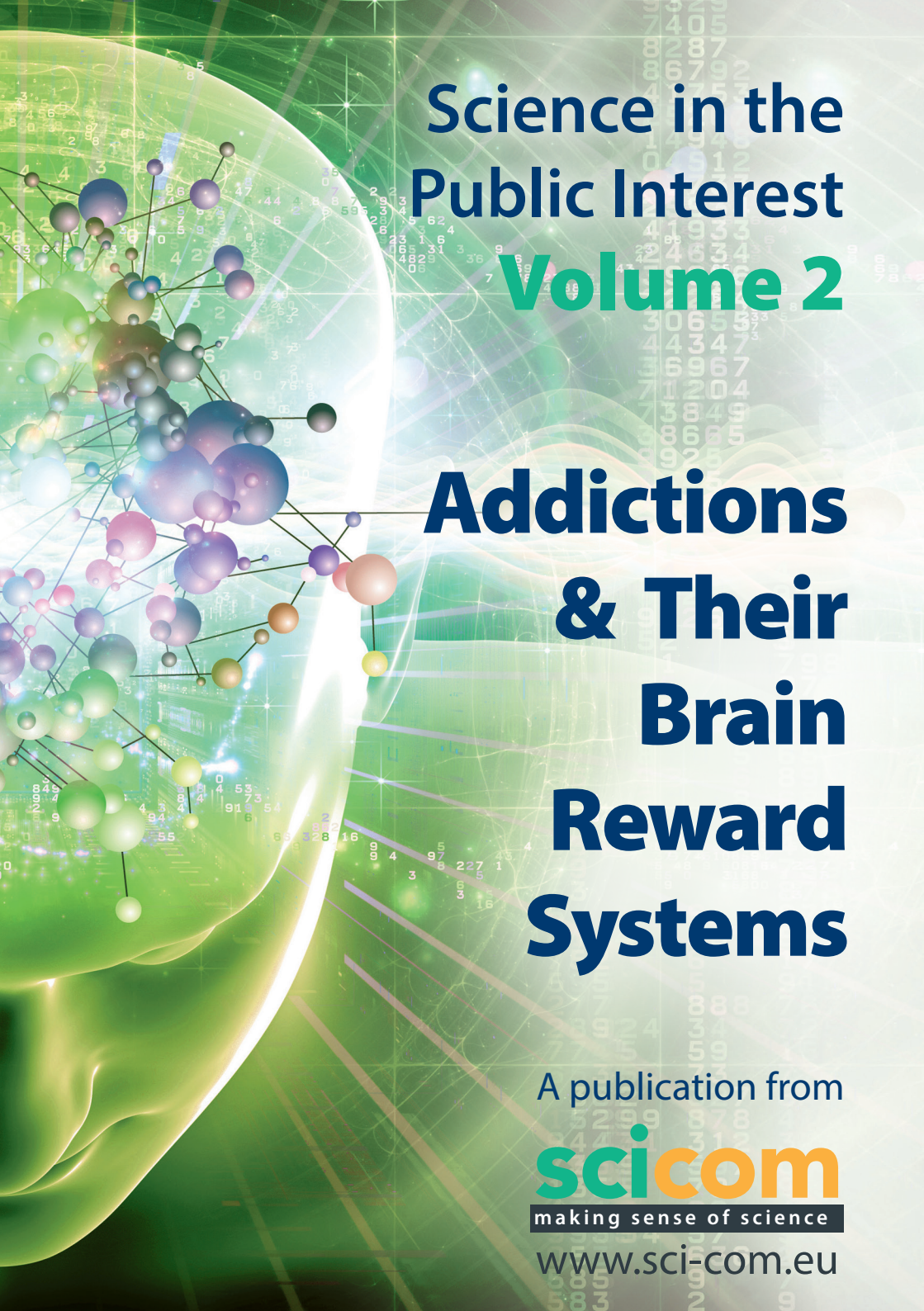

Science in the Public Interest

Volume 2

Addictions & Their Brain Reward Systems

A publication from

scicom

making sense of science

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Volume 2

Addictions & Their Brain Reward Systems

EDITORIAL

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NICOTINE

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ANNEX

Disclaimer: *The opinions expressed in this document reflect the collective views of the consultation event participants. These do not necessarily reflect the opinions of the participants' home organisations.*

Evidence-Based Policy Versus Policy-Biased Evidence:

The Challenge of Feeding Scientific Advice into Policy-Making

Addictions & Their Brain Reward Systems

Key Findings and Recommendations

High-Level Consultation Event
Brussels June 2013

This event shed new light on how the three strands of biological, psychological and social elements work together and emphasises the importance of continued global research into many unknown underlying mechanisms.

"Thank you for the opportunity to exchange ideas and experiences with the high level group of "science diplomats" you gathered in Brussels. Some Institutions could certainly learn from your example!"

Professor Vittorio Prodi, Member of the European Parliament, Science & Technology Open Assessment Panel (STOA) & The Committee on Industry, Research and Energy (ITRE)

NIH National Institute on Drug Abuse
The Science of Drug Abuse & Addiction

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UNITED NATIONS

Mr. Aidan Gilligan, Founder & CEO, SciCom – Making Sense of Science; Euroscience Governing Board Member.
Email: ag@sci-com.eu

Convener's Message:

SAVING LIVES CAN BE EASIER THAN YOU THINK

The purpose of this collection of private thoughts from some of the world's key decision-makers in public health is to explain how we might optimise science to save more than one and a half billion lives. One in seven people alive today will die needlessly. They are not at risk from starvation, war or communicable diseases. They are at risk from their own bad choices. One billion will die from smoking-related diseases; nearly half a billion will die from drinking; and some 35 million will die from drug-related use. This year alone, 6 million people will die from smoking; 2.5 million from drinking; and 200,000 from drugs (Source: WHO). The reason? Addiction and ill-conceived policy-making.

Now in its fourth year, *SciCom – Making Sense of Science* (www.sci-com.eu) is an advocate for science diplomacy. If diplomacy is the art of getting people to engage with each other when they otherwise might not want to, then science diplomacy is about encouraging stakeholders holding different opinions to meet, discuss and ideally agree some common ground. It is about establishing the most basic of starting-points, supported by compelling scientific evidence, enabling all stakeholders to progress and enact meaningful change.

Having worked inside the EU's scientific services for nearly ten years, it often amazed me how important legislation about the food we eat, the air we breathe or the transport we use is decided without the broader scientific inputs of those actually doing the science and 'in the know'. The approach was too often: 'Here is the policy we want. Find the science to support it.' We have all heard about **'bad science'** or **'bad pharma'** but what is less spoken about is the impact of the **'bad policy-maker'.** Of course, science does not always have clear answers. And important factors beyond the reach of science are often involved: fear, hype, ignorance, resentment, or economic and political advantage. But the simple truth is that when it comes to substance addictions today, the lives of millions of people needlessly hang in the balance.

Before immersing ourselves in the science of addiction, let's look at the societal context. Lifestyle and addictions are not our greatest killer. Starvation and malnutrition are. This is actually a policy choice we make at a global level. There is enough food to go around. Since the heady days of Live Aid, when the world connected to respond to the Ethiopian famine, satellite television has kicked in and we see stories of famine, war and natural disasters in our living rooms every night. We are so fatigued by it all, essentially numbed to it. Today, we are able to eradicate hunger. We can eliminate polio. Science has given us the means. These can and should be things of the past, but they are not.

In the developed world, our 'problems' are well-documented and largely of our own making. We are living longer, with children born today expected to reach one hundred years old. We can thank modern science for that. Our greatest causes of preventable death are now substance addictions linked to life-style, namely tobacco, alcohol and drugs. Again, this is a policy choice we choose to accept. In fact, we practically nurture it. It is our way of life. Our laws, attitudes and social structures underpin it. But that does not mean that science is turning a blind eye. On the contrary, **the race for ground-breaking brain research** is unlocking the very secrets of our personalities, causing a revolution in how we might address addiction and frame public policy.

In a perfect world we would use this new novel science to create better policies, positively impacting the lives of many. In the real world, unfortunately, civil servants and, indeed, scientists too often think that they are the policy-makers. At the same time, too many elected officials think that they are the scientists and know best. What is certain is that both groups fall into the trap of thinking that constant negative messaging on the harm caused by lifestyle choices is readily understood or sinks in. Ten years after Europe's first smoking ban in Ireland, for example, the Chief Medical Officer's Report shows a 3-4% total Irish population smoking increase. Alcohol awareness campaigns face similar hurdles. Science and policymaking clearly need to work together better if we are to come up with truly effective solutions.

ENGAGEMENT: WHY HAVING EVERYBODY INVOLVED MATTERS

SciCom does not shy away from questioning the status quo. Our scientific symposia, organised at the leading independent global conferences (American Association for the Advancement of Science, Euroscience Open Forum, World Science Forum), are designed to generate critical new thinking. We adopt an **'everybody's science/opinion is welcome'** approach. This challenges the established order of things, especially if you dare invite an industry expert – somebody actually doing science 'for sale'.

In truth, delegates love being taken out of their usual institutionalised preserves and meeting the people they are not supposed be in the same room as, let alone converse with in public. Surely this should be the norm? Medical experts and researchers should be sharing platforms with the alcoholics and the drinks companies and the policy-makers. As M.D. Wilson Compton argues, all medical students should have addictions treatment training. You can only get the full picture if everybody takes part. *SciCom* adds to the discussion by facilitating this type of all-inclusive debate. We passionately believe that science and scientists have a special claim to be heard, provided they are committed to:

- **INTEGRITY:** to uphold the inherent honesty of scientific enquiry and debate;
- **OPENNESS:** to keep the lab door open, and making clear any special interests;
- **CLARITY:** to speak in terms the public can understand; &
- **ENGAGEMENT:** to demonstrate that they take their duty to society seriously.

SUBSTANCE ADDICTIONS: WHY ASKING THE DIFFICULT QUESTIONS MATTERS

Tobacco: According to the tobacco atlas (*www.tobaccoatlas.org*) we know that smoking-related diseases caused 100 million deaths during the twentieth century. This is expecterd to increase ten-fold during the twenty-first century, reaching one billion. Why have cessation products as sold by big pharma largely failed? Are e-cigarette technologies delivering nicotine to be welcomed as 'safer'? The UK government's science says 'yes', the French government's science says 'no'. Who should we believe?

Alcohol: According to the WHO, at 2.5 million, almost 4% of all deaths worldwide are attributed to alcohol. This is a greater number than deaths caused by HIV/AIDS, violence or tuberculosis. It accounts for 9% of all deaths in the under 29 age group. So, why exactly is the bliss of booze so encouraged? Why do we start getting plastered at 15, stagger off to college and university and keep knocking it back in our 20's, 30's and beyond? Why do we believe the marketing men who

tell us that handling our booze is sophisticated and that really good things can happen when we have a drink? Why, when the Irish and Scottish governments are trying to take preventative action and, for example, ban alco-pops as enticements to children and introduce unit-price fixing, is the European Commission saying 'no'? Why is the legal age for consumption so varied from country to country in the first place?

Drugs: The UN estimates that 5% of the world's population use illicit drugs at least once per year and that drug abuse kills 200,000 people annually. Heroin users typically inject twice per day. Growing numbers of *'legal-high'* and synthetic drug users inject as much as ten times per day. That's 500% more needle usage, so 500% more disease transmission risk. HIV/Aids infections are declining in Sub-Saharan Africa. Where is it increasing the fastest? In Central & Eastern Europe. Should we thus have greater health-checks on free movement inside the EU? Will relaxing the so-called *'war on drugs'*, coupled with an emerging softer touch on cannabis, make all the difference? Washington, Colorado and Venezuela clearly say 'yes'.

There are just some of the questions we tackled at the ***2013 'Substance Addictions and their Brain Reward Systems' High-Level Consultation Event in Brussels.*** This collection of essays is a follow-up to these discussions. We chose substance addictions as a logical progression from our 2012 pilot event on **harm reduction science**, where much of the debate focused on the emerging brain science. In both instances, we tried to identify a topic that is perhaps the *'new black'*, one which appears to offer great promise, but which might never see the light of day because the scientific majority feels threatened by it, or policy-makers – who generally lead from behind in science – fear it upsets the funding status-quo. The health risk for the general public through inaction might be enormous. In advocating this brand of *'science in the public interest'*, SciCom *'nudges'* thought-leaders and decision-makers to get together, have a re-think and ideally, *'do the right thing'*.

In June 2012, we chose ***Harm Reduction Science*** pertaining to drugs and alcohol. Twenty-seven eminent European, African and American-based thought-leaders from fifteen countries were convened under the Co-Chairmanship of Professor Anne Glover, the then newly appointed Chief Scientific Adviser to European Commission President José Manuel Barroso, and Professor Patrick Cunningham, the then Irish Chief Scientific Adviser and Champion of EuroScience Open Forum 2012 Dublin.

These discussions broke new ground in terms of inviting in the right expertise and in their general openness and willingness to look at things from new and unexpected angles. The key findings are a must-read to truly appreciate the logic of this follow-up initiative *(http://tinyurl.com/ppbscbs)*. The fifteen key recommendations, agreed by all parties involved in the 2012 event, provide an important roadmap to guide best practice in global science-policy-making.

THEY ARE SUMMARISED HERE AND DETAILED ON PAGE 58:

OUR 15 KEY FINDINGS WERE:

SCIENCE AND POLICY – A CRUCIAL RELATIONSHIP

1. Science is a fundamental pillar of knowledge-based societies;
2. Science can help provide the evidence base for sound public policy;
3. The dialogue between science and policy is never straight-forward but remains a special relationship;

WHAT WE EXPECT FROM THE SCIENTIFIC COMMUNITY

4. The integrity of science needs to be positively asserted and defended;
5. Stronger emphasis must be given to the inclusion of social sciences to improve understanding of how the public may react or adapt to lifestyle challenges;
6. Scientists must learn to use established communication channels for providing policy advice more effectively, especially on life-or-death issues;

WHAT WE EXPECT FROM THE POLICY-MAKING COMMUNITY

7. Policy-makers must be receptive to scientific advice, even when this advice is uncomfortable;
8. For the science and policy relationship to work, policy-makers have to challenge science to deliver on their public investment;
9. Policy-makers should consult more widely and learn from best practices and pitfalls encountered elsewhere;

WHAT WE EXPECT FROM THE PUBLIC, INDUSTRY AND INTEREST GROUPS

10. The public plays a critical role in determining what positions policy-makers will take;
11. Industry is the largest investor in science and has every right to have its voice heard;
12. Interest groups similarly have every right to have their voice heard as guardians of the common good or legitimate sectoral interests;

WHAT NEEDS TO HAPPEN

13. Scientific advice must be more involved in all stages of the policy-making cycle, particularly in brain reward research;
14. Policy-making must learn to cope with the speed of scientific development and include greater foresight and policy anticipation;
15. Investment in substance addictions science and their brain reward systems is *"the right thing to do".*

In June 2013, we chose Substance Addictions and Their Brain Rewards as our High-Level Consultation Event topic. It struck us that the impetus given by major new funding announcements from President Obama and the European Commission to literally map the brain offered the perfect opportunity to take a fresh look at the addictions that, put simply, are avoidable, but kill us the most.

WHY THE EMERGING SCIENCE MATTERS

Wouldn't it be wonderful if we could attribute our compulsion for addictive damaging activities, such as over-drinking, taking illicit drugs or smoking, wholly to our genetic makeup? Then we could blame our parents for everything. We know it is bad for us but we still do it. Why?

Family, twin and adoption studies have established that addictions of all types have a strong genetic basis. For example, children removed from, or put up for adoption by parents who have existing conditions or go on to form addictions are more likely to develop compulsive behavior problems, regardless of their education or upbringing. Recent clinical and pre-clinical research is uncovering the specific genetic factors associated with the onset of these conditions.

We now know there is a connection between genetics and disease, but establishing a

relationship between genetic variation and behaviour is far harder. Is it just the feel of the lighter in the pocket that encourages a smoker to smoke, or just the special offer on wine at the counter that encourages a drinker to drink? Or are there genetic factors involved?

Global science is only beginning to understand all this. Many questions remain to be answered. For example, how does over-consumption of alcohol trigger addiction-like neuro adaptive responses in our brain-reward circuitry? Why are less than 25 percent of heroin users proven to be dependent, while other addictive substances need only one try for a permanent susceptibility to addiction to occur? How does nicotine work as the principal reinforcing component in tobacco smoke responsible for addiction?

Research clearly shows that genetics plays an important – but not the only – part. We know, for example, that compulsive behaviour usually comes about only after extended access. In some instances, freeing oneself from one substance addiction may mean brain susceptibility to another, perhaps explaining why many former alcoholics become compulsive golfers or gardeners. Their brains literally need to be fed with an addictive behaviour. On the other side of the coin, many smokers or heroin users can simply quit because they were never addicted in the first place, they just had the habit. As biologically deterministic as it may sound, we all have our aptitudes, traits and susceptibilities – and free will can prevail.

***SciCom's* gathering of front-line experts contends that what is true of compulsive behaviour is also true with addiction. Their combined work sheds new light on how the three strands of biological, psychological and social elements work together. The frank opinion pieces which follow challenge widely held myths on the causes of addiction and what constitutes an addict. They even go so far as to contend that society needs addictions, or at least new ones. A common thread is the importance of continued global research into many of the unknown underlying mechanisms. The consequences are profound for global public health policy.**

NEW FORMAT AND PRESTIGIOUS PARTNERS

NIH National Institute on Drug Abuse
The Science of Drug Abuse & Addiction

UNITED NATIONS

Two important changes were made in 2013. Firstly, the Consultation Event was co-organised with the ***US Department of Health and Human Science, National Institutes of Health, National Institute on Drug Abuse (NIH-NIDA)*** and the ***Office of the UN Secretary-General, Ban-ki Moon*** via his Special Envoy for HIV/Aids in Eastern Europe and Central Asia. It was hosted by, while remaining entirely independent of, the ***South African Government's Mission to the EU***.

Secondly, on 3rd June the event added an ***Introductory Networking Cocktail and Pre-Dinner*** for 120 guests, drawing in further EU, member state and third party participants based in Brussels. This had the important value of extending the reach of the event to as broad a range of stakeholders as possible, including those many EU officials who, as administrators rather than scientists, would not be qualified to contribute to a high-level panel, but who nevertheless have an important interest and influence in the scientific domain.

The *Consultation Event's* assembled group of experts and **attendees were individuals with pertinent experiences of real-life support to policy-making in the area of substance addictions** – perhaps never before brought together in this format. Participants included, amongst others, EU scientific officials; representatives of national governments, academies and agencies; UN bodies; prominent business leaders; stakeholders from pan-European scientific organisations and patient groups; senior editors from media and scientific journals; and distinguished figures from internationally renowned research facilities.

NETWORKING 'DIALOGUE & INCLUSIVENESS' EVENT REGISTERED PARTICIPANTS

- His Excellency, the Deputy Ambassador & the Mission Attachés of the South African Government to Belgium, to the Grand Duchy of Luxembourg and to the European Union
- The Scientific Counselor to the South African Science Minister
- The Danish Ministry of Science & Innovation
- The Danish Research Liaison Office
- The Capital Region Denmark EU Office
- United States of America Department of Health & Human Science, National Institutes of Health, Institute on Drugs Abuse (NIDA)
- The United Nations, Office of the Secretary General's Special Envoy
- The World Health Organisation's Representative to the European Union
- The Irish Presidency of the European Union
- The European Parliament's Science & Technology Open Assessment Panel
- The European Commission
  - Cabinet Research Commissioner Geoghegan-Quinn
  - Office of the Chief Scientific Adviser to President Barroso
  - Directorate General, Joint Research Centre
  - Directorate General, Research & Innovation
  - Directorate General, Justice, Fundamental Rights & Citizenship
  - Directorate General, Budget
- The European Research Council
- The European Research Executive Agency
- NATO
- The World Medical Association
- The European Brain Council
- The Global Commission on Drug Policy
- The International Center for Alcohol Policies
- The European Foundation for Alcohol Research
- The International Drug Policy Consortium
- The Addictions Research Institute, Erasmus University, Rotterdam
- Action On Smoking & Health, ASH
- The European Smokeless Tobacco Council
- Spirits Europe
- Euroscience
- Euroscience Open Forum

- The International Group of European Commission, Research Framework Programme Liaison Officers
- The Institute of Tropical Medicine, Antwerp
- Europe Direct
- Health Diplomats Switzerland
- Esprit du Bois France
- The European Universities Association
- The University of Copenhagen
- The Bloomberg School of Medicine, Johns Hopkins University
- HEC Paris
- The Free University of Brussels
- The University of Lausanne
- ERASMUS University, Rotterdam
- The University of Medicine & Pharmacy, Bucharest
- The University of Konstanz
- The International Press Association
- *The Financial Times*
- *The Irish Examiner*
- *Die Welt,* Germany
- *RTBF (Belgian French-speaking Television)*
- *Curierul,* Romania
- *Science et Avenir Magazine,* France
- *Science Business*
- *The European Journal of Risk Regulation*
- The Moldovan Journalism Center
- Johnson & Johnson
- The Brewers of Europe
- British American Tobacco
- European Industrial Research Management Association
- Nicoventures
- Business Europe
- Europabio
- SwissCore
- The Slovenian Business & Research Association
- PelicanDream Consulting
- SciCom – Making sense of Science

HOW WE DO WHAT WE DO

What is crucial is that this body of experts represented all stakeholder groups and stages of scientific interaction, from conception and development to implementation, monitoring and evaluation. Staying true to a key 2012 recommendation, everybody's science was welcome. Of particular note is that **scientific representatives from the drugs/pharma, alcohol and tobacco/nicotine industries were invited.** For example, the Chief Scientific Officer of *British American Tobacco* and the Director of *Action on Smoking & Health (ASH)* shared a panel. In this way, those making the products and

those dealing with the addicted and the dying, or framing the life-saving or life-taking policies, depending on your viewpoint, came together. This just does not happen too often, but it should.

The Consultation Event's format was equally novel and designed to produce new thinking. Based on speaker recommendations compiled by the overall Co-Chairs *(US National Institutes of Health & UN Secretary-General's Office),* three small **Working Groups** were set-up to look at 'global policy and research insights' into drugs, alcohol and tobacco. Everything was done deliberately to avoid a top-down approach and pre-judging the outcomes. The common thread was identifying best practices and pitfalls based on real-life experiences. The emphasis was on equality, open discussion and the harvesting of ideas while reaching firm conclusions about the challenge of ***"evidence-based policy versus policy-biased evidence"***.

Each group was assigned a **Panel Chair** *(see below).* All three groups were asked to consider five pivotal science-policy questions with common findings then presented by the Chair.

THE FIVE PIVOTAL PANEL QUESTIONS WERE:

1. **What should we expect from the scientific community?**
2. **What are the factors taken into account by the policy-making community?**
3. **What needs to improve from the perspective of third-parties and interest groups?**
4. **How should scientists, policy-makers and third-parties work together to manage risks and uncertainties at the same time as promoting innovation?**
5. **What needs to happen next?**

One representative from each group then gave a more specialised presentation on *'The Science'* and another on *'The Policy'*. A panel discussion was then facilitated by the Chair so as to flesh out further points of agreement or disaccord. An open discussion then took place with all conference delegates before the Chair wrapped up with some final pertinent comments about lessons learned and where the science and the policy might need to go to next.

PANEL 1: GLOBAL POLICY AND RESEARCH INSIGHTS INTO DRUG ADDICTION

- **Panel Chair: Mr. Michael Trace** *(British)*, Chairman, The International Drug Policy Consortium (IDPC); Former UK Deputy-Drug Czar to PM Tony Blair; Former Chairman, European Monitoring Centre on Drugs & Drug Addiction, Lisbon (EMCDDA).
- **Dr. Wayne Drevets** *(American)*, Scientific Vice President, Disease Area Leader in Mood Disorders, Janssen Pharmaceutical Companies of Johnson & Johnson.
- **Professor Françoise Dubois-Arber** *(Swiss)*, Faculty of Biology & Medicine, University Hospital of Lausanne, Switzerland.
- **Professor Michel Kazatchkine** *(French),* United Nations Special Envoy for HIV/AIDS in Eastern Europe and Central Asia; Former Executive Director, The Global Fund to fight AIDS, Tuberculosis & Malaria.
- **Ms. Nathalia Moll** *(Italian)*, Secretary General, Europabio.
- **Ms. Paolo Tardioli-Schiavo** *(Italian)*, European Commission, Directorate-General Justice, Fundamental Rights & Citizenship, Deputy-Head of the Anti-Drugs Policy Unit.

PANEL 2: GLOBAL POLICY AND RESEARCH INSIGHTS INTO ALCOHOL ADDICTION:

- **Panel Chair: Mr. Andrew Stonard** *(British)*, CEO, Esprit du Bois, France; Former Chief Executive, Rugby House – Drug & Alcohol Treatment Services, UK.
- **Dr. Marjana Martinic** *(German)*, Deputy President, International Center for Alcohol Policies (ICAP), Washington DC.
- **Professor Klaus Bock** *(Danish)*, Member of the European Research Council's Governing Board; Champion EuroScience Open Forum 2014 Copenhagen; Former Executive Vice-President for Research of Carlsberg A/S.
- **Ms. Ann Cahill** *(Irish)*, President of the International Press Association, European Affairs Correspondent, *The Irish Examiner.*
- **Professor Philippe de Witte** *(Belgian)*, Université Catholique de Louvain (UCL), Belgium & Chairman of the Advisory Board of the European Foundation for Alcohol Research.
- **Dr. Tim Schoenmakers** *(Dutch)*, IVO Addictions Research Institute, Erasmus University, Rotterdam.

PANEL 3: GLOBAL POLICY AND RESEARCH INSIGHTS INTO NICOTINE ADDICTION:

- **Panel Chair: Dr. Delon Human** *(South African)*, President and CEO, Health Diplomats; Secretary-General of the African Medical Association; Former Secretary of the World Medical Association.
- **Professor Alberto Alemanno** *(Italian)*, Jean Monnet Professor of EU Law and Risk Regulation, HEC Paris; Scholar at O'Neill Institute for National and Global Health Law and Adjunct Professor of Global Risk Regulation at Georgetown University Law Center.
- **Dr. Wilson M. Compton** *(American)*, Deputy Director, US National Institute on Drug Abuse (NIDA), Former Director, Division of Epidemiology, Services and Prevention Research.
- **Mr. Clive Cookson** *(British)*, Science Editor, *The Financial Times*.
- **Mr. Martin Dockrell** *(British)*, Director of Research & Policy, Action on Smoking & Health (ASH), London.
- **Dr. Christopher Proctor** *(British)*, Head of Research, Group Research & Development, British American Tobacco.
- **Guest speaker: Professor Vittorio Prodi** *(Italian)*, Member of the European Parliament, Science & Technology Open Assessment Panel (STOA) & The Committee on Industry, Research and Energy (ITRE).

A FLAVOUR OF OUR DISCUSSIONS

1. Societal problems such as the misuse of illicit drugs, alcohol or even tobacco are not necessarily problems with purely scientific solutions. It is more complicated than that. Yet innovation in science, such as new brain research, should be more embraced. It is vital in shedding new light on how the three strands of biological, psychological and social elements work together. Centuries-old substance addictions might be part and parcel of life today, but this does not mean that scientists can renege on being our front line in helping us better understand them. In truth, they must better learn to **'stand-up'** and **'shout-up'** when the wrong public health choices are being made.

2. Alcohol might damage the liver and tobacco the lungs but it all starts with the brain. This too easily gets forgotten. M.D. Wilson Compton of the US National Institutes of Health emphasizes the importance of continued global research into brain-reward circuitry, particularly into the unknown underlying mechanisms behind compulsive behavior and addiction-like neuro adaptive responses. As Prof. De Witte of Université Catholique de Louvain (UCL) argues on alcohol addiction, we are only beginning to understand the role of reward and reinforcement mechanisms and how they are established in memory formation, particularly for our youth.

3. All would agree with the assessment of Dr. Christopher Proctor of British American Tobacco relating to the underlying tensions between individual – versus population-based sciences when deciding policy. In some countries, elected officials can more easily make the case for harm reduction (e.g. free needle exchange) in illicit drugs when it is clearly explained that both the user and the general population may face a greater risk of HIV/Aids. But as Mike Trace of The International Drug Policy Consortium poignantly recalls from his experience as a Drug Czar, in other countries, asking voters to fund free needles or methadone treatments is totally unacceptable.

4. What we saw during this high-level consultation event was a remarkable consensus-building on the dangers of global inaction – the reticence to take calculated risks even when science presents us with the biggest public health opportunities of our time. The licensing or not of e-cigarettes is a good case in point. On one hand, five million British lives alone could be saved. On the other, it is too soon to say what the longer-term impacts of nicotine addiction might be. As M.D. Delon Human argues, not knowing is not a good enough excuse to do nothing. For some, 'nudge theory' in terms of gently convincing people to do the right thing via peer-pressure can also be seen as the policy-makers' inability to do the right thing in the first place – i.e. enact the best scientifically evidenced law.

5. Even if what we eat is less and less perceived as a personal choice, it is understandable that hard-pressed tax payers do not want to pay for the treatment of chronic diseases linked to dietary excess (e.g. type 2 diabetes). Likewise, few accept that alcohol addiction is an excuse for unsocial behavior, domestic violence and the clogging up of our accident and emergency services. The bill (psychologically and moral as well as financial) will be huge. Alcohol-related disease costs $220 billion annually in North America alone and is growing everywhere you care to look.

6. If we buy two chickens and get one free, we eat one and freeze two. But if we buy four cans of cider and get two free, we tend to drink them all. This can be resolved by the drinks and food industry themselves, aided by the pressure of tighter legislation, but is it fair to penalise the moderate drinker with higher prices? A more valid question might be: can society even function without alcohol? What we can start to see emerging from Brussels and elsewhere is a quick-fire reactionary view that alcohol today is where tobacco was thirty years ago. Will the mixed results on tobacco control concerning price, advertising and access be too easily applied as a one-size fits all remedy to other substances? We know it does not work with cigarettes or cannabis.

CONVENER'S CONCLUSION

During the twelve month set-up phase of this initiative, my aunt of died from tongue cancer linked to smoking while a cousin of mine in his 30's was declared an alcoholic needing help, joining a long line of family precedents. I also saw an elderly family member literally abused during the last six months of his life in a respite home where no-smoking applied and nurses routinely broke up his cigarettes, treating him like a child and rarely helping him to the external smokers' lounge. It struck me that family, friends and neighbours just took this on the chin as routine in life and that got me thinking. What has gone wrong with us all?

This larger 2013 event reinforced our 2012 finding that **scientific outcomes are better when the industries being regulated are engaged in an appropriate way.** It is just so obvious. If we can get the food industry to address fat, salt and now sugar in their products, why are more policy-makers and health experts not similarly engaging with our alcohol, tobacco/nicotine and drug/pharma companies? If reduced harm is clearly possible at the product development stage *(e.g. e-cigarettes, reduced toxicant tobacco leaf, alcohol labelling, alcohol-light products etc.),* scientists and health practitioners must surely mobilise to accelerate the incorporation of such evidence into policy-making. By not doing so, elected officials and their health-expert advisers are not held to the promises they make.

Policy-makers need to embrace an inclusive, 'whole-of-society' approach. On the other hand, powerful advocacy might, intentionally or unintentionally, result in the wrong scientific priorities. The informed public, including scientists, increasingly express themselves via special interest groups. Scientists are involved in public-private research or their own commercial endeavours – simply because they have to for funding. Knowledge of industrial research is more often a plus than a minus but you would hardly think so when you examine who is advising government on health. Inviting civil society and industrial representatives with the necessary skills onto scientific advisory panels should be less exceptional.

Technological progress and social development constantly interact. Globalisation, the Internet and now digital technologies are becoming the driving force in all areas of innovation and pervading all areas of society. Just look at the rapid development of e-cigarettes, with 4 million Germans now using them daily. This emphasises that society needs to play a part in decisions relating to their education processes, lifestyles, work patterns and role models in light of how new technologies and demographic change will affect them. Constantly telling people *'it's bad for you'* does not work. It is only by pioneering new inclusion-based, participatory processes with the general public to address the four stages of harm reduction: **1. don't start; 2. quit; 3. don't harm those around you; 4. don't harm yourself,** that we can make a difference that takes root. We have made a good start on stage 3, but remain reluctant to embrace stage 4 for fear of rewarding the addict.

In short, we need to redefine the voice of industrial partners and third parties with science, especially those actually dying from their addictions. We should hold our elected officials to the promises they make. Above all, those members of the scientific community who are genuine about supporting "evidence-based policies" (establish the addiction science first, then inform the policy) versus those supporting "policy-biased evidence" (establish the policy first, then find the science to support it) must make their voices better heard. We are not there yet.

HIGH-LEVEL CONSULTATION EVENT JUNE 2014

Scicom is pleased to announce: ***Addiction: Ethics, Integrity & The Policy-Maker*** as the 2014 theme. The third in this health series, it will be Co-Chaired by Professor Julian Kinderlerer, University of Cape Town and President of the European Group on Ethics in Science and New Technologies (EGE,) reporting to President Barroso, and Professor Michel Kazatchkine, United Nations Special Envoy for HIV/AIDS in Eastern Europe and Central Asia.

CONSULTATION EVENT 2013

Dr. Wilson M. Compton, *Deputy Director, US National Institute on Drug Abuse (NIDA)*

Consultation Event delegates

Networking Event, Nicotine Addiction Panel

Professor Michel Kazatchkine, *United Nations Special Envoy for HIV/AIDS in Eastern Europe and Central Asia*

Professor Vittorio Prodi, *Member of the European Parliament*

Mr. Martin Dockrell, *Director of Research & Policy, Action on Smoking & Health (ASH)*

THE SCIENCE OF ADDICTION: IMPLICATIONS FOR POLICY

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Drugs, both legal *(e.g., alcohol, nicotine)* and illegal *(e.g., cocaine, methamphetamine, heroin, marijuana)* as well as abused psychotherapeutics *(opioid analgesics, stimulant medications, benzodiazepines)* can be abused for several reasons, including the pursuit of pleasure, altered mental states, improved performance or, in certain instances, alleviation of a psychiatric disorder. However, stunning advances in the neurosciences have shown that, whatever the reason behind the initiation of an abuse trajectory, chronic drug abuse affects the brain in ways that undergird the stereotypic behavioural disruptions that characterise addicted individuals.

Addiction researchers have started to shed light on the ways in which chronic drug abuse changes the brain to cause the profound disruption we see in the behaviour of an addicted person. This is because drugs of abuse co-opt the brain's neuronal circuits necessary for insight, reward, motivation, and social behaviours. These drug-induced changes are long-lasting, persisting even after years of drug discontinuation, which has led to the recognition of addiction as a chronic and relapsing disease. **This model of addiction explains why addicted individuals make poor choices despite awareness of the negative consequences; why previously rewarding life situations and the threat of judicial punishment may not stop drug taking and why a medical rather than a criminal approach is more effective in curtailing addiction.** When considered together, these effects amount to a compelling argument for considering addiction a bona fide chronic and relapsing disease of the brain. Importantly, they also point the way for the development of more effective interventions for the prevention and treatment of addiction.

ADDICTION: A DEVELOPMENTAL DISORDER

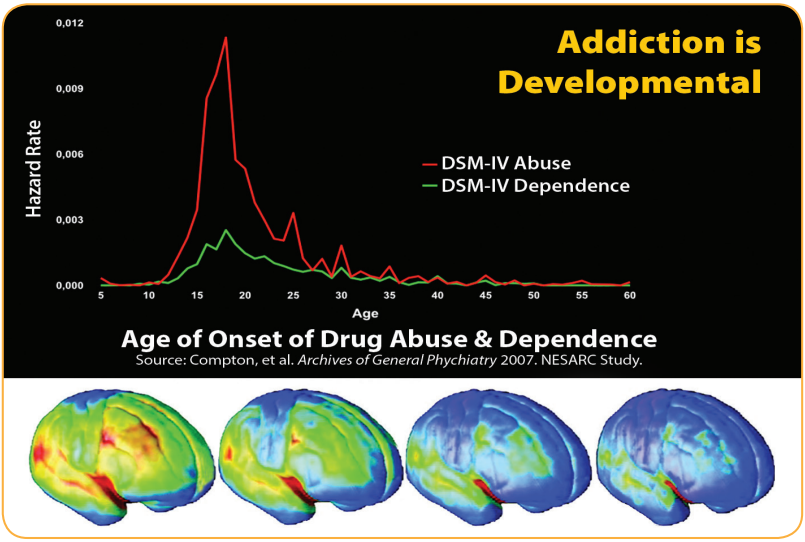
The propensity to use drugs is based in both individual predisposition and in environmental influences. Both of these factors, individual predisposition and their associated environments, interact with one another across human development. Environments that may influence future drug use include the prenatal intrauterine environment, infancy and childhood family environments, as well as the broader peer, neighbourhood, cultural, legal and social environments.

What has been observed is that experimentation with psychoactive substances generally starts in adolescence, a developmental stage characterised by risk-taking, novelty-seeking, and heightened sensitivity to peer-pressure, which might reflect incomplete development of brain regions involved in, eg. executive control, motivation, and decision making. In addition, epidemiological evidence shows that the process of addiction is much more likely to be triggered in an adolescent brain: convergent lines of evidence suggest that exposure to drugs or alcohol during adolescence may result in different neuroadaptations from those that occur during adulthood. Recent studies demonstrate eg. that the adolescent period is distinctly sensitive to long-term alteration by chronic exposure to ethanol or nicotine. This may explain the greater vulnerability of our youth to addiction. It appears that the fine balance in connections that normally exists between brain areas active in reward, motivation, learning and memory, and inhibitory control becomes severely disrupted in addiction.

DOPAMINE NEUROBIOLOGY OF DRUGS OF ABUSE

Many different neurotransmitters have been implicated in the process of addiction, but dopamine, in particular, stands out as being consistently associated with the reinforcing effects of nearly all substances that humans abuse. Through various, often indirect mechanisms, drugs of abuse increase extracellular dopamine concentrations in limbic regions, including the nucleus accumbens (NAc) in ways that surpass the magnitude and/or duration of the fast dopamine increases that occur in the NAc when triggered by natural reinforcers such as food or sex. This is important because abnormally high or protracted increases of dopamine-mediated neuronal activity in these subcortical and related cortical brain structures are translated into vastly different *(corrupted)* messages about reward prediction, stimulus-response, approach behavior, learning and decision-making.

The effects of excessive dopamine stimulation become more pronounced, widespread, and long lasting once substance use becomes chronic. For example, whether tested during early or protracted withdrawal, addicted subjects show lower levels of dopamine D2 receptors in striatum *(including NAc)*, which are associated with decreases in baseline activity in frontal brain regions implicated in salience attribution *(orbitofrontal cortex)* and inhibitory control *(anterior cingulate gyrus),* whose disruption results in compulsivity and impulsivity. In addition, drug-induced increases in dopamine also facilitate conditioned learning, so previously neutral stimuli become salient after being associated with the drug. These previously neutral stimuli can then increase dopamine, and elicit the desire for the drug, by themselves. This explains why an addicted individual is at risk of relapsing when exposed to an environment where he or she has previously taken the drug. Taken together, these results suggest that drug abuse creates an imbalance between the dopaminergic circuits that underlie reward and conditioning and those that underlie executive function *(emotional control and decision making)*, an imbalance that is postulated to contribute to the compulsive drug use and loss of control in addiction.



NEUROBIOLOGY OF ADDICTION

Drug and alcohol addiction can be conceptualised as a reward deficit disorder characterised by a transition from impulsive to compulsive drug intake that is mediated by positive and negative reinforcement, respectively. Once a person has transitioned to compulsive drug use, negative reinforcement *(i.e. behaviours designed to alleviate a negative emotional state in the absence of drug)* becomes a main driver of continued, escalated drug use. The characteristic compulsive drug intake despite adverse consequences that characterises this stage appears to rely on neuroadaptations in the brain reward and stress systems. Reward system changes include decreases of dopamine and GABA in the ventral striatum coupled with stress system enhancement of corticotropin-releasing factor (CRF) in the extended amygdala as well as blunting of the activity in the hypothalamic–pituitary–adrenal (HPA) axis.

Compulsive drug consumption also involves poor inhibitory control and poor executive functioning, which are mediated by prefrontal cortical regions of the brain. For example, for alcohol, regions of the prefrontal cortex are selectively damaged by chronic intermittent use and result in poor decision making that can perpetuate the addiction cycle. The combined research of the last decade reveals that drug induced impairments in the prefrontal cortex (PFC) areas exert a two-fold impact on addiction, first through its perturbed regulation of reward limbic regions and second through its involvement in higher-order executive function *(for example, self-control, salience attribution and awareness)*. Thus, abnormalities in these frontal regions may underlie both the compulsive nature of drug administration in addicted individuals and their inability to control their urges to take the drug when they are exposed to drugs or drug cues. These frontal abnormalities are also likely to contribute to the impaired judgment and cognitive deficits seen in many addicted individuals.

At a cellular level, drugs have been reported to alter the expression of specific genetic transcription factors *(nuclear proteins that bind to regulatory regions of genes, thereby modulating the rate of their transcription)*, as well as a wide variety of proteins involved in neurotransmission in several key brain regions. And there is growing evidence suggesting that many of the drug-induced changes in the patterns of gene expression lead to structural, synaptic, and behavioural plasticity in the brain.

At the neurotransmitter level, addiction-related adaptations have been documented not only for dopamine, but also for glutamate, GABA, opiates, serotonin, and various neuropeptides; and these changes contribute to the abnormal function of brain circuits. For example, in individuals who are addicted to cocaine, imaging studies have documented that disrupted dopamine activity in the brain *(shown by reductions in dopamine D2 receptors in striatum)* is associated with reduced baseline activity in the orbitofrontal cortex (OFC) and in the anterior cingulate gyrus—brain regions that are involved in salience attribution and inhibitory control.

ADDICTION VULNERABILITY

Genetic Factors: It is estimated that 40% to 60% of the vulnerability to addiction is attributable to genetic factors. Animal studies have identified several genes that are involved in drug responses and whose experimental modification markedly affects drug self-administration. In addition, animal studies have also identified candidate genes and genetic loci for alcohol responses, which overlap with genes and loci identified in human studies. Progress in identifying candidate genes for alcoholism and alcohol-related responses continues at a rapid pace. However, identifying the

biological function of these new candidate genes has emerged as a major challenge for the next decade. The hope is that a better understanding of the myriad interacting genetic factors and networks that influence addiction risk and trajectory will help increase the efficacy of addiction treatments and reduce the likelihood of relapse. One of the best examples of moving from gene identification to biological function is the association between drug metabolising genes and protection against drug/alcohol dependence. These genetic variations operate by modulating the accumulation of toxic *(aversive)* metabolites; therefore, if alcohol or drugs are consumed by individuals who carry variants that metabolise their substrate at unusually high or low rates, then the accumulation of toxic metabolites may occur and serve as a negative stimulus to discourage further consumption.

More recent evidence points to polymorphisms in receptor genes that can mediate drug effects and be associated with a higher risk of addiction. For example, a number of convergent results support a CHRNA5/A3/B4 gene cluster association with nicotine dependence and with the risk of such smoking-related diseases as lung cancer and peripheral arterial disease.

Environmental Factors: Environmental factors that have been consistently associated with a propensity to self-administer drugs include low socioeconomic status, poor parental support, within peer group deviancy, and drug availability. Stress might be a common feature in a wide variety of environmental factors that increase the risk for drug abuse and may help explain, for example, why social isolation *(which increases anxiety)* during a critical period of adolescence increases addiction vulnerability.

Imaging techniques now allow us to investigate how environmental factors affect the brain and how these, in turn, affect the behavioural responses to drugs of abuse. For example, animal studies have shown that environmental manipulations that increase D2 receptors in NAc markedly decrease drug consumption; a finding that could provide a mechanism by which a social stressor could modify the propensity to self-administer drugs. Many of the long-lasting changes in gene expression induced by an environmental event such as drug or alcohol exposure are now being studied as a means to identify how the environment can contribute to drug and alcohol addiction. They also provide a unique window into probing the complex mechanisms that connect environmental conditions to genetic output.

Comorbidity with Mental Illness: The risk for substance abuse and addiction in individuals with mental illness is significantly higher than in the general population. This high rate of comorbidity probably reflects, in part, overlapping environmental, genetic, and neurobiological factors that influence drug abuse and mental illness. In addition, alcoholism often presents in combination with the abuse of other drugs and with psychiatric disorders including mood, anxiety, sleep, and psychotic disorders. Among alcohol dependent individuals, nearly 40% have at least one lifetime psychiatric diagnosis and more than 20% have another drug abuse disorder. Almost 30% of people with psychiatric disorders exhibit substance abuse with 25% abusing alcohol and 15% abusing other drugs. These co-occurrences are problematic because they can complicate treatment and lead to synergistic negative health effects that are worse than either disorder alone.

It has been proposed that comorbidity might be due to the use of the abused drugs to self-medicate the mental illness in cases in which the onset of mental illness is followed by abuse of some types of drug. But, when drug abuse is followed by mental illness, the chronic exposure could lead to neurobiological changes, which might explain the increased risk of mental illness. **The higher risk of drug abuse in individuals with mental illnesses highlights the relevance**

of the early evaluation and treatment of mental diseases as an effective strategy to prevent drug addiction that starts as self-medication.

STRATEGIES TO COMBAT ADDICTION

The knowledge of the neurobiology of drugs and the adaptive changes that occur with addiction is guiding new strategies for prevention and treatment, and identifying areas in which further research is required.

Preventing Addiction: The greater vulnerability of adolescents to experimentation with drugs of abuse and to subsequent addiction underscores why preventing early exposure is such an important strategy to combat drug addiction. Epidemiologic studies show that the prevalence of drug use in adolescents has shifted up and down significantly over the past 30 years, and some of the shifts are associated with attitudes towards drugs. For example, the changing pattern in marijuana use is associated with perception of the risks associated with the drug: when adolescents perceived marijuana to be risky, the rate of use was low; whereas, when perceived risk was low, the rate of use was high. At present, prevention strategies include not only educational interventions based on comprehensive school-based programmes and effective media campaigns and strategies that decrease access to drugs and alcohol, but also strategies to provide supportive family and community environments that engage adolescents in productive and creative ways.

Treating Addiction: The adaptations in the brain that result from chronic drug exposure are long-lasting; therefore, addiction must be viewed as a chronic disease. This is why long-term treatment is required for many addiction cases, just as it is for other chronic diseases, like hypertension, diabetes, or asthma. By recognising the likelihood of relapse, this perspective radically modifies our expectations of addiction treatment outcomes, establishing the need for a more rational, chronic management model.

The involvement of multiple brain circuits *(reward, motivation, memory, learning, interoception, inhibitory control, and executive function)* and the associated behavioural disruptions point to the need for a multimodal approach in the treatment of the addicted individual. Therefore, interventions should not be limited to inhibiting the rewarding effects of a drug, but also explore and include strategies to enhance the saliency value of natural reinforcers *(including social support)*, strengthen inhibitory control, decrease conditioned responses, improve mood *(if disrupted)*, and strengthen executive function and decision making.

Among the recommended multimodal approaches, the most obvious rely on the combination of pharmacologic *(i.e., designed to interfere with the reinforcing effect of a drug or compensate neuroplastic maladaptations)* and behavioural *(i.e., aimed at strengthening/correcting specific circuits or cognitive domains)* interventions, which might target different underlying factors and therefore yield synergistic effects. Such combined treatment is strongly recommended because behavioural and pharmacological treatments are thought to operate by different yet complementary mechanisms that can have additive or even synergistic effects.

Finally, the treatment of comorbid conditions requires the treatment of the mental illness concurrent with the treatment for drug abuse. Because drugs of abuse adversely affect many organs in the body, they can contribute to the burden of many medical diseases, including cancer, cardiovascular and pulmonary diseases, HIV/AIDS, and hepatitis C, as well as to accidents and violence. Therefore, substance-abuse treatment will help to prevent or improve the outcome for many other clinical conditions.

CHALLENGES FOR SOCIETY

In many cases, drug abuse and addiction alienate the individual from both family and community, increasing isolation, and interfering with treatment and recovery. Because both the family and the community provide integral aspects of effective treatment and recovery, this identifies an important challenge: to reduce the stigma of addiction that interferes with intervention and proper rehabilitation.

Effective treatment of drug addiction in many individuals requires consideration of multiple social policies. For example, because of the considerable overlap of addiction and criminality, inclusion of effective drug treatment practices into criminal justice domains can lead to improvements in both health as well as safety. Addressing poverty or chronic adverse circumstance may also reduce overall vulnerability to the use of drugs.

The recognition of addiction as a disease that affects the brain might be essential for large-scale prevention and treatment programs that include participation of the medical community. Engagement of pediatricians and family physicians *(including the teaching of addiction medicine as part of medical students' training)* might facilitate early detection of drug abuse in childhood and adolescence. Moreover, screening for drug use could help clinicians to better manage medical diseases that are likely to be adversely affected by the concomitant use of drugs, such as cardiac and pulmonary diseases. Unfortunately, physicians, nurses, psychologists, and social workers receive little training in the management of addiction, despite it being one of the most common chronic disorders

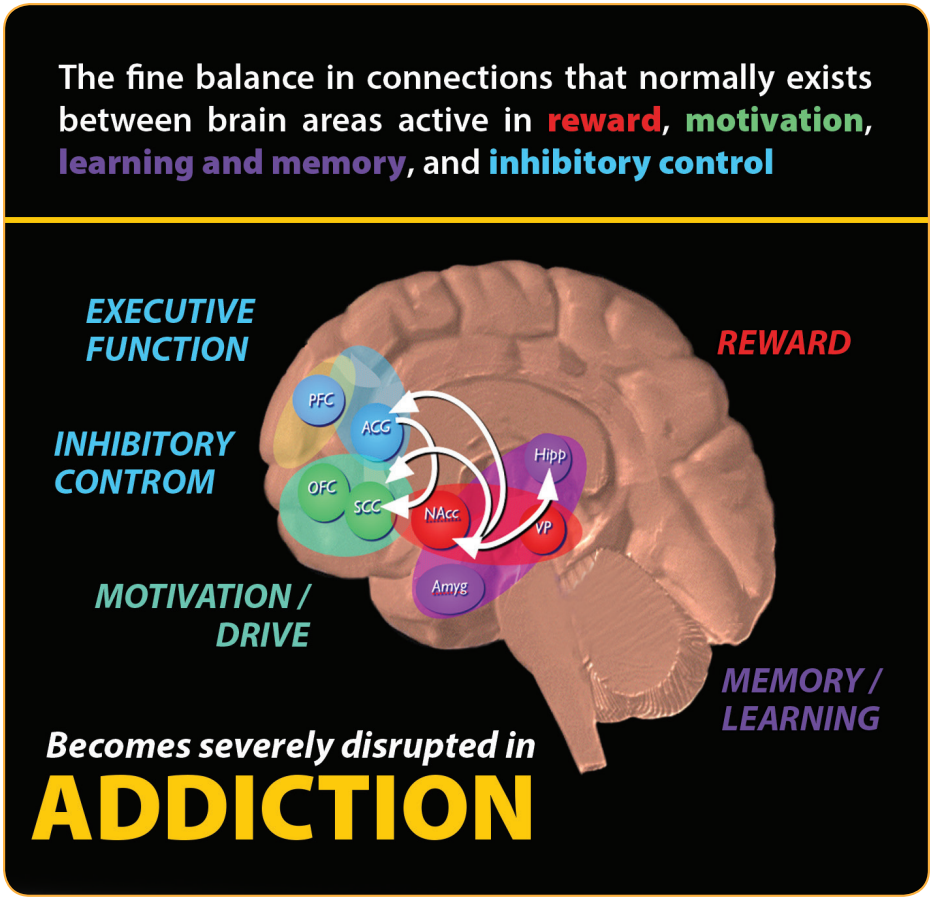
Another considerable obstacle in the treatment of addiction is the limited involvement of the pharmaceutical industry in the development of new medications. Issues such as stigma, lack of reimbursement for drug-abuse treatment, and the lack of a large market all contribute to the limited involvement of the pharmaceutical industry in the development of medications to treat drug addiction. The importance of this issue had been identified by the Institute of Medicine of the United States, which has recommended a programme to provide incentives to the pharmaceutical industry as a way of helping to address this problem.

As we learn more about the neurobiology of normal and pathologic human behaviour, a challenge for society will be to harness this knowledge to effectively guide public policy. For example, presently, critics of the medical model of addiction argue that this model removes the responsibility of the addicted individual from his or her behaviour. However, the value of the medical model of addiction as a public policy guide does not reside in its misguided use as an excuse for the maladaptive behaviour of the addicted individual, but in its ability to provide a framework to understand the underlying disease and treat it more effectively.

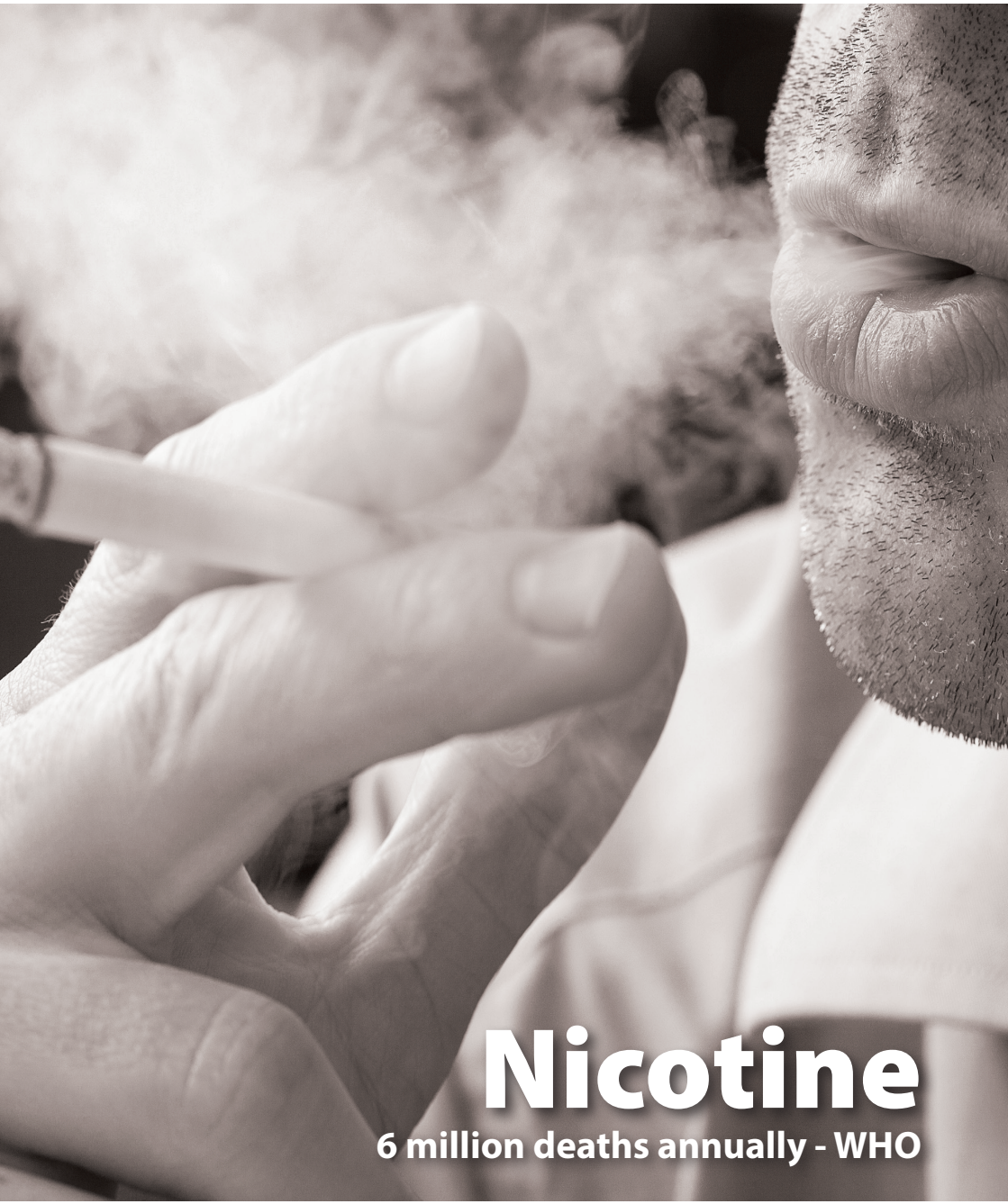
SUMMARY

Remarkable scientific advances have been made in genetics, molecular biology, behavioural neuropharmacology, and brain imaging that offer important new insights into how the human brain works and regulates behaviour. In the case of addiction, we can now investigate questions that were previously inaccessible, such as how environmental factors and genes affect the responses of the brain to drugs and produce neural adaptations that lead to the aberrant and stereotypic behaviours seen in addiction. This new knowledge is helping us to understand why addicted individuals relapse even in the face of threats such as divorce, loss of child custody, and incarceration, even when, in some cases, the drug is no longer perceived as pleasurable.

It is also changing our approach to the prevention and treatment of addiction. However, the translation of these findings into clinical practice is hampered by structural roadblocks, including the limited involvement of the medical community in the treatment of addiction and of the pharmaceutical industry in the development of new medications. One of the main challenges for agencies like the National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism is how to develop knowledge that will help us overcome these obstacles.



Note: *Views expressed in this paper are those of the author and do not necessarily represent the views of the National Institute on Drug Abuse or the United States Government.*



Nicotine

6 million deaths annually - WHO

SCIENCE AS A LIFESAVER IN HARM CAUSED BY DRUGS, ALCOHOL & TOBACCO

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HARM REDUCTION – THE UNSUNG HERO

One of the public health triumphs of the last century has been the prevention of the spread of the human immunodeficiency virus (HIV). UNAIDS reported a decline of 33% in the number of new infections from 2001 to 2012. Part of this success can be ascribed to the decrease in transmission of HIV among intravenous drug-users. Here harm reduction methods, such as education and encouraging countries to implement needle exchange programmes, have been successful in preventing disease and premature deaths. UNAIDS still recommends that countries provide a minimum of 200 sterile syringes per year for each person who injects drugs as a harm reduction measure.

The term "harm reduction" may have started with HIV, but is in fact an age-old practice. We know that the use of alcohol, tobacco and other psychoactive substances goes back many thousands of years. In most cultural settings, norms, social codes or rituals regulating consumption and associated behaviour were present. Over time these harm reduction practices have grown into a philosophy and science within public health, offering a progressive alternative to the prohibition of certain potentially dangerous lifestyle choices. Recognising that certain people always have and always will engage in behaviours which carry risks, **the aim of harm reduction is to mitigate the potential dangers and health risks associated with this, without achieving total abstinence.**

In modern terms harm reduction manifests as policies, programmes and interventions aimed at reducing the health, social and economic harms associated with not only illegal drugs, but also the safer use of automobiles *(e.g. seat belts, helmets)*, alcohol *(responsible drinking)*, tobacco *(non-combustible nicotine products)*, infection control *(hand washing)* and safe sex *(condoms)*. Despite the fact that harm reduction does prevent disease, disability and premature deaths, it is not universally accepted or practiced within the public health community. Within tobacco control, for example, some would argue that tobacco harm reduction is not possible and that abstinence and a tobacco-free world should be the paramount goal. Some drug addiction experts share the same vision of a "quit or die", drug-free world.

This abstinence-only approach often leads to a stigmatisation and dehumanisation of consumers and demonisation of the substances concerned. This article calls for a re-humanisation of the issue and a greater involvement of science in the development and expansion of harm reduction. It also reflects on some of the current opportunities where harm reduction might lead to the prevention of millions of premature deaths and disease, such as the e-cigarette revolution.

WHAT SUBSTANCES CAUSE THE MOST HARM?

Where can harm reduction science, policy and practice lead to the most gains? Consider that out of the approximately seven billion people on earth, there are:

- 1,3 billion consumers of tobacco products, of which cigarettes account for around 92% of the value of the global tobacco market. The World Health Organisation states that tobacco kills up to half of its users.
- 13-15 million intravenous drug users at risk of exposure to blood-borne infections. Up to 10% of HIV infections are linked to drug injection. Infections might also be contracted through contaminated drugs *(e.g. anthrax in heroin)* or secondary infections of injection sites.
- 2,5 Million deaths per year due to hazardous or harmful use of alcohol. This is currently the world's third largest risk factor for disease burden.

From these figures it is clear that tobacco harm reduction (THR) has the greatest potential to prevent disease and save lives. Paradoxically, nicotine used in nicotine replacement therapy and other THR products is regulated much more strictly in comparison with combustible cigarettes, the individual components of which are currently not regulated at all. Surely a more pragmatic and risk-differentiated regulatory system should be established to help guide consumers towards decreased risk in their choice of products!

ETHICS AND THE IMPERATIVE TO ENGAGE HEALTH PROFESSIONALS AND CONSUMERS

The relative disregard of consumers and the ethical elements of harm reduction merit closer inspection. Fortunately, the growth of HIV/AIDS consumer activism has highlighted the need for the involvement of consumers and patients in the debate. Their battle cry of *"NOTHING ABOUT US WITHOUT US"* proved to be a powerful galvanising force in assuring accessible and affordable anti-retroviral treatment for HIV/AIDS. It also paved the way for the development and empowerment of other consumer movements, such as seen with the burgeoning E-cigarette consumer movements worldwide.

TOBACCO HARM REDUCTION

Although nicotine is the major addictive substance in tobacco products, it is also unfairly given the major blame for the disease and death caused by tobacco products. In terms of toxicity, it is the smoke that kills, not the nicotine. Tobacco harm reduction is taken to mean encouraging and enabling smokers to reduce their risk of tobacco-related illness and death by switching to less hazardous tobacco products. This switch could be short-term or long-term, partial or full, with the understanding that **every time an alternative tobacco product is used in place of a cigarette, risk of tobacco-related illness and death is reduced.**

Health professionals can and should play a central role in strengthening the scientific evidence base related to drug, alcohol and tobacco harm reduction. There are surprisingly few health professionals in the world: approximately ten million physicians, 14 million nurses and about a million apiece of pharmacists and dentists. Ethics is a common thread in their work and its imperatives ought to be applied to these areas of addiction. Drug, alcohol and tobacco control is a natural product of a population-based, public health mind set. Harm reduction on the other hand, seems to be a natural outflow of health care provision to the individual. It should therefore be much easier for primary care health professionals to evaluate any potential role of a principled and pragmatic harm reduction approach in management of substance abuse.

Physicians in particular can play a meaningful role in this debate. The patient-physician relationship remains the core of their work. This unique relationship, facilitates an exchange of scientific knowledge and care within a framework of ethics and trust. It also places the individual

patient, as opposed to all of society, at the centre of the question – what is in the best interest of the patient in front of me?

An understanding of the values of the medical profession is also applicable to how consumers of drugs, alcohol and tobacco should be approached:

- **Autonomy:** Recognition of the consumer or patient's right to self-determination, i.e. the right to refuse or choose their treatment;
- **Beneficence:** Acting in a manner that promotes the wellbeing of others. In the medical context, this means taking actions that serve the best interests of patients;
- **Non-malfeasance:** "First, do no harm";
- **Justice:** This concerns the distribution of scarce health resources, and decisions about who receives scarce treatments *(fairness and equality)*;
- **Dignity:** The patient and the treating physician have the right to dignity; &
- **Truthfulness and honesty:** Informed consent.

PUBLIC VS. INDIVIDUAL HEALTH

At times there is a perception of conflict between 'public health' and 'individual health'. This is unfortunate since society is made up of individuals and in a perfect world the best interests of the patient would also be those of society at large. In harm reduction a divide is clearly visible; for example, Swedish citizens are allowed *(and even recommended)* to use snus as a cessation or substitute product for combustible tobacco, whilst in other EU countries this is not possible because snus is banned.

Perhaps more weight should be given to the right of individuals to health. Member states that are parties to the International Covenant on Economic, Social and Cultural Rights (ICESCR), specifically article 12, have recognised the right of every person to enjoy the "*highest attainable standard of physical and mental health*". This is also one of the mission statements of the World Health Organisation. In applying this principle to harm reduction, Kozlowski offers this wise guidance: ***"Public health concerns should trump individual rights only when there is clear and convincing evidence of harm to society. Lacking that evidence, individual rights should prevail".***

NON-COMBUSTIBLE NICOTINE: THE NEXT BIG BREAKTHROUGH IN PUBLIC HEALTH?

A striking oversight in tobacco control over the last decades has been the failure to address the product *(combustible cigarettes)* itself. Tobacco control measures have mostly focused on where, to whom and at what price cigarettes should or should not be sold; and on labelling and the disclosure of toxic ingredients. However, it has long been recognised that *"smokers smoke for the nicotine but die of the smoke"* and thus modification of the nicotine delivery system has been long overdue. Nobody questions harm reducing modifications to automobiles, but somehow the same sentiment does not apply to nicotine: e-cigarettes, for example, have not been universally welcomed as a possible tool in tobacco harm reduction.

Nonetheless, the current e-cigarette revolution, particularly how widely the product has been embraced by consumers, highlights its potential for harm reduction. The reasons why consumers are attracted to e-cigarettes include:

- **Health:** Perceived as less toxic than tobacco products;

- **Cessation:** To aid in quit smoking or to avoid relapsing;
- **Cravings:** To deal with cravings or other tobacco withdrawal symptoms;
- **Cost:** Cheaper than cigarettes;
- **Enjoyment;**
- **No second hand smoke;** &
- **Cutting down:** To reduce combustible tobacco intake.

Although originally invented in 1963, e-cigarettes were only commercialised in 2004, when they were sold in China. They first became available in Europe and the USA in 2006. Since then, e-cigarette sales have doubled or tripled every year. In 2012 the global market amounted to around $2 billion and given the rate of growth, it will probably be larger in 2014 than the market for nicotine replacement therapies *(gum, patches etc.)* A leading Wall Street tobacco stock analyst forecasts that e-cigarettes are well on their way to outselling conventional cigarettes if proportionate regulation is put in place to allow e-cigarettes to compete with combustible tobacco.

Significant health gains are to be expected if this type of growth is realised. During 2013, in the United Kingdom alone, there were approximately ten million cigarette smokers and one million *"vapours"* of e-cigarettes. A leading UK scientist of the Royal College of Physicians Tobacco Advisory Group said that: ***"if all smokers in Britain stopped smoking cigarettes and started smoking e-cigarettes, we would save 5 million premature deaths in people who are alive today".***

ARGUMENTS AGAINST HARM REDUCTION AND PRODUCTS

Despite the possible gains to be made from harm reduction, there remains a substantial resistance to such measures, including:

- These practices merely substitute one form of addictive drug with another, perpetuating the use of an addictive substance in society;
- The "gateway effect" is a very sensitive issue relating to children. For example, were children to use low risk nicotine, might this not lead them on to smoking cigarettes? This remains one of the most valid and troublesome concerns for the public health community;
- Decrease in cessation: Harm reduction decreases the effectiveness of the central message of tobacco control, that all nicotine or tobacco product use is potentially dangerous and undesirable;
- Increased relapse rates for consumers who have quit;
- Normalisation of drug and tobacco use;
- Promoting harm reduction could create a perception that the tobacco industry can play a constructive role in society, while at the same time continuing to sell highly hazardous cigarettes; &
- Public health advocates should not promote anything which is not entirely healthy.

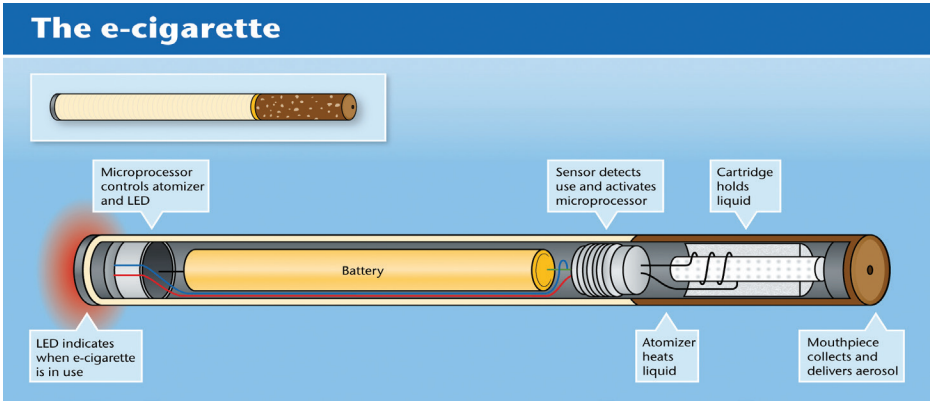
HOW CAN SCIENCE BE A LIFESAVER IN DRUG, TOBACCO AND ALCOHOL-RELATED HARM IN THE FUTURE?

In these areas the debate has too often resembled an ideological war rather than a systematic process of developing thoughtful, evidence-based policy. *Health Diplomats* and groups like *SciCom* are more than ever calling for a review process. All consultation event delegates agree that science can make a difference. The current debate and development of regulations on e-cigarettes, for

example, could be greatly aided by research and scientific validation in the following areas:

- **Establishing clear product safety and quality standards** to ensure the safety and quality of ingredients in non-combustible nicotine products;
- **Differentiation of risk** between the different classes of nicotine-containing products, from combustible cigarettes through e-cigarettes to NRT;
- **Rectifying the incorrect assertion** of 'equivalence' between smoking and e-cigarette use;
- **Rectifying misconceptions** about the toxicity of nicotine. Most health professionals still believe nicotine to be a carcinogen, which is not in line with the evidence;
- **Expanding behavioural science studies** for a better understanding of nicotine using behaviour, including how self-dosing is managed by consumers;
- **Developing health economic studies** to better understand the economic impact of harm reduction approaches and products;
- **Developing appropriate approaches to risk management** through marketing, pricing and tax mechanisms; &
- **Testing and clarifying assertions** regarding 'gateway effects' so as not to exaggerate risks and lose the opportunity to use risk-reduced products to prevent disease and save lives;

In summary, harm reduction science shows much promise. It could form the basis for risk-differentiated regulatory frameworks, the pragmatic use of risk-reduced products and lead to a more dignified approach to the consumers of drugs, alcohol and tobacco. For them, it could ultimately be the difference between life and death.



"We need a better regulated market based on sound science to prevent the promotion of smoking or e-cigarette use to non smokers and our youth. The innovation of companies towards new nicotine delivery systems is a fast growing, high-stakes phenomenon presenting both risks and undoubted opportunities for public health worldwide. We urgently need more research into nicotine addiction while encouraging other countries to take a pragmatic approach like the UK solely aimed at saving lives." **Martin Dockrell,** Director of Research & Policy, Action on Smoking & Health (ASH), London. www.ash.org.uk

RESEARCH INSIGHTS ON NICOTINE ADDICTION & CURRENT POLICY CHOICES

Dr. Christopher Proctor, Consultation Event Nicotine Panel Presenter is British American Tobacco's Chief Scientific Officer, working at Group Research and Development in Southampton. A PhD chemist, Dr Proctor has represented BAT in public hearings on the World Health Organisation's Framework Convention on Tobacco Control and has recently been invited as a scientific expert presenting at US FDA workshops. In 2003 Dr Proctor published: *'Sometimes a cigarette is just a cigarette'.* ***URL: www.bat-science.com Email: christopher_proctor@bat.com***

The World Health Organisation estimates that over the course of the 21st Century tobacco use may cause the premature deaths of a billion people or more unless urgent action is taken. Although use of all forms of tobacco and nicotine carries some health risks, cigarette smoking is both by far the most risky and also the dominant form of tobacco use in most countries. I can understand skepticism in some quarters as to why we, the manufacturers, can claim to have perhaps the most important role to play in delivering reduced harm. As first and foremost a scientist driven by this challenge, I believe we have turned an important corner. The opportunities at our fingertips and in the pipeline thanks to recent scientific and product development advances are truly of immense significance.

Increased risks for a range of fatal diseases *(including lung cancer, chronic obstructive pulmonary disease and various cardiovascular diseases)* are related with cigarette smoking in a dose response manner. These risks increase particularly with the duration of smoking but also with the numbers of cigarettes smoked each day. The increased relative risks reduce following cessation, and the rates of such reductions vary with both the disease *(cardiovascular relative risks typically reducing quicker than cancer risks)* and the individual's history of smoking. Many smokers state a desire to quit smoking and cigarette smoking prevalence rates have been reducing, particularly in Western populations. In many countries former smokers now outnumber current smokers. However, cigarette smoking is very addictive and many who quit for a period of time return to smoking, even with medical interventions such as the use of nicotine replacement therapy.

In its 2007 Report, Harm Reduction in Nicotine Addiction – Helping People Who Can't Quit, the Tobacco Advisory Group of the UK Royal College of Physicians reviewed research on nicotine addiction and the health risk profiles of cigarette smoking, oral tobacco use and medicinal nicotine. They noted that: *"Extensive experience with nicotine replacement therapy in clinical trial and observational study settings demonstrates that medicinal nicotine is a very safe drug"* and that: *"On toxicological and epidemiological grounds, some of the Swedish smokeless products appear to be associated with the lowest potential for harm to health."* The Group also noted that: *"Addiction to nicotine arises from a combination of genetic, environmental and pharmacological factors, but characteristics of the nicotine delivery system are also crucially important."* **Hence, many interested researchers and authorities have focused their efforts on developing products that will provide smokers with the desired nicotine through a delivery system presenting dramatically reduced health risks as compared to cigarettes.**

NICOTINE AND RECEPTORS

The pharmacological effects of nicotine have been characterised following decades of research

effort. John Newport Langley, alongside other researchers, used nicotine in classic experiments performed at the beginning of the 20th Century to develop the concept of receptive substances and receptors. Studies using the marine ray Torpedo helped the initial characterisation of the muscle nicotinic acetylcholine receptors (nAChR), now a very well characterised ligand-gated ion channel. Neuronal nAChRs are typically made up of five subunits, are heterogeneous, and the configuration of the receptor sub-units will determine the action of nicotine on the receptor.

It is this heterogeneity of the neuronal nAChR receptors that leads to the biphasic nature of nicotine, which can result in both stimulation and relaxation. For example, the average plasma level of nicotine found in smokers is likely to be sufficient to desensitise some nAChR receptors that have a high affinity to nicotine *(also making them unresponsive to the natural ligand acetylcholine)*, while a bolus of cigarette smoke may activate or desensitise other, less sensitive nAChR subtypes.

Large bodies of research have focused on the neurobiology of nicotine, understanding of nicotine addiction and development of better methods of cessation for smokers. The neurobiology of nicotine is complex and not fully elucidated. It is clear that nicotine preferentially stimulates dopamine release from neurons, particularly after temporary abstinence. **However, for most of the day a regular smoker will have plasma levels that result in the desensitisation of nicotinic receptors, and nicotine inhaled by smokers would not during this time cause stimulation of some of the dopamine pathways.** This suggests that the nicotine from smoking during this time is operating on other neurobiological pathways and/or smoking during these periods is reinforced by conditioned stimuli.

NICOTINE ADDICTION AND THE DELIVERY SYSTEM

There are a variety of reasons why cigarette smoking is the dominant form of nicotine use and why nicotine replacement therapies and oral tobacco products have not been complete substitutes for cigarette smoking for many people who seek to quit smoking. Cigarette smoking is a two-step process whereby smokers draw a volume of smoke into their mouths followed by an inhalation step that draws smoke down the respiratory tract into the lungs. Nicotine in the smoke causes an irritating sensation due to interaction with peripheral nerves at the back of the throat, often described by smokers as "throat catch" or "hit", and this provides the smoker with feedback on the amount of nicotine they are taking as they puff, allowing them to adjust their next puff. Nicotine in the smoke reaching the lungs is rapidly absorbed and transferred through the arterial blood stream to receptors in the brain *(a process sometimes referred to as the "bolus effect")*.

For example, the Community Epidemiology Work Group (CEWG) at the U.S. National Institute on Drug Abuse identifies and interprets emerging drug trends in the United States. The experts in the CEWG interpret these trends through a local and regional lens based on the concept that drug abuse shifts at the local level. These local shifts are due to the interactions of social networks, including interpersonal and market forces which are now increasingly impacted by global forces facilitated via the Internet (REF). Without this level of local and regional understanding, an effective approach is much harder to achieve.

Absorption of nicotine from the oral cavity to the bloodstream following the use of oral tobacco or nicotine replacement products ("NRT") is much slower than the nicotine absorption that follows smoke inhalation. For NRT users, the absence of both a bolus effect and feedback from throat sensations results in far less opportunity to adjust the nicotine dose during use. Nicotine replacement therapy is typically intended to provide short-term craving relief, and delivers less total nicotine than either cigarettes or oral tobacco products.

Studies of smoking behaviour show very large differences in nicotine intake across a

population, even among users of identical types of cigarettes. One of our studies involved collection of spent cigarette filters to estimate mouth level exposure to nicotine in thousands of smokers across eight different countries. **Results indicated that regardless of the machine-measured nicotine yield for any particular cigarette, exposure levels varied several-fold between individuals.** Smokers can adjust the amount of nicotine they take daily by changing the number of cigarettes they smoke each day and by changing the way in which they smoke each cigarette. Taking larger and more frequent puffs will increase exposure to nicotine and to other smoke toxicants. Smokers switching from cigarettes with higher machine-measured tar and nicotine yields to lower machine-measured yields often adjust their smoking behaviour such that they compensate, at least partially, by taking in larger amounts of smoke.

Smokers' ability to alter their smoke and nicotine exposure by changing their smoking behaviour may provide benefits to smokers by allowing for a continual optimisation of preferred nicotine or smoke dose. It is far more difficult to adjust the amount or rate of the nicotine dose derived from NRT or oral tobacco products, which may act as a barrier to satisfactory substitution of such products for cigarettes.

There is also data indicating that factors associated with cigarette smoking, other than obtaining nicotine also provide value to smokers and can make cessation difficult. These include the rituals of opening the pack, lighting and inserting the cigarette into the mouth, the taste and smell of the smoke, the sight of smoke on exhalation and issuing from the lit end of the cigarette and the social aspects of smoking in the presence of other smokers.

POTENTIAL OPPORTUNITIES OFFERED BY E-CIGARETTES

Electronic cigarettes, or electronic nicotine delivery systems *("ENDS" - as perhaps more accurately described by the World Health Organisation)* since they contain no tobacco and are not burnt, have become popular in the past few years. In the United States and several Western European countries there has been an appreciable adoption of e-cigarettes amongst cigarette smokers, often as partial or complete substitutes for cigarettes.

Many e-cigarettes are designed so as to appeal to cigarette smokers. These look like cigarettes, with filter-like ends that make their insertion in the mouth familiar to the smoker and with light-emitting diodes at the other end simulating the glow of a lit cigarette when a puff is taken. They produce an inhalable aerosol that is typically visible on exhalation and the pharmacokinetics of the nicotine uptake is closer to that provided by cigarette smoke than the pharmacokinetics of nicotine uptake from NRT or oral tobacco products. E-cigarette aerosol is generated by an electric heating element which is activated manually or when the user draws air through the device. The heating element vaporises a liquid formulation that typically contains nicotine, an excipient such as glycerol and sometimes added flavourings; the resulting vapour then condenses to form an aerosol.

The chemical content of the e-cigarette aerosol is substantially different than cigarette smoke and contains fewer toxicants at much lower levels than does cigarette smoke. Thus, most public health authorities agree that e-cigarettes are likely to pose dramatically lower risks of tobacco-related disease than do cigarettes. However, in addition to the vapourised components of the e-cigarette liquid formulation, certain impurities and other degradation/reaction products *(some of which are toxic)* may also be transferred to the inhaled vapour.

The characteristics of the e-cigarette aerosol depend mainly on the power of heating coil, the physical characteristics of the formulation *(such as viscosity and wettability)* and its specific

heat capacity. Many of the techniques developed to characterise cigarette smoke aerosols can be applied to e-cigarette aerosols. Both aerosols are sub-micron *(200 – 500 nm)* in diameter and have high particle concentrations on generation of up to 109 particles per cm3. Both aerosols are dynamic and change in size and composition within the lung through coagulation, hygroscopic growth *(water uptake by the soluble fraction of the aerosol)* and evaporation.

The processes for particle deposition in the body are reasonably well understood, and the rate of penetration into and absorption by the lung for the e-cigarette aerosol is comparable to tobacco smoke. Particles with diameters less than 2,500nm (2.5µm) can penetrate into the deep lung where there is a huge surface area available for systemic uptake. For particles of 50-1,000nm, deposition efficiency is low, with slow sedimentation of particles. For particles under 50nm, deposition efficiency increases in the deep lung through increased Brownian Motion although mass deliveries can be small. The exhaled e-cigarette aerosol will contain residual excipient with a very high percentage of water absorbed from the 100% humidity of the airways. The high water content is expected to disperse rapidly in the air.

E-cigarettes are a rapidly evolving product category, and it is likely that they can be improved to act as more complete substitutes for cigarette smoking both in their manner of delivering nicotine as well as provision of sensory and other experiences that smokers miss following cessation. The scientific understanding of e-cigarettes in terms of health risks and likely modes of use needs to improve in order to characterise their effects and potential to provide a complete substitute for cigarettes.

THE DEVELOPMENT OF PUBLIC POLICIES AND REGULATORY OVERSIGHT

Cigarette smoking, mediated to a large extent by nicotine addiction, is the largest preventable cause of premature mortality in many countries. One obvious public health reaction to this fact has been introduction of public health education and regulatory measures to prevent people from starting smoking and getting smokers to quit. These efforts have been relatively successful and smoking rates in some countries are considerably lower than they were a decade ago. However, there remain a considerable number of smokers globally, and alternative nicotine-providing products have to date only had modest commercial success in most places. **E-cigarettes have the potential to be a transformative technology that accelerates the move from cigarette smoking to less risky forms of nicotine use.**

Setting public policies to deal with tobacco harm reduction is not simple. The US Food and Drug Administration ("FDA") approaches tobacco regulation with a population health standard that considers not only whether novel nicotine or tobacco products offer individuals reduced health risks as compared to cigarettes but also the population-wide effects of the introduction of such products. For example, products such as e-cigarettes offer reduced health risks for individual users, but such gains might be offset if the availability of e-cigarettes results in more individuals becoming attracted to nicotine use and potentially migrating to cigarettes. Thus, the FDA is determined to set regulations on the basis of sound science that incorporates such population-wide concerns. In contrast, the Tobacco Free Initiative of the World Health Organisation has recommended prohibiting e-cigarettes as a preferred regulatory option, and some countries have enacted such measures. More pragmatic public policy and regulatory approaches may emerge from regions such as the European Union where e-cigarette use is already popular. **EU and FDA policies are likely to seek to maximise the public health opportunity that comes with e-cigarettes while minimising the potential risks. The direction of travel is clear. We are investing heavily in the supporting science and must make this journey together.**


Alcohol
2.5 million deaths annually - WHO

DRINKING PATTERNS, CULTURE & POLICY RESPONSES: A GLOBAL PERSPECTIVE

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Problems and diseases related to the harmful use of alcohol are high on the agenda of global public health policy. Alcohol ranks fifth among risk factors for disease and disability, according to the most recent calculations from the Global Burden of Disease study[1], and has become the focus of considerable political attention. In 2010, the 63rd World Health Assembly adopted the *WHO Global Strategy to Reduce the Harmful Use of Alcohol,*[2] and the *Global Action Plan for the Prevention and Control of NCDs 2013-2020*[3] identifies the harmful use of alcohol as one of the main areas for action. Yet alcohol stands apart from other risk factors for health, making it a unique challenge for prevention and policy.

Due to its dual nature, alcohol is implicated in outcomes that sit on a continuum from benefit to harm. The relationship between drinking and its consequences is influenced by many individual, societal and cultural factors.[4] At a political level, efforts to address alcohol-related harm may be impeded by tensions between local needs and priorities, and politicised global imperatives. **The ability to effectively address alcohol-related harm both at the micro and the macro level requires an understanding of the role that drinking (and alcohol itself) plays in society,** and how that role affects the relationship with outcomes. This allows a crafting of responses that are appropriate and flexible enough to meet particular needs and circumstances. Most importantly, policy and prevention must not be driven by ideology or moralistic positions, but by pragmatic considerations aimed at maximising benefits and minimising harm. They must be inclusive of opportunities, resources, and a broad range of stakeholders.

FROM DRINKING PATTERNS TO OUTCOMES

While most people who drink do so with few problems, many experience a range of harmful social and health outcomes in the three domains identified in WHO's definition of health as a *"state of complete physical, mental, and social wellbeing, and not merely the absence of disease or infirmity"*.[5] Alcohol is inextricably linked with each of these three areas, and also plays a role in how they relate to each other. The detrimental impact of chronic heavy drinking, for example, has been well described,[6] as has the relationship with acute outcomes, which include accidents, injuries, and mental health problems.[7] The involvement of alcohol in certain social issues, such as violence and public order has also been studied extensively.[8] At the same time, moderate drinking confers both somatic and mental health benefits[9], and has an impact on the intangible dimensions of quality of life *(Table 1)*.

Yet the outcomes of drinking do not depend solely on how much people drink, but also on where, when, by whom, and for which purpose alcohol is consumed.[10] These so-called 'drinking patterns' describe three distinct but interrelated aspects of alcohol consumption and are powerful predictors of both negative and positive outcomes. As a point of departure, the crafting of responses requires a thorough understanding of these often complex relationships.

The first component describes individuals and groups whose common practices or traits affect

drinking and its likely outcomes. For example, the physiological response to alcohol is quicker in women than in men, and occurs at lower levels of consumption. Women are also at risk for particular diseases in which alcohol plays a role, including breast cancer,[11] and the impact of heavy drinking on pregnancy and fetal development has been well described.[12] As a result, women generally drink less than men, and are also advised to do so where official recommendations on drinking exist.[13] Young people's inexperience with alcohol, their propensity for risk-taking, and certain physiological and developmental factors place them at higher risk than adults for adverse outcomes.[14] Appropriate interventions aimed at these groups, therefore, require a nuanced approach. Similarly, those individuals with particular health conditions or a genetic predisposition for alcohol dependence require tailored measures, including advice on whether to drink at all.

Table 1.The relationship between drinking patterns and outcomes for physical, mental, and social health. Beneficial and harmful effects have been described in research studies for the various diseases and conditions listed. Adapted from Stimson et al.[15]

Drinking Pattern		Reported Outcome Domains		
		Physical Health	**Mental Health**	**Social Health**
HEAVY DRINKING Chronic	HARMS	Alcohol dependence Neurological damage Liver cirrhosis Esophageal and laryngeal cancers Colorectal cancer Breast cancer Ischemic stroke Fetal alcohol spectrum disorders (FASD) Alcoholic gastritis	Dementia Alcoholic psychosis Depression	Productivity, absenteeism Family disruption Social costs of chronic harm
Episodic		Intentional and unintentional injuries ***(e.g., related to traffic crashes, workplace injuries, falls, assaults)***		Unintended / unwanted sexual activity Crime, violence Social costs of acute harm
MODERATE DRINKING	BENEFITS	**Protection from / Reduction in:** Type II diabetes mellitus Coronary heart disease Hemorrhagic stroke Pancreatitis Osteoporosis Macular degeneration Cholelithiasis *(gall bladder disease)* Prostate cancer	Improved cognitive function and memory *(especially in the elderly)* Wellbeing, pleasure, relaxation Reduction in vascular dementia	Quality of life Sociability and social integration Reduced all-cause mortality and morbidity across populations

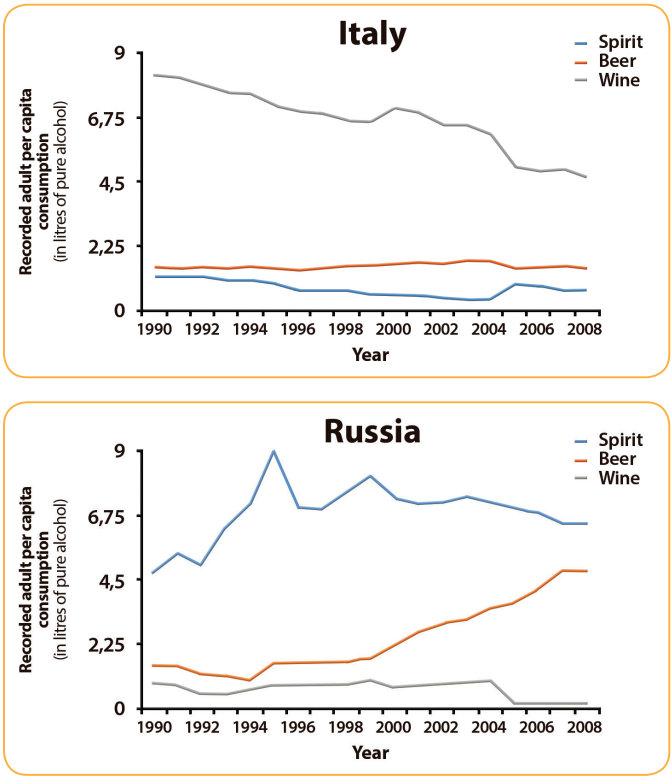
The second facet of drinking patterns includes culture-bound factors, such as norms and perceptions around the acceptability of drinking,[16] and societal views on drunkenness. Drinking cultures have been dichotomised into "wet" and "dry".[17] **At one end of the spectrum lies the Mediterranean-style pattern, which is regular and well integrated into daily life, but with little tolerance for intoxication and drunken behaviour. On the other end lies the Nordic-style pattern, with its concentrated episodes of heavy drinking and general acceptance of drunkenness as a normative outcome.** While many drinking cultures lie somewhere in between these two extremes, they serve as a useful illustration of the role played by cultural norms. They also exemplify the values and constraints that society places on drinking and how problems might be viewed.

Finally, behaviours also have an important bearing on consequences. The risks inherent in drinking and driving, for example, are all too familiar, as are its consequences, and the impact of "extreme"[18] drinking that has as its goal intoxication can easily be predicted. It is important to recognise that the implications of the relationship between drinking patterns and outcomes reach far beyond the individual. They also have a profound bearing on families and communities, social and public order, productivity, and social equity.

THE CULTURAL DIMENSIONS OF DRINKING

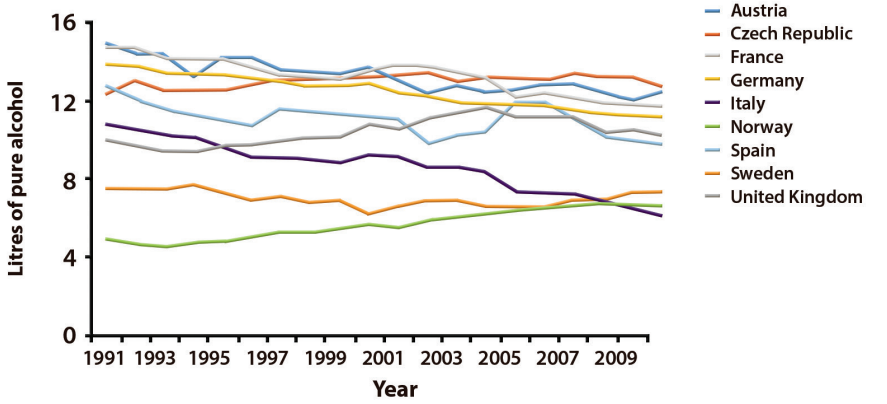
It is clear that culture plays a pivotal role in the relationship between drinking and outcomes. Yet culture is hardly static. Globalisation, urbanisation, migration and social integration have a profound impact on drinking styles and patterns. One example is the shift that has occurred over past decades in some European countries with regard to beverage preferences that were previously closely tied to national and cultural identify. In Italy, for example, the traditional consumption of wine has declined significantly; Russia, where spirits were once considered the beverage of choice, has experienced a shift towards beer, especially among younger consumers *(Figure 1)*.

Figure 1. Changing trends in alcohol beverage preferences Italy and Russia, 1990-2008.
Source: World Health Organisation (2013). Global Information System on Alcohol and Health (GISAH).



Changing beverage preferences are at times also accompanied by changes in total levels of alcohol consumption. Once widely disparate across the countries of Europe, country-level consumption has been gradually converging, a reflection of evolving preferences, homogenisation of cultures, and, in some cases, changes in alcohol regulation within the EU *(Figure 2)*.

Figure 2. Recorded total adult *(15+ years)* consumption of alcohol *(per capita)*, 1991-2010.
Source: World Health Organisation (2013). Global Information System on Alcohol and Health (GISAH).



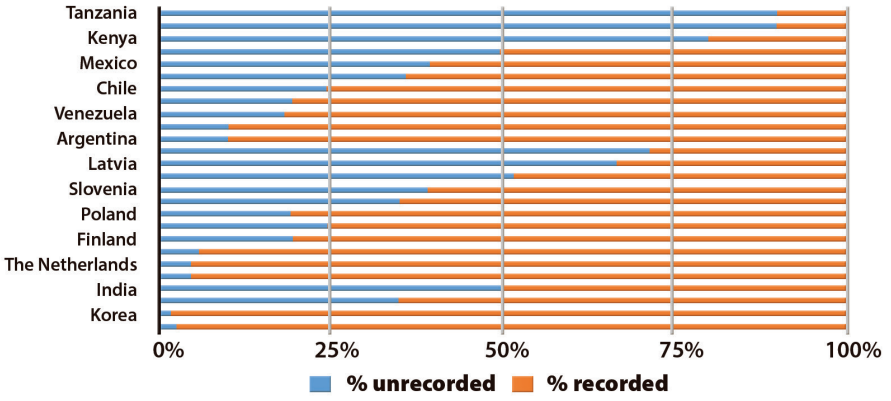
Cultural shifts have also been observed in other aspects of drinking. One notable example is the trend of increasing alcohol consumption among women in both developed and developing countries. There has been an increase in the numbers of women who drink, including in countries where this has traditionally been frowned upon. Some have blamed the globalisation of the alcohol market. However, changing gender roles, greater gender equality, the presence of more women in the workforce, and greater economic power surely play a sizeable role in this trend. However, these shifts have also been associated with heavier drinking among some women, with implications for problematic outcomes. According to the European School Survey Project on Alcohol and Other Drugs (ESPAD),[19] a longitudinal survey of students, **girls are not only increasingly keeping up with boys, but in some cases, such as in the UK, are out-drinking them.** These developments suggest the need for new approaches that are responsive to the ongoing societal changes and that can help minimise harm.

Changing consumption trends and patterns have also been observed across the developing world, and with them new challenges. Increases in economic prosperity and the emergence of a more affluent middle class have resulted in changes from traditional drinking styles to more "western" patterns of consumption. At the same time, a higher prevalence of alcohol-related chronic diseases and alcohol dependence has also been reported in these countries, particularly among urban populations.

The impact of changing drinking patterns in developing countries is further complicated by continued high levels of consumption of unrecorded alcohol. This segment, which does not figure in official government statistics, includes home-produced traditional beverages, illicit

and counterfeit products, and surrogates *(e.g., cleaning fluids, colognes)*,[20] and is conservatively estimated at around 30% of total global consumption. In some regions, the figures are significantly higher: **90% of all consumption in Eastern Africa; two thirds of all alcohol on the Indian Subcontinent; and a third in Europe and Latin America.**[21] There is also wide variation at country level in the proportion of the unrecorded alcohol market *(Figure 3)*. While some of these beverages are of reportedly high quality, others are high in alcohol content, contaminated, or adulterated with potentially toxic substances. There is also evidence, particularly in some regions, that locations where unrecorded alcohol is sold may also serve as settings for the sex trade and contribute to the spread of HIV/AIDS.[22]

Figure 3. The proportion of recorded and unrecorded alcohol in select countries.
Source: International Center for Alcohol Policies (ICAP).[23]



The complexity of the alcohol market in developing countries shows the challenges in unravelling the relationship between drinking patterns and harm. While regulators might be tempted to curtail access to branded products in an effort to reduce consumption, unrecorded alcohol remains outside the reach of government. From the standpoint of interventions, therefore, it is clear that approaches to addressing alcohol-related harm in developing countries, from both a public health and a social perspective, require measures that take into account the full cultural context and the reality of consumption among the population, as well as the potential for unintended consequences.

POLICY RESPONSES

Policies aimed at alcohol beverages, like most other health and social policies, should have as their primary goal the minimisation of harm while maximising benefit. This applies to individuals as much as to populations, and requires realistic, responsive and culturally appropriate approaches that can balance the rights and responsibilities of the individual with those of society.

Traditional public policy responses to alcohol problems have largely ignored the wide array of

idiosyncratic drinking cultures and the diversity in drinking patterns that exist around the world. The mainstay of policy measures has been a focus on regulation to reduce levels of consumption, on the assumption that this will also reduce problems. Restricting the availability of alcohol, most commonly by increasing price, curtailing hours of trade and licensing, and instituting government monopolies for the sale of alcohol beverages *(e.g., in Nordic countries, US and Canada),* and in some cases its production, form the pillars of alcohol control policies. Additional measures are aimed at restricting marketing and advertising, at limiting access by groups at particular risk for harm, notably young people, for whom legal purchase age limits apply,[24] and at reducing drinking combined with other activities, such as while driving[25] or in the workplace.

There is no question, given alcohol's potential for abuse and the risk for negative outcomes, that regulatory measures to prevent unfettered availability and access are needed. Indeed, alcohol is one of the world's most heavily regulated commodities. However, while the simplicity of population-level approaches holds obvious appeal for governments, they are blunt instruments, insensitive to the diversity of drinking patterns and problems that are of relevance to particular target populations. It has been shown, for example, that heavier drinkers are actually less responsive to pricing policies than are moderate drinkers,[26] and require a more targeted and specific approach. Similarly, while marketing restrictions are often hailed as a panacea to reducing drinking among young people, in reality, parents and peers are significantly more influential in shaping drinking patterns.[27]

The application of a one-size-fits-all approach is also unsatisfactory in addressing the world's many drinking cultures and myriad political, social and economic contexts, and can result in unintended outcomes.[28] These may create new problems without necessarily solving old ones. For example, pricing policies that aim to reduce consumption by **making alcohol beverages less affordable have encouraged consumers to simply switch to cheaper alcohol, which may be of poor quality.**[29] This includes a shift to the unrecorded sector, often associated with organised crime. Other measures, such as restrictions on the trade of alcohol, for example through alcohol retail monopolies in Nordic countries, has in part been responsible for high rates of smuggling and cross-border traffic.[30]

The appeal of regulation for governments is understandable. It is quick, demonstrates action, and brings in revenue. However, the reality is that in many countries, particularly in the developing world, regulatory measures are poorly enforced. **The infrastructure that allows policing and controls in high-income countries is lacking in the world's poorer ones.** There is also a tendency to ignore the social, political, and economic context within which alcohol policy measures must be applied. Social and health harms in developing countries, from the harmful use of alcohol to other areas, are also the product of a lack of resources for healthcare, public services, treatment options, and infrastructure. It is unrealistic to expect that policies that can be applied in Sweden or Australia can equally be applied, enforced, or are even appropriate in Nigeria or Colombia.

ENGAGEMENT FOR PREVENTION AND POLICY

What, then, is the solution? First, there is a need for a strong regulatory framework around the production, sale and consumption of alcohol. Yet there is a danger in assuming that, by itself, regulation can provide an adequate response. Feasible and sustainable interventions for reducing alcohol-related harm are not the ones that offer simple solutions. Rather, they must involve a pragmatic approach to alcohol problems. People will drink as long as alcohol products are legal and will continue to do so even when they are not. People will also continue to take risks, to drink

too much, and to ignore common sense. The imperative, therefore, is to strive to make sure that drinking, when it occurs, is as safe as it possibly can be.

Setting aside the prerequisite of a balanced regulatory framework, workable solutions are those that recognise this challenge. They include measures aimed specifically at reaching young people through education and changes in social norms to defer the onset of drinking or to prevent intoxication. Special measures that include screening, brief interventions, and treatment are needed to address the particular needs of problem drinkers. Changes to the drinking environment, and attention to the quality and integrity of beverages are, similarly, measures that can reduce the likelihood of harm. Education and awareness-raising among consumers, encouraging them to avoid harmful drinking patterns and to make informed and responsible choices, are also included in this array of measures.[31] The selection of the right mix needs to be made while bearing in mind the role that alcohol plays in a particular society, its cultural value and context, and the degree to which particular interventions are likely both to be appropriate and to enjoy public support.

Workable solutions are also those that build on the strengths of different stakeholders, allowing them to contribute to reducing harmful outcomes according to their individual competencies.[32] Regulation and the setting of policies is the realm of governments, but at national level, bearing in mind local context, challenges and culture. Educators, health professionals, and prevention specialists have a role in crafting interventions that can raise awareness and encourage safe and responsible drinking behaviours. Community leaders and civil society have a particularly important role in responding to immediate needs and in setting priorities. **Those who produce, sell and serve alcohol beverages also have a role to play within their respective competencies.** And, finally, the average consumer, almost universally ignored, has a role in making decisions and in voicing dissent when measures unreasonably infringe upon individual rights.

Encouragingly, WHO's Global Alcohol Strategy, at least in theory, offers an approach that has the potential to touch upon these various criteria for success, offers a flexible menu of prevention and policy approaches, and proposes a seat at the table for all relevant parties. However, whether it will live up to the complexities of drinking and culture, be inclusive and implemented in an appropriate and responsive way, or be usurped by ideology and moralistic positions remains to be seen.

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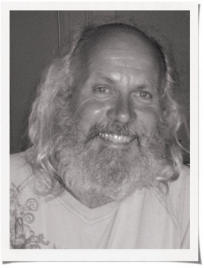

WE NEED TO LISTEN TO THE SCIENCE ABOUT ALCOHOL AND YOUNG PEOPLE

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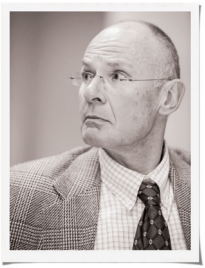

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BOYS AND GIRLS ARE BINGE-DRINKING CREATING PROBLEMS IN THEIR DAILY LIVES

Alcohol is a major cause of harm on a global basis, increasingly for our youth, but health policy and treatment responses have been inconsistent and ineffective. What is needed is a complete overhaul of our current thinking. It is time to go much further in actually listening to, and applying, what the latest brain research is telling us.

There appears to be a significant amount of information about the level and incidence of drinking by young people. It is increasing. This information becomes a key platform for concern and thinking in relation to what the brain science tells us about brain maturation during a human being's second decade and how levels of alcohol can delay or interfere with this key period of development. Not surprisingly, in such a controversial area there also exists a great deal of data interpretation and sensationalism.

Two major studies can be taken at face value to better our understanding of youth consumption of alcohol. One is American, the other European, and both arrive at the same upwards trend conclusion, yet interestingly, neither present any clear evidence of patterns of conformity across Nations.

The first study is: Monitoring the Future – National Results on Drug Use: 2012 Overview Key Findings on Adolescent Drug Use *(The University of Michigan Institute for Social Research).*

It states that alcohol has been widely used by American young people for a long time. In 2012, the proportions of 8th, 10th, and 12th graders who reported drinking an alcoholic beverage in the 30-day period prior to the survey were 11%, 28%, and 42%, respectively. In 2011, however, all measures of alcohol use – lifetime, annual, 30-day, and binge drinking – reached historic lows over the life of the study in all three grades.

Among 12th graders, binge drinking peaked with overall illicit drug use in 1979. Binge drinking then declined substantially from 41% in 1983 to a low of 28% in 1992, a drop of almost one third *(also the low point of any illicit drug use)*. However, in 2012 binge-drinking rose significantly among 12th graders, from 22% to 24%.

The second study is: *Substance Use Among Students in 36 European Countries (2011, The European School Survey Project on Alcohol and Other Drugs).*

It reported that in all 36 countries apart from Iceland, at least 70% of students have drunk alcohol at least once during their lifetime, with an average of 87% in the 2011 survey. The corresponding average figures for use in the past 12 months and the past 30 days are 79% and 57%, respectively. For all three time frames, there were small decreases from 2003 through 2007 to 2011. Of course, these averages are based on highly divergent country figures. For example, alcohol use during the past 30 days was reported by more than 75% of the students in the Czech Republic and Denmark, but only by 17% in Iceland and 32% in Albania.

Of the students who reported the amounts of various beverages that they consumed during the most recent day on which they drank alcohol, the estimated average consumption differed between the sexes, with boys drinking one-third more than girls *(2011 averages of 5.8 versus 4.3 centilitres of 100% alcohol)*.

A significant difference in this direction can be found in nearly all countries. In a large majority of the countries, beer is the dominant beverage among boys. Spirits is the most important beverage among girls in just over half of the countries. On average, these two beverages together account for about 70% of the students' total consumption.

Again, there are huge differences between countries. On their most recent drinking day, Danish students, on average, drunk more than three times as much as students in Albania, Moldova, Montenegro and Romania. Large quantities are mainly found among students in the Nordic and British Isles countries, while countries with smaller quantities often are located in South Eastern Europe. The average quantities consumed on the latest drinking day were about the same in 2011 as in 2007. At the national level, however, they increased significantly in 2011 in ten countries but dropped in only four.

This measure of 'heavy episodic drinking' *(five drinks or more on the same occasion during the last 30 days)* has undergone one of the most striking changes among girls. The aggregate-level average increased from 29% in 1995 to 41% in 2007. In the 2011 survey, however, this figure has dropped to 38%. Among boys, the figure is also slightly lower in 2011 (43%) than it was in 2007 (45%) and thus also relatively close to the 1995 figure (41%).

Two Nordic countries are at opposite ends of the scale when it comes to heavy episodic drinking. The proportion of students in Iceland who reported in 2011 that they had engaged in this behaviour during the past 30 days was 13%, while it was more than four times higher in Denmark (56%).

Between the two most recent surveys, the figures for heavy episodic drinking increased significantly in four countries *(Cyprus, Greece, Hungary and Serbia)*, while a significant fall can be seen in nine countries with comparable data, including the four Nordic countries of the Faroe Islands, Iceland, Norway and Sweden. The largest increases, of about 10 percentage points, happened in Cyprus and Hungary, while the largest decreases, of 9 percentage points, took place in the Faroe Islands and Iceland.

On average, nearly six in ten students had consumed at least one glass of alcohol at the age of 13 or younger and 12% had been drunk at that age. This reply was given, on average, by more boys than girls, and that tendency was the same in almost all countries.

A number of students reported having had problems during the past 12 months linked to

their alcohol consumption. The types of problem most commonly reported were "performed poorly at school or work" (13%) and having had serious problems with friends or parents (12% each). Countries where many students reported problems related to their alcohol consumption include Bulgaria, the Czech Republic, Latvia and Slovakia.

A CLOSER LOOK AT HOW THIS YOUTH DRINKING IMPACTS THEIR BRAIN

While there is a decline in drinking among young people, a significant percentage of young people engage in risky behaviour by repeated episodic heavy drinking. Substantial evidence indicates that the initiation of risky drinking is higher during adolescence than at other times in life. Risky drinking is often part of an overall profile of high-risk behaviours in adolescents, but the availability and role of alcohol consumption in society demands a thorough understanding of youth drinking.

The second decade of life is a time of physical maturation and continuing development of the brain. Emotions and motivations are thought to originate in the midbrain, whereas the frontal region of the brain exerts executive function and limitation of impulsive behaviour. Recognising that different regions of the brain develop at different times may help us to understand some of the impact of alcohol consumption during the second decade of life.

Understanding that the midbrain regions develop earlier and faster than the frontal regions helps explain why adolescents may experience more dramatic emotional responses following ingestion of alcohol yet not have sufficient ability to limit impulsivity. As a consequence of having inadequately developed executive functions, **adolescents are very vulnerable to the feeling of invincibility when drinking alcoholic beverages.**

Both animal and human studies have shown that heavy drinking can cause cognitive deficits, which further impair decision making, problem solving, planning, attention and learning. Thus, early heavy drinking can interfere with school performance and create behavioural difficulties for young people. For example, heavy drinking by young people can result in a wide range of costly health and social consequences, including fatal and nonfatal accidents, all types of interpersonal violence, risky sexual behaviour, academic problems, and alcohol poisoning.

The policy-maker and health community's focus must primarily be on modifiable risk factors since these factors represent potential targets for prevention. Unfortunately, the problem is complex and a single solution or policy to prevent youth drinking does not exist. Nevertheless, a number of strategies are effective in some circumstances and warrant further study in different populations.

Preventing risky drinking requires understanding of the important influence of family and peers. As young people develop independence and freedom from their parents, they learn behaviours related to drinking and other aspects of life from both family and peers. Genetic traits like impulsivity, anxiety, sensation seeking and emotional dysregulation can also contribute to harmful drinking. The expression of genetic traits and early learning is further influenced by the cultural and environmental milieu.

Social networking and digital media have developed rapidly over the last five years. However, they remain a largely unexplored domain both for exacerbating and alleviating problems related to alcohol use in young people. Equally, alcohol advertising across the board needs closer examination and tightening up. For example, youth are highly influenced by sports and it is this domain that many alcohol producers target. Where tobacco companies have been removed, one now sees a preponderance of alcohol and gambling companies presenting an image that alcohol and betting is good for you.

Much of the previous work regarding the effectiveness of public policies on harm associated

with alcohol consumption has examined the impact on the population as a whole. An exception is the growing body of knowledge regarding the vulnerability of the developing brain in adolescents to the harmful effects of alcohol. **This issue may have relevance for public policy regarding the age of purchase or consumption of alcoholic beverages which varies dramatically from 16 years in Europe to 21 years in America and even younger elsewhere.**

Some risk and protective factors are common to all cultures. These include biological and temperamental traits that predispose an individual to drink or not to drink and to experience greater reinforcement from drinking. On the other hand, other risk and protective factors are culturally determined, such as expectancies about alcohol and parental influence. It is expected that the former types are consistent across countries, whereas the latter may differ.

What is clear from *SciCom's* high-level gathering of experts and the growing body of scientific evidence being produced is that further work in this area should examine the impact of public policies on adolescents, who may be "at-risk" for harm associated with heavy drinking through no fault of their own.

WHAT POLICY-MAKERS ARE SAYING BUT NOT DOING

With such clear implications for alcohol on brain development, the lack of policy clarity has to be seen as alarming. Most Nations may well have regulatory controls in place around supply and sale, but it is obvious from the statistics that their application is far from effective.

The WHO estimates that the world drank the equivalent of 6.1 litres of pure alcohol per person in 2005. The biggest boozers are in Europe and the former Soviet States. Moldovans are the most bibulous, getting through 18.2 litres each and nearly 2 litres more than the Czechs in second place. Over 10 litres of the Moldovan's annual intake is reckoned to be *'unrecorded'* home-brewed liquor, making it particularly harmful to health. Such moonshine accounts for almost 30% of the world's drinking. More importantly, harm reduction strategies fail to recognise the strong links between alcohol-related harm and low income. It is referenced in many studies around the world, but it is mainly anecdotal. **An accepted figure is that 80% of overall alcohol harms are associated with the poorest 10% of the population.**

In the UK, the Chief Medical Officer, Sir Liam Donaldson, issued in 2009 a five-point guide on the consumption of alcohol by children and young people. His advice is:

- An alcohol-free childhood is the healthiest and best option – if children drink alcohol, it shouldn't be before they reach 15 years old;
- For those aged 15 - 17 years old, all alcohol consumption should be with the guidance of a parent or carer or in a supervised environment;
- Parents and young people should be aware that drinking, even at age 15 or older, can be hazardous to health and not drinking is the healthiest option for young people. If children aged 15 - 17 consume alcohol, they should do so infrequently and certainly on no more than one day a week;
- The importance of parental influences on children's alcohol use should be communicated to parents, carers and professionals. Parents and carers need advice on how to respond to alcohol use and misuse by children; &
- Support services must be available for children and young people who have alcohol related problems, and their parents.

HOWEVER, THIS IS GUIDANCE. WHAT THE LAW STATES IS THE FOLLOWING:

It is against the law:

- To sell alcohol to someone under 18 anywhere;
- For an adult to buy or attempt to buy alcohol on behalf of someone under 18. *(Retailers can reserve the right to refuse the sale of alcohol to an adult if they're accompanied by a child and think the alcohol is being bought for the child.);*
- For someone under 18 to buy alcohol, attempt to buy alcohol or to be sold alcohol;
- For someone under 18 to drink alcohol in licensed premises, except where the child is 16 or 17 years old and accompanied by an adult. In this case it is legal for them to drink, but not buy, beer, wine and cider with a table meal; &
- For an adult to buy alcohol for someone under 18 for consumption on licensed premises, except as above.

It is not illegal:

- For someone over 18 to buy a child over 16 beer, wine or cider if they are eating a table meal together in licensed premises; &
- For a child aged 5 to 16 to drink alcohol at home or on other private premises.

This example perfectly reflects the inconsistencies between the law on one hand, and the guidance being given by health experts and groups on the other, often in good faith, as a step to try to deal with a growing crisis of youth consumption of alcohol. As a measure to relieve some pressure on the 'troubled alcohol industry' and after a lengthy lobbying campaign, the UK's March 2013 budget stated that the price of a pint would be cut by a penny, in a surprise reversal of the chancellor's commitments to annually increase beer duty by two percentage points above inflation until 2015.

Chief Medical Officers worldwide are increasingly aware that the harmful use of alcohol is killing 2.5 million people, including 320,000 young people between 15 and 29 years of age. The harmful use of alcohol is especially fatal for younger age groups and alcohol is the world's leading risk factor for death among males aged 15-59, according to the World Health Organisation (WHO).

TO MAKE THIS MORE RELATIVE, THE UK GOVERNMENT'S 2012 ALCOHOL STRATEGY ESTIMATES THAT IN A COMMUNITY OF 100,000 PEOPLE, EACH YEAR:

- 2,000 people will be admitted to hospital with an alcohol-related condition;
- 1,000 people will be a victim of alcohol-related violent crime;
- Over 400 11 to 15 year olds will be drinking weekly;
- Over 13,000 people will binge-drink;
- Over 21,500 people will be regularly drinking above the lower-risk levels;
- Over 3,000 will be showing some signs of alcohol dependence; &
- Over 500 will be moderately or severely dependent on alcohol.

These figures are built into the Alcohol Harm Reduction Strategy for England and Wales which

estimate that over 8 million adults there are drinking more than 28 units per week. The 2012 Alcohol Strategy also acknowledges that **50% of stranger violence is alcohol-related, 30% of child abuse involves alcohol, 50% of domestic violence and up to 80% of admissions at Accident & Emergency hospital services at certain times are alcohol related.** We can pick any OECD country and find similarly high statistics.

Ireland, a nation synonymous with the pleasures of the pint and the craic of its pubs, has actually the highest abstinence rate in the EU with 25% of its population never drinking. That said, alcohol-related liver disease deaths have trebled in recent years. Alcohol is now killing twice as many Irish citizens as all other drugs combined – and Ireland ranks with Denmark as having the highest illicit drug use in the EU.

On safe drinking levels, a review appearing in Drug and Alcohol Today (2013) which looked at 57 countries, showed that 8 EU member states did not have readily accessible alcohol guidelines at all. Moreover, there was confusing variation in what constituted a 'standard drink' or 'unit of alcohol'. When you think about it, **most countries speak of 'daily limits' when it comes to alcohol, encouraging the perception that it is safe to drink 'every day'.** To make matters worse, not only might a 'unit' vary from country to country, it makes no scientific sense to apply it to everyone aged from 18 to 80 years, or from 60 to 160 kilos. Nor can it be properly applied to somebody in good health to somebody in poor health, on medication or not, on 100 euros a week or 1000 euros a week.

WHAT OUR ALCOHOL PANEL CONCLUDED: ANDY STONARD

The statistics on alcohol consumption speak for themselves and the implications of a growing body of scientific studies are very clear: we are sleep-walking into an alcohol epidemic that is global with devastating consequences on our youth. The latest evidence, incidentally, also shows a dramatic increase in alcohol consumption by our elderly, often city-bound and living alone.

Firstly, the most damaging impact of this process is that it remains easier to focus on the individual and to blame the individual, which of course remains the major treatment model for addiction to alcohol. Once addicted, then always addicted. It is a disease held only in abeyance by abstinence. The alcoholic is somehow different from the rest of us. They are over there and we are over here and ideally, they will stay anonymous. The industry will often play on this fact, telling policy-makers that they cannot tamper with *'freedom of choice'* or *'individual satisfaction'.* But we cannot deny that modern day marketing laws make 'alcohol pushers' of us all. We are bombarded by alcohol advertising everywhere we turn. It is impossible to celebrate anything or to be a celebrity without alcohol in the equation. There are signs that this is being noted. For example, the negative reaction in Ireland to *'Arthur's Day',* celebrating Guinness consumption, or to the drinks industry's widespread printing of free programme booklets for supporters during the European football Championships.

Secondly, all governments turn nice streams of revenue from the sales of this legal drug and it does create much needed jobs that, in turn, pay the taxes supporting the very governments and regulating bodies we depend upon. Even the EU receives a share of income from the sales of alcohol in its member states. Alcohol pricing in the UK today, for example, is 44% more affordable than it was in the 1980's and the number of breweries doubled in London alone in 2013, standing at a 70 year high across the country, producing 5,200 plus types of beer. Jobs also matter. *The Brewers of Europe* claim to support 2.5 million jobs in Europe and their latest press release points to the role of their 4,000 brewers in 'helping fight youth unemployment'. Their latest photo exhibition

took place at the European Parliament, no less, and is a campaign to 'show their sector's craft and dynamism'.

Thirdly, societal problems related to drinking alcohol certainly exist – violence *(stranger and domestic*), public disorder, accidents and road accidents, crime, absenteeism from work etc. **But alcohol production is a legal, regulated business. It is too simple to just 'hang' the blame for these problems on the drinks industry alone.** Neither can you blame it for fighting its corner and wrapping its business in history and culture and, more recently, the joys of beer with food. But there is surely a total abdication of the 'responsibility' they so often quote when we know so little about their supporting science.

Why do bottles of beer, wine and spirits provide so little basic ingredient and health information, as we expect from our milk, juices and even bottled water these days? Who gives this labelling exemption and what is the logic behind it? Does the WHO have a similar Products Directive on alcohol as we do on tobacco, for example? Where are the research teams innovating these products, how much is being spent, how much is being subsidised and more importantly, how robust is the science?

What our high-level consultation event demonstrated is that there exists in alcohol a battleground between health and industry built entirely upon contradictions and a mutually beneficial stand-off. Genuine health actors are muted and do not get their suggestions heard. The focus on tobacco and other health issues like obesity or ageing provides a convenient side-show to the real story about the real and present danger of alcohol consumption. 2.5 million lives lost annually is not insignificant. **We need to urgently develop a completely new alcohol health approach based on scientific understanding of how our brain works cognitively with alcohol. We'd surely all drink to that!**


M-76
Drugs
200,000 deaths annually - WHO

UN REVIEW PROCESS CALLING FOR WIDE-RANGING DEBATE ON DRUG POLICIES: WILL EUROPE SET THE EXAMPLE?

Prof. Michel Kazatchkine, MD, Consultation Event Co-Chair & UN Secretary-General's Special Envoy on HIV/AIDS in Eastern Europe and Central Asia; Member of the Global Commission on Drug Policy and Former Executive Director, The Global Fund to fight AIDS, Tuberculosis & Malaria.
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These are times for debate on drug policies. The call for debate came from the UN Secretary-General *"In 2014, the Commission on Narcotic Drugs will conduct a high-level review. This will be followed, in 2016, by the UN General Assembly Special Session on the issue. I urge Member States to use these opportunities to conduct a wide-ranging and open debate that considers all options."*

Opening the debate is timely since the UN General Assembly has not met on the issue of drugs for more than sixteen years. So many changes have occurred in that period of time in terms of geopolitics, world economics and development, societal behavior, drug production patterns, biomedical research, and drug consumption and policies. These have also been the years where the AIDS epidemic has decimated the community of people who inject drugs and where, as a consequence many countries, particularly in Western Europe, shifted pragmatically their drug policies towards a harm reduction and public health focus.

Just the last two years have seen a significant inflexion towards more permissive policies in a number of countries including countries in Latin America, Uruguay, Mexico, Argentina, and in two Sates in the USA, Washington and Colorado that voted by referendum on the legalisation of a regulated production and consumption of cannabis. President Obama, President Santos of Columbia, and the Presidents of Mexico and Guatemala have openly called for revisiting drug policies. *The Global Commission on Drug Policy*, an independent group of high-level politicians, professionals and intellectuals has claimed that the "war on drugs" has failed and is calling for reform. At the same time, a number of countries have taken stronger public stands on prohibition law enforcement, including China and the Russian Federation. Canada has recently installed minimum mandatory sentences for drug use, while twelve countries still have drug use punishable by death. Overall, laws and policies e.g regarding syringe possession or cannabis, vary from country to country, States and often, even cities ***(see for example: Reformdrugpolicy.com/cannabis-map/map/).***

As the Global Commission has noted, **it is time to bring to the international level an informed, global science-based discussion about humane and effective ways to reduce the harm to people and societies caused by drugs.** Independent platforms, such as those organised by *SciCom – Making Sense of Science*, which I attended in 2012 and Co-Chaired in 2013, are invaluable in this respect. Furthermore, it is great to see science conferences such as *AAAS* and *Euroscience Open Forum (ESOF)* now beginning to include such re-thinking sessions on their scientific programmes.

The debate should first focus on challenging the dominant prohibitionist paradigm and the widespread but poorly informed belief that drug use should be dealt with through the criminal justice system. Prohibitionist policies have failed to deliver on their stated goals of reducing drug

production, trafficking and consumption. One may further argue that prohibitionist policies have been counter-productive, fueling violence, corruption, violations of human rights, and diseases, including HIV/AIDS, hepatitis C and tuberculosis. **Policies based on the prohibitionist paradigm are not based on evidence, not cost-effective, do not reduce drug dependence and directly and indirectly cause serious harm to individuals, societies and democracies, in addition to not reducing the individual harms caused by drug taking.** Each year, hundreds of thousands of people globally die from preventable, drug-related disease and violence. Millions of users are arrested and incarcerated. Communities all over the world are confronted with drug-related crime on a daily basis.

Early in the AIDS epidemic, many countries in Western Europe recognised the link between unsafe injections, needle sharing and transmission of HIV and hepatitis, as well as the importance of large-scale implementation of Harm Reduction as a public health intervention. The UK, Belgium, the Czech Republic, Denmark, France, Germany, Greece, Italy, the Netherlands, Portugal, Spain and Switzerland quickly implemented harm reduction programmes, including needle exchange and opioid substitution therapy, for which there is comprehensive, compelling, and conclusive evidence that these approaches significantly prevent the risk of acquiring HIV, decrease overall drug-related mortality, increase life-long prospects of quitting drugs, and increase the chances that an individual will find work and live a normal family and social life.

The epidemiological evidence is clear: in countries that have adopted harm reduction and health-based approaches to drug use and addiction, the HIV epidemic among people who use drugs has declined, as we have clearly seen in Western Europe, Australia and Canada. In countries and regions that have neglected harm reduction and relied on ineffective and aggressive drug law enforcement, the HIV epidemic has not declined among injectors, as we see in Thailand, or, in the even more worrying case of the Russian Federation, the epidemic is rapidly expanding and spreading to the general population. In just the last three years, we have also seen how a decrease in funding and implementation of harm reduction programmes can lead, within just a few months, to HIV epidemic outbreaks, as has been the case in Romania and Greece.

This is why the World Health Organisation (WHO), UNAIDS and the UN Office on Drugs and Crime (UNODC) jointly recommend a package of Harm Reduction interventions, including needle exchange, substitution therapy, information and education, overdose prevention, and engagement of people who use drugs in decision-making - to which I would add - safe injection sites. It is remarkable, as discussed in *SciCom's* first compendium on Harm Reduction Science, that despite the evidence and these recommendations, a number of countries, particularly in Eastern Europe, still do not accept the evidence to base their policies. We too easily look to name and shame countries like Russia and the Ukraine which are certainly far behind in their thinking and approach, but closer to Brussels, many member and neighbouring states are failing in their duty of care.

It is highly unlikely in my view that the conventions will be revisited in 2016, but that should not prevent the international debate from largely refocusing on reducing harm as an essential component of drug policy. That implies to recognise that the goal of "a drug free world" does not make sense and that it is time to de-link the drug policy debate from the criminal issues that are just one component of the drug problem and frame it in a broader agenda of human and economic development, and public health.

It implies reframing the goal of drug policies to address the reality of drug use, and experimenting and moving to new and alternative policies. It also means establishing a new set of indicators and metrics to measure the outcomes of policies at the country and international levels. We can no longer rely on largely irrelevant data such as the number of seizures, arrests and

incarcerations. Instead, we need to use indicators that really matter in civilised societies: decreasing drug addiction, expansion of health services, improved health, reduced criminal violence, and safer and more peaceful communities.

Furthermore, different drugs generate different harms, and the international community should also revisit the current classification of the "dangerousness" of drugs. This could prevent some of the shocking disproportion that exists between "objective" harm and sentencing, and serve as a basis for further experimental regulation. As proposed in the European's Commission recently issued draft regulation, "policies on new psychoactive substances should be based upon the principle of proportionality in relation to risk of each substance".

I applaud that approach and also the engagement shown by Directorate-General Justice, Fundamental Rights and Citizenship in accepting a presenting role on our Drugs Panel at the High-Level Consultation Event. The European Parliament's Science & Technology Open Assessment Panel (STOA) were also represented unofficially by MEP Vittorio Prodi who made a stirring intervention, while CSA Glover sent her No2. DGs SANCO, RTD and JRC were unfortunately not represented when surely they have an obligation to get involved. We must keep this momentum going, hold our elected officials, our nominated Commissioners, Presidents and their civil services to account and get Brussels to acknowledge and take leadership in the forthcoming debates. **Europe is a major consumer of drugs, and thus a major driver of the drug market. It is also the home of some of the best examples of evidence-based, people-centered, public health-driven policies.**

Finally, these considerations also imply that the debate is opened around decriminalisation of possession for personal use. There is now also compelling evidence about the multiple harms caused by the criminalisation of users, ranging from the devastating consequences it has for the individual with regard to stigma, health and employment, to overburdening of courts and prison systems and rising costs for society. Many studies have documented how policing practices such as syringe confiscation and police crackdowns increase the risk of unsafe injections and how incarceration itself leads to elevated HIV risk because of ample access to drugs in prisons and absence of access to safe injection equipment. Removing the fear of criminal repercussions is also a pre-condition to the effective implementation of a public health approach. Decriminalisation means stopping the arrest and incarceration of users: it implies that the solution to the drug problem cannot be found in a criminal justice approach and that there is an urgent need for alternatives when people who use drugs have not otherwise committed crimes.

Europe has experience here and assembled evidence showing that *de jure* or *de facto* decriminalisation *(which is now in place in up to 30 countries in the world)* does not result in increased drug consumption and violence. Rather, it ends the poisonous and dysfunctional conflict between public health and law enforcement, and increases users' access to prevention and treatment services. Portugal, Switzerland and the Czech Republic are particularly well placed to discuss this evidence in the public debate. Several countries in Europe can provide some of the best evidence to support the switch from prohibition and law enforcement to a comprehensive set of human rights-, social- and public health-based policies that ensure access to prevention and treatment and involve "smarter" law enforcement that safeguards human rights and ensures citizen's security.

It is time for debate and it is time to change course. Governments must approach the UN review process with an open mind, a spirit of shared responsibility and a commitment to do drug policy better. As former President of Brazil Fernando Enrique Cardoso and Kofi Annan recently wrote: *"The fact is that today we know what works and what does not. It is time for a smarter approach to drug policy. Putting people's health and safety first is an imperative, not an afterthought".*

DRUG PROGRAMMES AND POLICIES: WHAT EVIDENCE OF EFFECTIVENESS?

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Debates on programmes and policies related to illicit drugs – at national or international level – are often difficult, emotional, and not driven by scientific evidence. However, over the last decades, there has been a lot of effort to conduct sound evaluation of programmes and policies and to review the available evidence of effectiveness. The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) provides on its website a review of the evidence of effectiveness of various programmes related to illicit drug use *(www.emcdda.europa.eu/best-practice)*. The level of evidence regarding prevention, substitution therapy, and harm reduction is briefly summarised here.

PREVENTION

The evidence appears "patchy": not all types of preventive activities and possible outcomes have been systematically assessed. For example, there is no consistent evidence that one of the frequently used types of prevention – i.e. mass media campaigns – is effective[1] in modifying illicit drug use – if used alone. On the other hand, comprehensive family-oriented prevention is likely to be beneficial to reduce cannabis use, according to a Cochrane review[2].

Several types of school-based interventions are classified by EMCDDA as beneficial or likely to be beneficial in reducing or delaying substance use: those using the concept of social influence and life skills[3], and those using peer-led approaches[4]. **Interventions focused only on the improvement of students' knowledge on drugs have no effect on illicit drug use**[5]. Comprehensive community-based programmes involving community, school and family have been proven to be beneficial in preventing or reducing illicit drug use[6].

TREATMENTS

There is no conclusive evidence at the moment regarding the treatment of cocaine addiction. The effectiveness of pharmacological treatment with antipsychotic drugs, anticonvulsivants or psychostimulants is still unknown. Some other pharmacological approaches *(for example with antidepressants or dopamine agonists)* or cognitive / behavioural psychosocial interventions[7] are likely to be beneficial.

The situation regarding treatment of heroin addiction is completely different: there is compelling evidence of effectiveness for diverse types of treatments. Maintenance treatments with methadone or buprenorphine are beneficial regarding retention in treatment, reduction of opioid use, HIV infection acquisition and mortality[8]. Psycho-social interventions and case management added to maintenance treatment are also beneficial. Maintenance treatments for pregnant women are considered likely to be beneficial[9].

Regarding heroin maintenance treatment for patients in whom methadone maintenance has failed, there is a more balanced evidence with a trade-off between benefits in terms of retention

in treatment, reduction of criminal activity, mortality reduction and possible side-effects of treatment[10]. The effectiveness of therapeutic communities for the treatment of drug misuse and dependence is still unknown[11].

HARM REDUCTION INTERVENTIONS

The status of evidence regarding harm reduction interventions is mixed. Many interventions are directed to vulnerable populations, most of them active drug consumers, and they operate in low-threshold settings where protection of anonymity is the rule. Research in these types of settings is difficult, especially experimental research able to bring the highest level of evidence, such as randomised controlled trials. There has been, nevertheless, a lot of observational research and research reviews in these settings and populations, bringing enough evidence to make decisions. The following interventions are now considered likely to be beneficial:

- Needle/syringe exchange programmes: to reduce injecting risk behaviour and HIV infection[12];
- Drug consumption rooms : to reduce injecting risk behaviour[13];
- Ensuring continuity of treatment from prison to community: to reduce mortality[12]; &
- Combination of oral substitution treatments and needle/syringe exchange programmes: to reduce HIV/HCV incidence[14].

BEYOND EVIDENCE

The evidence reported here comes mostly from experimental studies conducted in specific contexts. They give information on efficacy *(i.e: the intervention works in an experimental context),* less on effectiveness *(i.e: the intervention can work in the real, ordinary world in the context of "normal" implementation)*. In the real world, the intensity and quality of a given programme may vary, the coverage of the target population may also be unequal on a given territory. This may reduce the size of the effect of the intervention. Monitoring the implementation *(intensity, quality and coverage)* of interventions is therefore important.

In the real world, interventions meant to reduce drug related problems are generally not unique nor independent. Combination of programmes may show results where a single programme does not, provided that a certain degree of coherence between programmes exists. Comprehensive and coherent drug policies have an increased potential for effectiveness *(www.challengeaddiction.ch)*. **Randomised controlled trials are generally not relevant to evaluate complex policies:** comprehensive evaluation, using many sources of information that can be triangulated to explore proofs of effectiveness, are necessary. These sources of information *(specific surveys, routine statistics such as drug treatment statistics, mortality statistics, police and justice statistics, etc.)* and other types of data, have to be combined, with a transversal and longitudinal view. In this case we can speak of accumulating or cumulative evidence.

As an example, in Switzerland, a comprehensive continuous evaluation of the national drug policy was set up in 1991 and followed up until 2003[15]. Many studies were set up, some of them repeated over time. This new harm reduction policy was under close scrutiny for political reasons. Progressively, over years, there was convergent and cumulative evidence from the evaluation that:

- Sale/distribution of syringes was well accepted by the population *(87% in favour) (1991)*;
- The harm reduction policy did not deter injecting drug users for entering treatment *(1991)*;
- There was a decrease in the number of new HIV cases among IDU *(since 1992)*;
- There was a decrease in needle sharing and stabilisation at a low level *(since 1994)*;

- No increase in injecting behaviour was observed: stabilisation in syringe demand occurred, followed by a decrease *(1996)*; &
- Coverage of syringes remained high, risk behaviours and HIV incidence low, over time (2009)[16 17].

In conclusion, this accumulated evidence brought by a continuous evaluation was particularly useful to pacify political debates, and contributed to consolidate and maintain a firm and effective harm reduction policy.

Child's play?

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PUNISHMENT STRATEGIES DO NOT REDUCE DEMAND FOR DRUGS

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In June 2013, we enjoyed a high level workshop looking at the real science of drug addiction and its implications for policy-making. We heard evidence from some of the world's foremost experts, also on other substance addictions, that would point to urgent changes required in some of the policies and programmes that have characterised international drug control for the last century:

Social and ethnographic studies have demonstrated that the reasons why young people first decide to take illegal drugs, and why experimentation turns into regular use, are grounded in fashion, peer pressure, attitudes to risk, and socio-economic conditions. The legal status of the preferred substance and the risk of arrest and punishment do not seem to have a significant impact on the number of young people who use drugs. But the dominant strategy used by many governments in an attempt to reduce demand for drugs is to declare them to be prohibited and to arrest and punish those caught in possession in an attempt to deter potential users from becoming involved. Whatever the other pros and cons of a punishment strategy, it cannot be expected to reduce demand at a population level.

Similarly, a wide body of evidence now exists regarding the impact of drug education and prevention programmes on population levels of drug use. Some of these studies show that well designed programmes can have an impact on knowledge, attitudes, and age of first initiation of some participants. **But no specific drug prevention or education programme has ever registered a significant or sustained impact on overall levels of drug use amongst the target population.** Yet, this remains the prime objective of most government prevention programmes – to reduce overall use – and a high proportion of programmes still rely heavily on simple risk and fear messages in the hope that they will deter potential users.

Our understanding of the nature of addiction has increased massively in recent years. The neurological processes that encourage repeat use and dependence, and their interaction with psychological and social factors, can increasingly be defined and observed, and their complexity acknowledged. These scientific breakthroughs are stimulating broad debates around the nature of addiction and free will, but it is clear that drug dependence does have a physical and neurological basis. Some government interventions – particularly those that rely on coercion and punishment – are therefore rendered invalid. The idea that an individual struggling with drug dependence will be able to overcome the condition as a result of an increase in the harshness of their environment, or by being exposed to further humiliation and abuse, has rightly been rejected by the academic and professional communities, and the United Nations.

In a slightly different field, all assessments of the scale and nature of the international market in illicit drugs have shown that, despite all efforts and operational achievements in eradicating crops and seizing drug shipments, the levels of supply continue to be driven by demand for specific commodities. The predominant logic for international drug control for a century has been that the constriction of supply of specific substances would lead to the stifling, and eventual disappearance,

of the market. While it may be possible to temporarily limit the availability of specific drugs in specific *(particularly emerging)* markets, it is clear that when demand for illicit drugs is established, the potential for trading profit ensures that a method of supply is found, and where one route is disrupted, another *(perhaps with more consequential harms)* replaces it.

In such a complex field, informed by so many academic and scientific disciplines, it is unlikely that future policy decisions will ever be able to claim to be purely science and evidence based. But as *SciCom's* high-level consultation event clearly evidenced, even a limited review of current scientific knowledge should lead to significant questions about much of what is currently done in the name of international drug control.

Ex-smoker and brain-rewards research advocate, US President Barack Obama has weighed into the substance addictions debate claiming *"smoking marijuana is no more dangerous than alcohol",* but still called it *"a bad idea".*

BEST PRACTICE IN GLOBAL SCIENCE POLICY-MAKING

SCIENCE AND POLICY – A CRUCIAL RELATIONSHIP

1) Science is a fundamental pillar of the knowledge-based society. Science provides innovation, technological development, and ultimately benefits to humanity. Science is also a value per se, expanding the frontiers of knowledge and should not only be judged in economic terms.
2) Science can help make better policies. In an ever more complex and globalised economy and society, its importance is growing. Yet, it is just one element in decision-making. Governmental decisions are ultimately political. Contrary to scientists, policy-makers are elected, which gives them the right (and the duty) to take decisions.
3) The dialogue between science and policy is not straight forward. Policy-makers have multiple sources of solicited and unsolicited advice, thus science does not speak with one voice. Scientific evidence is not always welcomed by policy-makers, which can lead to it being ignored or distorted.

WHAT WE EXPECT FROM THE SCIENTIFIC COMMUNITY

4) Science must be independent and transparent. Vested interests must be disclosed and conflicts of interest avoided. Science must have an inherent integrity and quality, both individually and as a whole, underpinned by continuous peer review. It should not be optimistic or pessimistic but accurate and strive for greater inter- and multi-disciplinarity.
5) Stronger emphasis must be given to the inclusion of social sciences to improve understanding of how the public may react or adapt. This will further help scientists understand their role in society. Their collective wisdom is essential in more proactively helping policy-makers to get things right. Science must accept that such inputs are often required ad-hoc, as there is not always time for tailor-made studies or optimal solutions.
6) There are established channels for providing policy advice - scientists must learn to use these more effectively, and be less aloof and perhaps less arrogant. In so doing, science must enhance its voice, be courageous in policy debates, and get better organized to ensure more accurate representation of its findings. This requires greater understanding of, and earlier engagement with, the general public, private sector and non-governmental organizations who are equal stakeholders.

WHAT WE EXPECT FROM THE POLICY-MAKING COMMUNITY

7) Points 4, 5 and 6 largely apply to policy-makers who must be receptive to scientific advice, even when this advice is uncomfortable. They should involve scientists at all stages in the policy-making cycle and pose the right questions in a timely fashion, as the quality of advice can be determined by the necessary speed of response.
8) For the science and policy relationship to work, policy-makers have to challenge science to deliver on their public investment. In so doing, policy-makers must not look at aspirations only, but should define explicit goals.
9) Policy-makers may be restricted in the level of expertise or tools they have at their disposal. Nevertheless, they should consult more widely and learn from best practices and pitfalls encountered elsewhere. In particular, they should keep their door open and more readily include the private/corporate sector and civil society groups/NGOs in public dialogue on scientific evidence.

WHAT WE EXPECT FROM THE PUBLIC, INDUSTRY AND INTEREST GROUPS

10) The public plays a critical role as policy-makers are largely elected and public views usually determine what positions policy-makers will take or support, sometimes against the grain of what the scientific evidence is telling us. This explains why industry and interest groups spend so much time and resources trying to influence public opinion. Scientists must learn to find transparent ways and means to counter-balance this if the messages being passed are scientifically incorrect. Even so, scientists must realize that scientific consensus may not exist and avoid framing issues as science versus the public with science in the right. The public, also, must be more trusting of science and be made to understand that societal problems are not necessarily problems with purely scientific solutions. Crucially, they need to value innovative science and accept that calculated risks are fundamental to realizing proven benefits.
11) Industry is the largest investor in science and has every right to have its voice heard and to expect that the policy-making framework is set up to facilitate its success which is both economic and societal. Industry should strive for better practice in disclosing its vested interests and avoid conflicts of interest when engaging with external scientists and policy-makers. Above all, industrial research should be underpinned by an inherent integrity and quality. It should avoid a battle-ground mentality and the promotion of public disinformation to muddle the scientific picture when competitors or policy-makers appear to be going in a direction it may not prefer.
12) Interest groups similarly have every right to have their voice heard as guardians of the common good or legitimate sectoral interests and are a crucial cog in the policy-making cycle. They must be transparent and accountable but above all, responsible for the information and misinformation they disseminate to suit their purpose. When interest groups clearly get it right, both the scientific and policy-making community should give them the credit they deserve. When they get it clearly wrong, they should learn to hold their hands up and contribute to dismantling the public myths about science they have helped create.

WHAT NEEDS TO HAPPEN

13) Scientific advice must be more involved in all stages of the policy cycle: from policy anticipation and development to policy implementation and evaluation. Particularly in Europe, scientists need to be more readily seconded into political circles. This interaction will help bridge the gap whereby scientists tend to think long-term while policy-makers tend to think in short-term categories (election cycles). At the same time, scientists think on all spatial scales – from the atom to the universe – while most policy-makers rather care for their constituency.
14) Policy-making must learn to cope with the speed of scientific development and include greater foresight and policy anticipation. Aspects of future risk and uncertainty are particularly complex and difficult for policy-makers to grapple with. Science should be more forthright in providing advice on the costs and benefits of action or inaction. Similarly, the precautionary principle must not be misused for impeding technological progress.
15) There is a need to build trust between scientists, policy-makers and other societal actors through a long-term, sustained and participatory dialogue – nobody should be excluded or left behind. There is a need for institutions that can serve as "brokers" and "interpreters" between the science and policy arenas. Global challenges need global solutions. It is therefore of the utmost importance to join efforts globally to provide the best possible scientific advice.

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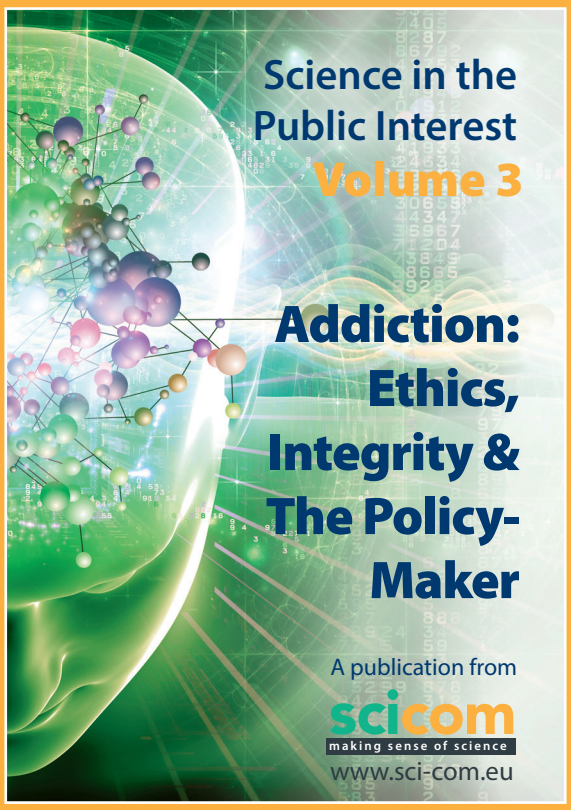

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