ في الأراضي الفلسطينية المحتلة.

وقد أجريت دراسة تحليلية على أساس احتساب تكلفة النتائج من منظور اجتماعي، كان من نتائجها أن اعتماد استراتيجية تزداد فيها تكاليف الرعاية الصحية يمكن أن تناسب الحالة الفلسطينية. حيث يمكننا القول بإن إضافة تطعيم الالتهاب الكبدي الوبائي أ إلى برنامج التطعيمات في وزارة الصحة الفلسطينية طبقاً للأولويات المبررة سوف تساعد في عملة الوقاية والقضاء على الالتهاب الكبدي الوبائي أ من خلال التطعيم، وتحسين الظروف الصحية بشكل عام في المجتمع الفلسطيني.

I. Introduction

According to current health reports, Hepatitis A Virus (HAV) is one of the most widespread diseases in different countries around the world, regardless of their development level. Approximately 1.5 million cases are being reported annually and Palestine is no exception. Evidence from the surveillance system in the Occupied Palestinian Territory (OPT) demonstrated a downward incidence rate of HAV until 2002 when the reverse trend started. This was associated with deterioration in the socioeconomic and hygienic conditions of the OPT, mainly following the Israeli army incursion into main Palestinian cities and towns during 2002. The new trend re-opened the discussion on the feasibility, and efficiency, of introducing a vaccination program against HAV, and its modality. HAV infection is commonly harmless if it happened during the childhood period; however, it is difficult to determine who had passed into adulthood without being infected by the virus and hence becoming vulnerable to serious complications upon contracting the disease in adulthood. Such scenario is becoming plausible in many deprived areas of the OPT such as villages, refugee camps and a good part of Gaza Strip, where polluted water and uncontrolled sewage problems are becoming major public health concerns. In addition, the severe deterioration of all socioeconomic indicators and the worsening of individuals' living conditions because of the ongoing conflict complicate the picture further.

This study aims to introduce an economic analysis of the most affordable and economically-efficient alternative to be adopted by the Palestinian Ministry of Health to manage HAV in the OPT. It takes into consideration the direct and indirect costs of vaccination and the potential savings associated with different levels of its implementation. The analysis proceeds to consider the best level for vaccination strategy to be adopted given the limited resources in the Palestinian case where the continuous annual deficit reported in the government budget reaches nearly 30% of the GDP.

HAV is increasingly being reported by different countries regardless of their development level, with approximately 1.5 million annual cases worldwide. This reflects a multidimensional impact for this disease on societies over time, (Robert G. Sacy, Miran Haddad and others, 2005). International experiences reported that there are three possible epidemiological patterns of HAV in most societies; ***first***: a high prevalence of antibodies in the population from an early age as is the case in most developing countries; ***second***: a significantly low incidence level which may increase gradually with age as is generally the case in developed countries; and ***third***: a very low incidence in younger population and high prevalence in older generations, which is the case of countries that have undergone an accelerated development process over the last few decades. (Eli Schwartz, and David Raveh, 1997).

According to relevant health sources dealing with health and socioeconomic impacts and consequences of HAV on infected persons and societies, efforts were devoted to minimize the health complications of infected people, especially the elders. The economic loss of their production capacities coupled with consequences on their families and society may occur if they were not immune, (in Israel around 20% of people over 60 where found to be not immune, (Eli Schwartz, and David Raveh, 1997).

Currently, HAV became a vaccine-preventable disease in different countries with the recommended inactivated vaccine (HAVRIX, SKB) available in most medical markets around the world. This also applies to the Palestinian case, where the estimated cost of the screening test and the vaccine reaches 130 US $ (based on its price in the Israeli markets).

Because we are interested to improve the public health which will positively impact the Palestinian production and living standards, it may be important to examine the most economic alternative for dealing with HAV in Palestine. Reducing the disease incidence by

preventing transmission and ultimately eliminating indigenous HAV transmission could help improve the health of the Palestinian society which is our main goal.

From a statistical point of view, the latest available statistics from official sources show that there was a decrease in the number of reported cases of HAV in Palestine over the period 1995 – 2005. The statistics also show that around 10% of children less than 5 years old had obtained the HAV vaccine through the private sector as this vaccine is not on the official (National) vaccination list in the Ministry of Health. In addition, several sources indicate that the vaccinations increase in relation to the mother's education level. According to statistical sources at least one and half million new HAV infections occur annually in Palestine. The incidence rate of Hepatitis A has maintained the same average of 85 per 100,000 during the last 5 years up to 2006, compared with 59.3 in 2000. The majority of HAV infections still take place in early childhood, when it is asymptomatic and of little clinical significance. This result, which is based on the outcome of the Ministry of Health report 2004, refused the shifting epidemiology theory and recommended that a vaccination against HAV is not needed in the Palestinian Territory. Figure 1 represents the annual reported incidence rate of HAV disease in Palestine for the period 1996 – 2005 per 100,000.

As seen from this figure the incidence rate had a downward sloping trend before 2002, but starts an upward trend later on, possible due to the deterioration in the socioeconomic and hygiene conditions in the Palestinian Territory after the Israeli incursion to the main Palestinian cities in West Bank and Gaza Strip during that period and later. This trend reopens the discussion for the feasibility of introducing vaccination programs against HAV and what are the borders or coverage of that vaccination program? Or would it be better to adhere to the no-vaccination recommended in accordance with the outcome of the Ministry of Health's 2000 study?

The no-vaccination alternative or policy may be valid under some assumptions; that no further deteriorations will occur in the level of hygiene (environment) in the future, that natural vaccinations (occurring form usual incidence) will protect the majority of the growing population in the Palestinian Territory, and that infections from external transmission of HAV will be less probable (no risky group that may bring HAV into Palestine).

Reviewing these assumptions reveals how difficult they would be to manage given what happens in reality. The Palestinian environment has increasingly been deteriorating as a result of several internal and external factors especially in the Refugee Camps areas. The Gaza Strip water resources and sewage problems are getting worse, (in the village of Um Al Nasr in April 2007, the old sewage system completely failed and covered the whole area). That is in addition to the negative impact of sewage problems on food production related to vegetable and fruit crops in Nablus and Jericho in the West Bank area, and the probability of bringing in HAV through travelers coming in from diseased areas or Palestinians visiting those areas. In addition, and taking into account the incidence rate of HAV in Palestine, we are trying to answer the following question. Are HAV incidence levels at a high point that should be targeted by a vaccination program or are they at lower levels which may respond to direct intervention?

Future complications of HAV for elders, the difficulties in diagnosing infected persons and the cost of leaving this vaccine out of the national list, need to be examined to decide whether to include this vaccine in the Ministry of Health Vaccination list, or whether this policy recommendation is not justified.

That vaccination cost remains high would be an argument against introducing it as a national strategy, especially in developing countries like the Palestinian Territory. What then would be the best vaccination strategy to be adopted given the expected associated costs and budgets? Should HAV vaccination be included in the national program of immunization? Should children be the target group for the recommended vaccination programs? Or perhaps

vaccination strategies should target those groups who may be at a higher risk – those of 20 years or more living in shoddy environments or patients with liver difficulties or travelers in and out of the Palestinian Territory.

II. Methodology and Analysis

The paper adopts a Cost-Consequences analysis based on the Human Capital approach, which takes into account loss of productivity and education days lost, to compare savings to potential costs. The cost component is divided into direct medical and non-medical factors and the indirect cost items are assessed based on local cost data in addition to some regional and international prevalence and incidence information. Comparators are represented by no vaccination, selective and mass vaccination. Available data from official sources is organized to perform comparisons between competing HAV management strategies (comparators) through an estimation of the following list of indicators:

- Cost of no intervention as distributed by age group and region, based on the Human Capital approach.
- Cost of vaccination, without screening, as distributed by age group and region.
- Cost of vaccination with screening, as distributed by age group and region.
- Potential cost-savings for the different alternatives.

HAV is of particular importance in the Palestinian case for many reasons:

- HAV may have severe adverse consequences on those with chronic liver disease with no information showing for it on their previous health records. Such people make a significant portion in the PT.
- As food consumption is one of the primary means for the transmission of HAV, it is very important to take care of food production, service related establishments and food handlers. From our information on third world countries such as the Palestinian market we can rightfully feel worried about the health situation in this field, due to the lack of quality in the work environment, unknown goods entering the market and others threats, which all indicate a more likely area to host HAV.
- There has been an increase in the number of schools, child care centers, health care institutions, institutions for people with disabilities and the like in the last 15 years (The age of the Palestinian Authority). Those centers need a lot of work and control to have healthier environments, as any health problems in those centers may transfer the virus elsewhere.
- Another point is related to the experience of the catastrophe that happened when the sewage system destroyed a complete village. Although this may be an exception we need to address the potential risk to workers exposed to sewage as collectors and street cleaners as it can be a medium for transmission. The problem with these parties is that they treat their illness as part of the job package and it may be very difficult to examine them unless health complications manifest.
- The lack of information on the rate of immunity for the elder population and for groups under risk, beside the fact that no one can insure a 100% immunity against the disease for life.

III. Analysis Framework

For the sake of consistent analysis we follow with the basic assumptions that will serve as the borders for later analysis:

- The available incidence rate of HAV is the true incidence of HAV in Palestinian Territory as reported by the Ministry of Health.

- Death from HAV infection only occurs in hospitals as a consequence of fulminant hepatitis.
- HAV serology screening test had a sensitivity and specificity of 100%; and persons with naturally acquired immunity, or those already infected with HAV, will retain life-long protective immunity.

This paper will depend on the Cost – Consequences analysis approach, taking into account that costs for the analytical part will be classified as follow:

Direct Costs:

The economic analysis in this paper considers the costs of the vaccine (110 US $ according to Eli Schwartz and David Raveh 1997), including its administration, serology tests and medical visits. The analysis takes into account the costs of the treating HAV without complications, HAV with cholestasis and HAV with fulminant liver failure. These direct costs will be calculated according to data associated with each comparators component. The analysis will include estimates for transportation and other related costs as additional percentages to the total costs. No discounting will be performed under the assumption that the cost of HAV treatment will occur in one year.

Indirect Costs:

Productively losses will be calculated using the Human Capital approach. The working days lost will be collected according to the percentage of expected infected persons from the labor force, using the number of patients and the lost working days ranging from 4 – 20 working weeks. Taking into account the distribution of population according to age group to avoid miscalculations, I should emphasize that the illness cost for infected persons who are less than the official labor age (less than 15 years old) will be undertaken by considering the working days lost by their parents. The distribution of labor force will depend on the 2006 census and results of the Labor Force Quarterly Survey implemented by the Palestinian Central Bureau of Statistics.

Cost Distribution (Categories):

The available data from the mentioned official sources (PCBS) will be organized in a way to enable comparisons between the comparators, and it will look like:

- The cost of no intervention distributed by age group, region (depending on data availability) and the sum for the national level based on the Human Capital concept (Loss of productivity, education days per expected infected inhabitant).
- The cost of vaccination without screening in the same distribution as in previous point.
- The cost of vaccination with screening in the same distribution.
- The potential cost-savings in the different alternatives.

The criterion for selecting the best comparator is the savings in resources arising from vaccination.

Information about HAV

It is known from medical and health journals related to this issue that HAV, is named in the clinical documents as “the 27-nm RNA and classified as a picornavirus”. According to the specifications of its impacts, it can produce either an asymptomatic or symptomatic infection in individuals and it may have an incubation period of at least two weeks (up to seven weeks). It’s worth mentioning that HAV infection may cause fever, malaise, anorexia, nausea, abdominal discomfort, dark urine, and jaundice.

According to the medical clarification introduced by Dr Samia Hlaili, (direct meeting) the dangers of HAV infection is related to the age of the individual. That is to say, children less

than 6 years old will most likely have an easy pass through with no health complications; some say that 70% of infections in this age are asymptomatic; this means that if the illness occurs it is typically not accompanied by jaundice according to the experience of specialized doctors in this medical area. On the other hand, the experts are more concerned with older people as the consequences of the HAV became very dangerous to their. It should be mentioned that persons with chronic liver disease are at an increased risk for acute liver failure. In the Palestinian case we have further complications; the weaknesses in the health care system in general, the lack of required resources for the medical interventions, beside the lack of information on the probability of older individuals who may at risk in the future.

Before presenting the design of the suitable methodology for this analysis, I have to outline the main obstacles that occur in the diagnosis of HAV as health experts report in their medical and clinical follow up on this virus.

Health experts say that diagnosing Hepatitis A is not easy, and this applies not only to developing countries but also to the developed ones. Experts find it very difficult to differentiate HAV from other types of viral hepatitis through clinical or epidemiologic features alone. According to the Division of Viral Hepatitis, National Center for Infectious Diseases – USA, "a serologic testing to detect immunoglobulin M (IgM) antibody to the capsid proteins of HAV (IgM anti-HAV) is required to confirm a diagnosis of acute HAV infection. Total anti-HAV testing is used in epidemiologic studies to measure the prevalence of previous infection or by clinicians to determine whether a person with an indication for pre-exposure prophylaxis is already immune. Also they indicate that HAV RNA can be detected in the blood and stool of the majority of persons during the acute phase of infection by using nucleic acid amplification methods, and nucleic acid sequencing has been used to determine the relatedness of HAV isolates for epidemiologic investigations (28--30)."

In the Palestinian case it should be taken into consideration that Palestinian research laboratories may not have the capabilities – technical, financial and other –for this type of diagnosis, and this situation adds another difficulty to using the comprehensive vaccination approach. Accordingly it may be more practical to start by targeting high risk areas or groups – where there is a turning point in hygiene to the worse and high risk groups like travelers to and from the Palestinian Territory.

IV. Expected Groups at Risk of HAV in PT

As seen in figure 2, the Middle East region is an area with a high concentration of HAV, and may be considered a source of contracting the virus for frequent travelers.

Meanwhile users of injection and non injection drugs should also be considered at high risk as should elder who have not been infected by HAV before. In addition, bearing in mind that students and food workers maybe probable carriers for HAV.

V. International Experiences in Controlling HAV

According to the experiences of USA and Israel, introducing the vaccine proved to be the safest and most effective technique in preventing HAV in countries with low to intermediate rates of this disease (Wasley et al. 2005, Dagan et al. 2005). Their vaccination programs were launched simultaneously in 1999. In the USA, it was recommended that routine vaccination of children be implemented in 11 states with HAV rates that were 20 or more cases per 100,000 inhabitants during the baseline period 1987 to1997 (Wasley et al. 2005). In Israel, the vaccination program covers all children aged 18 to 24 months (Dagan et al. 2005). It should be mentioned that these strategies have achieved a significant reduction in the rate of HAV in both countries in a short duration. Israel recognized a sharp drop in disease rates

among older children, and among adults. The results also indicate a drop in disease rates among both low and high socioeconomic status in both countries.

An important point to highlight from these experiences is the role of children as a source of infection and one of the important transmission mechanisms for HAV. This conclusion strongly emphasizes that vaccination of children is the most effective technique to reduce the incidence of HAV over time and to potentially eliminate infection in countries with similar conditions.

According to the available information on the USA experiences in the management of HAV, positive results were realized from introducing a controlling program against HAV. The following chart reflects the reported incidence rate of HAV in the USA between 1980 and 2000. Introducing the vaccine clearly decreases the level of incidence rate over time. However, the question here should be to what extent is the vaccination recommended in relation to the incidence rate. What is the threshold that requires introducing a vaccination program, or entails the opposite.

VI. Discussions and Analysis

For the sake of accuracy, of the analysis and the expected outcomes, the available data from official sources was organized and classified. This includes the distribution of the population by age group (at mid-2006) and the incidence rate of HAV as reported by the Ministry of Health (MOH) for the year 2005. All relevant costs and other calculations are based on the available data provided by the Palestinian Central Bureau of Statistics (PCBS), for more details see Annex 1.

It should be mentioned that the year 2002 can be regarded as a turning point, as the number of reported cases in the PT start showing a consistent increase from this point on. We need to be careful that the reported number of around 3000 cases in 2006 (85 cases per 100000 person in PT) is not necessary the accurate real number because of under-reporting of cases and asymptomatic or unrecognized infection. So many more HAV infections occur than are reported each year in the PT. But even so, this rate of incidence is high compared with other countries that have started programs to control HAV.

The available data serves in constructing three analytical scenarios pertaining the management of HAV in the PT, according to the Cost – Consequences/ Saving approach. From the first glance, the results appearing in the following chart show that there is a significant level of HAV incidence by age group particularly in the age group 0 – 14 years.

This reflects the deteriorating hygiene levels in the PT and the low standards of living for an increasing numbers of Palestinians due to the ongoing economic crisis reflected by the high level of poverty (60% of the Households are under poverty line, and one person out of 4 is unemployed according to PCPS statistics). This situation is common for viral diseases such as HAV. On the other hand the reported trend reflects the cyclicality of the disease – a decline over a period of time followed by a new active period when the environment is favorable such as the case of the PT after 2002.

This cyclical life of HAV makes it very difficult to predict the right policy to be undertaken by relevant parties. To let things be without any intervention on the national level, or to introduce an intervention policy to control this disease according to a national program with predetermined boarders and priorities?

From a management point of view, this cyclical life of HAV does not guarantee the complete disappearance of the virus despite all programs and measures. Even according to international experiences vaccination do not guarantee a lifelong protection (among adults and children, studies have demonstrated that detectable antibodies persists for at least 5-8 years after

completing the vaccination series. Although data regarding long-term efficacy is limited, no cases among vaccinated children were observed in one community at 5-6 years of follow-up. Estimates of antibody persistence derived from mathematical models of antibody decline indicate that protective levels of anti-HAV persist for at least 20 years). CDC Website, and access10/6/2007)

This implies that when a country faces deteriorating hygienic conditions and socioeconomic situations it could expect to encounter a new wave of this disease emanating from such areas and other transmitters as discussed above.

As a result of this brief analysis of the disease's lifecycle, it is recommended to review the previous plan set by relevant parties in the Palestinian Government (PG) in their 2000 report because they reflect a certain section of the HAV life cycle (a downward trend), whereas now things indicate that a new phase (an upward trend).

VII. Results

As seen from Appendix 1, (estimates and calculations), three scenarios are developed based on the available data – bearing in mind that the lack of disaggregated data on HAV incidences by age group, geographic region, and other factors has been a major constraint – which are more applicable on the national level as it would be difficult to draw practical recommendations on the disaggregated level.

As a base for the three scenarios, the different costs (Direct, indirect) were calculated in the same methodology, including all relevant components as outlined in the analytical methodology section of the study. The outcome of the compiled calculations for the different scenarios reveals the followings:

Scenario 1:

This alternative addressed the case at the baseline, where it was built on the number of infected cases per year amounting to 3305 cases based on the reported incidence rate by the MOH. This number was distributed according to age group and relevant costs were calculated, the results of this scenario show a net saving by negative 118.8 million US $, and this reflect a very conservative scenario. The high probability of under estimating reality due to under reporting infected cases, either as households may not report these infections specially for very young children or weaknesses in the national health care systems, is one of the main limitations facing this alternative.

Scenario 2:

This scenario provides an incremental approach or technique, where a priority classification is the cornerstone for the implementation process. Under this approach, direct attention is given to two groups for two different reasons. The first undertakes a complete vaccination process for newborns without pre –screening (because children are the most common carrier for the disease and experience shows positive results from vaccination for this group).The second targets elders (50 years and above). Because there is no concrete data on this part in our official sources, this may reflect a limitation for this scenario but not a deadly one. Any overlap of infected cases can be excluded from the vaccination after the screening tests.

The outcome of this scenario shows a net savings of negative 50 million US $ due to the fact that we select a more specific target group, and it can be affordable from the cost perspective on the government's side, and also of the expected positive albeit intangible results from minimizing negative consequences of this elder group that might be very costly and may create a real burden on the national health system if left undiagnosed.

Scenario 3:

This alternative moves to a more complicated situation, where it reflects a nationwide wave of HAV in the PT, based on the assumption of further deteriorations in hygiene and socioeconomic climate. Those assumptions are seen as probable because of the current siege and economic crisis since 2006, and also because of internal matters (Palestinian vs. Palestinian clashes) that will prevent any quick improvements. This scenario also suggests that all those who were not infected by HAV previously may be at risk in the future. The elders group, and those who have liver problems are at risk regardless of their situation (around 2% of the total population).

The outcome of this scenario indicates positive net savings of half a billion US $, due to the fact that the cost of getting sick is higher than the cost of screening and vaccination. The argument is based on the economic consequences on individuals in the labor force (employed) when infections and complications may take longer than the normal incubation period of the disease. Another argument for this scenario is that it provides complete coverage for the population, especially high risk individuals who cannot be detected through the incremental approach. However, this scenario is quite costly (as seen from the associated cost calculations).

As a result, it seems that the most affordable scenario is the incremental one (scenario 2) which serves both the social perspective, and the budget constraints of the government. If adequate disaggregated data were more readily available, we may be able to add more increments to this scenario, such as groups under risk according to geographic regions etc.

VIII. Future Actions That Can Be Taken by PNA

For preventing the spread of HAV infection, we should consider the following measures, with low cost and positive results:

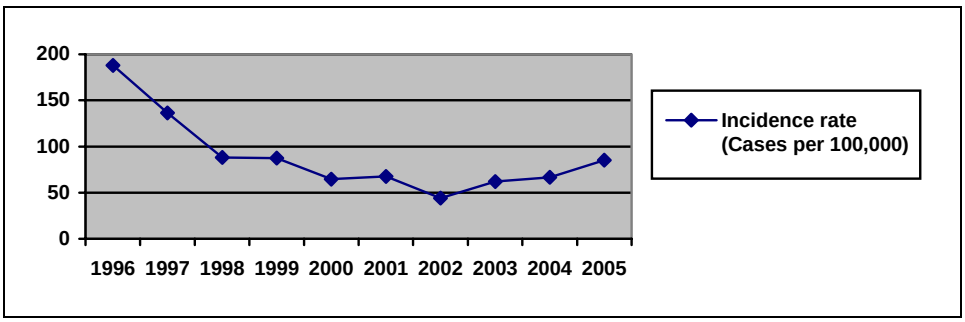
- Improving the level of hygiene, starting from the living area to own personal hygiene like hand washing …etc.
- Improving the sanitation levels and introducing clean water sources especially in the Gaza Strip and other highly polluted areas.
- Screening travelers and risky individuals.
- Raising awareness of the causes of HAV.

VIIII. Conclusion

As for the duration of protection after HAV vaccination according to international experience – mainly USA as one of the pioneering countries that launched intervention programs to control HAV – it should be noted that in adults and children, studies have demonstrated that detectable antibodies persist for at least 5-8 years after completing the vaccination series. Although data regarding long-term efficacy is limited, no cases among vaccinated children were observed in one community at 5-6 years of follow-up. Estimates of antibody persistence derived from mathematical models of antibody decline indicate that protective levels of anti-HAV persist for at least 20 years. Source: http://www.cdc.gov/ncidod/diseases/hepatitis/slideset/hep).

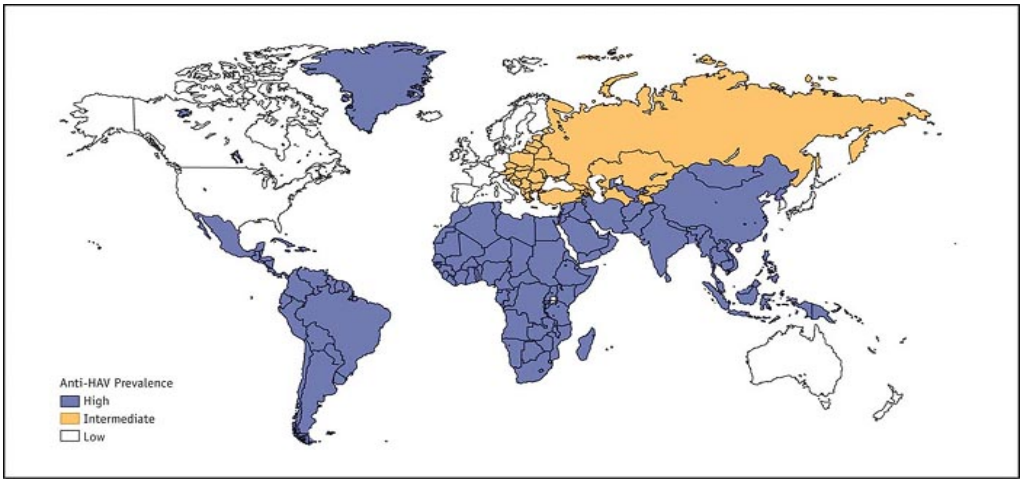
According to our cost – effectiveness analysis, the cost of adding the HAV vaccine onto the official MOH list, versus the cost associated with keeping up the status quo (HAV vaccine sold commercially), an incremental strategy can well serve the Palestinian case. A national strategy to incorporate HAV vaccine in the vaccination programs of the Ministry of Health, according to a justified scope of priorities and coverage, will assist in the process to prevent and control Hepatitis A through vaccination along with improving the overall health conditions of the Palestinians.

Figure 1:



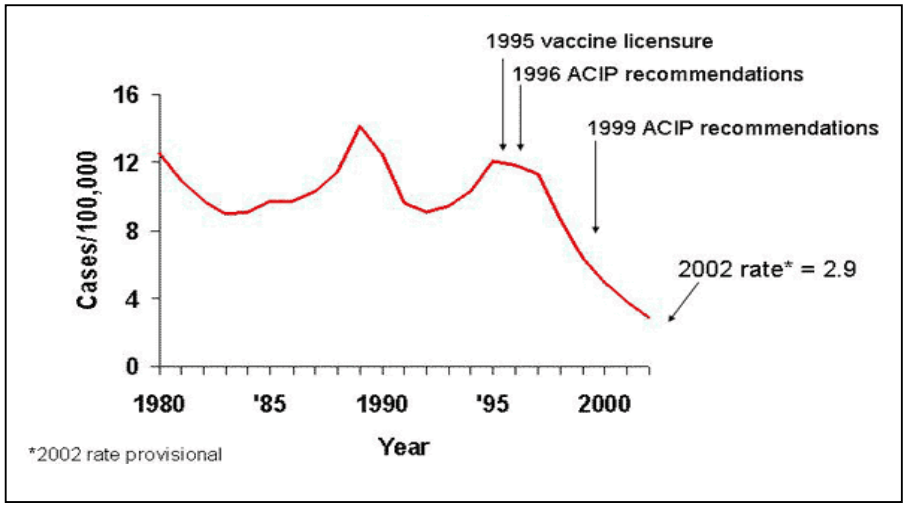
Source: Ministry of Health Database 2007

Figure 2:



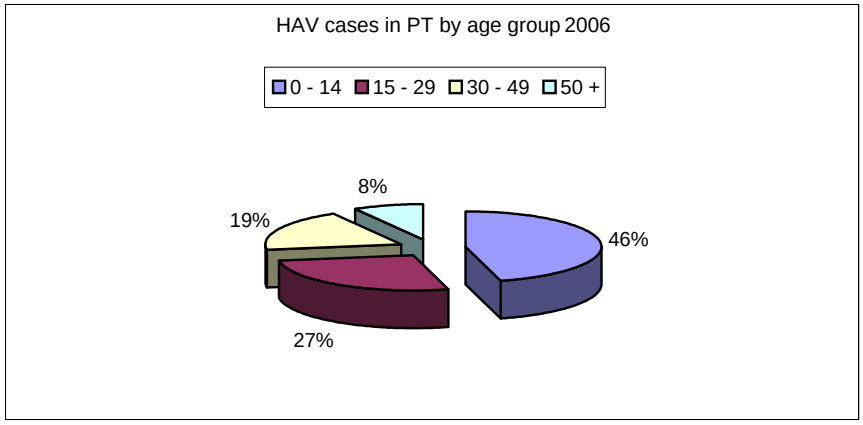
Source: http://www.cdc.gov/ncidod/diseases/hepatitis/slideset/hep

Figure 3:



Source: http://www.cdc.gov/ncidod/diseases/hepatitis/slideset/hep

Figure 4:



Source: Ministry of Health data base 2007

Table 1: Distribution of Basic Data

Group type	Age group	Population	Number of uninfected cases	Number of HH	Number of infected cases	Number of danger cases	Infection days
1	0- 4	671,289	670,803	231,312	486	0	28
1	5-9	599,474	598,964	206,539	510	0	28
1	10-14	506,728	506,297	174,585	431	0	28
2	15-19	420,441	420,084	144,856	357	0	28
2	20-24	339,209	338,921	116,869	288	0	28
2	25-29	285,586	285,343	98,394	243	0	28
2	30-34	241,756	241,551	83,293	205	0	28
2	35-39	202,324	202,152	69,708	172	0	28
2	40-44	167,474	167,332	57,701	142	0	28
2	45-49	129,266	129,156	44,537	110	0	28
3	**50-54**	**88,829**	88,753	30,605	76	**76**	**56**
3	**55-59**	**67,743**	67,685	23,340	58	**58**	**56**
3	**60-64**	**51,545**	51,501	17,759	44	**44**	**56**
3	**65-69**	**41,395**	41,360	14,262	35	**35**	**56**
3	**70-74**	**34,236**	34,207	11,795	29	**29**	**56**
3	**75-79**	**22,472**	22,453	7,742	19	**19**	**56**
3	**80+**	**18,525**	18,509	6,383	16	**16**	**56**
Total		**3,888,292**	**3,885,072**	**1,339,680**	**3220**	**276**	

Table 2: Baseline and Moderate Scenarios

Baseline scenario (intervention for those who are infected)						Moderate scenario (targeting selected groups)
Indirect medical and no medical costs	**Direct medical costs**	**Cost of no vaccination program**	**Cost of screening**	**Cost of vaccination**	**Cost of vaccination program**	**Vaccination of new births and persons with 50 years and more**
281,645	48,560	330,205	11414368.1	67080340.4	78494708.5	10000000
295,541	50,955	346,496	11979288.9	59896444.7	71875733.6	0
249,817	43,072	292,889	10125945.6	50629728.1	60755673.7	0
203,704	35,737	239,441	8401672.5	42008362.5	50410035.0	0
164,347	28,833	193,180	6778413.4	33892067.2	40670480.6	0
138,366	24,275	162,641	5706865.0	28534325.1	34241190.2	0
117,131	20,549	137,680	4831010.1	24155050.7	28986060.8	0
98,026	17,198	115,224	4043040.4	20215202.4	24258242.9	0
81,141	14,235	95,376	3346632.9	16733164.7	20079797.6	0
62,629	10,988	73,617	2583122.4	12915612.3	15498734.8	0
85,320	22,651	107,972	1775069.9	8875349.5	10650419.4	0
65,067	17,274	82,342	1353708.3	6768541.8	8122250.21	0
49,509	13,144	62,653	1030023.7	5150118.6	6180142.41	0
40,112	10,556	50,667	827196.2	4135981.4	4963177.71	0
33,175	8,730	41,905	684137.9	3420689.94	4104827.9	0
21,775	5,730	27,506	449057.9	2245289.8	2694347.8	0
17,951	4,724	22,675	370185.1	1850925.4	2221110.45	42,216,850.00
2,005,256	377,211	2,382,468	75,699,739	388,507,195	464,206,934	52216850

Table 3: Scenario Number 3, the Bad Situation

Cost of infection (a)	Cost of screening (b)	Cost of vaccination (c)	Total cost (d = b + c)
3469672.8	11404664	67023322.1	78427986.57
3098092.0	11969107	59845532.7	71814639.28
2618779.0	10117339	50586692.9	60704031.42
176435122.6	8394531	41972655.4	50367186.49
142346682.4	6772652	33863259.0	40635910.77
119844165.8	5702014	28510071.0	34212085.22
101451213.1	4826904	24134518.9	28961422.74
84903850.3	4039604	20198019.5	24237623.45
70279291.8	3343788	16718941.5	20062729.82
54245572.0	2580927	12904634.1	15485560.94
74552936.1	1773561	8867805.5	10641366.59
56855751.5	1352558	6762788.6	8115346.301
43260996.9	1029148	5145741.1	6174889.289
34742244.0	826493	4132465.8	4958959.009
176932.2	683556	3417782.4	4101338.824
116135.7	448676	2243381.4	2692057.66
95737.5	369870	1849352.1	2219222.506
968493175.7	75635392.81	388176964.1	463812356.9
			504,680,818.79