Impact case study (REF3b)

Institution: University of Cambridge
Unit of Assessment: UoA2
Title of case study: Strategies for the prevention of type 2 diabetes

1. Summary of the impact (indicative maximum 100 words)

Research founded on population-based cohort studies has directly informed NICE Public Health guidance on the prevention of diabetes. In prospective studies Wareham and Griffin demonstrated that diabetes can be predicted by a simple risk score using routinely available information and by HbA1c levels. Although people with a high HbA1c account for 36% of incidence, the majority of future cases emerge from the larger population of people with moderately elevated levels, justifying a more population-wide perspective on the prevention of diabetes. The research also showed that the same behaviour targets that are effective in high risk individuals are strongly associated with diabetes in the wider population.

2. Underpinning research (indicative maximum 500 words)

Professor Wareham (since 1993) and Professor Griffin (since 1999) of the MRC Epidemiology Unit, University of Cambridge have established a programme of research based on population-based cohort studies in which diabetes incidence has been ascertained (Forouhi et al, 2007)(Chamnan et al, 2011)(Langenberg et al, 2011). These cohort studies have been used not only to describe the relationship between aetiological factors and risk of diabetes (e.g. Romaguera et al, 2013) but also to address key questions that inform strategies for the prevention of diabetes. Previous randomised controlled trials (RCT) have shown that lifestyle intervention can halve risk of progression to diabetes among people at high risk. However, these explanatory trials are not easily translated into everyday practice and our research has aimed at identifying barriers to successful translation and at potential solutions.

Firstly, the explanatory RCTs define individuals as being at high risk on the basis of demonstrable non-diabetic hyperglycaemia defined using the time consuming oral glucose tolerance test. In analyses using the prospective EPIC-Norfolk cohort study commenced by the University of Cambridge in 1990 (Principal Investigators Professors Khaw and Wareham), the MRC Epidemiology Unit has shown that easily measured risk factors such as family history and obesity are strongly predictive of risk and that information on them is readily available in General Practice notes. When combined together in a simple risk score, these factors not only predict prevalent undiagnosed diabetes (Griffin et al, 2000) but are also predictive of future diabetes (Rahman et al, 2008). The advantage of this form of pragmatic risk score is that it can be deployed in primary care without the necessity for acquisition of additional information. Thus it can be used as the initial step in a combined approach to detect previously undiagnosed diabetes and those at risk of future disease in whom additional testing and intervention would be warranted.

Secondly the Unit has investigated the utility of simpler methods for defining diabetes than can be used in place of the time consuming oral glucose tolerance test. The measurement of HbA1c in the EPIC-Norfolk study has allowed investigation of its relationship to cardiovascular disease incidence and mortality which are part of the argument justifying the change in criteria to allow diabetes to be defined on the basis of HbA1c levels. In 2011 the Unit described the incidence of diabetes using the new diagnostic criteria showing that individuals with an HbA1c greater than 6.0% but less than the threshold for diabetes of 6.5% had a 3 year risk of progression to diabetes of 7 per 100 person years of follow up. 36% of incident cases came from this category, justifying it as a target for individualised preventive interventions (Chamnan et al, 2011).

Finally the Unit has investigated alternative approaches to prevention. In the Finnish Diabetes Prevention program, the achievement of five key behavioural targets (reducing weight, increasing physical activity, reducing total fat, reducing saturated fat and increasing dietary fibre) was strongly associated with a reduction in the risk of developing diabetes. The Unit has shown that the same targets were strongly inversely associated with risk in the general population (Simmons et al, 2006) and that they should therefore be the main behavioural recommendations for the population as a whole, not just for high risk individuals. The Unit also demonstrated that focusing prevention efforts

only on individuals at high risk was a less effective strategy than a population-wide approach to prevention (Harding et al, 2006).

3. References to the research (indicative maximum of six references)

1. Griffin, S. J., P. S. Little, C. N. Hales, A. L. Kinmonth and N. J. Wareham (2000). "Diabetes risk score: towards earlier detection of type 2 diabetes in general practice." Diabetes Metab Res Rev **16**(3): 164-71. **PMID:** 10867715

2. Simmons, R. K., A. H. Harding, R. W. Jakes, A. Welch, N. J. Wareham and S. J. Griffin (2006). "How much might achievement of diabetes prevention behaviour goals reduce the incidence of diabetes if implemented at the population level?" Diabetologia **49**(5): 905-11. **PMID:** 16508778

3. Harding, A. H., S. J. Griffin and N. J. Wareham (2006). "Population impact of strategies for identifying groups at high risk of type 2 diabetes." Prev Med **42**(5): 364-8. **PMID:** 16504278

4. Forouhi, N. G., J. Luan, S. Hennings and N. J. Wareham (2007). "Incidence of Type 2 diabetes in England and its association with baseline impaired fasting glucose: the Ely study 1990-2000." Diabet Med **24**(2): 200-7. **PMID:** 17257284

5. Rahman, M., R. K. Simmons, A. H. Harding, N. J. Wareham and S. J. Griffin (2008). "A simple risk score identifies individuals at high risk of developing Type 2 diabetes: a prospective cohort study." Fam Pract **25**(3): 191-6. **PMID:** 18515811

6. Chamnan, P., R. K. Simmons, N. G. Forouhi, R. N. Luben, K. T. Khaw, N. J. Wareham and S. J. Griffin (2011). "Incidence of type 2 diabetes using proposed HbA1c diagnostic criteria in the european prospective investigation of cancer-norfolk cohort: implications for preventive strategies." Diabetes Care **34**(4): 950-6. **PMID:** 20622160

7. Langenberg, C., S. Sharp, N. G. Forouhi, P. W. Franks, M. B. Schulze, N. Kerrison, et al (2011). "Design and cohort description of the InterAct Project: an examination of the interaction of genetic and lifestyle factors on the incidence of type 2 diabetes in the EPIC Study." Diabetologia **54**(9): 2272-82. **PMID:** 21717116

8. Romaguera, D., T. Norat, P. Wark, A. Vergnaud, B. Schulze, G. van Woudenbergh et al (2013) "Consumption of sweet beverages and type 2 diabetes incidence in European adults: results from EPIC-InterAct". Diabetologia. 56:1520-30.PMID:23620057

4. Details of the impact (indicative maximum 750 words)

The programme of research addressing strategies for the prevention of type 2 diabetes has had its impact through the publication of NICE Public Health Guidance in 2011 and 2012. The NICE Public Health programme produced two pieces of guidance. The first focussed on the prevention of progression from high risk state to diabetes (NICE guidance. Preventing type 2 diabetes: risk identification and intervention for individuals at high risk. NICE Public Health Guidance 38, 2012, (section 5, ref 1). The second guidance examined population and community-level interventions in high risk groups and the general population (NICE guidance. Preventing type 2 diabetes: population and community-level interventions in high risk groups and the general population. NICE Public Health Guidance 35, 2011, (section 5, ref 2).

The research described in this impact statement is cited in both NICE reports. The guidance on interventions in high risk individuals (section 5 ref 1) focused on two main activities: Identifying people at risk of developing type 2 diabetes using a staged (or stepped) approach using a validated risk-assessment score and a blood test (either the fasting blood glucose or the HbA1c test) to confirm high risk and the provision to those at high risk of a quality-assured, evidence-based, intensive lifestyle-change programme to prevent or delay the onset of type 2 diabetes. The NICE guidance cites evidence from the EPIC-Norfolk cohort in which the incidence of diabetes by level of HbA1c is described, justifying the category of 6.0-<6.5% as a high risk category in which the risk of progression to diabetes is 15 times greater than in those individuals with an HbA1c <5.0% (research reference 6). In describing the range of possible validated risk-assessment tools, the NICE guidance cites the original paper on the Cambridge Risk Score (research reference 1) which has subsequently been shown not only to predict prevalent undiagnosed diabetes but also incident diabetes (research reference 5).

The second piece of NICE Public Health Guidance examined strategies for prevention at the

population level. Evidence of the incidence of diabetes in the UK is cited from the paper on the Ely Study by Forouhi et al (research reference 4). The report cites the paper by Simmons et al (research reference 2) as the justification for recommending the focus of prevention at the population level on the same 5 behavioural targets that have been shown to be effective among the high risk population. It also cites the analysis in the EPIC-Norfolk study (research reference 3) which demonstrates that although the high risk approach may be effective in the relatively small group of individuals to whom it is targeted, greater public health potential comes from the application of strategies that attempt to address the same behaviours at the population level.

The guidance concludes that when developing national strategy to target non-communicable diseases with a major link to diet, physical activity and obesity (for example, type 2 diabetes, cardiovascular disease, certain cancers), policy makers should consider integrating the strategy with other relevant national actions to prevent related non-communicable diseases addressing the key risk factors (for example, being overweight or obese, a sedentary lifestyle and an unhealthy diet) highlighting the contribution that partners in national and local government, industry, healthcare and the voluntary sector can make by working together to reduce the risk of non-communicable diseases for the population as a whole taking account of variations in different population subgroups (for example, by ethnicity, age or gender) linking to targets and outcomes for reducing the key risk factors for type 2 diabetes and other non-communicable diseases.

The work on the overall approach to prevention has contributed to strategic discussions beyond NICE through Wareham's contribution to the work of the International Diabetes Federation in formulating its Global Diabetes Plan 2011-2021 in the run up to the UN summit on non-communicable disease in 2011 (section 5, ref 3). The research into specific risk factors also has an impact through dissemination in the public media, with the findings from the large scale pan-European cohort study InterAct led by Wareham (research reference 7) on the association of sugar-sweetened beverages and incident diabetes (research reference 8), for example, being widely discussed and informing public policy debates about actions that might limit consumption (section 5, ref 4).

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. NICE guidance. Preventing type 2 diabetes: risk identification and intervention for individuals at high risk. NICE Public Health Guidance 38, 2012. www.nice.org.uk/nicemedia/live/13791/59951/59951.pdf Research paper 1 quoted on page 72, Research paper 6 quoted on page 70.

2. NICE guidance. Preventing type 2 diabetes: population and community-level interventions in high risk groups and the general population. NICE Public Health Guidance 35, 2011 www.nice.org.uk/nicemedia/live/13472/54345/54345.pdf Research reference 2 quoted on page 35, Research reference 3 quoted on page 31, Research reference 4 quoted on page 48.

3. The IDF Global Plan for Diabetes 2011-2021. http://www.idf.org/sites/default/files/Global_Diabetes_Plan_Final.pdf

4. Public awareness of association of specific risk factors with diabetes incidence from large scale studies. E.g. http://www.dailymail.co.uk/health/article-2314353/Diabetes-danger-just-ONE-sugary-drink-day-Chance-developing-Type-2-increases-fifth.html