Bertil Aldman Award Lecture

Trying to apply science to motor vehicle safety policy decision making

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Once more in my life, I have acted irresponsibly optimistically when asked to give the Bertil Aldman Award Lecture today in this 42th IRCOBI annual meeting. I confess so because once I delved into the history of IRCOBI, the contributions of physician and engineer Dr. Bertil Aldman, read through some recent lectures by Drs. Mackay, Arbogast and Mr. Ward, and learnt that one of the first "Bertil Alman" lectures in this conference was given by William Haddon… I realized these were insurmountable precedents. The most overwhelming fact, though, was the realization on how small a part of road safety history I am, small and novice enough to be born on the same year Drs. Mackay and Aldman met at a conference that eventually led into the creation or IRCOBI.

Thus, it is with immense gratitude and humbleness that I come to this podium to share with you some of my thoughts about the world of science (which you currently represent) and the world of public decision making (which at present time I am learning about).

Background and History

And before I do that, let me describe to you that my current challenge relates to putting public health theory into practice in my current role as the Head of the Dirección General de Tráfico in Spain. DGT, as we all refer to it, is the central government institution which depends on the Ministry of Interior of the Spanish government in command of numerous road safety issues in Spain as a whole, including coordinating the Consejo Superior de Tráfico, an interministerial body. In such capacity, we are obligated to compile and produce the statistics on road traffic for the whole of the country, to produce drafts and process through Parliament most of the travel and road safety legislation that affects all of Spain, including the Road Safety Law and the circulation code. We manage and monitor interurban traffic through both intelligent transport systems and our own traffic police and urban traffic monitoring for all of the territory except interurban roads of the Basc Country, Catalonia and the 2300 villages in Spain who have municipal traffic officers. DGT was founded actually in 1959 and that means we are older than, for example, the National Traffic Highway Safety Administration in the US. DGT currently encompasses some 15000 workers through Spain and a yearly budget of some 850 million euros. Though its history it has been run by politicians, administration officers and military personnel, but never by a public health university-driven physician convinced the world can be healthier place if we modulate better our mobility patterns.

Even though Spain has, like other Western Europe countries, very low road-related mortality rates, in 2013 1,680 people died in our roads, an all inclusive figure which includes crashes occurring in interurban and municipal roads from everywhere in the country including Catalonia and the Basque Country area.

One thousand six hundred and eighty deaths is the Spanish contribution to the 1.3 million road deaths worldwide. And if history helps, the Spanish example is a good one to strengthen our believe that eradication of 1.3 deaths is possible; possibly even faster than what our own history shows. One thousand six hundred and eighty deaths in one year is the lowest number ever in our history, even less than when we first started recording the data back in the 1960, even before Murray met Aldman. Since then, we have multiplied our vehicle fleet 13 times. We have multiplied our driver population census by 9.5, we have multiplied our population by 1.5 and the number of tourist who visit us by 9. The 2013 figure is even better if we put it in contrast with the government strategic objectives that were confirmed by the Spanish Parliament back in 2011 and that were to be followed up with 13 indicators: baseline data were available and the expected targets by 2020 were set. We are extremely thankful to our society, and you, road safety professionals around the world,

because 2013 –that is 7 years ahead of the scheduled timeline, we have succeeded in securing five of the 13 indicators, including the death rate per million. This means Spain is currently according to the latest current data one of the top performing countries in the world, if fact only preceded by Sweden, UK, Denmark and the Netherlands. This is even less than the average EU rate, Australian rate, Japanese rate and of course US rate.

Why bother

To some, the current fatality figures would lead to complacency. And whether to fall under complacency is where science and reason come first into conflict. If we are doing well, it must be because we are doing the right things, right? Why should we look for a fix if "nothing ain´t broken" -- also known as resistance to change. Or worse, the resistance to question oneselves.

Furthermore, if I were to be moved to change, what should we do? Should we do what somebody tells us to do, i.e., "eminence-based" policy? or what science tells me us is best to do, i.e., "evidence-based" policy? Of course, even if you set yourself on the evidence track you have to find some evidence and it is not necessary true that we can invest the time or effort in developing it appropriately. And even in the circumstance that you find the one paper out there in the Netherlands or in New Zealand, you need to evaluate not only the quality of that publication but also its external validity. Does it apply to my circumstances? Are they talking about the same plan I am hoping to implement? How do I translate their experience to other's experience? Also, how does that one piece or research fit into the body, the general body, of knowledge? Science is built over centuries and it requires coherence, it requires repetitiveness, it requires a number of key parameters. Last but not least, even if I were lucky enough to have substantial evidence, then I would need to have the capacity to adapt to the new situation.

Trying to understand whether we needed change

About six years ago, time and effort was spent in the EU to develop predictive models to assess how European countries would evolve in regards to road safety. The published models came even with confidence intervals. A model was set per each EU country member… and after the models were created, decision makers were confident to set the 2020 50% fatality reduction goal that you recognize from the Decade for Action objectives. In the case of my country, Spain, the model showed a continuous reduction until 2020, so if fact it was easier to agree to the goal –one had nothing to do but just to "continue life as is".

In seeing those models, the first question that comes to mind relates to what were the variables that made it into them. It took me 2 years to find the answer because the whole process was like a black box. In the end, we learnt that the model only had exposure, expressed as vehicle miles driven. And when that was evident, the next question arose: where did the Spanish exposure data come from? In my prior professional live, I had been chasing that type of data it for 15 years! But with the new job came the excuse to come back to this quest and reevaluate what did we know about exposure.

The last nationally representative survey on the ways Spaniards move was conducted in 2007 by the Ministry of Transport using a telephone-based self-reported methodology collecting detailed information on the number of trips we do and the means we use for those. It was determined that the 40 some million Spaniards performed some 42 thousand million trips a year; 69% of which were by private cars and approximately, 3% of which were in mopeds or motorcycles and 3% of which were in public transportation modes and yes of course 4% of them were pedestrian based trips. Interesting as this is, it did not help determine whether we are moving more or less over the past years, so we turned our attention to our own DGT-based measure of exposure which is basically a number of spots on interurban roads from which we captured plates and we captured them along the way and we determined the so-called long distance trips. According to this system, Spaniards have conducted fewer a fewer trips since 2007. So, exposure, the main predictor in the road safety models mentioned before…. exposure was going down. After all, we were on the good path to make the predictions come true, weren´t we? What was portrayed as the only risk factor is going down and that is why we are going down in the number of deaths – in an overly simplistic interpretation. Or another reason not to change.

Well, maybe not… because under the apparent tranquility something was troubling us…. In a rather novel

approach, we decided to apply the same epidemiological method to road safety death count as it is used in infectious conditions, such as flu or measles…. (parenthetically let me tell you that despite the fact that many people compare motor vehicle injuries with chronic conditions, many more similarities can be found with infectious diseases). In fact all this is, is an analytical model which talks about an epidemic index and takes the past previous 5 years of data presented on a weekly basis and determines the average highest rate and the lowest rate per each and every week of any one year and plots the number of deaths of the present year. The system allows to monitor whether you are above the past 5 years average, which is understood to be criteria for an epidemic outbreak. What we saw is that in several weeks, we were getting values higher than those means…. Thus, we got under alert…. Coincidentally, news from other EU countries were signaling increases in road deaths there too. What was going on? We looked into our DGT exposure data and …yes!, there it was, an increase in the number of trips by 1.5%. What else could be going on? The so-called pyramid populations gave us other clues…. Since 2008, the year the predictive models were built we have all aged … and being biomechanics experts as you are, you know the consequences of this ageing. What else…., what about the age of our fleet? Our vehicle fleet has increased over the past seven years. The average age of a private passenger car is Spain is now eleven years old; actually thirteen years old when it comes to cars in crashes with at least one death. Among all audiences in the world, surely we do not need to go over the negative impact on outcomes that riding in an older vehicle has. Unquestionably, an older vehicle today is more likely to be associated with a death than a new vehicle today. Once poor maintenance is added, then and even bigger problem arises, and currently some 6% of our circulating vehicles have failed to pass their regular technical inspection.

As if all the above were not sufficient, there are a number of other rising problems: distraction, of course mobile phones; but also illegal drugs. At present time, 9% of our driving population stopped at random, I repeat, 3% of drivers stopped at random on our roads –urban and interurban– are positive to cocaine, cannabis, methamphetamines or combinations of all of them. In 2014 we implemented, for the first time ever, rigorous drug testing on the roadside conducting more than 20,000 preventive tests and showing a 50% positive rate. A rate that goes up to 60% when we analyzed those dead on the road.

In summary, the fatalities predictive model was overly simplistic and had become inappropriate. We were getting ready for “the perfect storm”. Not admitting it, not changing what we do would make us drift away from Zero. That is, away from our several zero´s of concern: primarily zero injured and zero congestion but also towards zero pollution, even zero noise pollution, which are welcome healthy additions too. And if in doing so, we can bring down the economic losses associated with motorized traffic, then perfect. Last, if we manage to do so in a very efficient way, then even better.

But how should we get moving towards zeros?

Once it was clear we needed to get into action, the question on what to act upon became a key one. And this is where the debate between the eminence and evidence, began. Not to mention the possible interference of tradition, fashion, economic interests, fear or faith.

The data showed us we could not be guided by “tradition” since the environment was shifting…. Thus, should we rely on “expert” opinion? As in many other governmental and societal areas, “experts” abound. Particularly, emphatically speaking “experts” abound. Whether their expertise is real or self-declared is a different issue. To address this, we could look backwards and see how these experts had contributed to the field in the past. After all, over the past decades, DGT has spent quite substantial amounts on money funding “research”. A look into the distribution patterns illustrated the fact that some “research” institutions got even 20% of our research budget and that many different institutions had received some money. In sum, lots of funded projects, lots of money spent and different combinations of both.

So, research was applied to research to find out the H factors of funded professionals over the past decade (acknowledging, of course, all the limitations of H factor). The findings, in short, highlighted that amongst the 3 research groups most generously funded, there was one researcher who had an H factor of 10; another one got a 9; and a third one had a 4..., and that was all that there was in terms of H factor. This vividly contrast with the

H factors of many of you in the audience, or the H factor of, for example, Dr. Rune Elvik , whom I will come back to in a few sentences, whose H factor at the time of this evaluation was 141.

That is, much of what DGT had funded was either mislabeled as research or represented ineffective and inefficient efforts. We are not to ignore the difficulties of doing good and publishable research in an English language scientifically dominated world, but one lives where one lives and if one decides to follow the research path, the game rules need to be accepted and followed…. Else, you are playing a different game.

Once it was clear we were lacking references of our own, we turned into international references. Starting with Elvik´s review. And yes, it takes time to understand reviews, it is not reading for the general population. But if one works on mobility, it is one´s duty to understand it or else, surround yourself of enough good advisors to help you understand this type of evidence. No review, no science is ever perfect. And those resisting change would come with a zillion excuses not to rely on Elvik´s review: funny enough, one of the first "complaints" in doing this exercise was about the lack of Spanish references (had we not proved there were none available?; other complaint related to the dates of the latest interventions included in the review process –namely 2009 (a complaint easily solved if anyone provided 2009 onwards publications to the discussion table); the second most common "complaint" was a classic one 'I don't believe the data'; and last, but not least, was the magic one: using Elvik´s own words when he wrote in the text *'This book does not offer a prescription for road safety policy. It does not tell readers which road safety measures ought to be taken, nor does it instruct policymakers in how to set priorities for the provision of road safety.*' Some would call this "the worldly expressions of the intrinsically human resistance to change". Or to question themselves, I would add.

To put Elvik´s review in perspective, let me summarize it by explaining that they evaluated 2,025 publications which, clustered, most of them, on 128 interventions. The authors´ further grouped these interventions around 10 areas: design of roads, maintenance of roads, traffic management, vehicle design and protection systems, inspection of vehicles, training of drivers and professional drivers, education, general education for the population and communication campaigns, police supervision and sanctions, attention to victims post-crash or general policy instruments on road safety. For each of these categories, a varying number of interventions were available. In reading the book, others may want to see these interventions as in covering different cells of the Haddon Matrix.

Which ones are the effective interventions?

In an effort to visualize the findings of their review, let me introduce a graph model where no effect in the intervention is shown in the y axis as 0, the point estimate for the effect as a dot and the variation in effectiveness (which not necessarily the 95% confidence intervals) as bars around the central point estimate. Dots over the zero line represent interventions that increase injury risks whereas dots under the zero line represent effective interventions.

When it came to the findings for road design and road equipment, there were 20 different interventions. Most of which were proven to be effective in the 20 to 60% effectiveness range. In contrast, traffic control measures showed less positive findings, thus DGT´s challenge was to go into the detail to see what interventions were in detail and evaluate whether they match our own.

Vehicle design and protective devices were the second most effective set of interventions with effectiveness ranging from 20 to 80 percent. Here is where belts, airbags and all other passive safety devices that we have come to appreciate so much are reviewed. In contrast, vehicle and garage periodical inspections showed to very positive results.

In the driver training and regulation of professional drivers area at least 3 interventions seemed to work whereas all others are on the verge of not being effective. Road safety information and general campaigns for the population showed very mixed results too.

Surprisingly, for our institution, police enforcement and sanctions have barely been evaluated and the results

are not very promising.

Post-accident care, in particular quick emergency medical services, had an effectiveness of 30% in reducing fatality rates. That's one of the best ones and then everything else mixed feelings, including helicopters, rescue helicopters.

And general policy, also good.

In summary, according to this particularly thorough review there were a substantial number of actions that were proven to be effective, a number of actions whose thorough research proved non-conclusive findings and a number of them which were non-effective.

The value of humbleness

And so, what to do with all this information? Firstly acknowledge that "experts", tradition, fear, money or even faith may have not come across the concept of systematic reviews. And then, move on to embrace the learning.

At DGT we started an evaluation process aligning our interventions and the review results: What does our institution do? And how does it match with these findings? What it is that works that we do? And what it is that works that we don't do? And there is no excuse not to do it. Let's evaluate and let's implement it. On the other side: what it is that we do that does not work according to Elvik´s review? Can you proof it works? Then do it. If you cannot prove it –or you prove it inefficient too, let us clean up and free human and economic resources. Maybe the road fatality reduction in the country over the past decade or so has less to do with what the press and the "experts" have been presenting to the general population. Maybe the future reduction will be to be pushed with interventions outside our traditional realm…

Our decisions at DGT affect a complex and big reality. There are 47 million Spaniards and some 65 million of you who come to visit the country every year. Thus, a huge population whose mobility we have to coordinate. We have 660,000 km of public roadways. We have 33 million vehicles that are registered in Spain and a really big and yet undetermined number of vehicles of those of you who come for a visit and bring your own car. Not to say, all the traffic that goes into Africa from Northern Europe in transit. This is our reality and we need to be aware and effective and efficient in handling it.

Back in 1990 there was this publication by the Harvard Injury Control Center where some 500 live-saving interventions for which there was effectiveness evidence were compared according to their efficiency. These interventions related to healthcare provision, residential interventions to prevent home-related injuries; transportation interventions to produce a reduction in motor vehicle injuries; occupational safety, environmental interventions and others. The results proofed that transportation-related interventions were very efficient. Most of what works in transport either saves money or it's a very minor cost. Minor cost meaning 56,000 USA dollars per one life saved. A small fraction of the 1.4 million euros the social cost of a traffic fatality represents, at least in Span. Thus, a minor investment for a very big return.

Indeed, decisions are made constantly when it comes to mobility design and implementation. Even not doing anything is a decision in itself. How to act upon those decisions varies. As I have come to realize over these years, some policy decisions are based on opinion -- "expert" opinion; some on tradition –what we have always done; others, on fashion –what I just heard about at a conference; often times decisions are based on money (just because I have the money or simply because I do not have it, or because there is the potential to make money); lastly, some decisions get made out of fear -- general fear, whereas other are based simply in faith –the faith that it will work. Decisions based on evidence are not only rare, they are impossible if no evidence exists. And that is why at DGT in 2014, we launched our first time ever public call for research, serious research on mobility and motor vehicle crashes in the country, which has just had a second round. In addition, we are inserting evidence assessments in our yearly budget allocation process.

And in coming to a closing, I will express my gratitude for all the wok you IRCOBI members --present an past, Dr. Aldman included, have developed over the years demonstrating that your willingness to question yourselves and debate amongst peers has, unquestionably significantly contributed in this Towards Zero world movement we are all currently living through. Your work, and that of other engineers was working for the World even while decision makers were not paying much attention.

I also would like to express my desire that future engineers, present and future decision makers, and all, embrace the notion that earnest curiosity is, indeed, good for humanity: Let always curiosity be bigger than fear. And let us focus on eradicating the adverse consequences of bad mobility soon.

Last, and as for DGT, I will continue to work on science and objectivity be brought forward in our decision-making processes.

Thank you very much.

Acknowledgment

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