

# Nanomaterials and Graphene for Cancer Therapeutics: A Patient Public Involvement and Engagement Study

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We were interested in gaining a deeper understanding of patients' opinion and acceptability on the use of nanomaterials to treat cancer. 2D-Health researchers developed a patient-led questionnaire to explore patient and public views on our technology and to gain an understanding of their knowledge and acceptance of nanotherapeutics. Then the questionnaire was circulated widely through social media networks of various cancer patient groups and the captured data analysed and communicated. We aimed to educate and understand how we can better communicate our scientific research and help bridge any gaps in knowledge with patients that would potentially be users of our technologies.

The initial step was the questionnaire design between 2D-Health researcher volunteers and eight patients with a range of cancer types that were recruited to advise upon the development of the questionnaire. The questionnaire contained 45 questions aimed to capture information relating for four key areas: demographics, baseline knowledge, acceptance of immunotherapy containing nanomaterials and informed understanding/acceptance using infographics to convey information. Following ethical approval, the questionnaire was circulated online. 242 responses to the Questionnaire were received, with 147 complete and quality-validated responses used for data analysis. The respondents identified their gender, had a range of educational backgrounds and were aged from 18-70+ years old. The majority of respondents were cancer patients (65%) diagnosed with a range of malignancies and at all Stages from I-IV.

The results from this survey indicated that 26% of respondents were familiar with the term 'nanomaterials' at start of survey, with average rating of understanding 3.4 [scale 0-10]. After viewing the educational infographic this increased to 5.5 [scale 0-10] and further increased to 6.7 by the end of the Questionnaire. In response to any concerns about accepting a cancer therapy containing graphene, the majority of respondents had no concerns and were generally accepting of graphene-based treatments. This was regardless of age/gender/cancer stage/severity of side effects. Finally, after reading an infographic about how graphene is used in cancer treatment, respondents were asked to rate [scale 0-10] their understanding of how graphene could be used as a potential cancer therapeutic agent and the likelihood of them accepting graphene as a potential cancer therapeutic agent. The response was again positive with an average score of 8/10 for acceptance.

Overall, this PPI&E project highlighted the importance of direct engagement between researchers and patients to gauge patient perception when developing new technologies. The total cohort of patients we interacted with at various levels of the project were generally very accepting of novel therapeutic methods, including graphene-based immunotherapies. We will use the data to guide our future research and to design clear information for patients.